REDESCRIPTION AND DISTRIBUTIONAL RANGE EXTENSION OF A POORLY KNOWN ANCHOVY *STOLEPHORUS NELSONI* (ACTINOPTERYGI: CLUPEIFORMES: ENGRAULIDAE)

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**Background.** The poorly known anchovy *Stolephorus nelsoni* Wongratana, 1987 (Engraulidae), previously known only from the type specimens from Australia, is redescribed and its validity confirmed, on the basis of the holotype, paratype, and 15 additional specimens from Indonesia and Australia. Similar to *Stolephorus brachycephalus* Wongratana, 1983 in sharing the maxilla reaching more or less to the posterior border of opercle, a predorsal-fin scute absent and the preopercle rounded, the specific distinctiveness of *S. nelsoni* and differences between the two species have remained unclear. This study sought to confirm the validities of the two species and the distributional range of *S. nelsoni*.

**Materials and methods.** Seventeen and 9 specimens of *S. nelsoni* and *S. brachycephalus*, respectively, including the holotype of each, were examined morphologically, counts and proportional measurements following Hata and Motomura (2017).

**Results.** Comparisons of *S. nelsoni* with *S. brachycephalus* revealed the former to have 12–14 (mode 13) branchiostegal rays [vs. 10–11 (11)], 15–17 branched anal fin rays [vs. 20–22 (20)] and relatively fewer gill rakers [37–43 (39, 40) on the first gill arch vs. 35–37 (35)]. *Stolephorus nelsoni* also differed from *S. brachycephalus* in body depth [21.7%–23.7% (mean 22.6%) of standard length vs. 18.2%–20.3% (19.1%)], anal-fin base length [16.1%–19.3% (17.6%) vs. 21.6%–24.4% (23.2%)], caudal-peduncle length [15.7%–21.7% (18.8%) vs. 12.6%–15.2% (14.1%)] and snout length [4.5%–5.5% (5.1%) vs. 3.6%–4.3% (4.0%)].

**Conclusion.** The validities of both species were confirmed, Indonesian examples of *S. nelsoni* being the first known records of the species outside Australian waters.

**Keywords:** taxonomy, validity, morphology, distribution, *Stolephorus brachycephalus*

INTRODUCTION

The Nelson’s anchovy, *Stolephorus nelsoni* Wongratana, 1987, based on four specimens from Western Australia and Queensland, Australia was originally described by Wongratana (1987), and confirmed as a valid species by Whitehead et al. (1988) and Wongratana et al. (1999). Paxton et al. (2006) listed the type specimens of *S. nelsoni* in their review of Australian engraulid fishes, there having been no additional specimens recorded. *Stolephorus nelsoni* is herein redescribed as a valid species, following examination of type and additional specimens from Australia and Indonesia, the latter representing the first records of the species outside Australian waters. Morphological differences between *S. nelsoni* and the closely related congener *Stolephorus brachycephalus* Wongratana, 1983 are also provided.

MATERIALS AND METHODS

Counts and proportional measurements followed Hata and Motomura (2017). All measurements were made with digital callipers to the nearest 0.1 mm. Standard and head lengths are abbreviated as SL and HL respectively. Institutional codes follow Sabaj (2016).

RESULTS

**Family ENGRAULIDAE**

*Stolephorus nelsoni* Wongratana, 1987
(Fig. 1; Tables 1, 2)

*Solephorus nelsoni* Wongratana 1987: 4, fig. 2 (type locality: Wallal, Eighty Mile Beach, Western Australia, Australia; paratype localities: Townsville, Queensland, Australia); Whitehead et al. 1988: 417, unnumbered figs.

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(Eighty Mile Beach, north Wallal, Western Australia and Townsville, Queensland, Australia); Wongratana et al. 1999: 1738, unnumbered figs. (Eighty Mile Beach, north Wallal, Western Australia and Townsville, Queensland, Australia); Paxton et al. 2006: 315 (Eighty Mile Beach, north Wallal, Western Australia and Townsville, Queensland, Australia).

