

Two new soleid fishes of the genus *Aseraggodes* from Micronesia, with a record of *A. smithi* from Palau

JOHN E. RANDALL

Bishop Museum, 1525 Bernice St.
Honolulu, HI 96817-2704, USA

PETER BARTSCH

Museum für Naturkunde, Humboldt Universität
Invalidenstrasse 43, D-10115, Berlin, Germany

Abstract—The soleid fish *Aseraggodes heraldi*, formerly identified as *A. melanostictus* (Peters), is described as a new species from two specimens, 38.5 and 47 mm SL, collected from shallow water at Kwajalein Atoll, Marshall Islands. It is distinct in having 75 dorsal rays, 57–58 anal rays (the rays of both fins branched), 68–70 lateral-line scales, 37 vertebrae, 12 dorsal pterygiophores anterior to fourth neural spine, and no caudal peduncle. A photograph and an x-ray are provided of the holotype of *A. melanostictus*, known from one specimen taken in 73 m at the island of Bougainville. *Aseraggodes firmisquamis* is described from one 31.8-mm specimen from 6 m in Palau, distinct in having 66 dorsal rays, 49 anal rays, partially embedded scales, 74 lateral-line scales, 36 vertebrae, 12 dorsal pterygiophores before the fourth neural spine, no caudal peduncle, and a color pattern of many large irregular white spots and three rows of black spots. *Aseraggodes smithi* Woods, previously known from one specimen, 18.5 mm SL, from Rongerik Atoll, Marshall Islands, is reported from three specimens, 14.5–23 mm SL from 6–10 m in Palau. It is distinguished by having 64–67 dorsal rays, 42–43 anal rays, 64–67 lateral-line scales, a ventral branch of lateral line on head following edge of preopercle; 33–34 vertebrae, 14–15 dorsal pterygiophores before the fourth neural spine, a very short caudal peduncle, a very narrow interorbital space, and light gray color dominated by large irregular dark-edged white spots and a few smaller black spots.

Introduction

Species of the family Soleidae are easily distinguished from other flatfishes by a combination of the following characters: eyes on the right side, the right pelvic fin not attached to the anal fin, a contorted mouth, no free margin of the preopercle, and a long tubular anterior nostril. The large soleid genus *Aseraggodes* Kaup is distinct in lacking pectoral fins; having ctenoid scales; no

second lateral line on the ocular side of head, continuing anterodorsally on body; 10 + 23–30 vertebrae (the first vertebra very small and not counted by some authors); first two dorsal pterygiophores merged to form a thicker structure, the erisme (see Wagemans et al. 2002), arched above the cranium, its distal end branched to support the first two dorsal rays; villiform teeth in a band only on blind side of jaws; caudal fin of 18 rays not broadly joined with dorsal and anal fins, and base of dorsal and anal rays lacking a pore (as found in species of the genus *Pardachirus* Günther for the release of a strong toxin when under stress—see Clark & George 1979). At least two species of *Aseraggodes* have a skin toxin (Randall & Melendéz 1987; Randall 2002), but not from a series of large glands, each leading to a prominent pore.

In the third of the three-volume report on the fishes of the Marshall and Mariana Islands, Woods in Schultz and collaborators (1966: 70–74) identified three small soles from the Marshall Islands in the National Museum of Natural History, Washington, D.C. (USNM) as species of the genus *Aseraggodes*. One from Rongelap Atoll was described as new, *A. whitakeri*. The holotype (USNM 141765, 38 mm SL) was examined by the first author. It is a fully mature female with 37 vertebrae. Woods' counts of 72 dorsal rays and 51 anal rays are corrected to 77 and 52, respectively. This species is distinctive in having the snout overlapping the lower jaw, a character that was mistakenly attributed by Woods to a second new species, *A. smithi*, described from one specimen only 18.5 mm in SL.

Woods identified the third species of *Aseraggodes* from one specimen (USNM 141788, 38 mm SL) from a lagoon reef of Kwajalein Atoll as *A. melanostictus* (Peters) "with uncertainty." The depth of capture was not given, but the fish collections at the atoll in 1946 were made by wading or skin diving. Peters (1877) described *Solea melanosticta* from a specimen 90 mm in total length taken in 40 fathoms (73 m) at the island of Bougainville in the southwest Pacific during the *Gazelle* Expedition (see Studer 1889). It was reclassified in *Aseraggodes* Kaup in a revision of the genus by Chabanaud (1930a).

