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ISSN 0945-9871
Publisher: Aquapress, Redazione aqua,
I-27010 Miradolo Terme (Pavia), Italy
www.aqua-aquapress.com
Printer: Pronto Stampa Srl – Bergamo – Italy
Copyediting and layout: Rossella Bulla
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Cirrhilabrus nahackyi, a new wrasse (Perciformes; Labridae) from the South Pacific

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Received: 20 May 2011 – Accepted: 6 July 2011

Abstract
Cirrhilabrus nahackyi, a new species of labrid fish found at Viti Levu, Fiji, and at Tongatapu in Tonga is described from five specimens, 30.9-65.0 mm SL, captured in 35-50 m depths on outer reef slopes. The new species closely resembles C. bathyphilus from the Coral Sea. However, terminal males differ in having an elevated pennant at the first and second dorsal spine. The male coloration of C. nahackyi also differs with regards to the dorsal and caudal fins. The spinous part of the dorsal fin is dusky yellow and lacks a violet band, while the soft portion of this fin has a distinctive yellow base, and larger red mid-dorsal band, which is not present in C. bathyphilus. Additionally, the caudal fin of the new species is red with only a thin sub-marginal black line in the upper half of the fin in terminal males compared to a yellow caudal fin in C. bathyphilus, which has blue blotches on the membrane in the upper part and has a broader black submarginal band extending the entire depth of the fin. The dorsal fin of the new species is also slightly longer than that of C. bathyphilus.

Résumé
Cirrhilabrus nahackyi, une nouvelle espèce de labre découverte à Viti Levu, Fidji et à Tongatapu, Tonga, est décrite sur base de cinq spécimens, de 30,9-65,0 mm SL, capturée à une profondeur de 35-50 m sur des tombants récifaux du large. La nouvelle espèce ressemble de près à C. bathyphilus de la Mer de Corail. Néanmoins, les mâles adultes se distinguent par une haute excroissance sur la première et la deuxième épine dorsale. La coloration du mâle de C. nahackyi diffère aussi pour ce qui concerne les nageoires dorsale et caudale. La partie dure de la dorsale est d’un jaune sale et n’a pas de bande violette alors que la partie molle de cette nageoire a une base jaune nette et une plus large bande à mi-nageoire, ce qui n’existe pas chez C. bathyphilus. En outre, la caudale de la nouvelle espèce est rouge avec seulement une fine ligne noire submarginale dans la moitié supérieure de la nageoire chez les mâles adultes alors que la caudale de C. bathyphilus est jaune, avec des taches bleues sur la membrane dans la partie supérieure, et une bande submarginale noire plus large qui s’étend sur toute la nageoire. La dorsale de la nouvelle espèce est aussi un peu plus longue que celle de C. bathyphilus.

Zusammenfassung

Sommario
Cirrhilabrus nahackyi, una nuova specie di labride rinvenuta a Viti Levu, Fidi e a Tongatapu a Tonga, è descritta sulla base di cinque esemplari di 30,9-65,0 mm SL, catturati a 35-50 m di profondità sul versante esterno della barriera. La nuova specie è molto somigliante a C. bathyphilus del Mar dei Coralli. Tuttavia, i maschi terminali differiscono per avere un’estensione a guisa di bandierina sulla prima e sulla seconda spina dorsale. Il maschio di C. nahackyi differisce inoltre per la colorazione delle pinne dorsale e caudale. La parte spinosa della dorsale è di color giallo opaco e manca della banda violettta, mentre la parte molle ha una base gialla ben evidente e una banda rossa mediana più larga che non è presente in C. bathyphilus.
Cirrhilabrus nahackyi, a new wrasse (Perciformes; Labridae) from the South Pacific

INTRODUCTION

The labrid genus Cirrhilabrus Temminck & Schlegel, 1845 contains small, colorful and sexually dimorphic coral-reef fishes that range across the tropical and subtropical Indo-Pacific region. Prior to 1958, only the following species were known: C. cyanopleura (Bleeker, 1851), C. temminckii Bleeker, 1853a, C. jordani Snyder, 1904, and C. exquisitus Smith, 1957. Four additional species, including C. solorensis Bleeker, 1853b, C. heterodon Bleeker, 1871, and C. lyukyuensis Ishikawa, 1904, have generally been regarded as synonyms. However, some authors now recognize C. solorensis as a valid species (Allen & Randall 1996; Allen & Kuiter 1999; Parenti & Randall 2000). In a recent paper describing C. beau-perryi from Papua New Guinea, Allen et al. (2008) noted that the genus contains 46 valid species. Since then Randall and Tanaka (2009) added Cirrhilabrus naokoae from Indonesia as the 47th species making Cirrhilabrus the second most speciose genus in the family. At present only Halichoeres contains more species, Parenti & Randall (2011) noted 80 species, although a recent molecular study has cast doubt on the generic placement of several species presently included in Halichoeres (Barber et al. 2005). Reallocation of some of these species to other genera may result in Cirrhilabrus being the largest genus of Labridae.

Allen et al. (2003) attributed many discoveries of new Cirrhilabrus over the past 30 years to the development and availability of SCUBA equipment for scientific diving. Some of the more recently described species occur below 40-50 m. New technology involving mixed-gas and rebreather diving equipment has made these deeper habitats more accessible to scientific surveys and further new discoveries are likely.

The second author received an aquarium photograph in 2002 from Larry Sharron in Tonga of a Cirrhilabrus that appeared to be a close ally of C. bathyphilus Randall & Nagareda, 2002. The fish was sold to aquarium fish dealers before the second author recognized it as a probable new species. In 2005 John Randall from the Bishop Museum in Hawaii informed the first author that Bruce Carlson from the Georgia Aquarium (Atlanta, USA) had received several fish from aquarium fish collector Tony Nahacky in Fiji and photographs confirmed it was probably conspecific with the undescribed Cirrhilabrus from Tonga. Unfortunately the difficulty in removing this fish from a large public display meant that we were unable to examine it. The first author contacted the collector directly and our efforts to secure specimens were rewarded when Tony Nahacky collected four fish and forwarded them to the first author in December 2005.

Cirrhilabrus bathyphilus was originally described from the Coral Sea (Holmes Reef off north-eastern Australia and Chesterfield Bank near New Caledonia and now reported from Vanuatu) as the 42nd member of the genus (Fig. 1). In the present paper we describe a new species Cirrhilabrus nahackyi collected in Fiji and Tonga in the South Pacific as the 48th species of Cirrhilabrus.

METHODS

Lengths given for specimens are standard length (SL), the straight-line distance from the median anterior point of the upper lip to the base of the caudal fin (posterior end of the hypural plate). Head length is measured from the median anterior point of the upper lip to the posterior end of the opercular membrane; snout length is from the same anterior point to the fleshy edge of the orbit. Body depth is the greatest depth measured to the base of the dorsal fin spine, ray and dorsal fin height are taken from the upper lip to the anterior origin of the respective fin. Lengths of each fin spine, ray and dorsal fin height are taken from the base of each element.

Pectoral ray counts include the short rudimentary upper ray. The lateral line scale counts are given in two parts; the anterior count from the upper end of the opercular flap to below the soft portion of the dorsal fin. The second or posterior lateral line count is from the midlateral peduncular portion to the base of the caudal fin (a single scale usually located posterior to the base of the caudal fin is included). Gill raker counts include rudiments and only a total...
count is given as it is difficult to determine which
gill raker is at the angle. Type specimens are
deposited at the Queensland Museum, Brisbane
(QM), United States National Museum, Washing-
ton (USNM) and the University of Miyazaki- Fishes
Science, Miyazaki (MUFS).

Cirrhilabrus nachakyi, n. sp.
Nahacky’s Wrasse (Figs 2-5, Table I)

Cirrhilabrus sp. Nahacky’s Fairy Wrasse - Michael
2009: 115-117.
Cirrhilabrus sp 1. Tongan Fairy Wrasse - Kuiter
2010: 142.

Holotype: QM I.38421, male, 55.6 mm SL, Bega
Lagoon, Viti Levu, Fiji Islands, over gentle sloping
rubble bottom, 35 m, hand-net, December 2005.
Paratype: QM I.38242, female, 31.8 mm SL, same
data as holotype; USNM 387558, male, 42.4 mm
SL, same data as holotype; MUFS 23365-23367,
male, 52.8 mm SL, same data as holotype; QM
I.38241, 65.0 mm SL, Tongatapu, Tonga, from the
aquarium trade, June 2007.

Diagnosis: Dorsal rays XI, 9; anal rays III, 9; pectoral
rays 15; lateral line scales 17-15; median predorsal
scales 5; horizontal rows of scales on cheek 2;
gill rakers 14-15; body depth 3.00-3.45 in SL; body
width 2.0-2.2 in body depth; head length 2.7-3.1 in
SL; snout length 3.85-4.15 in head length; pelvic fin
short, not reaching base of anal fin, 4.3-5.2 in SL;
caudal fin rounded; eye large, orbit diameter 3.15-
3.85 in head length. Color in life of males: abdomen
pale yellow; body red dorsally fading to yellowish
ventrally; soft portion of dorsal black outer band,
red band mid-dorsally and broader posteriorly, yel-
low band at base; spinous portion black on the first
membrane fading to irregular dusky on yellow
toward first soft ray, thin outer margin violet to pale
blue; nape dusky. Color in alcohol pale, males with
black submarginal band in dorsal fin, caudal fin
translucent. Largest specimen 65 mm SL.

Description: Dorsal rays XI, 9; anal rays III, 9; first
dorsal and anal soft rays unbranched, all others
branched, last to base; pectoral rays 15, upper two
unbranched; pelvic rays 1, 5; principal caudal rays 13;
median 11 unbranched; upper and lower procurent
caudal rays 6, posteriormost segmented; lateral line
interrupted; dorso-anterior series of pored scales
17-15; scales above lateral line to base of dorsal fin 2;
scales below lateral line to base of anal fin 6; median
predorsal scales 5; median prepelvic scales 6; cir-
cumpeduncular scales 16; horizontal scale rows on
cheek 2; gill rakers 14 (14-15); branchiostegal rays 5;
vertebrae 9 + 16.

Body depth 3.0 (3.10-3.45) in SL; body com-

Fig. 1. Holotype of Cirrhilabrus bathyphilus, AMS I.151103.001 male 48.7 mm SL, Holmes Reef, Coral Sea. Photo by F. Walsh.
pressed, width 2.05 (2.0-2.2) in body depth; head length 2.75 (2.7-3.1) in SL; dorsal profile of head convex; snout moderately pointed its length 4.05 (3.85-4.15) in head length; orbit large 3.7 (3.15-3.85) in head length; interorbital space convex, least bony width 4.15 (3.85-4.35) in head length; caudal peduncle depth 2.3 (2.20-2.45); caudal peduncle length 2.05 (2.05-2.40) in head.

Mouth terminal and oblique, forming angle of approximately 30° to horizontal axis of body and head; mouth small, maxilla extending just posterior to vertical through anterior nostril, upper jaw length 4.4 (4.00-4.35) in head length; dentition typical of the genus, front and upper jaw with three pairs of canine teeth anteriorly at side of upper jaw, anterior pair forward projecting, next two pairs increasing in length, more recurved and laterally projecting; upper with closely set small conical teeth (16 in holotype posterior to third canine); lower jaw with single pair of forward and laterally projecting canines and closely set small conical teeth, first five largest and just posterior of canines (18 in holotype); tongue short and rounded. Gill rakers short, longest on first gill arch and less than one-half of longest gill filaments.

Posterior margin of preopercle with 33 (28-34) small serrae; edge of preopercle free from behind centre of eye to below anterior edge of pupil; lower and rounded margin of preopercle thin and membranous.

Posterior nostril subtriangular with short rim, located just below upper eye level and just forward to front edge of eye; anterior nostril very short membranous tube, slightly higher posteriorly and located anteroventral to posterior nostril, its diameter about equal to sensory pores of cephalic lateralis system. Suborbital pores from middle of eye to below front edge of eye 12 (10-13); pores along free edge of preopercle 8 (7-8); pores on mandible to front of chin 4.

Scales cycloid; head scaled except interorbital space, snout and chin; opercle covered by seven large scales; cheek with two horizontal rows of scales below eye; naked lower flange of preopercle thin, greatest width at angle about 2.5 in orbit diameter in holotype; base of dorsal and anal fins with single row of large elongated scales, one per membrane; last pored scale on lateral line at base of caudal fin enlarged and pointed; terminal scale on midline just posterior to last pored scale greatly enlarged and pointed; no scales on paired fins; pelvic fins with median ventral process of two elongate scales about three-fourths the length of pelvic spine, thin axillary scale of each pelvic fin about three-fourths the length of pelvic spine.

Origin of dorsal fin above third lateral line scale; predorsal distance 3.2 (3.00-3.35) in SL; dorsal fin height elevated in terminal males 1.75 (1.05-2.25) in head length (interspinous membranes of dorsal fin extending above spine tips and supported by slender fleshy rod behind first and second dorsal spines, forming pennant); first dorsal spine 3.2 (2.25-3.65) in head length, about equal to second

Fig. 2. Holotype of Cirrhilabrus nahackyi Q.M. I.38421, male, 55.6 mm SL, Bega Lagoon, Fiji. Photo by F. Walsh.
Table I. Proportional measurements of type specimens of *Cirrhilabrus nahackyi* as percentage of standard length.

<table>
<thead>
<tr>
<th></th>
<th>Holotype</th>
<th>Paratypes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>QM 1.38421</td>
<td>QM 1.38242</td>
</tr>
<tr>
<td>Sex</td>
<td>male</td>
<td>female</td>
</tr>
<tr>
<td>Standard length (mm)</td>
<td>55.6</td>
<td>31.8</td>
</tr>
<tr>
<td>Body depth</td>
<td>33.5</td>
<td>31.8</td>
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<tr>
<td>Body width</td>
<td>16.4</td>
<td>15.4</td>
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<tr>
<td>Head length</td>
<td>36.5</td>
<td>36.8</td>
</tr>
<tr>
<td>Snout length</td>
<td>9.0</td>
<td>9.1</td>
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<tr>
<td>Orbit diameter</td>
<td>9.9</td>
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<tr>
<td>Interorbital width</td>
<td>8.8</td>
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<tr>
<td>Upper jaw length</td>
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</tr>
<tr>
<td>Caudal peduncle depth</td>
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<td>15.7</td>
</tr>
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<td>Caudal peduncle length</td>
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<td>Predorsal length</td>
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<tr>
<td>Preanal length</td>
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<tr>
<td>Prepelvic length</td>
<td>34.5</td>
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<tr>
<td>Dorsal fin base</td>
<td>63.3</td>
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<tr>
<td>Height of dorsal fin</td>
<td>20.7</td>
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<td>First dorsal spine</td>
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<td>10.1</td>
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<tr>
<td>Longest dorsal spine</td>
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<tr>
<td>Longest dorsal ray</td>
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<td>16.4</td>
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<tr>
<td>Anal fin base</td>
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<td>28.0</td>
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<td>First anal spine</td>
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<td>Second anal spine</td>
<td>9.9</td>
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<tr>
<td>Third anal spine</td>
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<td>Longest anal ray</td>
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<tr>
<td>Caudal concavity</td>
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<tr>
<td>Pelvic fin length</td>
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</tr>
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</table>

Fig. 3. Paratype of *Cirrhilabrus nahackyi* QM 1.38242, female, 31.8 mm SL, Bega Lagoon, Fiji. Photo by F. Walsh.
spine in males; other dorsal spines subequal, the longest 2.55 (2.0-2.4) in head length; first or second soft dorsal ray longest 1.95 (1.90-2.25) in head length; origin of anal fin vertically below last dorsal spine; preanal length 1.7 (1.65-1.90) in SL; first anal spine 4.3 (3.95-4.75) in head; second anal spine 3.7 (3.15-3.70) in head; third anal spine 3.1 (2.3-3.0) in head; sixth, seventh or eighth anal soft rays longest, 1.8 (1.75-2.40) in head; caudal fin 3.7 (3.55-4.10) in SL, caudal fin rounded to slightly rounded on males and slightly rounded on females; third pectoral ray longest 1.55 (1.40-1.55) in head; pelvic fin short extending just beyond anus, longer in males than females; second ray longest 1.55 (1.55-1.85) in head, 4.3 (4.7-5.2) in SL.

Color of male holotype in alcohol: pale yellowish, dusky on nape and extending to below third dorsal spine; dorsal fin mostly dusky grey, first membrane black, soft portion with narrow translucent outer margin and broad outer black band narrowing posteriorly, translucent below and forming narrowing band running anteriorly to base of second dorsal ray; caudal fin translucent with few small dusky spots distally; remaining fins translucent.

Color of the female paratypes in alcohol: pale yellowish, nape dusky to below third dorsal spine; first dorsal fin membrane black; all other fins translucent.