Material examined. 17 specimens, 41.2–81.5 mm SL. AMNH 57157, holotype of Stolephorus nelsoni, 71.6 mm SL, Wallal, Eighty Mile Beach, Western Australia, Australia, 15 May 1969, G. J. Nelson, W. H. Butler and D. E. Rosen; AMS IB. 3173, 59.2 mm SL, off Darwin, Northern Territory, Australia; AMS I. 26599-006, 61.7 mm SL, Cairns, Queensland, Australia; AMS I. 28535-001, 41.2 mm SL, Mackenzie Island, Queensland, Australia; NTM S. 12898-003, 2 specimens, 59.0 mm SL, north of Bowra Shoals, Fog Bay, Northern Territory, Australia, 12°42′S, 130°11′E, 20–21 m depth; NTM S. 13281-017, 7 specimens, 59.6–81.5 mm SL, northeast of Point Charles, Beagle Gulf, Northern Territory, Australia, 12°11′27″S, 130°24′27″E; NTM S. 14844-002, 2 specimens, 72.7–73.8 mm SL, estuary of Otokwa River, Irian Jaya, Indonesia, 04°56′2″S, 137°15′07″E, 25 May 1996; USNM 280176, paratype of Stolephorus nelsoni, 71.6 mm SL, Eighty Mile Beach, Western Australia, Australia.

Diagnosis. A species of Stolephorus with the following combination of characters: gill rakers 16–19 (modally 17) in upper series on first gill arch, 20–24 (22) in lower series, 37–43 (39, 40) in total; gill rakers 12–14 (13) in upper series on second gill arch, 18–22 (20, 21) in lower series, 30–36 (33) in total; gill rakers 9–12 (10) in upper series on third gill arch, 12–13 (12) in lower series, 21–25 (23) in total; gill rakers 8–9 (8, 9) in upper series on fourth gill arch, 9–11 (10) in lower series, 18–20 (18) in total; prepelvic scutes 4–7 (5); branchiostegal rays 12–14 (13); pectoral fin with 13–15 rays; anal fin with three unbranched rays and 15–17 branched rays; long upper jaw, posterior tip more or less reaching posterior border of opercle; no predorsal scute; body deep, 21.1%–23.7% SL; anal-fin base short, 16.1%–19.3% SL; caudal peduncle long, 15.7%–21.7% SL, snout relatively long, 4.5%–5.5% SL; posterior border of preopercle convexly rounded; a pair of dark patches behind occiput without a following pair of dark lines; no black spots below eye or on lower-jaw tip.

Description. Data for holotype presented first, followed by paratype and non-type data in parentheses (if different). Counts and measurements, expressed as percentages of SL or HL, given in Tables 1 and 2.

Body compressed laterally, elongate, deepest at dorsal-fin origin. Dorsal profile of head and body slightly convex from snout tip to dorsal-fin origin, straight along dorsal-fin base. Ventral profile of head and body slightly convex from lower-jaw tip to pelvic-fin insertion, slightly convex or straight from pelvic-fin insertion to anal-fin origin, more or less straight along anal-fin base. Dorsal and ventral profiles of caudal peduncle slightly concave. Belly rounded. Anus situated just anterior to anal-fin origin. Caudal peduncle compressed; depth slightly greater than orbit diameter. Snout tip rounded; snout length less than eye diameter. Mouth large, inferior, ventral to body axis, extending backward beyond posterior margin of eye. Lower jaw slender, shorter than upper jaw. Maxilla long, its posterior tip pointed, just reaching to posterior border of opercle (beyond or just short of posterior border of opercle in some specimens). Single row of conical teeth on each jaw and palatines. Small conical teeth in patch on vomer. Small tooth...
Redescription of *Stolephorus nelsoni*

**Distribution.** *Stolephorus nelsoni* is distributed along the northern coast of Australia (from Eighty Mile Beach, Western Australia to near Darwin, Northern Territory) and in the IDN and AUS (Indonesia and Australia). The type locality is Eighty Mile Beach, Northern Territory.

**Coloration of preserved specimens.** Body uniformly pale ivory with silver longitudinal band, its width slightly less than pupil diameter, from just posterior to upper opercular margin to caudal-fin base. A pair of dark patches behind occiput without a following pair of dark lines; no black spots below eye or on lower-jaw tip. Live and fresh coloration unknown.