The first author collected a second specimen of *Aseraggodes* from Kwajalein in 1975 from a pool in the outer-reef flat that is the same species as Woods' specimen from the atoll. It was deposited in the Bishop Museum, Honolulu (BPBM 18445, 47 mm SL). Because a sole taken in 73 m off Bougainville might not be the same species as one from shallow water at a Marshall Islands atoll, a comparison was made of these two Kwajalein specimens with the holotype of *Solea melanosticta* at the Museum für Naturkunde, Universität Humboldt, Berlin (ZMB 9814, 72.5 mm SL). It was concluded that the Marshall Islands sole represents a new species.

Another small specimen collected in 1968 in Palau that was identified in the Bishop Museum only as *Aseraggodes* sp. also proved to be undescribed. Three additional small specimens from Palau obtained on loan from the Royal Ontario Museum were expected to be the same species as the Bishop Museum one. However, they proved to be *A. smithi* Woods. A detailed diagnosis is provided for *smithi*, based primarily on the Palau specimens.

Materials and Methods

Specimens in this study are from the following institutions: Bernice P. Bishop Museum, Honolulu (BPBM); Royal Ontario Museum, Toronto (ROM); U.S. National Museum of Natural History, Washington, D.C. (USNM); and the Museum für Naturkunde, Humboldt Universität, Berlin, Germany (ZMB).

Standard length (SL) is measured horizontally from the front of the upper lip to the base of the caudal fin (end of hypural plate). Body depth is the maximum distance between the base of the dorsal and anal fins; body width is the maximum thickness midlaterally between the ocular and blind surfaces. Head length is measured horizontally from the front of the upper lip to a vertical at the posterior end of the opercular membrane. Snout length is taken from the front of the upper lip to the anterior edge of the upper eye. Eye diameter is the greatest diameter of the lower eye (the dark eyeball, not the fleshy cutaneous part). Interorbital width is the vertical distance between horizontal lines at the lower edge of the upper eye and the upper edge of the lower eye. Upper-jaw length is measured on the blind side from the front of the upper lip to the rear edge of the maxilla (more accurately measured on this side than the ocular side). Caudal-peduncle depth is the least depth (if peduncle is absent, the depth of the base of the caudal fin is used); caudal-peduncle length is the horizontal distance between verticals at the rear base of the anal fin and base of the caudal fin at its ventral edge. Predorsal, preanal, and prepelvic lengths are measured from the base of the first ray of these fins to the tip of the upper lip. Lengths of fin rays are measured from the base in a straight line to the distal end. Caudal-fin and pelvic-fin measurements are the length of the longest ray.

Proportional measurements are given in Table 1 as percentages of the standard length. Proportions in the text are rounded to the nearest 0.05.

Lateral-line scales are counted on the ocular side from the base of the caudal fin to the front of the straight part on the head (therefore including several pored scales anterior to the upper end of the gill opening). Scale counts above and below the lateral line are the highest obtained in an oblique row between the lateral line and the base of the dorsal and anal fins, respectively.

Vertebral counts include the very small first vertebra (therefore 10 abdominal vertebrae, not 9 as recorded by some authors).

In a review of the Japanese species of soleid fishes, Ochiai (1963) used the count of the number of dorsal pterygiophores (he called these interneural spines) associated with the first three vertebrae (actually, four as he did not include the first very small vertebra) as a taxonomic character. He is followed here in the use of this useful count.

Data in parentheses for the description of the first new species refer to the paratype.