Color of male holotype in life (Figs 2, 4): bright red shading to yellowish red posteriorly, with several indistinct slightly darker red lines following centers of longitudinal scale series punctuated by series of approximately eight irregularly spaced violet spots on each line (stress coloration), six faint violet-red longitudinal lines on head; three above and three either side of eye extending from snout to opercle; chest and lower third of head below eye and posterior to chin abruptly pale yellowish, shading to yellowish red on abdomen; nape dusky and extending to just below third dorsal spine above lateral line; iris red-yellow; spinous portion of dorsal fin yellow, first spinous membrane and pennant black, with broad dusky band centrally and shading to thin dusky yellow band at first soft dorsal ray, base of each spine with dusky triangle; soft portion of fin distinctly differing from spinous, with broad black submarginal band, narrowing slightly posteriorly, broad red central band broadening posteriorly, base of soft portion similar to spinous, yellow with dusky triangle at each dorsal ray base; anal fin yellow with blue-violet margin and broad irregular red submarginal band; caudal fin red shading to translucent distally, faint line of dusky submarginal spots; pelvic fins translucent yellow, first two membranes yellow; pectoral fins transparent, red to yellow at base.

The largest male paratype from Tonga has an overall yellowish body and the four lines on the head are more discernible than in the holotype; and the caudal fin has a submarginal black line, thickest dorsally with a blue-violet margin.

Color of female paratype in life (Fig. 3): bright red body and head, shading to yellow on
abdomen and below eye, six violet lines with red margin following centers of longitudinal scale series with irregular larger violet spots, uppermost line extending from snout along mid-dorsal line and dorsal fin base, other five lines extending from snout to base of caudal fin, lower three lines on either side of eye, lowest just below the horizontal mid-line; dorsal fin translucent yellow except for black first dorsal spine; anal and caudal fins translucent yellow; paired fins transparent.

Fig. 5. Cirrhilabrus nahackyi, terminal male, 10cm TL, collected in 48 m from Tonga. Photo by L. Sharron.

Fig. 6. Cirrhilabrus cf. bathyphilus, QM I.38235 male, 69.4 mm SL, Efate Island Vanuatu. Photo by F. Walsh.
REMARKS
The new species is known only from Fiji and Tonga. It appears to be closely related to Cirrhilabrus bathyphilus, which occurs in the Coral Sea off Australia, Vanuatu and New Caledonia. Both species share several common morphological features such as general body coloration, size, and also are found in similar rubble habitats on outer reef slopes. The caudal fin shape, general coloration, and color of the dorsal fin are key differences between the two species. Moreover, C. nahackyi has a rounded caudal fin in terminal males compared to the emarginate shape of C. bathyphilus. The new species also lacks the violet blue spots and thick submarginal black band on the caudal fin that are typical of C. bathyphilus. Instead, the caudal fin is paler red with only a thin submarginal black band present in terminal males. The dorsal fin of the new species is dusky yellow on the spinous portion, except for the first membrane, which is black and extended in height, and the soft portion has three distinct bands of yellow at the base, red centrally, and a black outer band. In contrast, C. bathyphilus has an outer black band running the full length of the fin and a distinctive violet blue band in the middle of the dorsal fin.

It has come to our attention that another fish that is similar to C. nahackyi is found at Efate Island in Vanuatu (Fig. 6). Larry Sharron supplied specimens, which have become known as the "Hooded Fairy Wrasse" in the aquarium trade as well as specimens from Tanna Island in southern Vanuatu. The latter fish appears to be C. bathyphilus but the Efate Island labrid we believe is a subspecies of C. bathyphilus which we plan to describe in a future paper and will illustrate the various color forms of C. bathyphilus.

ACKNOWLEDGMENTS
We are especially grateful to Tony Nahacky who supplied the four type specimens and provided detailed information on the type location for Cirrhilabrus nahackyi. We are also very grateful to Larry Sharron for his initial recognition and information of this new species and for supplying location information for the fifth paratype specimen. We would also like to thank Dr John Randall for assisting greatly with his knowledge and his encouragement, Dr Gerry R. Allen for his help in reviewing our manuscript, Bruce Carlson for some of the first photographs the new species, Jeff Johnson of the Queensland Museum for assistance with the specimens and Sue Morrison of the Western Australian Museum for x-rays.

REFERENCES
A new species of Dragonet (Synchiropus: Callionymidae) from Indonesia

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Received: 21 June 2011 - Accepted: 21 July 2011

Abstract
Synchiropus tudorjonesi is described on the basis of 4 specimens, 21.1-35.5 mm SL, collected at Cenderawasih Bay, West Papua, in Indonesia. The species has also been recorded from Bali, Indonesia, from underwater photographs. It appears to be most closely related to S. morrisoni, which ranges widely in the western Pacific. The two species have overlapping distributions in Indonesia, but are ecologically separated with S. tudorjonesi occurring in deeper water (50-70 m) compared to the shallower depth range (about 12-33 m) of S. morrisoni. Both species exhibit similar meristic and morphometric features. However, the adult male of S. morrisoni has a much taller first dorsal fin, which may reach twice the height of the second dorsal fin (or to 2.5 in SL) compared to the much lower fin (4.2 in SL) of S. tudorjonesi. There are also significant colour differences, particularly with regards to the male's first dorsal fin.

Zusammenfassung

Résumé
Synchiropus tudorjonesi est décrit sur base de 4 spécimens, 21.1-35.5 mm de LS, collectés à Cenderawasih Bay, Papouasie occidentale, Indonésie. L ’espèce à également été signalée à Bali, Indonésie, à partir de photographies sous-marines. Elle semble la plus proche de S. morrisoni, qui occupe de grands espaces dans le Pacifique ouest. Les deux espèces ont des distributions qui se chevauchent en Indonésie, mais sont séparées écologiquement dans la mesure où S. tudorjonesi occupe des eaux plus profondes (50-70 m) que S. morrisoni qui évolue moins bas (12-33 m en environ). Les deux espèces ont des données méristiques et morphométriques similaires. Néanmoins, le mâle adulte de S. morrisoni a une première dorsale nettement plus grande qui peut atteindre deux fois la hauteur de la secononde dorsale (ou jusqu’a 2,5 en LS) alors que S. tudorjonesi a la nageoire bien plus courte (4,2 en LS). Il y a également des différences notables de couleur, particulièrement eu égard à la première dorsale du mâle.

INTRODUCTION
Dragonets of the family Callionymidae are bottom-living fishes frequently found on sand, mud,
or dead coral rubble. They usually rest on their outstretched pelvic fins and move about the reef in slow, short bursts. Males are generally more Colourful than females and use their ornate first dorsal fin to signal their spawning intentions to nearby females. In some species the first dorsal is exceedingly tall and sail-like and is fully erected during courtship displays. More than 125 species are known from the Indo-Pacific region. However, there is disagreement concerning the generic classification of dragonets with some researchers following the scheme of Nakabo (1982) in which 19 genera are recognized, while others subscribe to the classification of Fricke (1983), who recognized only nine genera, placing the majority of species in Callionymus Linnaeus, 1758 and Synchiropus Gill, 1859.

The present paper describes a new species that we first became aware of from photographs taken at Bali, Indonesia, labelled as Synchiropus cf. morrisoni, which appeared in Kuiter & Tonozuka (2001). Four specimens were eventually collected in September 2010 by the second author during deep (60-70 m) scuba dives at Cenderawasih Bay, West Papua Province, Indonesia. The specimens include both sexes and clearly belong to a new taxon, closely related to S. morrisoni Schultz, 1960.

**Materials and Methods**

The format of the new species description and methods of counting and measuring are the same as those utilised by Fricke (1981 and 1983). We have adhered to Fricke’s generic classification rather than that of Nakabo (1982), primarily because of the former author’s in-depth treatment of Indo-Pacific species in the 1983 monograph and subsequent publications. Counts and proportions appearing in parentheses apply to the paratypes if different from the holotype. Proportional measurements of type specimens, expressed as percentage of the standard length, are provided in Table I. Type specimens are deposited at Museum Zoologicum Bogoriense, Cibinong, Indonesia (MZB) and the Western Australian Museum, Perth (WAM).

**Synchiropus tudorjonesi** n. sp.

Red-back Dragonet

Figs 1-2; Table I

**Holotype**: MZB 20019, male, 35.5 mm SL, oceanic patch reef, 02°25.830’S, 134°54.409’E, north of Tridacna Atoll, Cenderawasih Bay, West Papua Province, Indonesia, 70 m, clove oil and hand net, M. Erdmann, 20 September 2010.

**Paratypes**: MZB 20020, female, 21.2 mm SL, collected with holotype; WAM P.33357-001, female, 24.4 mm SL, same collection data as holotype except 13 September 2010; WAM P.33368-002, female, 25.2 mm SL, collected with holotype.

**Diagnosis**: A species of the subgenus Synchiropus (see Fricke 1981) with the following combination of features: dorsal rays VIII + 8; anal rays 6-7 (usually 7); all dorsal rays branched; anal rays unbranched (except last branched at base); preopercular spine with very small main tip and 1-3 recurved spinules along dorsal margin; colour in life mainly bright red with black pectoral fin base, diffuse blackish zone on ventral half of side punctuated by variable-sized white spots; male with moderately elevated spinous dorsal fin with four black oblique bands, alternating with narrower bands of yellow and blue; female with shorter, mainly black spinous dorsal fin.

**Description**: Dorsal rays VIII + 8, all soft rays unbranched; anal rays 7 (one paratype with 6), unbranched except last ray branched at base; pectoral rays 21; pelvic rays 1, 5; branched caudal rays 7 (one paratype with 6); principal caudal rays 9 (one paratype with 8); upper and lower procurent caudal rays 3-4.

Body elongate and slightly depressed, greatest depth 4.8 (4.6-4.8) in SL, and greatest width 1.0 (0.9-1.0) in greatest depth. Head slightly compressed (male) or slightly depressed (female), length 3.3 (2.8-3.2) in SL; snout shorter than orbit diameter, 3.7 (3.8-4.4) in head length; orbit diameter 2.5 (2.4-2.6) in head length; interorbital very narrow, 15.4 (18.0-22.0) in head length. Caudal peduncle moderately long and slender, least depth 10.1 (10.6-11.8) in SL and length 6.7 (4.9-6.2) in SL. Branchial opening sublateral in position. Preopercular spine length 3.6 (4.1-4.7) in head length; preopercular spine with very small main tip and 1-3 recurved spinules along dorsal margin.

Lateral line extending from preorbital region to about middle of third branched caudal fin ray (counted from dorsal margin) with short suborbital and long preoperculo-mandibular branch, two ventral branches before pectoral fin base, and series of short dorsal branches along side of body; lateral lines of opposite sides of body interconnected by commissure across occipital region.

Snout to origin of first dorsal fin 2.9 (2.5-2.8), and origin of second dorsal fin 2.0 (1.8-2.0), both...
in SL; first dorsal fin of male holotype moderately elevated, first spine 2.0, second spine 1.4, third spine 1.3, and fourth spine 1.5, all in head length. First dorsal fin of female paratypes lower, first spine 2.2-3.7, second spine 2.1-3.1, third spine 1.9-2.5, and fourth spine 3.3-4.1, all in head length. First dorsal fin higher than second dorsal fin in male and female, first and last dorsal rays 1.7 (1.9-2.0) and 1.3 (2.1-2.4) respectively in head length, the last ray slightly elongated in male. Preanal length 1.7 (1.6) in SL; anal fin origin level with base of third ray of second dorsal fin; length of last anal ray 1.3 (1.5-1.8) in head length. Prepelvic length 3.3 (3.0-3.3) in SL; pelvic fins relatively elongate and extending to base of third anal ray when laid back, 0.9 (0.9-1.0) in head length. Pectoral fins relatively short, 1.3 (1.7-1.9) in head length. Caudal fin slightly rounded, 3.1 (3.2-3.9) in SL.

Colour in life (Fig. 1): mainly bright mottled red with black pectoral fin base, diffuse blackish zone on ventral half of side, both upper and lower side punctuated by variable-sized white spots; lower side of head and breast whitish to yellowish (with small blue spots on male); first dorsal fin of male with four black oblique bands, alternating with narrower bands of yellow and blue; female with mainly black spinous dorsal fin; second dorsal fin reddish with white and dark brown spots arranged in oblique bands; caudal fin with about 6-7 alternating brown and white to bluish bars intermingled with white spots; anal fin blackish; pelvic fins translucent with diffuse red and yel-

Fig. 1. Synchiropus tudorjonesi, underwater photograph of anesthetized freshly collected male holotype, 35.5 mm SL (upper fish), and female paratype, 25.2 mm SL, Cenderawash Bay, Indonesia. Photo by G. R. Allen.
lowish bands; pectoral fins translucent with large reddish blotches on basal half.

**Colour in alcohol** (Fig. 2): overall yellowish tan with six large dark brown blotches (bifurcate ventrally) on lower half of side; first dorsal fin of male with four dark brown oblique bands, alternating with narrower bands of dark brown and white; female with mainly black spinous dorsal fin; soft dorsal fin whitish with 3-4 dark brown streaks on each fin membrane; caudal fin whitish with 2-3 (only darker bars seen in life remain evident) horizontally elongate streaks on each fin membrane, most prominent on basal half; anal fin dark to dusky brown except narrowly whitish at base; pelvic and pectoral fins whitish with dark brown patch on upper half, extending dorsally on “shoulder” where it encircles pale spot just above fin.

**Remarks:** The new species appears to be most closely related to Synchiropus morrisoni (Fig. 3), which ranges widely in the western Pacific (Randall 2005; personal observations) with records from the Japan (Izu and Ryukyu Islands), Micronesia (Palau to Marshall Islands), Fiji, Samoa, Chesterfield Islands, Great Barrier Reef, Indonesia (Bali, Sulawesi, and West Papua), Philippines (Luzon), and Papua New Guinea (Madang). Both species exhibit similar meristic and morphometric features. However, the adult male of S. morrisoni has a much taller first dorsal fin, which may reach twice the height of the second dorsal fin (or to 2.5 in SL) compared to the much lower fin (4.2 in SL) of S. tudorjonesi. There is also a pronounced difference in the colour pattern of the male’s first dorsal fin: that of S. morrisoni has numerous (generally more than eight), mainly vertically oriented dark brownish bands compared to the four black bands of S. tudorjonesi. Although the general colour pattern of the body is similar for the two species, that of S. morrisoni is generally more brownish than red, and tends to be more strongly mottled. Finally

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**Fig. 2.** Synchiropus tudorjonesi, preserved male holotype, 35.5 mm SL (upper fish), and female paratype, 25.2 mm SL, Cenderawasih Bay, Indonesia. Photo by G. R. Allen.
**Table I.** Proportional measurements of type specimens of *Synchiropus tudorjonesi* as percentage of the standard length.