**Body features.** Body moderately elongate, compressed, its depth greater than body height. Dorsal and anal fins each with minute first ray, three anteriormost rays closely spaced and unbranched. Anal-fin origin just below base of tenth (tenth to twelfth) dorsal-fin ray; posterior tip of depressed fin not reaching caudal-fin base. Uppermost pectoral-fin ray unbranched, inserted below lateral midline of body; posterior tip of fin not reaching vertical through pelvic-fin insertion. Pelvic fin shorter than pectoral fin, insertion anterior to vertical through dorsal-fin origin; posterior tip of depressed fin reaching to vertical through origin of fourth dorsal-fin ray (third to fifth).

**Table 1**

| Character                         | Stolephorus nelsoni | Stolephorus brachycephalus |
|----------------------------------|---------------------|-----------------------------|
|                                  | Holotype Western Australia | Paratype AMNH 280176 | Non-type IDN and AUS | Mode | Holotype BMNH 1979.3.21.447 | Paratypes BMNH 10 + 9 | Mode |
| Standard length (SL) [mm]        | 71.6                | 41.2 – 81.5                | 41.8                | 26.5 – 28.1 |
| Dorsal-fin rays (unbranched)     | 3                   | 3                            | 3                   | 3 |
| Dorsal-fin rays (branched)       | 13                  | 12 – 13                      | 13                  | 12 – 13 |
| Anal-fin rays (unbranched)       | 3                   | 3                            | 3                   | 3 |
| Anal-fin rays (branched)         | 17                  | 15 – 17                      | 17                  | 20 – 22 |
| Pectoral-fin rays (unbranched)   | 1                   | 1                            | 1                   | 1 |
| Pectoral-fin rays (branched)     | 12                  | 12 – 14                      | 12                  | 10 – 12 |
| Pelvic-fin rays (unbranched)     | 1                   | 1                            | 1                   | 1 |
| Pelvic-fin rays (branched)       | 6                   | 6                            | 6                   | 6 |
| Caudal-fin rays (upper + lower)  | 10 + 9              | 10 + 9                       | 10 + 9              | 10 + 9 |
| Gill rakers on 1st gill arch (upper) | 19                | 18                          | 17                  | 15  |
| Gill rakers on 1st gill arch (lower) | 23               | 24                          | 22                  | 21  |
| Gill rakers on 1st gill arch (total) | 42              | 42                          | 40                  | 35  |
| Gill rakers on 2nd gill arch (upper) | 14                | 14                          | 13                  | 11  |
| Gill rakers on 2nd gill arch (lower) | 22              | broken                      | 18 – 22             | 18  |
| Gill rakers on 2nd gill arch (total) | 36             | broken                      | 30 – 35             | 30  |
| Gill rakers on 3rd gill arch (upper) | 12              | broken                      | 9 – 11              | 9   |
| Gill rakers on 3rd gill arch (lower) | 13              | broken                      | 12 – 13             | 11  |
| Gill rakers on 3rd gill arch (total) | 25             | broken                      | 21 – 24             | 20  |
| Gill rakers on 4th gill arch (upper) | 9              | broken                      | 8 – 9               | 6   |
| Gill rakers on 4th gill arch (lower) | 11              | broken                      | 9 – 11              | 9   |
| Gill rakers on 4th gill arch (total) | 20             | broken                      | 18 – 20             | 18  |
| Gill rakers on posterior face of 3rd gill arch | 7          | broken                      | 3 – 6               | 5   |
| Prepelvic scutes                | 4                   | 4                            | 4                   | 2 – 5 |
| Scale rows in longitudinal series | 35                  | 34 – 36                      | 35                  | 33  |
| Transverse scales               | 8                   | 8                            | 8                   | 8   |
| Branchiostegal rays             | 13                  | broken                      | 12 – 14             | 13  |
| Pseudobranchial filaments       | broken              | broken                      | 16 – 20             | 18  |

IDN and AUS = Indonesia and Australia, AMNH = AMNH 57157, USNM = USNM 280176, BMNH = BMNH 1979.3.21.447.
DISCUSSION

**Stolephorus nelsoni** was described by Wongratana (1987) based on four specimens collected from Western Australia and Queensland, Australia, the species being known to date only from the type specimens. Examination of additional material from the northern coast of Australia and Indonesia confirmed the validity of *S. nelsoni*, with the unique combination of characters described in the Diagnosis (above). Although Wongratana (1987) recorded *S. nelsoni* as having 20 or 21 anal-fin rays, modified in Whitehead et al. (1988) and Wongratana et al. (1999) as three unbranched rays and 20 branched rays, the anal-fin ray count observed in the presently reported study was 15–17, the values indicated in Whitehead et al. (1988) and Wongratana et al. (1999) being clearly erroneous.