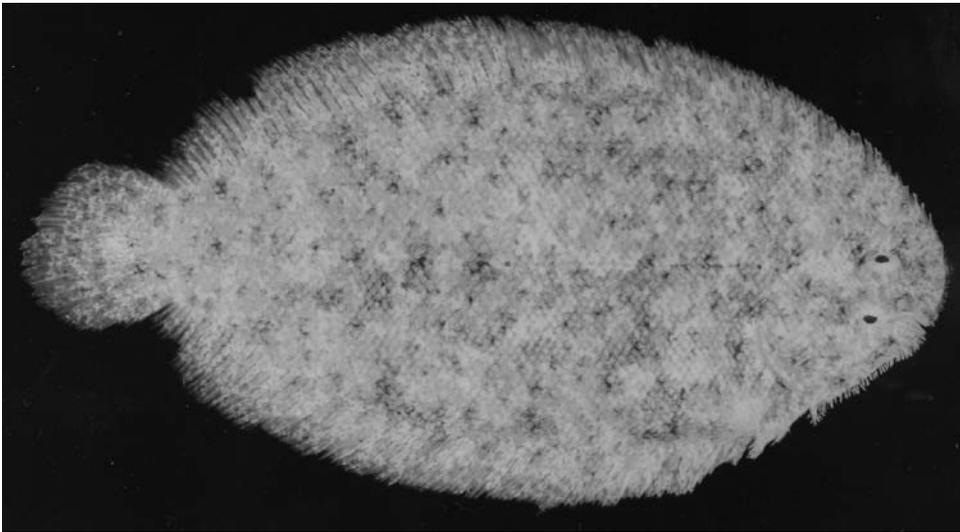


Figure 1. Holotype of *Aseraggodes heraldi*, BPBM 18445, 47 mm SL, Kwajalein Atoll, Marshall Islands.

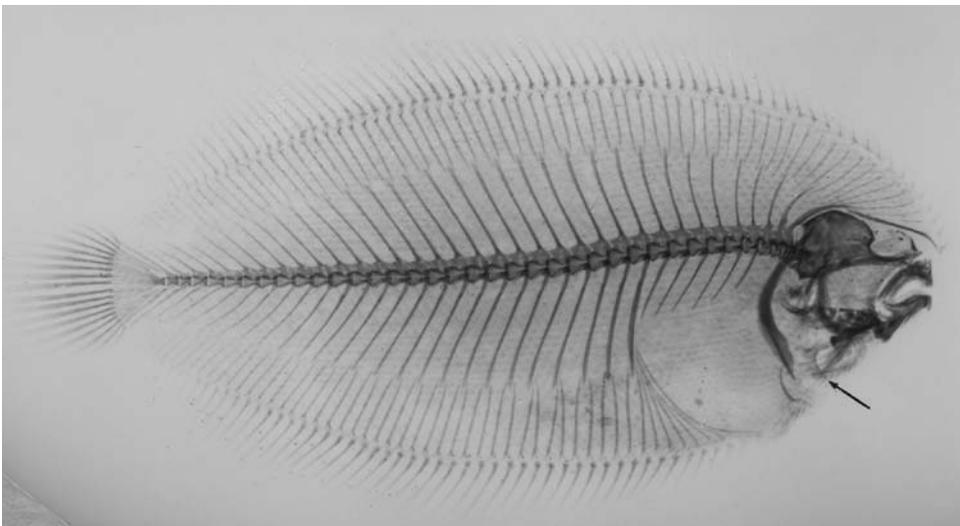


Figure 2. X-ray of holotype of *Aseraggodes heraldi*. Arrow indicates position of ventral end of urohyal bone.

Aseraggodes heraldi, new species
Figures 1, 2; Table 1

Aseraggodes melanostictus (non Peters) Woods in Schultz et al. 1966: 70, pl. 132 B (Kwajalein Atoll, Marshall Islands).

HOLOTYPE: BPBM 18445, 47 mm, Marshall Islands, Kwajalein Atoll, Kwajalein Island, "Japanese pools" in outer-reef flat, northernmost pool in 0–1 m, rotenone, J.E. Randall, 20 July 1975.

PARATYPE: USNM 141788, 38 mm, Marshall Islands, Kwajalein Atoll, lagoon reef near south end of Ennylabegan Island, E.S. Herald, 1 September 1946.

DIAGNOSIS: Dorsal rays 75; anal rays 57–58; lateral-line scales of ocular side 68–70; vertebrae 10 + 27; dorsal pterygiophores anterior to fourth neural spine 12; body depth 2.25–2.35 in SL; head length 3.75–3.8 in SL; snout not overlapping lower lip; tubular anterior nostril just reaching edge of eye when depressed posteriorly; ventral edge of head with about 40 cirri, none broad and lappet-like; no caudal peduncle (if measured from base of lowermost caudal ray to a vertical at base of last anal ray); depth at base of caudal fin 1.8–1.9 in head length; caudal fin rounded, 4.45–4.65 in SL; ocular side of body light brown, with scattered small black blotches, the most prominent two on lateral line half way between head and base of caudal fin; many scales near-white, providing an irregular mottled pattern.

DESCRIPTION: Dorsal rays 75; anal rays 57 (58); dorsal rays of holotype double-branched, except first 18 and last 19; anal rays of holotype double-branched except the first and the last 24; caudal rays 18, the median 16 branched; pelvic rays 5, all branched; lateral-line scales on ocular side 69 (67), 5–6 anterior to a vertical at upper end of gill opening; scales above lateral line on ocular side to dorsal-fin base about 26; scales below lateral line to anal-fin base about 30; vertebrae 10 + 27; 3 pterygiophores (including the erisme) before tip of second neural spine; space between second and third neural spines with 6 pterygiophores; space between third and fourth neural spines with 3 pterygiophores (hence a total of 12 dorsal pterygiophores, anterior to fourth neural spine).