<table>
<thead>
<tr>
<th>Character</th>
<th>Holotype M ZB 20019</th>
<th>Paratype WAM P.33368</th>
<th>Paratype WAM P.33357</th>
<th>Paratype WAM 20020</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sex</strong></td>
<td>male</td>
<td>female</td>
<td>female</td>
<td>female</td>
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<tr>
<td><strong>Standard length</strong></td>
<td>35.5</td>
<td>25.2</td>
<td>24.4</td>
<td>21.2</td>
</tr>
<tr>
<td><strong>Body depth</strong></td>
<td>20.8</td>
<td>21.0</td>
<td>21.7</td>
<td>20.8</td>
</tr>
<tr>
<td><strong>Body width</strong></td>
<td>21.7</td>
<td>22.6</td>
<td>23.4</td>
<td>21.2</td>
</tr>
<tr>
<td><strong>Head length</strong></td>
<td>30.4</td>
<td>35.7</td>
<td>33.6</td>
<td>31.1</td>
</tr>
<tr>
<td><strong>Snout length</strong></td>
<td>8.2</td>
<td>9.5</td>
<td>7.8</td>
<td>7.1</td>
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<tr>
<td><strong>Eye diameter</strong></td>
<td>12.4</td>
<td>13.9</td>
<td>13.9</td>
<td>12.3</td>
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<tr>
<td><strong>Interorbital width</strong></td>
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<td>2.0</td>
<td>1.6</td>
<td>1.4</td>
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<tr>
<td><strong>Preopercular spine length</strong></td>
<td>8.5</td>
<td>7.5</td>
<td>8.2</td>
<td>6.6</td>
</tr>
<tr>
<td><strong>Caudal peduncle depth</strong></td>
<td>9.9</td>
<td>8.7</td>
<td>9.4</td>
<td>8.5</td>
</tr>
<tr>
<td><strong>Caudal peduncle length</strong></td>
<td>14.9</td>
<td>20.2</td>
<td>16.4</td>
<td>16.0</td>
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<tr>
<td><strong>Urogenital papilla length</strong></td>
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<td>0.8</td>
<td>0.0</td>
<td>0.0</td>
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<td><strong>Predorsal (1) length</strong></td>
<td>34.6</td>
<td>39.7</td>
<td>39.8</td>
<td>35.4</td>
</tr>
<tr>
<td><strong>Predorsal (2) length</strong></td>
<td>51.0</td>
<td>55.6</td>
<td>53.3</td>
<td>50.0</td>
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<td><strong>Preanal length</strong></td>
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<td>62.3</td>
<td>62.7</td>
<td>61.3</td>
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<td><strong>Prepelvic length</strong></td>
<td>30.7</td>
<td>33.3</td>
<td>32.0</td>
<td>30.7</td>
</tr>
<tr>
<td><strong>First dorsal spine length</strong></td>
<td>15.5</td>
<td>12.3</td>
<td>15.2</td>
<td>8.5</td>
</tr>
<tr>
<td><strong>Second dorsal spine length</strong></td>
<td>22.3</td>
<td>11.9</td>
<td>16.4</td>
<td>9.9</td>
</tr>
<tr>
<td><strong>Third dorsal spine length</strong></td>
<td>23.9</td>
<td>14.7</td>
<td>17.6</td>
<td>12.3</td>
</tr>
<tr>
<td><strong>Fourth dorsal spine length</strong></td>
<td>19.7</td>
<td>8.7</td>
<td>10.2</td>
<td>9.4</td>
</tr>
<tr>
<td><strong>First dorsal ray length</strong></td>
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<td>18.3</td>
<td>17.6</td>
<td>15.6</td>
</tr>
<tr>
<td><strong>Last dorsal ray length</strong></td>
<td>24.2</td>
<td>17.9</td>
<td>16.0</td>
<td>12.7</td>
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<tr>
<td><strong>Last anal ray length</strong></td>
<td>23.4</td>
<td>19.8</td>
<td>18.4</td>
<td>20.3</td>
</tr>
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<td><strong>Pectoral fin length</strong></td>
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<td>19.0</td>
<td>17.6</td>
<td>18.4</td>
</tr>
<tr>
<td><strong>Pelvic fin length</strong></td>
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<td>35.3</td>
<td>36.1</td>
<td>34.4</td>
</tr>
<tr>
<td><strong>Caudal fin length</strong></td>
<td>32.7</td>
<td>31.7</td>
<td>29.9</td>
<td>25.9</td>
</tr>
</tbody>
</table>

**Fig. 3.** *Synchiropus morrisoni*, male, 57.0 mm SL, Okinawa, Ryukyu Islands. Photo by J. E. Randall.
there is also a difference in habitat with S. morrisoni usually occurring at depths between about 12-33 m (Randall 2005; personal observations) compared to 50-70 m for the new species.

**Habitat and distribution:** The new species was collected from 70 m depth on reefs of Cenderawash Bay that are situated well offshore in clear water, oceanic conditions. The type specimens were each collected in a similar microhabitat that consisted of scattered coral and sponge outcrops with interspersed rubble substrate; when startled, the animals would invariably seek shelter under the nearest outcrop. Individuals from Tulamben, Bali, Indonesia were also reported (as Synchiropus cf. morrisoni) by Kuiter and Tonozuka (2001) from a depth of 50 m.

**Etymology:** The new species is named *tudorjonesi* after Paul Tudor Jones, in honour of his dedication and selfless service to the United States National Fish and Wildlife Foundation (NFWF). Under his strong leadership as chairman from 2006 to 2009, the NFWF has grown into a highly respected conservation institution and expanded its programs from a national focus to a global one, including protection of the Bird’s Head Seascape reefs which, this beautiful dragonet species calls home. Through these efforts, Mr. Tudor Jones has forever left his mark on the noble pursuit of nature preservation.

**ACKNOWLEDGMENTS**

We thank the Balai Besar Taman Nasional Teluk Cenderawash (particularly Christina Matakupan and Titus Wemiyaupea) for their support and participation in the field survey that uncovered this species. We also thank Hamid Toha and the State University of Papua for their assistance in the survey, which was completed under Teluk Cenderawash National Park license No. SI.1029/IV-14/TEK/2010. We sincerely thank the Siebel Family Charitable Foundation, Rodney and Nancy Chiamulon, and Dan Cohen for their generous financial support of this survey, and also the Indonesian Institute of Sciences (specifically Dr. Suharsono and Ibu Rianta Afriadi) for loaning the specimens for study. Finally, we thank the captain and crew of the MV TenuKira for their tireless efforts in supporting an exhaustive dive schedule.

**REFERENCES**

Abstract

The silky shark Carcharhinus falciformis population has declined drastically in the last few years, due to extensive by-catch in tuna purse-seine and longline fisheries in the eastern Pacific Ocean. No information exists on the reproductive biology of this species in the eastern Pacific Ocean to support fishery or conservation management. A total of 295 silky sharks were analyzed, with 179 females captured, ranging between 88 and 316 cm TL and 116 males, ranging between 142 and 260 cm TL. The sex ratio of females to males was 1:0.6. The increase in of oocytes instead of ovarian egg and oviducal gland diameters as well as the presence of uterine eggs or developing embryos indicated that female maturation occurred at about 180 cm TL; while clasper development and the presence of sperm clumps indicated that males matured at about 182 cm TL. The short-term sperm storage found in females could be an advantage for species that present sexual segregation and live in open waters, increasing reproductive efficiency. In the 20 gravid females examined, the average number of embryos per female was five, with a range of 2-9 embryos. Females with embryos 6-8 cm TL were observed in July and September; whereas embryos 20-30 cm TL were found from September to November. One female with full term embryos (80 cm) was captured at the end of June suggesting an 11-12 month gestation period.

Zusammenfassung


Résumé

La population du Carcharinus falciformis a drastiquement diminué ces dernières années à cause de la capture involontaire en sennes à thons et de la pêche à longue ligne dans le Pacifique. On ne dispose pas d’informations sur la biologie reproductive de cette espèce dans le Pacifique est pour assister la pêche ou la préservation. Un total de 295 individus ont été examinés: 179 femelles, de 88 à 316 cm de LT, et 116 mâles, de 142 à 260 cm de LT. Le sex ratio des femelles par rapport aux mâles était de 1:0,6. L’augmentation du diamètre de l’œuf ovarien et de la glande de l’oviducte, ainsi que la présence d’œufs utérins ou d’embryons en développement ont indiqué que la maturité de la femelle se produisait à environ 180 cm de LT; d’autre part, le développement de ptérygopode et la présence de paquets de sperme montrent que les mâles sont mûrs à près de 182 cm de LT. Le stockage de courte durée de sperme trouvé chez des femelles pourrait être un avantage pour des...
The silky shark, *Carcharhinus falciformis*, is a cosmopolitan species found throughout tropical and subtropical waters. In the eastern Pacific it ranges from southern Baja California to Peru. It is an abundant offshore oceanic and epipelagic tropical shark. It occasionally occurs inshore where the water is as shallow as 18 m; in the open ocean it occurs from the surface down to at least 500 m depth. Water temperatures of 23° to 24° C have been recorded where it occurs (Compagno 1984).

In the eastern Pacific Ocean the silky shark is captured by longline and occasionally with gillnets (Castro 1996). Males were considered mature when claspers were completely calcified and the rhiphiodon could be spread open (Springer 1960; Clark & von Schmidt 1965). Females were considered mature when they had at least one of the following characteristics: gravidity, ripe ovarian eggs, oviducal gland width over 20 mm in diameter, or a well-developed uterus. Most of the time checking for uterine scars in the uterus was undertaken for most of the females, to avoid taking into account
aborted females; sometimes fishermen allowed us to take samples just while they are preparing the sharks for transportation, so in a few cases it was impossible to be sure of the presence of these scars. Additionally, maturity was corroborated in males by the presence of sperm clumps in the seminal vesicle (Pratt & Tanaka 1994); whereas in females it was corroborated by the presence of sperm in the oviducal gland. The reproductive system was removed and fixed in buffered 10% formalin. Sections 5-6 µm thick were prepared using the conventional histological process with haematoxylin-eosin stain (Castro & Wourms 1993) to analyze the gonads under the microscope.

RESULTS

Seasonal abundance, sex ratio and size
Silky sharks are seasonal in commercial catches of the west coast of Baja California Sur from June to November (summer and autumn), with a maximum frequency in September. A total of 179 females and 116 males were examined. The sex ratio was 1F:0.6M. The range in total length for females was 88-316 cm (average 180 cm TL), and for males the range was 142-260 cm TL (average 182 cm TL). Specimens 176 to 225 cm TL comprised 76% of the total captures.

Morphological and histological analysis: males
The testes in the silky shark are almost totally surrounded by the epigonal organ except in the distal region. They are paired, elongated and dorsoventrally flattened organs (Fig. 2), which are attached to the dorsal wall of the abdominal cavity by a mesorchium. Depending on the size of the adult, the testes range from 17 to 33.5 cm in length. Seminiferous follicle development spreads from a germinal zone across the diameter of the testicles to the opposite wall, where the efferent ductules form a manifold collection system to receive spermatozoa (Fig. 3). The efferent ductules continue in a series of fine tubules and communicate with the head of the epididymis.

The epididymides are convoluted, unpigmented and digitiform (Fig. 2). In adults, each epididymis

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Fig. 1. Location of the fishing camps Punta Belcher and Punta Lobos in the west coast of Baja California Sur, Mexico.
is approximately 25 cm long and 2 cm wide. The tubules of this organ are divided in two types: Leydig glands and epididymis tubules. The epithelium of the Leydig gland has two kinds of cells: ciliated and secretory (Fig. 4a). The epididymis tubule has a pseudostratified columnar epithelium with cilia and individual spermatozoa scattered in the lumen (Fig. 4b). In addition to sperm, three types of particulate matter occur in the lumen of the ducts: Sertoli cell bodies, Sertoli cytoplasts, and Leydig gland bodies. The role of these components in sperm aggregation or maintenance is unknown (Hamlett 1999). Towards the terminal end of the epididymis the ductus deferens are formed (Fig. 2). In C. falciformis, organized masses of naked sperm bound with a cohesive matrix forming ovoid to sub-spherical masses were found in the seminal vesicle (Fig. 2). These ovoid sperm aggregates (96 to 310 µm) were found as a single layer of radially aligned sperm clumps organized around a core of eosinophilic material (Fig. 5) known as single layer spermatozeugmata (Pratt & Tanaka 1994).

**Morphological and histological analysis: females**

In C. falciformis, only the right ovary is functional, as in most carcharhinids (Pratt 1988). It is located at the distal surface of the epigonal organ, at the forward end of the abdominal cavity (Fig. 6), and attaches to the dorsal wall of the abdominal cavity by a mesovarium. The ovary in adults ranged from 9 to 25 cm long and from 2.6 cm to 9.6 cm wide. Ovulating females carried 8-11 oocytes 30-35 mm in diameter. The silky shark ovary contained corpora atretica in various stages of development. In 86 ovaries, we found these structures to range from 4-34 mm in diameter. Post-ovulatory follicles (corpora lutea) from 6 to 33 mm were found in the ovaries of pregnant females. The relative development of the corpora lutea and corpora atretica and their function remains unknown (Dodd 1983). The paired oviducts are slender segments, which emerge from the peritoneal cavity by an ostium in the falciform ligament (Fig. 6). The upper portion of each oviduct is narrow and short, and leads into the oviducal gland. This gland is heart-shaped, from 13 to 50 mm in diameter. Externally, each gland resembles a symmetrical white organ with two horns on the lateral anterior surface (Fig. 6). Sperm storage was found in only one of 50 glands of analyzed mature females. The spermatozoa were located in the thin-walled tubules of the oviducal gland around the curves of the lumen. The tubules are formed by two different types of cells, secretory and ciliated. The sperm was loosely packed in tubules with well-stained heads up current (Fig. 7).
The uterus is divided in two parts, one of which is designated as the third membrane store chamber. In the oviducal gland, the fertilized egg is enclosed in a membrane; it then passes through the third membrane store chamber and enters the uterus. The third membrane remains around the embryo until it reaches birth size. The uterus size increases with the size of the developing embryo. In females with uterine eggs, the uterus is 20-22 cm long; in females with small embryos (6-8 cm TL), the uterus is 33-34 cm long; and in term females (80 cm embryos), the uterus reaches almost 50 cm long and a width of about 15 cm.

**Size at maturity**

**Males:** Development of the testis is gradual; at about 180 cm TL it can reach a length of 25 cm (Fig. 8). Sharks with uncalcified claspers had testes in early stages of spermatogenesis and a small amount of sperm present in the lower epididymis. The claspers begin to elongate at about 160 cm TL and become calcified at 179 cm TL. All specimens larger than 181 cm TL were mature, with sperm aggregates present in the seminal vesicle (Fig. 9). The size at maturity L₅₀ (with 95% CI) in males occurred at 182 (180-182) cm TL.

**Females:** The size of the oviducal gland started to increase when females reached 180 cm TL (Fig. 10). In juveniles under 170 cm TL the gland measured 5-10 mm in width; whereas in females 180 cm TL it measured 20-40 mm in width. Immature females had undeveloped oocytes 6-10 mm in maximum diameter. The oocytes did not start growing until the females reached 180 cm TL (Fig. 11). The size at maturity L₅₀ (with 95% CI) in females occurred at 180 (179-180) cm TL. Larger females were also seen to be carrying ripe oocytes 20-43 mm in diameter. The presence of ovulatory females with mating bites on their bodies or with sperm in their uteri was very sporadic. Only two recently inseminated females were caught during our study, on 31 August 2001 and 31 July 2002. One of them had oocytes 32 mm in diameter.
Another female caught on 24 November 2000 bore mating scars and oocytes 35 mm in diameter. In our sample of 20 gravid females, the average number of embryos per female was five, with a range of 2-9 embryos. Ovulating females with uterine eggs and embryos 6-8 cm TL were observed in July and September, whereas embryos 20-30 cm TL were found from September to November. Only one female with full term embryos (80 cm) was captured at the end of June.

**DISCUSSION**

*Carcharhinus falciformis* begins its northward migration in June. The schools stay off the west coast of Baja California Sur from June to October, arriving off Punta Belcher and Punta Lobos in August, although most of the adults arrive in September and October (Fig. 12). The timing of the *C. falciformis* captures was consistent with changes in the surface water temperature. Gómez & Vélez (1982) recorded that the water temperature of the California current increases to 20°C to 25°C in summer. *Carcharhinus falciformis* leave the west coast of Baja California Sur in early fall and migrate southward when the sea surface water temperature decreases below 20°C. It is known that the increase in water temperature influences the migrations of other carcharhinids such as *C. isodon* and *C. limbatus* off the east coast of the U.S.A. (Castro 1993, 1996). Most of the *C. falciformis* examined along the west coast of Baja California Sur were large specimens (176-225 cm TL). Cadena (2001) found similar sized sharks (170-220 cm TL) in the Gulf of California. Juveniles of *C. falciformis* have been recorded in coastal waters of south-west Mexico. Chong-Robles (2003) found gravid females carrying term embryos and neonates (50-83 cm TL) in March and May off the Oaxaca, Mexico, coast; whereas Ronquillo (1999) found gravid females in Chiapas, Mexico, during June. It appears that *C. falciformis* use the coastal waters of south-west Mexico as nursery grounds and migrate to the north in the summer to feed and possibly to copulate. Villatorio & Rivera (1994) reported a 1F:1M sex ratio. Del Rosario (1998) and Ronquillo (1999) reported the same ratio for Guatemala and Chiapas respectively. Bonfil et al. (1993) suggested a 1F:1M ratio for *C. falciformis* in nature. Their results differ from our findings (1F:0.6M), although those studies correspond to annual samplings and the presence of *C. falciformis* off the western coast of Baja California Sur is seasonal, occurring from July to October.

Maturation in males is reached at about 182 cm TL and it involves the gradual development of the testes, the calcification of the claspers and the presence of sperm aggregates in the seminal vesicle. The testes development (diametric) and spermatogenesis in *C. falciformis* are similar to those found in the catshark *Scyliorhinus canicula* (Dodd 1983). According to Hamlett (1999), in all elasmobranchs thus far examined the fundamental details of seminiferous follicle development and spermatogenesis are similar. The sperm clumps found in *C. falci-
Fig. 8. **Total length versus testes length.**

Fig. 9. **Total length versus clasper length and degree of calcification.** The cross corresponds to the males with fully calcified claspers and spermatozeugmata in the seminal vesicle.
Reproductive Biology of the Silky Shark *Carcharhinus falciformis* (Chondrichthyes: Carcharhinidae) off the west coast of Baja California Sur, Mexico

**Fig. 10.** Total length versus oviducal gland length.

**Fig. 11.** Total length versus egg diameter.
formis (single layered spermatozeugmata), have been found in other carcharhinids like the black tip shark Carcharhinus limbatus and the sandbar shark Carcharhinus plumbeus (Pratt & Tanaka 1994). We confirmed that the presence of sperm aggregates is a more reliable indicator of maturity than clasper condition because the presence of sperm aggregates ensures that if the shark copulates there is a better probability of fecundation. We acknowledge that the use of the clasper calcification criterion instead of the presence of sperm aggregates is more practical and economical (but the sperm aggregation method is more accurate by far).