Although *S. nelsoni* is similar to *S. brachycephalus* (Fig. 3) in sharing the maxilla well beyond the posterior margin of preopercle, the latter rounded posteriorly, and the dorsal fin without scutes, the former has more gill rakers (24 in *S. nelsoni* vs. 20–22 in *S. brachycephalus*) and branchiostegal rays (12 or 13 vs. 10 or 11), and a tooth patch on the hyoid bone upper edge (vs. teeth absent), according to Wongratana et al. 1999. The present

| Character                          | Stolephorus nelsoni | Stolephorus brachycephalus |
|-----------------------------------|---------------------|-----------------------------|
| Holotype                          | Western Australia   | Papua New Guinea            |
| Paratype                          | IDN and AUS         | n = 15                      |
| Non-type                          | Mean                | Mean                        |
| Holotype                          | Paratypes           |                            |
| AMNH                              | USNM                | BMNH                        |
| Standard length (SL) [mm]         | 71.6                | 41.8                        |
| As % SL                           | 26.4                | 26.5–28.1                   |
| No standard length (SL) [mm]      | 27.2                | 15.8                        |
| Body length (HL)                  | 23.7                | 23.9                        |
| Body depth                        | 23.6                | 23.5                        |
| Pre-dorsal-fin length             | 55.2                | 53.2                        |
| Snout tip to pectoral-fin insertion | 30.1            | 29.4                        |
| Snout tip to pelvic-fin insertion | 49.1                | 46.9                        |
| Snout to anal-fin origin          | 66.7                | 64.8                        |
| Length of dorsal-fin base         | 16.7                | 15.6                        |
| Length of anal-fin base           | 17.2                | 17.1                        |
| Length of anal-fin base           | 18.1                | 16.5                        |
| Depth of caudal peduncle          | 10.0                | 9.9                         |
| Pectoral-fin length               | broken              | 17.1                        |
| Pelvic-fin length                 | 9.3                 | 9.0                         |
| Interorbital width                | 6.7                 | 7.2                         |
| Snout length                      | 5.4                 | 4.9                         |
| Upper-jaw length                  | 22.9                | 22.5                        |
| Mandibular length                 | 18.8                | 18.0                        |
| 1st dorsal-fin ray length         | 2.1                 | 1.8                         |
| 2nd dorsal-fin ray length         | broken              | 7.4                         |
| 3rd dorsal-fin ray length         | broken              | broken                      |
| 1st anal-fin ray length           | 1.8                 | 1.8                         |
| 2nd anal-fin ray length           | 5.1                 | 4.7                         |
| 3rd anal-fin ray length           | broken              | broken                      |
| 1st pectoral-fin ray length       | broken              | 15.2–17.8                   |
| 1st pelvic-fin ray length         | 9.3                 | 8.6                         |
| As % HL                           | 32.5                | 32.9                        |
| Length of orbit                   | 23.5                | 23.3                        |
| Length of eye                     | 122.6               | 128.8                       |
| D-P1                              | 90.3                | 93.7                        |
| D-A                               | 90.2                | 94.5                        |
| P1-P2                             | 68.5                | 68.3                        |
| P2-A                              | 62.2                | 68.8                        |
| Postorbital length of the head    | 51.1                | 51.6                        |