Body oval and moderately elongate, the depth 2.25 (2.35) in SL; body thin, the width (thickness) 5.95 (5.4) in body depth; head length 3.75 (3.8) in SL; dorsal profile of head slightly more convex than ventral profile; snout length 3.3 (3.2) in head length; eyes elevated and small, the diameter 5.95 (5.5) in head length; eyes separated by a narrow concave space, the least vertical interorbital width 11.6 (11.0) in head length; upper eye in advance of lower, a vertical at posterior edge of upper eye (edge of dark eyeball) passing through posterior edge of pupil of lower eye; upper end of gill opening at level of a line passing an eye diameter below lower eye; no caudal peduncle (base of lowermost caudal ray ending above base of last anal ray); depth at base of caudal fin 1.9 (1.8) in head length.

Table 1. Proportional measurements of specimens of *Aseraggodes heraldi*, *A. melanostictus*, *A. firmisquamis*, and *A. smithi* as Percentages of standard length.

	<i>heraldi</i>		<i>melanostictus</i>	<i>firmisquamis</i>		<i>smithi</i>	
	Holotype BPBM 18445	Paratype USNM 141788	Holotype ZMB 9814	Holotype BPBM 30652 ROM 76582		ROM 76582	BPBM 76582
Standard Length (mm)	47.0	38.0	72.5	31.8	23.0	17.3	14.5
Body depth	44.7	42.7	43.3	40.0	41.3	40.1	40.9
Body width	7.5	7.9	7.3	7.5	8.1	7.0	7.0
Head length	26.7	26.3	23.7	25.5	28.2	27.9	27.4
Snout length	8.1	8.2	6.2	9.4	9.6	9.8	10.6
Eye diameter	4.5	4.8	3.3	4.1	5.0	4.9	4.9
Interorbital width	2.3	2.4	3.5	2.6	1.4	1.6	2.0
Upper-jaw length	8.5	8.4	7.9	9.1	10.0	10.2	10.3
Caudal-base depth	14.0	14.5	14.9	12.6	14.8	13.5	14.5
Caudal-peduncle length	0	0	0	0	1.3	1.2	1.4
Predorsal length	6.4	6.6	3.0	5.7	5.2	5.8	6.2
Preanal length	25.5	25.2	23.7	26.3	30.5	30.7	31.7
Prepelvic length	20.8	20.7	21.5	23.5	24.8	23.4	24.9
First dorsal ray	5.7	5.8	4.1	9.6	9.4	10.2	10.4
Longest dorsal ray	15.1	15.3	16.6	17.8	17.9	18.2	20.3
First anal ray	5.3	5.3	5.2	9.4	9.6	10.4	11.0
Longest anal ray	14.9	15.0	16.4	16.8	17.8	18.0	20.4
Caudal-fin length	21.6	22.5	17.2	28.3	29.2	29.0	31.0
Pelvic-fin length	8.6	8.8	8.4	11.5	15.4	15.1	16.5

Mouth inferior, the jaws strongly curved; front of upper lip not overlapping lower lip when mouth closed; maxilla extending slightly posterior to a vertical at front edge of eye, the upper-jaw length 3.15 in head length; lower jaw on blind side with a band of close-set, incurving teeth in a maximum of five rows; upper jaw with a similar band but in at most four rows and restricted to anterior half of jaw; anterior nostril a long tapering tube anterior to upper edge of lower eye, just reaching a vertical at anterior edge of eye when laid back, its length nearly equal to eye diameter; posterior nostril an oblique slit in labial groove directly in front of lower fourth of lower eye; anterior nostril of blind side a slender tapering tube above middle of upper jaw; posterior nostril of blind side not detected.

Scales ctenoid on both sides (except those of lateral line partially embedded and without cteni), the scales of holotype with at most 12 cteni (scales of paratype with fewer and shorter cteni); scales on ocular side of head progressively smaller anteriorly and ventrally, the very small ones at front of snout without cteni; eyes separated by three rows of scales, with about three rows extending onto medial and anterior edges of eyes; anterior edge of snout with a series of fine cirri; ventral edge of head with about 40 slightly more prominent cirri (none broad and lappet-like); no cirri on opercle at edge of gill opening on either side. Lateral line straight on both sides along middle of body, on ocular side in alignment with upper eye when projecting forward; an indistinct supratemporal branch of lateral line on blind side of head, visible as a narrow

channel containing a series of tiny papillae, continuing dorsally two to three scale rows below dorsal fin to about middle of body; no supratemporal branch visible on ocular side of head and body.