Maturation in females is reached at about 180 cm TL and is marked by the growth of the oviducal gland, enlargement of the uteri and the ripening of the oocytes. This size at maturity corresponds with the sizes recorded for C. falciformis in the Mexican Pacific and Guatemala (Del Rosario 1998; Ronquillo 1999; Cadena 2001). Although C. falciformis is considered a circumtropical species (Castro 1983), the size at maturity is different in different areas (Table I). Fourmanoir (1961) found for Madagascar that males mature at about 240 cm TL and females at about 248-269 cm TL. At Aldabra Atoll, Indian Ocean, Stevens (1984) found that males mature at about 239 cm TL and females at about 216 cm TL. In the Pacific Ocean, Strasburg (1958) recorded 12 pregnant females of 213-236 cm TL and Stevens (1984) recorded mature males at 214 cm TL and females at 202-208 cm TL for the Tasman Sea. A possible explanation in relation to differences in the maturity size is that individuals from the eastern Pacific Ocean are smaller than those from the Indian Ocean. This has been recorded for other carcharhinids like the black tip shark, C. limbatus. Castro (1996) stated that C. limbatus in the western North Atlantic differs significantly in numerous traits such as size, markings, age at maturity, brood size and other characters from the Pacific specimens.

We observed the absence of a defined seasonality for C. falciformis reproduction off the west coast of Baja California Sur. The sperm found inside one oviducal gland belonged to a pregnant female with intrauterine eggs. The arrangement of the sperm inside the tubules coincides with the “short-term sperm storage” classification defined by Pratt (1993) and is found in sharks in which ovulation is prolonged over several weeks. Sperm storage is an advantage for species that presents sexual segregation and lives in open waters, increasing the efficiency in reproduction. Strasburg (1958) stated that the brood size of C. falciformis was two to eleven embryos. Gilbert & Schlenitzauer (1966) report one female with nine embryos in the Atlantic Ocean. Cadena (2001) gave a range of 1-12 young for specimens seen off the Gulf of California. In the 20 gravid females recorded in our study, the average number of embryos per female was five, with a range of 2-9 embryos. Unfortunately characteristics such as low fecundity and a late age of sexual maturation, leave species like C. falciformis vulnerable to overexploitation.

**Table I.** Size at maturity of silky shark Carcharhinus falciformis in different parts of the world.

<table>
<thead>
<tr>
<th>Author and year</th>
<th>Region</th>
<th>Size at maturity TL (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strasburg (1958)</td>
<td>Central Pacific M adagascar</td>
<td>♀213-216</td>
</tr>
<tr>
<td>Fourmanoir (1961)</td>
<td>INDIAN OCEAN Aldabra Atoll</td>
<td>♀248-269 ♀240</td>
</tr>
<tr>
<td>Stevens (1984)</td>
<td>South Pacific Tasman Sea</td>
<td>♀216 ♀239</td>
</tr>
<tr>
<td>Stevens (1984)</td>
<td>EAST PACIFIC Campeche Bank</td>
<td>♀202-208 ♀214</td>
</tr>
<tr>
<td>Ronquillo (1999)</td>
<td>Gulf of Tehuantepec, Mexico</td>
<td>♀176 ♀178</td>
</tr>
<tr>
<td>Caden (2001)</td>
<td>Gulf of California, Mexico</td>
<td>♀180 ♀180</td>
</tr>
<tr>
<td>Present study</td>
<td>West Coast of Baja California, Mexico</td>
<td>♀180 ♀182</td>
</tr>
</tbody>
</table>

**Fig. 12.** Silky shark, caught by artisanal fishermen, Punta Lobos, Baja California Sur, México. Photo by M. Carrera.
ACKNOWLEDGEMENTS

We would like to thank the Instituto Politécnico Nacional (SIP) for funding the project “Trophic ecology of sharks and mantas in the lower Gulf of California”; the fishermen of Punta Belcher, Punta Lobos and Las Barrancas for their help during sampling; and the Fish Ecology and Invertebrates Laboratories from CICIMAR, B.P.C.V. and F.G.M., received grants from SIBE (COFAA), EDI (IPN), and SNI-CONACYT.

REFERENCES


A new species of *Odontanthias* Bleeker (*Perciformes: Serranidae: Anthiinae*) from Mona Passage off Puerto Rico, the first record of the genus from the Atlantic Ocean

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Received: 21 April 2011 - Accepted: 27 August 2011

Abstract

*Odontanthias hensleyi*, a new species of anthiine serranid fish, is described from four specimens collected off the west coast of Puerto Rico in Mona Passage. This is the first Atlantic record for the genus *Odontanthias*, heretofore known from 13 Indo-Pacific species. The new species is distinguished from all other species of *Odontanthias* by the following combination of characters: 15 soft rays in the dorsal fin, 18 pectoral fin rays, vomerine tooth patch subquadrangular to diamond-shaped without posterior prolongation, pelvic fin and caudal fin lobes very well produced, and coloration (side of head with two bright yellow stripes; pelvic, anal and caudal fins bright yellow).

Zusammenfassung


Resumen

Se describe una nueva especie de pez ánthido: *Odontanthias hensleyi* (Perciformes: Serranidae, Anthiinae), a partir de cuatro especímenes recolectados en el Canal de La Mona, al oeste de Puerto Rico. Se conocen trece especies del Género *Odontanthias* para la región Indo-Pacífica, pero éste es el primer reporte de la presencia de una especie de dicho Género en el Océano Atlántico. La nueva especie se distingue por las siguientes características: quince rayos blandos en la aleta dorsal, dieciocho rayos en las aletas pectorales, el parcho del diente vomerino de forma subcuadrangular o de diamante y sin una prolongación posterior, los lóbulos de las aletas pélvica y caudal pronunciados y una coloración particular (franjas brillantes amarillas a ambos lados de la cabeza y las aletas pélvica, anal y caudal del mismo amarillo).

Résumé

*Odontanthias hensleyi*, une nouvelle espèce de Serraniidé, est décrit sur base de quatre spécimens collectés au large de la côte ouest de Porto Rico, dans le canal de la M na. C'est la première mention atlantique du genre *Odontanthias*, connu jusqu’ici par 13 espèces de l'Indo-Pacifique. La nouvelle espèce se distingue de toutes les autres espèces d’*Odontanthias* par la combinaison des caractéristiques suivantes : 15 rayons mous dans la dorsale, 18 rayons dans la pectorale, une zone de dents du vomer subcuadrangulaire à diamantiforme, sans prolongement postérieur, des lóbulos de pélvienne et de caudale très allongés et la coloration (le côté de la tête avec deux lignes jaune clair, pelviennes, anale et caudale jaune clair).

Sommario

*Odontanthias hensleyi* è una nuova specie di castagnola descritta sulla base di quattro esemplari presi al largo della costa occidentale di Puerto Rico in M ona Passage. Si tratta della prima specie del genere *Odontanthias* dell’Atlantico; infatti, questo genere era noto finora per 13 specie tutte dell’Indo-Pacifico. La nuova specie si distingue da tutte le altre del genere *Odontanthias* per la seguente combinazione...
INTRODUCTION

Randall & Heemstra (2006) reviewed the anthine serranid genus *Odontanthias* Bleeker, 1873, considering it to include 13 Indo-Pacific species, two of which were new to science, and described a new anthine genus, *Meganthias*. They (2006: 2) noted that: “The generic classification of the fishes of the Anthiidae has been very confused, and this is certainly true for *Odontanthias* and related genera.” Based on morphology the genera most closely related to *Odontanthias* would appear to be *Holanthias* (with which it has been frequently synonymized) and *Meganthias*. Randall & Heemstra (2006: 4) distinguished *Odontanthias* from *Holanthias* on the basis of the shape of the caudal fin (“deeply emarginate with rounded lobes to lunate” in *Odontanthias* vs. “near-truncate to rounded or rhomboid... with a long slender lobe in the ventral part of the fin of one of the species” in *Holanthias*) and the absence of accessory scales on the body scales of species of *Odontanthias* (although present “on the head and nape of a few species”) vs. “numerous accessory scales on the body scales of *Holanthias*.”

In the diagnosis presented in the original description of *Meganthias*, Randall & Heemstra (2006) wrote that their new genus had the characters of *Odontanthias* except for a number of morphological differences, the most important of which would seem to be anal soft rays 8 or 9 and the presence of accessory scales (“dense on head and nape,” Randall & Heemstra 2006: 27) in *Meganthias* vs. anal soft rays 7 or 8 (usually 7) and the absence of accessory scales on the body (“but may be present on head and nape of some species,” p. 4) in *Odontanthias*.

The new species becomes the fourteenth species of *Odontanthias* to be described, represents the first record of the genus from the Atlantic Ocean and is the twenty-third anthine species recorded from the Atlantic Ocean.

METHODS AND ABBREVIATIONS

Methods are those of Anderson & Heemstra (1980), as modified by Anderson et al. (1990) and Anderson & Baldwin (2000). Abbreviations include: SL (standard length), UPRM (University of Puerto Rico, Mayagüez) and USNM (National Museum of Natural History, Smithsonian Institution, Washington, D.C.).
examined only by radiography, the values are those of the holotype).

Dorsal fin rays X, 15. Anal fin rays III, 7. Pectoral fin rays 18. Pelvic fin rays I, 5. Caudal fin rays: principal 15 (8 + 7); branched 13 (7 + 6); procurrent 8 dorsally, 8 ventrally. Branchiostegal rays 7. Gill rakers on first arch 13* or 14 + 28 to 30 (29*) (total 42* or 43). Tubed lateral line scales 33* to 38 (35*). Rows of cheek scales ca. 7* or 8. Rows of scales between lateral line and mid-base of spinous dorsal fin 1.5* or 2. Scales between dorsal fin origin and lateral line 12* to 14. Circumpeduncular scales 16* to 18. Vertebrae 26 (10 precaudal + 16 caudal). First caudal vertebra without parapophyses. Formula for configuration of supranormal bones, anterior neural spines and anterior dorsal pterygiophores 0/0/2/1 + 1/1/ (using notation of Ahlstrom et al. 1976). Pleural ribs 8, on vertebrae 3 through 10. Epineurals associated with first 11 vertebrae. No trisegmental pterygiophores associated with dorsal or anal fins. No spur on posteriormost ventral procurrent caudal-fin ray (see Johnson 1975); penultimate ventral procurrent

<table>
<thead>
<tr>
<th>Character</th>
<th>Holotype</th>
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<th>Para II</th>
<th>Para III</th>
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<td>157</td>
<td>159</td>
<td>162</td>
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<td>35.4</td>
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<td>63.7</td>
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<td>Dorsal fin, base length</td>
<td>58.9</td>
<td>57.5</td>
<td>60.1</td>
<td>56.1</td>
</tr>
<tr>
<td>Anal fin, base length</td>
<td>18.1</td>
<td>16.3</td>
<td>18.5</td>
<td>16.6</td>
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<tr>
<td>Anal fin, length</td>
<td>37.5</td>
<td>34.9</td>
<td>37.7</td>
<td>33.7</td>
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<tr>
<td>Pectoral fin, length</td>
<td>40.4</td>
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<td>36.1</td>
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<td>79.9</td>
<td>67.8</td>
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<td>ca. 60.7</td>
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<td>17.9</td>
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<td>76.9</td>
<td>&gt;73.4</td>
<td>Dam.</td>
</tr>
<tr>
<td>Lower caudal lobe</td>
<td>84.5</td>
<td>Dam.</td>
<td>&gt;75.3</td>
<td>&gt;65.8</td>
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<td>1st dorsal spine</td>
<td>5.9</td>
<td>6.8</td>
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<td>2nd dorsal spine</td>
<td>9.7</td>
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<td>9.7</td>
<td>8.0</td>
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<tr>
<td>3rd dorsal spine</td>
<td>11.5</td>
<td>10.5</td>
<td>10.7</td>
<td>10.1</td>
</tr>
<tr>
<td>4th dorsal spine</td>
<td>13.6</td>
<td>12.8</td>
<td>11.9</td>
<td>10.9</td>
</tr>
<tr>
<td>Longest dorsal spine</td>
<td>10th-14.0</td>
<td>9th-13.9</td>
<td>5th-12.2</td>
<td>4th-10.9</td>
</tr>
<tr>
<td>1st dorsal soft ray</td>
<td>16.5</td>
<td>15.5</td>
<td>15.5</td>
<td>14.7</td>
</tr>
<tr>
<td>Last dorsal soft ray</td>
<td>14.2</td>
<td>14.1</td>
<td>&gt;12.3</td>
<td>14.1</td>
</tr>
<tr>
<td>Longest dorsal soft ray</td>
<td>10th-28.4</td>
<td>9th-28.6</td>
<td>10th-27.0</td>
<td>10th-25.0</td>
</tr>
<tr>
<td>1st anal spine</td>
<td>7.1</td>
<td>6.1</td>
<td>Dam.</td>
<td>5.4</td>
</tr>
<tr>
<td>2nd anal spine</td>
<td>13.0</td>
<td>12.5</td>
<td>11.6</td>
<td>10.8</td>
</tr>
<tr>
<td>3rd anal spine</td>
<td>13.5</td>
<td>14.4</td>
<td>Dam.</td>
<td>11.5</td>
</tr>
<tr>
<td>Longest anal soft ray</td>
<td>4th-25.9</td>
<td>4th-22.6</td>
<td>4th-21.3</td>
<td>4th-21.5</td>
</tr>
</tbody>
</table>

Table I. Morphometric data for Odontanthias hensleyi n. sp. Holotype USNM 400888; Para I = Paratype, UPRM 3809; Para II = Paratype, UPRM 3794; Para III = Paratype, UPRM 3793. Standard lengths in mm, other measurements in percentages of standard length. Dam. = damaged; > = slightly damaged.

Mouth terminal, oblique; premaxillae protrusile; lower jaw usually exceeding upper jaw slightly with mouth closed. Supramaxilla apparently present (due to dense squamation on upper jaw, presence difficult to determine with certainty). Labial border of maxilla with or without hook (see Anderson et al. 1990: 926, fig. 2); holotype: right maxilla with very short hook, left without hook; on one paratype (UPRM 3793), hook absent but maxilla widened on both sides at point where hook would occur; on second paratype (UPRM 3794) hook present on left side, shelf and short anterior projection from shelf present on right side; on third paratype (UPRM 3809) hook present on each side. Posterior border of maxilla truncate; maxilla reaching posteriorly to vertical through posterior border of pupil to as far as vertical through posterior border of orbit. Anterior and posterior nares close to eye and to each other, internarial distance 7 to 13 times in snout length; anterior nares in short tube, posterior border of tube not reaching posterior nares when reflected; posterior nares oval, much larger than anterior nares, with long axis of oval running dorsoventrally. Interorbital space convex. No fleshy papillae on border of orbit. Preopercle without anroorse spines on horizontal limb; horizontal limb with one to a few serrae or with irregular border; vertical limb with numerous small serrae; region of angle with larger serrae, or with roughened border. Distal margins of interopercle and subopercle smooth, or with few small serrae near their junction or in places somewhat roughened. Premaxilla with series of conical teeth laterally and band of villiform teeth medially; at anterior end of jaw one or two canine(s) adjacent to patch of very small teeth; symphysis edentate. Dentary with 1 to 3 recurved canine(s) about one-fourth to one-third way back from anterior end of jaw; anterior to recurved canine(s) patch or band of villiform to very small conical teeth; posterior to recurved canine(s) series or band of small conical teeth extending along jaw; exserted canine at anterior end of jaw; symphysis edentate. Vomer, palatines, endopterygoids and tongue with small teeth; vomerine tooth patch subquadrangular to diamond shaped, without posterior prolongation; palatine and endopterygoid teeth in longitudinal patches (endopterygoid teeth not seen on two of paratypes, UPRM 3793 & 3809).

Lateral line complete, anteriorly ascending above pectoral fin base to run parallel to dorsal body contour a few scale rows ventral to base of dorsal fin, then descending precipitously ventral to posterior end of soft dorsal fin to run posteriorly near middle of caudal peduncle and terminating at distal end of hypurals. Tubes in lateral line scales mostly simple, a few scales on holotype and one of paratypes (UPRM 3809) with distally branched tubes. Scales ctenoid with only marginal cteni, i.e., no ctenial bases present proximal to marginal cteni (see Hughes 1981; this type of scale called peripheral ctenoid by Roberts 1993). No secondary squamation on body, but a few accessory scales present on head. Most of head, including dorsum of snout, interorbital region, maxilla and dentary covered with scales. Lips, lateral aspect of snout, lachrymal, gular region, branchiostegal and branchiostegal membranes without scales. Spinous dorsal fin without scales; soft dorsal and anal fins with scales basally and with columns of scales on some interradial membranes; pectoral and pelvic fins scaly basally and for some distance out onto fins; most of caudal fin heavily covered with scales. Pelvic axillary scales poorly developed or absent; scales in ventral midline between pelvic fin bases (interpelvic process) well developed.