IDN and AUS = Indonesia and Australia, AMNH = AMNH 57157, USNM = USNM 280176, BMNH = BMNH 1979.3.21.447.
comparisons of *S. nelsoni* with *S. brachycephalus*, based on 17 and 9 specimens, respectively, confirmed the branchiostegal ray and hyoid bone tooth conditions described by Wongratana et al. (1999). However, the lower gill raker number in *S. nelsoni* was 20–24 (modally 22), a greater range than that reported by Wongratana et al. (1999). The comparable range for *S. brachycephalus* was 20 or 21, not 20–22 as shown by Whitehead et al. (1988) and Wongratana et al. (1999). Therefore, lower gill raker numbers cannot clearly separate the two species. However, *S. nelsoni* differs from *S. brachycephalus* in having relatively more total gill rakers on the first gill arch (37–43 vs. 35–37), and fewer branched anal-fin rays (15–17 vs. 20–22) and branched pectoral-fin rays (12–14 vs. 10–12; Table 1). Morphometrically, *S. nelsoni* differs from *S. brachycephalus* in having a deeper body (21.1%–23.7% SL vs. 18.2%–20.3%), shorter anal-fin base (16.1%–19.3% vs. 21.6%–24.4%), longer caudal peduncle (15.7%–21.7% vs. 12.6%–15.2%) and longer snout (4.5%–5.5% vs. 3.6%–4.3%; Table 2; Fig. 4). Notwithstanding, *S. brachycephalus* has been reported only from specimens smaller than 41.8 mm SL (Wongratana 1983, Whitehead et al. 1988, Wongratana et al. 1999, this study), which may or may not have been adult. If larger and smaller specimens of *S. brachycephalus* and *S. nelsoni*, respectively, become available, the differences shown here between *S. nelsoni* and *S. brachycephalus* may not hold up.

The collection of *S. nelsoni* specimens from Indonesian and northern Australian waters suggests that the species is also likely distributed off the southern coast of Papua New Guinea.

**Comparative material examined.** *Stolephorus brachycephalus*, 9 specimens, 26.5–41.8 mm SL: BMNH 1979.3.21.447, holotype of *Stolephorus brachycephalus*, 41.8 mm SL, east side of Daru Wharf, Gulf of Papua, Papua New Guinea; USNM 270294, 8 paratypes of *Stolephorus brachycephalus*, 25.6–28.1 mm SL, east side of Daru Wharf, Gulf of Papua, Papua New Guinea.

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REFERENCES

Hata H. Motomura H. 2017. A new species of anchovy, Encrasicholina auster (Clupeiformes: Engraulidae), from Fiji, southwestern Pacific. New Zealand Journal of Zoology 44 (2): 122–128. DOI: 10.1080/03014223.2016.1268177

Paxton J.R., Gates J.E., Bray D.J., Hoese D.F. 2006. Engraulidae. Anchovies. Pp. 310–317. In: Hoese D.F., Bray D.J., Paxton J.R., Allen G.R. (eds.) Zoological catalogue of Australia. Volume 35. Fishes. Part 1–3. CSIRO Publishing, Collingwood VIC, Australia.

Sabaj M.H. 2016. Standard symbolic codes for institutional resource collections in herpetology and ichthyology: An online reference. Version 6.5 (16 August 2016). American Society of Ichthyologists and Herpetologists, Washington DC, USA. [Accessed 19 March 2018] https://asih.org/sites/default/files/documents/symbolic_codes_for_collections_v6.5_2016.pdf#search=%27Standard+symbolic+codes+for+institutional+resource+collections+in+herpetology+and+ichthyology%27.

Whitehead P.J.P., Nelson G.J., Wongratana T. 1988. FAO species catalogue, Vol. 7. Clupeoid fishes of the world (suborder Clupeoidei). An annotated and illustrated catalogue of the herrings, sardines, pilchards, sprats, shads, anchovies and wolf-herrings. Part 2 – Engraulidae. FAO Fisheries Synopsis, No. 125 7 (2): i–viii + 305–579.

Wongratana T. 1983. Diagnosis of 24 new species and proposal of a new name for a species of Indo-Pacific clupeoid fishes. Japanese Journal of Ichthyology 29 (4): 385–407. DOI: 10.11369/jji1950.29.385

Wongratana T. 1987. Two new species of anchovies of the genus Stolephorus (Engraulidae), with a key to species of Engraulis, Encrasicholina, and Stolephorus. American Museum Novitates 2876: 1–8.

Wongratana T., Munroe T.A., Nizinski M.S. 1999. Order Clupeiformes. Engraulidae, Anchovies. Pp. 1698–1753. In: Carpenter K.E., Niem V.H. (eds.) FAO species identification guide for fishery purposes. The living marine resources of the western central Pacific, Vol. 3. Batoid fishes, chimaeras and bony fishes Part 1 (Elopidae to Linophrynidae). FAO, Rome.

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