Dorsal and anal spines without long filaments. Anal fin truncate posteriorly; second anal spine more robust than first or third. Pectoral fin nearly symmetrical, middle rays longest, reaching posteriorly to vertical through middle of base of soft dorsal fin; dorsalmost pectoral fin ray unbranched, other pectoral-fin rays branched. Pelvic fin inserted beneath pectoral fin base; first three pelvic-fin soft rays produced, second longest, reaching past base of anal fin to well past base of caudal fin. Caudal fin lunate with very long filamentous lobes; upper lobe 2.1 to 2.4 times as long as head, lower lobe 1.9 to 2.3 times as long as head.

Coloration: Description based on color photographs of holotype (except where noted) (Fig. 1). Head mostly reddish orange dorsally and laterally, yellowish ventrally (one paratype mainly red anterior to orbit, mostly violet posterior to orbit, mostly white ventrally). Head with two wavy bright yellow stripes; dorsal stripe running from near midorbit to posterior margin of opercle, ventral stripe extending from below anterior part of orbit (from near anterior end of snout in paratype) to base of pectoral fin; short yellow band on upper jaw near its anterior end. Iris of eye with bright yel-
low circle of pigment surrounding pupil; peripheral to yellow, circle of red, then semicircle of dull purple, then semicircle of red (paratype similar but with semicircle of bright blue anteriorly). Dorsally body mostly reddish orange with numerous yellow blotches; laterally alternating horizontal silvery and reddish orange (or yellowish) lines ventral to lateral line; ventrally pale; caudal peduncle mostly yellow. Dorsal fin yellow green suffused with red (red anteriorly, blue posteriorly on paratype); pectoral fin dull orange (not seen clearly on paratype); pelvic, anal and caudal fins bright yellow.

**Comparisons:** Based on data and illustrations provided by Randall & Heemstra (2006), O. hensleyi differs from all but two of the described species of Odontanthias in having 15 soft rays in the dorsal fin, whereas six described species have 14 or fewer, and five have 16 or more. It differs from the other two described species of the genus in having 18 pectoral fin rays, whereas those two have 17 or fewer. Also, it differs from most other Odontanthias in having the vomerine teeth in a subquadrangular to diamond-shaped patch without a posterior prolongation, in contrast to a variety of shapes in those other species (see Randall & Heemstra 2006: 8, fig. 1). In addition O. hensleyi can be distinguished from other Odontanthias by the following combination of characters: pelvic fin reaching past base of anal fin to well past base of caudal fin; upper and lower lobes of caudal fin produced into long filaments; head with two bright yellow stripes on side; and pelvic, anal and caudal fins bright yellow (compare Fig. 1, herein, with figs 4 & 5 and plates I-VI in Randall & Heemstra 2006).

**Sexuality:** Histological examination of gonadal tissue shows the holotype of O. hensleyi to be a male. Where investigated histologically and/or behaviorally many species of anthiines have been found to be protogynous. Consequently, it would not be surprising to learn that this species is protogynous.

**Distribution:** All four specimens of O. hensleyi were collected in Mona Passage, the strait between Puerto Rico and the Dominican Republic leading from the open Atlantic to the Caribbean Sea.

**Remarks:** Due to the unsettled state of the higher classification of teleosts, we have taken a conservative approach and retained the Serranidae in the Order Perciformes, but acknowledge the fact that not all ichthyologists would agree with that assignment. For example, Wiley & Johnson (2010), using morphological synapomorphies, proposed a Linnaean classification of teleosts based on monophyletic groups, placing the Serranidae in the Order Scorpaeniformes, Suborder Serranoidae.

Mona Passage is the only known locality for another relatively recently described fish species. Symphysanodon mona was described from a single specimen collected by the R/V Oregon in October 1959, at 18°13′ N, 67°20′ W, in 384 meters (Anderson & Springer 2005). The apparent restricted distributions of these two species are probably collecting artifacts.

**Etymology:** The specific epithet hensleyi is for Dannie A. Hensley, formerly an ichthyologist at the University of Puerto Rico, Mayagüez (Ballantine et al. 2008 and Courtenay et al. 2011 provided obituaries for Hensley, 1944-2008). The common name Euripos Jewelfish is derived from a Greek word meaning “canal, channel, ditch, or strait” in allusion to the type locality, Mona Passage, and the fact that the new species like most anthiine fishes is a jewel to behold.

**ADDENDUM**

While the manuscript for this paper was in press, the description of another new species of Odontanthias was published. White (2011) described Odontanthias randalli from 11 specimens obtained from a fish market in eastern Lombok, Indonesia. White’s new species can be distinguished from O. hensleyi by the following (data for O. randalli precede those for O. hensleyi): soft rays in the dorsal fin 16 or 17 vs. 15; pectoral-fin rays 15 or 16 vs. 18; vomerine tooth patch arrowhead shaped vs. subquadrangular to diamond shaped without posterior prolongation; pelvic, anal and caudal fins variously colored vs. bright yellow. With the additions of O. hensleyi and O. randalli, the number of described species in the genus Odontanthias becomes 15.

**ACKNOWLEDGEMENTS**

Captain Eugenio Piñeiro Soler and Miguel A. Vargas collected the specimens of the new species, while fishing commercially for Etelis oculatus (Queen Snapper) off Rincón on the west coast of Puerto Rico. Matthew T. Craig sent all of the known specimens of the new species to the first author. Denise E. DeVore photographed the holotype and one of the paratypes; Antony S. H arold produced the radiograph studied; William A. Roumillat examined and interpreted histological sections of gonadal tissue; and Phillip C. Heemstra...
and G. David Johnson commented on a presub-
mission draft of the manuscript. This is Contribu-
tion Number 369 of the Grice Marine Biological
Laboratory, College of Charleston.

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**Abstract**

This paper introduces the ecological and biological characteristics of the Inconnu (Stenodus leucichthys leucichthys). This is a Caspian Sea endemic species of the family Salmonidae, listed as Extinct in the Wild in IUCN's Red Data Book due to restricted access to spawning grounds, dam construction, illegal fishing, and environmental pollution. This valuable species has considerable ecological and economical importance for the region, but there are little data for the Caspian Sea populations. We discuss its distribution, ecological and reproductive characteristics, and the causes of its extinction in the Caspian Sea.

**Zusammenfassung**

In dieser Arbeit werden die ökologischen und biologischen Merkmale des Weißlachses („Inconnu“) Stenodus leucichthys leucichthys einführend behandelt. Es handelt sich um eine endemische Art des Kaspischen Meeres aus der Familie der Lachsische (Salmonidae), die in der Roten Liste des IUCN als „ausgestorben“ geführt wird; als Gründe werden Einschränkung der Lachgründe, Staudammnassen, illegale Befischung und Umweltverschmutzung genannt. Die wertvolle Art hat erhebliche ökologische und ökonomische Bedeutung für die Region, aber es gibt wenige Daten über die Populationen des Kaspischen Meeres. Wir diskutieren die Verbreitung, die ökologischen und fortpflanzungsbiologischen Kennzeichen sowie die Gründe für die Ausrottung im Kaspischen Meer.

**Résumé**

Cet article propose les caractéristiques écologiques et biologiques du Stenodus (Stenodus leucichthys leucichthys). Il s'agit d'une espèce endémique de la Caspienne, de la famille de Salmonidae, répertoriée comme étiénte dans la nature selon l'IUCN's Red Data Book, à cause de l'accès malaisé aux frayères, à la construction d'un barrage, à la pêche illégale et à la pollution de l'environnement. Cette espèce a une importance considérable sur le plan écologique et économical dans la région, mais il y a peu de données concernant les populations de la mer Caspienne. Nous traitons de sa distribution, de ses caractéristiques écologiques et reproduktives et des causes de son extinction en mer Caspienne.

**Sommario**

Questo articolo presenta le caratteristiche ecologiche e biologiche del salmone bianco noto anche come "Inconnu" (Stenodus leucichthys leucichthys). Si tratta di una specie endemica del Mar Caspio appartenente alla famiglia Salmonidae e elencata come “Estinta in natura” dallo IUCN Red Data Book a causa delle limitazioni degli spazi riproduttivi, della costruzione di dighe, della pesca illegale e dell’inquinamento ambientale. Questa specie ha un’importanza considerevole per la regione dal punto di vista ecologico ed economico, ma esistono pochi dati per le popolazioni del Mar Caspio. Se ne discutono la distribuzione, l’ecologia, la riproduzione e le cause dell’estinzione nel Mar Caspio.

**INTRODUCTION**

The Inconnu (Stenodus leucichthys leucichthys Güldenstädt) is the largest and fastest-growing member of the whitefish subfamily Coregoninae (Salmonidae). Two subspecies of Inconnu are recognized, with S. l. leucichthys isolated in the Caspian Sea drainage of western Asia, while S. l. nelma (Pallas) is found in the Arctic and sub-arctic regions of north-western North America and northern Eurasia (Stephenson et al. 2005). It is known by a range of common names: Inconnu (English), Belorbitsa (Russian), Mahi Ziba (Persian), Stenode Blanc (French), Salmon Blanco (Spanish) Ak balyk (Kazakh) and Azatmahy (Turkmenian).

Stenodus leucichthys leucichthys is the Caspian endemic subspecies and mainly occurs along the western and eastern coasts of the middle Caspian...
Sea at depths of 60-65 m (Berg 1948). Declining natural populations in the Caspian Sea due to heavy fishing pressure, increasing water pollution and habitat alteration and destruction have resulted in S. l. leucichthys being listed as “Extinct in the wild” (IUCN Red List 2010). Concerns about the decline of Stenodus l. leucichthys populations led Volga River hatcheries to carry out artificial reproduction and restocking in the Caspian Sea (Belyaeva & Milstein 1959). The Arctic subspecies, Stenodus leucichthys nelma, was introduced into the northern Volga River drainage and is now expanding, so may threaten surviving populations and cultivated stocks through hybridization (Freyhof & Kottelat 2008).

Despite the ecological and economic importance of this fish, very little is known about it in the Caspian Sea. Therefore, the aim of this study is to introduce and better understand the ecological and biological characteristics of this valuable species.

**Identification:** D II-VI (9-13), A II-IV 9-15, dorsal fin high and pointed, adipose fin present, pelvic fins with well developed axillary process, vertebrae 65-68, manubrium absent, with hook-shaped processes on the caputulm, anterior edge of hyomandibular round, only 19 to 26 gill rakers present on lower limb of first gill arch. Scales large, 99-120 in lateral line. Body fusiform and moderately slender, head relatively small, mouth large and terminal, lower jaw long, tip projecting, hind end reaching back behind eye, upper jaw reaching to level of pupil, teeth present on jaws, vomer, palatines and tongue. Pyloric caeca 191-193. Maximum length and weight 130 cm and 35 kg respectively; much larger individuals have been recorded. Sides of body silvery, belly silvery white without spots, dorsum usually green, blue or pale brown (Fig. 1). Sexual dimorphism develops during spawning period, when epithelial tubercles appear on head and side of body of males (Berg 1948; Shariaty 2001).

**Distribution:** Stenodus l. leucichthys is found only in rivers draining to the Caspian Sea, from which it mainly ascends the Volga, while very few fish ascend the Ural, and it is rarely found in the Terek. It is widely found along the western coast north of Makhach-kala and along the eastern coast (Mangyshlak). Its closest relative, Stenodus leucichthys nelma, penetrates into the Caspian Sea from the Arctic Ocean basin through the Post-Glacial ponded lakes which are situated between the basins of the Volga and the Kama, on the one hand, and of the Baltic Sea and the Arctic Ocean, on the other (Berg 1948). Stenodus l. leucichthys spends the warm season in the central and southern regions of the Caspian Sea (Kottelat & Freyhof 2007) mainly in Guilan and no record of this species has been reported from the Mazandaran and Golestan coasts (FAO 1991). Figure 2 shows the distribution of S. l. leucichthys in the Caspian Sea basin.

**Habitat and ecology:** Stenodus l. leucichthys is a pelagic species which inhabits open waters to the depth 65 m, and has not been found below 65 m (its optimum depths are 25-45 m). This fish is an oxyphilic species and prefers waters with temperature below 20°C. It is heterotrophic and an active

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**Fig. 1.** Stenodus leucichthys leucichthys from the southern part of the Caspian Sea; weight 4300 g; total length 75 cm. Photo by S. Poursaeid.
At 30 days after hatching, fingerlings begin to feed on invertebrates and larvae and small juveniles of other fishes. In the sea, adult *S. l. leucichthys* feeds mainly on small fish (clupeids, engraulids, juvenile cyprinids, atherinids, gobiids etc) (Podlesny 1947; Svetovidov 1984; Shariaty 2001). *Stenodus l. leucichthys* is amphidromous. However, amphidromy is not obligatory and non-amphidromous populations have been described in some locations (Petrova 1976). Mature adults migrate from sea to the delta of the Volga in the fall, winter and the early spring. Therefore, the species has two seasonal forms, spring and autumn, which are differentiated in time of entry to the Volga for spawning (Berg 1948). Adults migrate downward to the sea after spawning, but many of them die (Freyhof & Kottelat 2008). The alevins immediately descend to the sea after hatching.

**Reproduction:** The main spawning sites of *S. l. leucichthys* are located in the basin of the Kama, in the Ufa River, 3000 km upstream from the mouth of the Volga (Shariaty 2001). The secondary spawning grounds are situated in the Belaya between Ufa and Sterlitamak. The spawning season in the Ufa begins from the middle of October to the beginning of November. Males mature at +5 to +6 years while females reach maturity at the age of +6 to +7 years (Freyhof & Kottelat 2008). *Stenodus l. leucichthys* spawns twice during its life cycle with an interval of two years (Berg 1948). Its optimum temperature for reproduction is 0.1 to 6°C. Semi-adhesive eggs are deposited on the gravel and rock substrate (Kottelat & Freyhof 2007). The sex ratio of brooders in the natural spawning grounds is almost 1:1 as for the subspecies *Stenodus leucichthys nelma* (Brown 2000). The average fecundity is $250 \times 10^3$ eggs per individual (104.5-400$\times 10^3$). On average, about 26% of the total weight of each fish is egg weight (Berg 1948). Embryonic development takes about 180-200 days. Fry hatch from March up to the early May (mostly the second half of April). From the seventh day onward, fry begin to feed on plankton. The fry stage lasts around two months and then they develop into fingerlings (Berg 1948).

**Threats:** The sharp decline in their abundance due to the construction of dams, insufficient spawning areas, increasing illegal fishing, unstable hydrological conditions, river contamination and damage caused by other fish (especially kilka) and crustaceans has resulted in this species being listed as extinct in the wild (Letichevski 1983; IUCN 2010).
governments should be made in understanding the biology, ecology and behaviour for managing this valuable species. One key objective in working with endangered species is to increase the number of individuals of the species concerned by artificially/controlled reproduction in captivity. Unfortunately, there is no policy for preserving this species in the Caspian Sea from illegal fishermen by countries bordering the Sea and this should be done according to fishing methods, size of net mesh and time/place prohibition. Previously, the Russian federation enhanced the spawning areas in the lower parts of the Volgograd hydroelectric power station for increased efficiency of natural reproduction.

In connection with the present study, the negative influences of the modern environment needs to be studied (i.e. all possible causes of stress, environmental changes, destruction of spawning grounds) in order to better organize protection of this species and thus develop the necessary strategies for action. Findings from this preliminary data suggest that further research is needed for the future, including population genetics, artificial spawning, domestication for future aquaculture activities, natural behaviour during migration and spawning, as well as ionic balance and osmoregulation. The collective goal of this research should enhance the effectiveness of breeding programs, increase populations of remaining wild stock, and to improve our understanding of the biological knowledge of this species. Since stocks have declined, much effort is needed to rehabilitate the wild populations by all countries around the Caspian Sea.

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Abstract

Myrichthys paleracio new species is described from two specimens collected in shallow-water coral reefs from the Verde Passage, southern Luzon Island, Philippines. It differs from all known Myrichthys in its vivid brown-and-white coloration, its body elongation (body depth 43 times in total length) and its mean vertebral formula (3/77.5/183). A key to the species of Myrichthys is provided.

INTRODUCTION

The snake eels of the cosmopolitan genus Myrichthys were revised by McCosker & Rosenblatt (1993). They recognized nine valid species and 28 synonyms. We are unaware of subsequent publications that have either described additional species or changed the taxonomy of the taxa treated therein. We herein describe a tenth species from the Verde Passage, southern Luzon Island, Philippines. Two specimens of this vividly patterned snake eel were collected by Peri Paleracio, an avid naturalist, diver, and fish collector, and we are pleased to name it in his honor.

MATERIALS AND METHODS

Measurements are straight-line, made either with a 300 mm ruler with 0.5 mm gradations (for total length, trunk length, and tail length) and recorded to the nearest 0.5 mm, or with dial calipers (all other measurements) and recorded to the nearest 0.1 mm. Body length comprises head and trunk lengths. Head length is measured from the snout tip to the posterodorsal margin of the gill opening; trunk length is taken from the end of the head to mid-anus; and maximum body depth does not include the median fins. Head-pore terminology follows that of McCosker et al. (1989: 257), such that the supraorbital pores are expressed as the ethmoidal pore + pores in supraorbital canal, i.e., 1 + 3, and the infraorbital pores are expressed as pores along the upper jaw + those in vertical part of canal behind eye (the “postorbital pores”), i.e., 4 + 2, in that frequently the last pore included along the
upper jaw is part of the postorbital series. Vertebral counts (which include the hypural) were taken from radiographs. The mean vertebral formula (MVF) is expressed as the average of predorsal, preanal, and total vertebrae (Böhlke 1982). Institutional abbreviations follow the Standard Symbolic Codes for Institutional Research Collections in Herpetology and Ichthyology (Leviton et al. 1985).

**Myrichthys paleracio**, n. sp.
*Peri's snake eel (Figs 1-3)*

**Holotype:** CAS 233313, 311 mm, an immature male, Layag Layag, 13.688° N 120.841° E, Luzon Island, Batangas Province, Philippines, hand net, P. Paleracio, 15 May 2011.

**Paratype:** WAM 33154.001, 315+ mm (tail broken and healed), ripe female, Caban Island, 13°41.376’ N 120°50.374’ E), Verde Passage, Batangas Province, Philippines, mixed sand, rubble and coral, 33m, hand net, P. Paleracio, 12 June 2009.

**Diagnosis:** An elongate species of *Myrichthys* with depth 43 times and tail 1.8 in TL; pectoral fin minute, its length about twice in eye; numerous large brown spots on head and body; and total vertebrae 183, mean vertebral formula 3/77.5/183.

**Counts and measurements** (in mm) of the holotype (followed by those of the paratype in parentheses): Total length 311 (315+, damaged tail); head 23.7 (35.3); trunk 120.3 (186.7); tail 167 (?); predorsal distance 13.6 (23.6); pectoral fin length 1.2 (2.1); pectoral fin base 2.2 (4.4); body depth at gill openings ~7.2 (~16); body width at gill openings ~5.5 (~10.5); snout 4.2 (6.9); tip of snout to rictus of jaw 6.6 (10.5); tip of chin to rictus of jaw 5.0 (7.9); eye diameter 2.2 (3.9); interorbital distance 3.6 (6.6); gill opening height 2.1 (4.0); isthmus width ~3.8 (~7.0). Predorsal vertebrae 2 (4), preanal vertebrae 79 (76); total vertebrae 183. Ten lateral line pores in left branchial region; remainder small and difficult to discern.

**Description:** Body elongate, its depth at gill openings 43 in TL; head and trunk 2.16 and head 13.1 in TL; snout rounded, conical when viewed from above; lower jaw included, snout tip reaching base of anterior nostrils; eye large, 2.7-3.0 in upper jaw, its center well behind midpoint of upper jaw; anterior nostrils tubular, elongate, about twice in eye, with small lappet extending from each side; posterior nostrils in upper lip, not visible externally, beginning before eye and ending beneath middle of pupil; upper lip papillate, particularly between anterior and posterior nostrils; broad fleshy chevron dividing snout between anterior nostrils; dorsal fin origin on head, well in advance of gill opening, 1.5-1.7 in H L; pectoral fin minute, much shorter than its base, nearly twice in eye diameter.

**Teeth** granular, small and fixed, irregularly biserial in jaws and on vomer; small intermaxillary chevron anteriorly, followed by gap.

**Colour in life** (Figs 1-3) and in preservation: white to pale, overlain on head, trunk and tail with about 50 or more brown saddles, extending from base of dorsal fin to ventral edge of flank (many saddles incomplete, some irregular, and all wider than pale interspaces, meeting along ventral surface posterior to anus); snout, chin, and anterior nostrils markedly white; eye within brown mask, followed by two diagonal bands and several eye-sized brown spots; throat and anteroventral trunk region overlain with several eye-sized brown spots; pectoral fins pale; median fin margins pale, brown body saddles extending onto base of dorsal fins; tail tip pale.

**Remarks:** The new species differs from its congeners on the basis of its coloration, reduced pectoral fin and vertebral number. It is most closely related to the dark-spotted and banded Indo-Pacific species *M. maculosus* (Fig. 3) and *M. colubrinus* and differs from them in the distribution, number and size of its spots and in its vertebral number. *M. maculosus* (Fig. 3) and *M. colubrinus* also occur in shallow water within the Philippines Archipelago, however none were observed at the locations where *M. paleracio* was captured. Other individuals were seen but not collected from Layag Layag.

The paratype, although a larger specimen than the holotype, has had much of its tail bitten off and regrown (we calculate that it may have been
Fig. 1. *Myrichthys paleracio*, approximately 500 mm TL, underwater photograph, Caban Island, Verde Channel, Luzon, Philippines. Photo by G. R. Allen.

Fig. 2. *Myrichthys paleracio*, paratype, 315 mm TL (tail damaged), underwater photograph, Caban Island, Verde Channel, Luzon, Philippines. Photo by G. R. Allen.
Description of a new Snake Eel (Pisces: Ophichthidae: Myrichthys) from the Philippines

Fig. 3. Comparison of head coloration of Myrichthys (from top): M. paleracio. Two photos by G. R. Allen. M. maculosus. Photo by R. Steene at Miyake-jima, Japan. M. colubrinus. Photo by R. Myers at Fiji.
approximately 480mm in length). We have therefore selected the smaller but complete specimen to be the holotype.

**Key to the species of Myrichthys (modified from McCosker and Rosenblatt 1993)**

1a. Body coloration pale, overlain with 25-55 black or brown rings or saddles, separated by white or pale interspaces, encircling or partially encircling the body; body very elongate, its depth 43-70 times in total length. ........... 2

1b. Body coloration pale or dark, overlain with round spots which are either dark, pale, or dark diffuse spots with bright centers; anal and dorsal fin end about equally relative to tail tip; body moderately elongate, its depth 25-45 times in total length. ........................................ 3

2a. Anal fin ends about 2 head lengths before tail tip, well in advance of end of dorsal fin; body overlain with 25-35 black or brown rings or saddles, separated by white or pale interspaces which are equal to or wider than the darker rings; body extremely elongate, its depth 50-70 times in total length. ........................................ 4

2b. Anal fin ends less than a head length before tail tip, at the same level as the end of the dorsal fin; body overlain with 50-55 brown rings and saddles, separated by white interspaces which are narrower than the darker rings; body depth 43 times in total length. ................................. M. colubrinus (Boddaert) (Indo-Pacific)

3a. Body coloration of round pale spots on a dark background of brown or green. ................................. M. breviceps (Richardson) (western Atlantic)

3b. Body coloration pale, overlain with dark spots or diffuse dark spots with bright centers. ................................. 4

4a. Spots on body diffuse with bright centers (gold in life) ................................................................. 5

4b. Spots on body dark and distinct, without pale or bright centers. ......................................................... 6

5a. Total vertebrae 151-159 ............................................. M. pardalis (Valenciennes) (eastern Atlantic)

5b. Total vertebrae 164-173 ............................................. M. ocellatus (Lesueur) (western Atlantic)

6a. Pectoral fin reduced, its length less than the width at its base; dorsal fin origin above 1st, 2nd or 3rd vertebra, 1.4-2.0 in head length; total vertebrae 149-197. ........................................... 7

6b. Pectoral fin developed, longer than the width at its base; dorsal fin origin above 6th, 7th or 8th vertebra, 1.1-1.4 in head length; total vertebrae 159-167. ............................................................. M. aspetocheiros McCosker & Rosenblatt (eastern Pacific).

7a. Total vertebrae 177-197 ............................................. 8

7b. Total vertebrae 149-168 .................................. 9

8a. Total vertebrae 177-183; spotting on chin and throat of adults smaller than or equal to eye, spotting on flanks round. ............................................. M. magnificus (Abbott) (Hawaii, Leeward and Johnston islands).

8b. Total vertebrae 180-197; spotting on chin and throat of adults larger than eye, spotting on flanks generally ovoid. ............................................. M. maculosus (Cuvier) (Indo-Pacific)

9a. Total vertebrae 149-156 ............................................. M. tigrinus Girard (eastern Pacific)

9b. Total vertebrae 158-168 ............................................. M. pantostigmajus Jordan & McCregor (Revillagigedo and Clipperton islands).

**Behaviour and ecology:** The new species was observed underwater with the use of scuba gear by the second author at Caban Island (capture site of paratype). Three individuals were seen at depths of 25-35 m on a relatively flat, low relief bottom with mixed sand, rubble and small coral formations. The eels were invariably encountered in the open and were swimming slowly, apparently searching the bottom for prey (probably small fishes or crustaceans).

**Distribution:** Myrichthys paleracio is currently known only from the Verde Channel area of southern Luzon, Batangas Province, Philippines in 25-35 m.

**Etymology:** We take pleasure in naming this new eel in honor of its collector, Peri Paleracio, to be treated as a noun in apposition.

**Acknowledgements**

We are grateful to the California Academy of Sciences, which sponsored the first author’s participation in the 2011 Hearst Expedition to the Philippines. Collection and curatorial assistance for this trip was kindly provided by David Catania (CAS). We also thank Roger Steene of Cairns, Australia, for his companionship and diving assistance during the second author’s 2009 trip to the Verde Channel area during which the first specimen was collected. Roger Steene and Robert Myers generously provided underwater photographs.
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Abstract
The Whitespotted Puffer, Arothron hispidus (Linnaeus), wide-ranging in the Indo-Pacific region and the tropical eastern Pacific, is very variable in color pattern. It has been misidentified as A. reticularis (Bloch & Schneider), which is also Indo-Pacific in distribution. Color variation of A. hispidus is documented, particularly in the Red Sea where it is unusually diverse in color pattern. The record of A. reticularis from the southern Red Sea by Roux-Estève (1956), recognized in three checklists of Red Sea fishes, is invalidated. The two species are distinguished by the area of skin covered by spinules and by color pattern. A subadult specimen of A. reticularis collected from fresh water in Palau represents a first record for Micronesia and an underwater photograph is a first record for New Caledonia. The need is stressed for specimens of the various color forms of A. hispidus, especially in the Red Sea, for morphological study, determination of possible sexual dichromatism and for molecular research.

Résumé
Arothron hispidus (Linnez), largement répandu dans l’Indo-Pacifique et l’est tropical du Pacifique, est de coloration très variable. Il a été identifié erronément comme A. reticularis (Bloch & Schneider) dont la distribution concerne aussi l’Indo-Pacifique. La variation de couleur d’A. hispidus est documentée, particulièrement en mer Rouge où son patron de coloration est inhabituellement diversifié. La présence d’A. reticularis au sud de la mer Rouge signalée par Roux-Estève (1956), reprise dans trois relevés de poissons de la mer Rouge, est invalidée. Les deux espèces se distinguent par la zone de peau couverte de spinules et par la coloration. Un spécimen subadulte d’A. reticularis, collecté en eau douce à Palau, est une première occurrence pour la Micronésie et une photographie sous-marine constitue une première pour la Nouvelle Calédonie. Le besoin de spécimens de diverses variétés de couleur d’A. hispidus, surtout en mer Rouge, se fait sentir pour une étude morphologique, la détermination d’un possible dichromatisme sexuel et l’analyse moléculaire.

Zusammenfassung

Sommaio
Il pesce riccio, Arothron hispidus (Linnaeus), ampiamente diffuso nella regione indopacificà e nelle zone tropicali del Pacifico orientale, ha una colorazione molto variabile. È stato confuso con A. reticularis (Bloch & Schneider), anch’esso presente nell’Indo-Pacifico. Sono documentate le varianti di A. hispidus soprattutto nel Mar Rosso dove esiste un’insolita diversità di colorazioni. La segnalazione di A. reticularis nel Mar Rosso meridionale da parte di Roux-Estève (1956), riconosciuta in tre checklist dei pesci del Mar Rosso, è invalidata. Le due specie si distinguono per l’area di pelle coperta da spinule e per la colorazione. Un
Color variation of the puffer Arothron hispidus (Linnaeus) and comparison with A. reticularis (Bloch & Schneider)

INTRODUCTION

The Whitespotted Puffer, Arothron hispidus (Linnaeus, 1758), type locality India, is the most widespread of the tetraodontid fishes, ranging from the Red Sea south to Western Cape, South Africa, east to the western Pacific from New South Wales to southern Japan, in Oceania to the Hawaiian Islands and islands of French Polynesia and in the eastern Pacific from Panama to the Gulf of California. It is a large species, attaining a total length of at least 48 cm.

The similar Arothron reticularis (Bloch & Schneider, 1801), also a large Indo-Pacific species with a type locality of India and ranging east to Fiji (Herre 1936), is much less common (for example, the Bishop Museum has 38 lots of A. hispidus, but only five of A. reticularis). It was not reported from the Red Sea until 1956, when Roux-Estève identified a specimen, 197 mm in total length, from the island of Abulat (Abu Latt) in the Farasan Islands, southern Red Sea, as Tetraodon reticularis. Her record was included in three checklists of Red Sea fishes (Dor 1984; Goren & Dor 1994; Golani & Bogorodsky 2010). We cannot find a record of Arothron reticularis from the Indian Ocean west of the southern tip of India (Smith & Heemstra 1986; Fricke 1999; Manilo & Bogorodsky 2003). The westernmost locality appears to be Sri Lanka (Matsuura in Kimura et al. 2009). Also, A. reticularis is often found in estuaries and the young of Arothron reticularis are restricted to mangrove areas and the lower reaches of streams (Veeruraj et al. 2011). The Red Sea coast lacks permanent streams and well-developed estuaries. Roux-Estève's Red Sea specimen (MNHN 52-252) was examined and photographed by the third author at the Muséum National d'Histoire Naturelle in Paris (Fig. 1) and reidentified as A. hispidus.

Roux-Estève is not alone in misidentifying specimens of Arothron hispidus as A. reticularis. Some Bishop Museum specimens were first mislabeled as A. reticularis, as well as some of the first author's photographs, and only three of the seven illustrations currently identified as A. reticularis in FishBase are correctly identified as this species. Shen et al. (1993: pl. 205, fig. 7) used an illustration of A. reticularis to represent A. hispidus. Adding to the confusion has been the extreme variation in color exhibited by what we believe to be one species, Arothron hispidus, in the Red Sea. The most perplexing are large individuals that have been photographed underwater with either a reticular or a linear pattern instead of a pattern of mainly white spots. We include here a diagnosis of A. hispidus, a comparison with A. reticularis and photographs of both species.

MATERIAL

Specimens for the present study are from the Bishop Museum, Honolulu (BPBM), Muséum National d'Histoire Naturelle, Paris (MNHN), Universität Humboldt, Museum für Naturkunde, Berlin (ZMB) and Uppsala Universitet Zoologiska Museet, Uppsala.

We asked representatives of the Senckenberg Museum in Frankfurt and the U. S. National Museum of Natural History in Washington, D.C., to see if their collections held any adult specimens of Arothron hispidus with a linear or reticular color pattern. None were found.

Figures 1-8 are specimen photographs of A. hispidus, in order west to east, from the Red Sea to the Line Islands in the Pacific. Figures 9-17 are underwater photographs of A. hispidus in the Red Sea, and Figures 18-22 are photographs of A. reticularis, one of which is a juvenile specimen in the Fisheries Research Laboratory of Mie University, Japan (FRLM).

Arothron hispidus (Linnaeus, 1758)

Figures 1-17

Tetraodon hispidus Linnaeus, 1758: 333 (type locality, India).
Tetraodon perspicillaris Rüppell, 1829: 63 (type locality, Red Sea).
Tetraodon semistriatus Rüppell, 1837: 58, pl. 16, fig. 3 (type locality, Massawa, Eritrea).
Tetraodon laterna Richardson, 1845: 124, pl. 61, fig. 2 (type locality, Canton, China).
Tetraodon pusillus Klunzinger, 1871: 645 (type locality, El Quseir, Red Sea).

Diagnosis: Dorsal fin rays 10 or 11; anal fin rays 9-11; pectoral rays 17-19; small spinules on head and body except for snout, posterior caudal pedun-
Fig. 1. *Arothron hispidus*, MNHN 52-252, 160 mm SL, Abu Latt, Farasan Islands. Photo by J. M. Rose.

Fig. 2. *Arothron hispidus*, BPBM 18112, 240 mm SL, Gulf of Aqaba. Photo by J. E. Randall.

Fig. 3. *Arothron hispidus*, 333 mm SL, Sudan, specimen lost. Photo by J. E. Randall.
Color variation of the puffer Arothron hispidus (Linnaeus) and comparison with A. reticularis (Bloch & Schneider)

Fig. 4. Arothron hispidus, BPBM 20139, 80 mm SL, Mauritius. Photo by J. E. Randall.

Fig. 5. Arothron hispidus, BPBM 27686, 210 mm SL, SW India. Photo by J. E. Randall.

Fig. 6. Arothron hispidus, FRLM 30622, 50 mm SL, Libong Island, SW Thailand. Photo by S. Kimura.
cle and base of fins; snout length 4.6-6.1 in standard length (SL); nasal organ with two fleshy flaps bifurcating from common base; bony ridge above eye, interorbital space concave; bony interorbital width 4.8-7.0 in SL; anal fin origin below or posterior to rear base of dorsal fin; caudal fin rounded, posterior margin irregular, 2.6-3.8 in SL; color extremely variable, most often olivaceous with small white spots, white ventrally, with dark body color extending ventrally into the white ventral part of head and abdomen appearing as bars (three on head, three on abdomen); base of pectoral fin within vertically oval black spot containing a few white or yellow curved lines and/or small spots, often with one or more white lines encircling fin base; subadults with white spots often forming circle around eye and adults may have several complete white rings (Fig. 11 and Lieske & Myers 2004: 220, lower fig.). Subadults (Fig. 4) and juveniles (Fig. 6) sparsely spotted with white. With growth, white spots become more numerous. Some individuals with white lines, as shown in Figures 10 and 12, while others (Figs 11,13,14) remaining white-spotted, except for rings around eyes and gill openings; others developing reticular pattern (Figs 15 and 16) or a mainly linear pattern (Fig. 17). Base of dorsal fin usually with few white spots; anal fin generally none. Caudal fin varying from having only a few white spots on base to being almost completely white-spotted; some specimens with

Fig. 7. Arothron hispidus, BPBM 14801, 226 mm SL, Lord Howe Island. Photo by J. E. Randall.

Fig. 8. Arothron hispidus, BPBM 33888, 243 mm SL, Kirimitaki, Line Islands. Photo by J. E. Randall.
Color variation of the puffer *Arothron hispidus* (Linnaeus) and comparison with *A. reticularis* (Bloch & Schneider).

**Fig. 9.** *Arothron hispidus*, Gulf of Aqaba. Photo by J. E. Randall.

**Fig. 10.** *Arothron hispidus*, Marsa Alam, Egypt. Photo by S. V. Bogorodsky.
Fig. 11. Arothron hispidus, Ras Ghamila, Egypt. Photo by S. V. Bogorodsky.

Fig. 12. Arothron hispidus, Sudan. Photo by J. E. Randall.

Fig. 13. Arothron hispidus, El Quseir, Egypt. Photo by S. V. Bogorodsky.
caudal fins having mixed spots and lines; still others with linear or reticular pattern. Largest specimen reported, 48 cm TL.

**Comparison with Arothron reticularis** Because puffers are so variable in form, it is difficult to find morphological characters to distinguish some species from close relatives. We can confirm that the most important difference, as reported by Matsuura (1999), in separating *A. hispidus* from *A. reticularis*, is the distribution of the small dermal spinules on the body. They cover the entire body in *A. reticularis*, except for the region around the mouth and the base of the fins, whereas they are absent on the snout and at least the posterior half of the caudal peduncle of *A. hispidus* (see Fig. 4). Wheeler (1991: 192, Fig. 29) provided a photograph of Linnaeus’ holotype of *Tetraodon hispidus*, ZMUU 102, 93 mm SL, at the University of Uppsala.

![Fig. 14. Arothron hispidus, Sharm el Sheikh, Egypt. Photo by S. V. Bogorodsky.](image)

![Fig. 15. Arothron hispidus, Tiran Island, Egypt. Photo by J. L. Rose.](image)
Fig. 16. Arothron hispidus, El Quseir, Egypt. Photo by S. V. Bogorodsky.

Fig. 17. Arothron hispidus, N Obhur, Saudi Arabia. Photo by R. Field.
Color variation of the puffer Arothron hispidus (Linnaeus) and comparison with A. reticularis (Bloch & Schneider)

Fig. 18. Arothron reticularis, syntype, ZMB 4259, 185 mm SL, Tranquebar, India. Photo by P. Bartsch.

Fig. 19. Arothron reticularis, BPBM 28931, 355 mm SL, Lizard Island, Great Barrier Reef. Photo by J. E. Randall.

Fig. 20. Arothron reticularis, BPBM 7431, 153 mm SL, Babelthuap, Palau. Photo by J. E. Randall.
Fig. 21. Arothron reticularis, Baie de Prony, New Caledonia. Photo by R. F. Myers.

Fig. 22. Arothron reticularis, FRLM 30626, 54 mm SL, Libong Island, SW Thailand. Photo by S. Kimura.
sala in Sweden. The spinules are clearly absent from the snout and all of the caudal peduncle. One of two syntypes of Tetrodon reticularis Bloch & Schneider at the Museum für Naturkunde der Humboldt-Universität, Berlin is lost (Paepke 1999). Figure 18 is a photograph of the remaining syntype, ZMB 4259, 185 mm SL, from Tranquebar, India. Spinules can be seen on the snout before the eye and over the caudal peduncle. Matsurua (1999) also reported that A. reticularis has a wider interorbital space than A. hispidus.

Like A. hispidus, A. reticularis is variable in coloration. It can be distinguished in color by having continuous dark brown bands that curve from below the eye across the abdomen and there are no ventral extensions of the dark body color into the pale ventral part of the head and body. Also, for any given size, the white spots posteriorly on the body and caudal fin are larger in A. reticularis and they more uniformly cover the caudal fin, whereas in A. hispidus they may be missing from the posterior part of the fin, if not the entire fin. We present color illustrations of an adult of A. reticularis (BPBM 28931, 355 mm SL) from the Great Barrier Reef (Fig. 19); a subadult (BPBM 7431, 153 mm SL) collected in fresh water from the M izu River, Babelthup, Palau (Fig. 20), a first record for M icronesia; an underwater photograph of an adult taken by Robert F. Myers at Baie de Prony, New Caledonia (Fig. 21), a first record for the island; and a juvenile from the south-west coast of Thailand provided by Seishi Kimura (Fig. 22).

Arothron hispidus and A. reticularis are both well illustrated in color in M asuda et al. (1984: pl. 331), M asuda & Kobayashi (1994: 430), and Allen et al. (2003: 441).

Remarks: Arothron hispidus can be found in a variety of habitats from coral or rocky reefs to open sand or mud substrates, seagrass beds, algal flats, or estuaries, from depths of 1-99 m (Stuhlsaker 1973). It is more often seen in sheltered than exposed waters, and more often on soft than hard substrata. It may at times be seen at rest on sand, exposed waters, and more often on soft than hard substrata. They described its mode of feeding on this venomous asteroid in detail. Randall (1985) wrote of the extremely varied diet: algae (including Jania and Halimeda), bivalves, gastropods, tunicates, sponges, corals, zoanthid anemones, crabs, tube worms, sea urchins, brittle stars, starfishes (including Acanthaster), hermit crabs, hydroids and detritus.

The different English common names reflect the variation in color pattern: Whitespotted Puffer, Stripebelly Puffer, Spiny Balloonfish, and Stars-and-Stripes Puffer.

One Hawaiian name, Makimaki, may be in reference to its toxicity (Titcomb 1972). This species is one of the most virulently poisonous of tetraodontid fishes (Halstead 1967). Yamada in Nakabo (2002) reported the skin, testes, liver and ovaries toxic, adding that there are conflicting reports on the toxicity of the flesh.

Rüppell (1829) described Tetrodon perspicillaris from the Red Sea, noting the white rings around the orbit and branchial opening. His species name is derived from the Latin perspicillum meaning spectacles, in obvious reference to the rings around the eyes. Rüppell (1837: 58, pl. 16, fig. 3) described a second species as T tetraodon semistriatus. His illustration is the same color form as shown here by Figure 12 (total length estimated as 32 cm when the photo was taken). The second Rüppell name (semistriatus) is in reference to the body being partly lined. Klausewitz (1960) and Tor-tonese (1968) treated the Red Sea population as a subspecies, Arothron hispidus perspicillaris. The Red Sea population of Arothron hispidus more densely white-spotted than A. hispidus (Fig. 2, 3, 10-13) than that of the Indian Ocean (Figs 4, 5; Smith in Smith & Heemstra 1986: fig. 263; Debelius 1993: 308). As noted by Matsurua in Masuda et al. (1984: 364, pl. 331, fig. H), Matsurua (1999: 130), and Figure 7 here, the Pacific Ocean population of Arothron hispidus differs in color from that of the Indian Ocean in having narrow wavy dark stripes ventrally on the body and fewer white spots. Figure 8 from Kiritimati in the Line Islands, however, is an exception in lacking the narrow dark stripes ventrally on the body and in having numerous white spots (as well as bright yellow pectoral fins).

We have no specimens of large individuals of Arothron hispidus from the Red Sea that exhibit such variable color pattern and express here the need for such specimens. Perhaps some of the variation is a result of sexual dichromatism. Molecular study would be most welcome. It would also be useful in deciding if taxonomic recognition is warranted for the apparent different populations within the Indo-Pacific region.
ACKNOWLEDGEMENTS

We thank Dr. Peter Bartsch of the Museum für Naturkunde der Humboldt Universität zu Berlin for his photograph of the existing syntype of Arothron reticularis, Dr. Seishi Kimura of the Fisheries Research Laboratory of Mie University for providing his photographs of juvenile specimens of Arothron hispidus and A. reticularis from the Andaman Sea, Jean Louis Rose and Richard Field for their underwater photographs of A. hispidus taken in the Red Sea, and Robert F. Myers for his underwater photograph of A. reticularis from New Caledonia. The most useful reference for this study was the review of the genus Arothron by Keichi Matsuura (1999), and we thank him for additional information. We are grateful to Dr. Tilman Alpermann of the Senckenberg Museum, and Dianne Pitassy and Dr. Jeffrey T. Williams of the U.S. National Museum of Natural History for searching for adult specimens of Arothron hispidus for us. The second author acknowledges with gratitude the support for his fieldwork in the Red Sea from the Faculty of Marine Science of King Abdulaziz University, Jeddah, Saudi Arabia. The third author thanks Dr. Peter Bartsch of the Museum für Naturkunde der Humboldt Universität zu Berlin. GOREN, M. & DOR, M. 1994. Pitassy and Dr. Jeffrey T. Williams of the U. S. National Museum of Natural History for searching for us. The third author thanks Dr. Peter Bartsch of the Museum für Naturkunde der Humboldt Universität zu Berlin. GOREN, M. & DOR, M. 1994.

REFERENCES


The first record of Hippocampus denise (Syngnathidae) from Australia

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Received: 18 March 2011 - Accepted: 11 July 2011

Abstract

A specimen of Hippocampus denise (Syngnathidae) recently collected from the outer Great Barrier Reef, Queensland, constitutes the first record of this species from Australian waters. Counts and proportional measurements confirm the identity of the specimen. It was taken by ROV at a depth greater than previously reported for the species and from a new host species of octocoral. We postulate that one reason for the species having previously evaded detection in the region is due to the paucity of knowledge of Australian mesophotic reef systems and briefly discuss the implications of this on assessing the species’ conservation status.

Zusammenfassung

Kürzlich konnte ein Exemplar von Hippocampus denise (Syngnathidae) im äußeren Bereich des Großen Barrierrereiffs, Queensland, gefangen werden; damit ist der Erstnachweis dieser Art in australischen Gewässern gelungen. Nach Kennzahlen und proportionalen Messungen konnte die Art eindeutig bestimmt werden. Das Exemplar war durch ein ferngesteuertes Fahrzeug (ROV) in einer größeren Tiefe gesammelt worden als nach bisherigen Berichten und über einer neuen Wirtsart der Octokoralen. Ein Grund für den bisher fehlenden Nachweis dort sind unserer Auffassung nach die geringen Kenntnisse über die mesophotischen australischen Riffsysteme; die Folgerungen im Blick auf den Schutzstatus der Art werden kurz diskutiert.

Résumé

Un spécimen d’Hippocampus denise (Syngnathidae) récemment collecté au large de la Grande Barrière de Corail, Queensland, constitue la première mention de cette espèce pour les eaux australiennes. Les données méristiques et morphométriques confirment l’identité de l’espèce. Elle a été capturée par ROV à une profondeur plus importante que signalée jusqu’ici et sur une nouvelle espèce-hôte d’octocoral. Nous postulons que la raison qui explique que cette espèce a échappé à toute détection dans la région est due à la connaissance trop partielle des récifs mesopotiques australiens et nous en abordons brièvement les conséquences pour ce qui concerne le statut de la conservation de l’espèce.

Sommaario

Un esemplare di Hippocampus denise (Syngnathidae) recentemente raccolto lungo il margine esterno della Grande Barriera Australiana, Queensland, rappresenta la prima segnalazione di questa specie in acque australiane. Le misurazioni meristiche confermano l’identificazione dell’esemplare. Questo è stato raccolto con l’ausilio di un ROV ad una profondità più elevata di quella precedentemente registrata per questa specie e su una diversa specie ospite di octocorallo. Si ipotizza che una ragione del mancato rilevamento di questa specie nella regione sia dovuta alla scarsa conoscenza dei sistemi mesofotici della barriera australiana e si discutono brevemente le implicazioni che ciò può comportare nella determinazione dello stato di conservazione delle specie.

INTRODUCTION

One of the smallest known species of seahorse, Hippocampus denise Lourie & Randall, 2003, has not been recorded from Australia despite its very widespread occurrence in adjacent regions of the Indo-West Pacific that make up the “Coral Triangle”. This gorgonian octocoral-dwelling species is recorded to range from Malaysia and throughout Indonesia to Palau, Micronesia and south-east to the Solomon Islands and Vanuatu (Lourie & Randall 2003). Lourie & Kuiter (2008) also report it from New Ireland Province, Papua New Guinea (PNG) and photographs published on the web indicate that it also occurs in West New Britain and Milne Bay Provinces, PNG (Banks 2006 –
reported as *H. bargibanti* Whitley). We report the first finding of *Hippocampus denise* in Australian waters, from a single specimen on an octocoral collected by a remotely operated vehicle (ROV) used in a study of mesophotic (30-150 m depth) coral communities off the North Queensland coast (Bongaerts et al. 2011). It is deposited in the South Australian Museum, Adelaide (SAMA).

**MATERIAL AND METHODS**

Material examined – *Hippocampus denise*, SAMA F13806, 13.7 mm SL, approximately 240 km ENE Cairns, Qld, NW corner of Holmes Reef East, 16°.421’ S, 147°.987’ E, 25 October 2010, on *Villogorgia* sp. taken by ROV from a depth of ~100 metres, collected by Tom Bridge and Dave Whillas (AUV Coral Sea Exploratory Expedition); fixed and preserved in 70% ethanol.

To verify the specimen’s identity, counts and measurements were taken following Lourie & Randall (2003). Counts of trunk rings (TrR), tail rings (TaR) and pectoral, dorsal and anal fin rays (PF, DF and AF, respectively) were made using a microscope and from a microtomograph (CT scan) of the specimen as per Foster & Gomon (2010). Measurements to the nearest 0.1 mm were made using a microscope with an eyepiece graticule and from an enlarged photograph incorporating a scale bar. Measurements were made of head length (HL), trunk length (TrL), tail length (TaL), snout length (SnL), orbital diameter (OD), post orbital length (PO), crown height (CH), trunk depth at TrR 9 (TD9), dorsal fin base length (DL). Standard length (SL) = HL + TrL + TaL.

**RESULTS AND DISCUSSION**

**Description** - Colour in life, dark reddish-orange with faint banding on the tail; sex uncertain but body proportions and comparison of the CT scan with X-rays of sexed individuals (Lourie & Randall 2003) suggest it is a non-breeding male.

Counts – TrR 12; TaR 29; PF 11; DF 14; AF 4. Principal measurements (mm) – HL 2.2; TrL 3.6; TaL 7.9. Proportional measurements (as percentages of SL, HL or SnL, as indicated, with range from 14 specimens of *Hippocampus denise* examined by Lourie & Kuiter (2008) shown in parentheses) – HL 16.1% in SL (16.0-23.1); HD 53.6% in HL (41.1-55.7); SnL 37.2% in HL (27.1-38.7); SnD 76.4% in SnL (62.7-81.2); OD 23.5% in HL (18.8-23.5); PO 40.8% in HL (39.1-45.2); CH 45.4% in HL (35.2-51.6); TrL 26.3% in SL (23.1-31.7); TaL 57.7% in SL (47.4-57.2); TD9 10.2% in SL (4.1-15.5); DL 10.2% in SL (6.4-10.1).

In appearance the specimen SAMA F13806 closely resembles the description and published photographs of *Hippocampus denise* (Lourie & Randall 2003). All counts and proportional measurements are consistent with those reported for the species by Lourie & Randall (2003) and Lourie & Kuiter (2008) with the departures of TaL and DL from the cited ranges statistically insignificant. A similar species, *H. bargibanti*, is known to occur on the Great Barrier Reef (GBR) (Paxton et al. 2006) but significant proportional measurements (Lourie & Randall 2003: Table I) along with tail features distinguish the two species.

![Fig. 1. Hippocampus denise, SAMA F13806, from Holmes Reef East, Queensland photographed soon after collection. Photo by E. Roberts.](image-url)
ring count, a non-bulbous snout and an absence of tubercles above the eyes specifically exclude this species.

As well as being the first Australian record of Hippocampus denise, the specimen, SAM A F13806, is notable for the depth at which it was found (100 m) - the deepest yet reported for the species - and for the host species, Villogorgia sp. Previously reported hosts are Annella, Muricella and Echinogorgia, at depths ranging from 13-90 m (Lourie & Randall 2003). Gorgonian octocorals occur on mesophotic reefs throughout northern Australian seas, including a vast area of the GBR outer shelf to 150 m depth (Bridge et al. 2011). That H. denise has not previously been recorded seems surprising and suggests that it may be rare in Australian waters. However, this species of pygmy seahorse, along with others that may occur in the region, is so small and cryptic that it is extremely difficult to find, the difficulty compounded by its distribution well into the mesophotic zone beyond the range of scuba divers. Mesophotic communities in Australia have received little attention compared to their shallow-water counterparts due to their relative inaccessibility and only recently have technological advances, such as the use of ROVs, opened up the zone for exploration. Well-known Coral Triangle octocoral species have also recently been found for the first time in Australian waters during surveys of the GBR outer shelf (Bridge, unpublished data) and it is probable that more species of pygmy seahorses occur in northern Australian waters but no focused searches have yet been made. Unfortunately, research is hampered in Australia by restrictive scientific diving regulations on, for example, the use of rebreather units which are being used elsewhere to survey the mesophotic zone (e.g. Pyle et al. 2008).

Pygmy seahorses are tiny, few more so than H. denise, and are likely to be missed unless specifically searched for in suitable communities. Hippocampus denise is listed as “Data Deficient” on the IUCN Red List of Threatened Species (Project Seahorse 2003) and the conservation action calls for further research on the species biology, ecology, habitat, abundance, and distribution. Targeted surveys are necessary to gather this information before an assessment of the conservation status of the species in Australia can be made.

ACKNOWLEDGEMENTS

Thanks go to Peter Blias of the South Australian Museum for CT scanning the specimen, Chris Jones for discovering the specimen on the octocoral, David Whillas for the ROV operations, Ed Roberts for photographing the specimen, and the crew of Eye to Eye Marine Encounters for their logistical support. Thanks also to the anonymous reviewers for their very helpful comments on the manuscript. We acknowledge Australian Geographic, C&R Consulting, the National Science Foundation (ATM-0941760) and the Pacific Blue Foundation for funding.

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Teodor T. Nalbant - 1933-2011

"The foundation of my love of science is my love of beauty" (Cyril Crossland) was Teodor Nalbant's motto for his scientific career. "These are simple words which are better understood only by those who dedicated years of their lives to the biological field" he said during the celebration of his 70th anniversary, while he had reached 50 years of activity within the scientific community.

Nalbant was born on 18th of December 1933, on the shore of the Black Sea, at Constanța, Romania. Moving with his family to Tulcea in 1939, a decisive moment for his future profession and life plans began with the meeting of the Danube Delta where I had my first meeting with this unforgettable scientist. We did a field trip together in 2008 to the place where it had all begun for him. Prior we were invited for a seminar in Bucharest's "Grigore Antipa" National Museum where the monumental B n rescu - Nalbant collection with over 10,000 specimens, especially of the families Cyprinidae, Cobitidae and Gobiidae, is under the custody of the Museum. We also went together to the type locality of the endemic genus Romanichthys valanciuncula and had a great time together. Two years later he came to visit me in Italy and we agreed to do a book together, about the cobitids and nemacheilids of the world and I got started with specimens I collected for him in Turkey and elsewhere in 2009. Unfortunately his health must have been deteriorating, I rarely heard from him. He passed away while I was on field trips in the Amazon on November 29th, 2011.

Nalbant's family wanted him to follow a medical career, but he succeeded in attending the Faculty of Biology from Cluj in the autumn of 1953, he met Petru Banărescu with whom he continuously shared, till Banărescu's end (1921-2009), his love of beauty and fishes, publishing together more than 40 papers, especially in the systematic, phylogeny and zoogeography of the fishes of the families Cyprinidae (Gobioninae) and Cobitidae. In February 1958 Nalbant graduated from the University of Bucharest, and then worked as a biologist at the Institute of Hydrotechnical Studies and Research (1959-1961), followed by the Institute of Fisheries (1961-1970), where he became the senior scientist. Later he was employed by the National Museum of Natural History in Bucharest "Grigore Antipa" (1970-1975), where he was senior curator, in the Institute of Biological Sciences, Department of Taxonomy and Evolution. Nalbant published over 150 papers, first on the freshwater and marine fishes of Romania, then on the ichthyofauna from other geographical areas - his first paper appeared in 1956. He covered a very large spectrum of fields: systematics, morphology, speciation, ecology, ethology, zoogeography, paleontology, and other aspects of an applied nature.

But one of Nalbant's main concern, was the study of the ichthyofauna based on the material collected by Romanian and foreign expeditions. Within this context his studies resulted in very important discoveries in marine fishes from the Central and North Pacific, Eastern and North-Western tropical Atlantic, the Indian Ocean, and freshwater fishes from Central Africa, Afghanistan, the Himalayas, India, Iran, Turkey, and Cuba. Also his studies on fishes of the families Cyprinidae were of great importance, from material mostly collected during the expeditions of the "Uranie", "Challenger", "Albatross", "Galathere", and "Noona Dan".

As a result of his studies, he discovered and described, alone or in collaboration a new cobitid subfamily (Vallianellinae Nalbant, B n rescu, 1997 - Cobitidae), and an impressive number of taxa whose illustrations point out not only his talent in drawing (sample below) but also in accurate observations. His descriptions include 23 new genera and subgenera, and 58 species and subspecies including a blind fish, Lucifuga simile. Nalbant contributed to many international publications by writing the chapters on the families Cobitidae and Chaetodontidae. He participated in long lasting expeditions as in the North-West Atlantic Ocean (in 1967 and 1969) and along the West African coasts (1969), as well as in Romanian expeditions (one with me) and one to the coast of Tanzania resulting in the discovery and the description of numerous new genera and species.

Nalbant always correlated the outer morphological features with those of the inner morphology, of ecology, ethology and of zoogeography which was and is very important for a better understanding of species. Something all ichthyologists should do. The genus Nalbatichtlzys Schultz 1967, as well the subgenus Nalbantius Maugé & Bauchot, 1984 (later given generic status), Schistura nalbarzti Mirza & B n rescu, 1979, and the cumacean crustacean Cyclaspis nalhanti Petrescu, 1998, immortalized this amazing scientist and certainly no ichthyologist or loach-lover will ever forget this humble and very natural Romanian. Farewell Theo.

Heiko Bleher
What can I say about the woman who probably knows more about the family Gobiidae than anyone else? What can I say about Helen Larson that the ichthyological society and scientists in this world do not know already? I am sure not much. But there is something I must say, and that is: THANK YOU VERY MUCH for the fantastic work you have done for three consecutive years for this journal as scientific editor (2009-2011). THANK YOU for having helped so many to publish only prime peer-reviewed articles in aqua and in rejecting those which have not deserved to be published. THANK YOU for the advice you gave to authors around the globe, for all the corrections you have done, and especially on some very long papers. THANK YOU for your tireless and constant communication with reviewers worldwide.

Helen, I look forward to your having the time you want and need during your retirement to complete the tremendous task of recording most of the missing species of the largest fish family on this planet, not only to cataloguing and giving them names, but also to revising those groups which are in limbo. I promise to help as long as I can and in every possible way. I look forward to our project with Doug and hope it will take off and mature in 2012. I look forward to continuing to work with you to compile the volumes of the Gobiidae group, and to having in a few years something extremely valuable for today’s and future generations. For ichthyologists, taxonomists and scientists, and for all people interested in learning more about the amazing goby-treasures we have on earth, ... thank you.

Heiko Bleher

I am also very thankful to Frank L. Pezold III, for taking over as the new scientific editor for aqua, with the beginning of 2012 and volume 18.

Frank has studied at the University of New Orleans, B.A. English (1974), M.S. in Biological Sciences (1979), and at the University of Texas at Austin, where he received his Ph.D. in Zoology (1984). Today he is Professor of Biology and Dean of the College of Science and Engineering at Texas A&M University – Corpus Christi (TAMUCC) (since 2006). He has also been a Research Associate of the American Museum of Natural History since 2005.

Frank’s lab focuses on the diversity, evolution and conservation of fishes with an emphasis on gobid fish systematics. He and his students conduct fieldwork in the southern US, California, Mexico, Central America, Caribbean Sea, West Africa, Red Sea, and throughout the central, western and southern Pacific nations. His current projects (besides aqua) include: 1) population structure of amphidromous fishes of Micronesia, 2) evolution and systematics of the gobid genera Ctenogobius, Oxyurichthys, Stiphodon and Sicydium, 2) cryptobenthic Pacific coral reef fish community ecology and evolution, 3) ecological speciation and adaptive radiation of gobies, 4) cryptic speciation in African freshwater sleepers (Eleotridae: Kribia), and 5) conservation genetics of California desert fishes. His research is been supported by the National Science Foundation (NSF), the MacArthur Foundation, World Bank, the USDA Forest Service, the Nature Conservancy and Conservation International. And Frank’s recent publications have appeared in Zootaxa, Biology of Fishes, Journal of Natural History, at Science Publisher Inc., in aqua, International Journal of Ichthyology, in Fishes of the freshwaters of the lower Guinea ichthyogeographical province: Cameroon, Equatorial Guinea, Gabon and Congo Brazzaville, G. Teugels, M. Stiassny and C. Hopkins eds., in the Proceedings of the California Academy of Sciences and in Copeia.

I look forward to working very closely together with Frank for aqua to grow even more in the years to come, although it is already today one of the prime scientific journal of ichthyology, thanks to the great help from recent scientific editors, the late Keith Banister, Walter Ivantsoff, Friedhelm Krupp, and Helen Larson.

Heiko Bleher
Index of *aqua* Vol. 17 (1-4) (Index by: 1. Author(s); 2. New Taxa; 3. Biology/Ecology/Biography/Reviews)

**Author(s):**


Castro, José L.: Resurrection of the name Carcarhusin cordale, a species different from *Carcarhusin porosus*. *aqua* 17 (1): 1-10, 15 January 2011


Hoese, Douglas F., Shibukawa, Koichi and Sakaue, Jiro: A redescription of the gobid fish *Cryptocentrus maculatus* with clarification of *Cryptocentrus leptophilus* and *C. melanopus*. *aqua* 17 (3): 163-172, 10 July 2011


Kullander, Sven O.: A review of *Dicroasus forini* and *Dicroasus warzei*, two species of cichlid fishes from the Amazon River basin in Brazil (*Teleostei*: *Cichlidae*). *aqua* 17 (2): 73-84, 26 April 2011


Winterbottom, Richard: Six new species of the genus *Trinma* (*Percomorpha*: *Gobiidae*) from the Raja Ampat Islands, Indonesia, with notes on cephalic sensory papillae nomenclature. *aqua* 17 (3): 127-162, 10 July 2011

**New Taxa:**


*Etmopterus joungi* n. sp., a new species of lanternshark (*Squaliformes*: *Etmopteridae*) from Taiwan. *aqua* 17 (2): 61-72, 26 April 2011


*Sashatherina giganteus* n. sp. A new species and genus of a large and unusual freshwater hardyhead, *Sashatherina giganteus* (*Pisces*: *Atherinidae*) from West Papua, Indonesia and a comparison with its closest relatives of the genus *Cryptocentrus*. *aqua* 17 (1): 43-57, 15 January 2011

*Trinma cheni* n. sp. Six new species of the genus *Trinma* (*Percomorpha*: *Gobiidae*) from the Raja Ampat Islands, Indonesia, with notes on cephalic sensory papillae nomenclature. *aqua* 17 (3): 127-162, 10 July 2011

*Trinma erdmanni* n. sp. Six new species of the genus *Trinma* (*Percomorpha*: *Gobiidae*) from the Raja Ampat Islands, Indonesia, with notes on cephalic sensory papillae nomenclature. *aqua* 17 (3): 127-162, 10 July 2011

*Trinma habrum* n. sp. Six new species of the genus *Trinma* (*Percomorpha*: *Gobiidae*) from the Raja Ampat Islands, Indonesia, with notes on cephalic sensory papillae nomenclature. *aqua* 17 (3): 127-162, 10 July 2011

*Trinma halmatsum* n. sp. Six new species of the genus *Trinma* (*Percomorpha*: *Gobiidae*) from the Raja Ampat Islands, Indonesia, with notes on cephalic sensory papillae nomenclature. *aqua* 17 (3): 127-162, 10 July 2011

*Trinma malaondros* n. sp. A new species of pygmy goby (*Gobiidae*) from the Indo-west Pacific. *aqua* 17 (2): 103-110, 26 April 2011

*Trinma papayum* n. sp. Six new species of the genus *Trinma* (*Percomorpha*: *Gobiidae*) from the Raja Ampat Islands, Indonesia, with notes on cephalic sensory papillae nomenclature. *aqua* 17 (3): 127-162, 10 July 2011

*Trinma xanthochrum* n. sp. Six new species of the genus *Trinma* (*Percomorpha*: *Gobiidae*) from the Raja Ampat Islands, Indonesia, with notes on cephalic sensory papillae nomenclature. *aqua* 17 (3): 127-162, 10 July 2011

**Biology/Ecology/Biography/Reviews:**

A redescription of the gobid fish *Cryptocentrus stevensi* (Teleostei: *Cryptocentridae*), with clarification of *Cryptocentrus leptophilus* and *C. melanopus*. *aqua* 17 (3): 163-172, 10 July 2011

A review of *Dicroasus forini* and *Dicroasus warzei*, two species of cichlid fishes from the Amazon River basin in Brazil (*Teleostei*: *Cichlidae*). *aqua* 17 (2): 73-84, 26 April 2011


Feeding habits of the convict surgeonfish *Acanthus triostegus* (Teleostei: *Acanthuridae*) on the Los Frailes reef, Baja California Sur, Mexico. *aqua* 17 (3): 121-126, 10 July 2011


Resurrection of the name Carcarhusin cordale, a species different from *Carcarhhusin porosus*. *aqua* 17 (1): 1-10, 15 January 2011
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Contents:

Fenton Walsh and Hiroyuki Tanaka: Cirrhilabrus nahackyi, a new wrasse (Perciformes; Labridae) from the South Pacific ................................................................. 1-8

Gerald R. Allen and Mark V. Erdmann: A new species of Dragonet (Synchiropus Callionymidae) from Indonesia ............ 9-14

E. Mauricio Hoyos-Padilla, B. Patricia Ceballos-Vázquez and Félipe Galván-Magaña: Reproductive Biology of the Silky Shark Carcharhinus falciformis (Chondrichthyas; Carcharhinidae) off the west coast of Baja California Sur, Mexico .......... 15-24


Samaneh Poursaied & Bahram Falahatkar: Threatened fishes of the world: Stenodus leucichthys leucichthys Güldenstädt, 1772 (Salmonidae) ........................................................................................................ 31-34

John E. McCosker and Gerald R. Allen: Description of a new Snake Eel (Pisces; Ophichthidae: Myrichthys) from the Philippines ........................................................................................................ 35-40

John E. Randall, Sergey V. Bogorodsky and Jean Michel Rose: Color variation of the puffer Arothron hispidsus (Linnaeus) and comparison with A. reticularis (Bloch & Schneider) ................................................................. 41-54

Ralph Foster, Thomas C. L. Bridge and Pim Bongaerts: The first record of Hippocampus denise (Syngnathidae) from Australia ........................................................................................................... 55-57

Orbituary: Teodor T. Nalbant (1933-2011) ................................................................. 58

Dr Helen Larson – retired from aqua and Dr Frank L. Pezold – new Scientific Editor of aqua .............................................. 59

Index of aqua Vol. 17 (1-4) ........................................................................................................................ 60

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Cover photo: Comparison of head coloration of Myrichthys paleracio. Photos by G. R. Allen

New genus and new species of Gobiidae in a upcoming issue of aqua. Photo by J. Van Tassell.