Base of dorsal and anal fins with a scaly sheath of two to three rows of scales; scales continuing a short distance out on rays on anterior part of dorsal fin of holotype, fewer scales on rays posteriorly, and none on about posterior two-thirds of fin; paratype lacking scales distal to basal scaly sheath, having instead a fleshy ridge on each ray that narrows distally, the ridge of anterior rays with well-spaced cirri along free edge except in outer part (cirri may be present more than half distance to tip of ray).

Origin of dorsal fin (base of first ray) anterior to upper eye, the predorsal length 4.2 (4.0) in head length; first dorsal ray (only the tip free) 4.85 (4.55) in head length; longest dorsal ray 1.75 (1.7) in head length; origin of anal fin below base of nineteenth dorsal ray, the preanal length 3.9–3.95 in SL; anus directly anterior to first anal ray; genital papilla adjacent to base of first ray on ocular side; first anal ray 5.05 (4.95) in head length; longest anal ray 1.8 (1.75) in head length; caudal fin rounded, 4.65 (4.45) in SL; pelvic fins close together on ventral edge of body, their origins adjacent; prepelvic length 4.8 (4.85) in SL; third pelvic rays longest, reaching to or slightly posterior to base of second anal ray, 3.1 (3.0) in head length.

Color of holotype when fresh: ocular side light brown, the scale edges narrowly dark; many scales nearly white, some as isolated small spots, others grouped to form irregular blotches; numerous small irregular dark blotches on head, body, and basally in median fins, the darkest along lateral line (the two darkest near middle of body between head and base of caudal fin); darkest spots on head just behind each eye.

Color of holotype in alcohol: light yellowish brown, the dark scale edges and white scales no longer evident, only the dark blotches remaining, though lighter and less distinct; fins pale.

Color of paratype shown in Schultz et al. (1966: pl. 132, fig. B).

ETYMOLOGY: This species is named for the late Earl S. Herald, former Director of the Steinhart Aquarium in San Francisco, who collected the first specimen.

REMARKS: Woods in Schultz et al. (1966) tentatively identified this species as *Aseraggodes melanostictus*, largely because of its having nearly the same dorsal ray, anal ray, and lateral-line scale counts as given by Peters (1877) for his holotype. However, this study corrects the lateral-line scale count of Peter's specimen from 70 to 79 (compared to 67–69 for *heraldi*), as a result of including those on the head before the upper end of the gill opening.

We present two photographs of the holotype of *Aseraggodes melanostictus* as Figures 3 and 4. Two morphological differences are readily seen from a comparison with Figure 1 of the holotype of *A. heraldi*: the more obtuse anterior profile of the head of *melanostictus* and the more elongate body (depth 2.5 in SL,

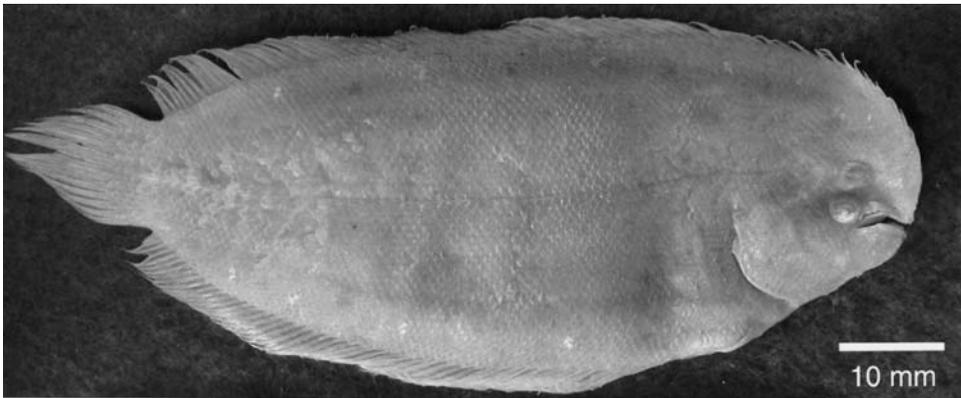


Figure 3. Holotype of *Solea melanosticta*, ZMB 9814, 72.5 mm SL, Bougainville.



Figure 4. Head of holotype of *Solea melanosticta*.

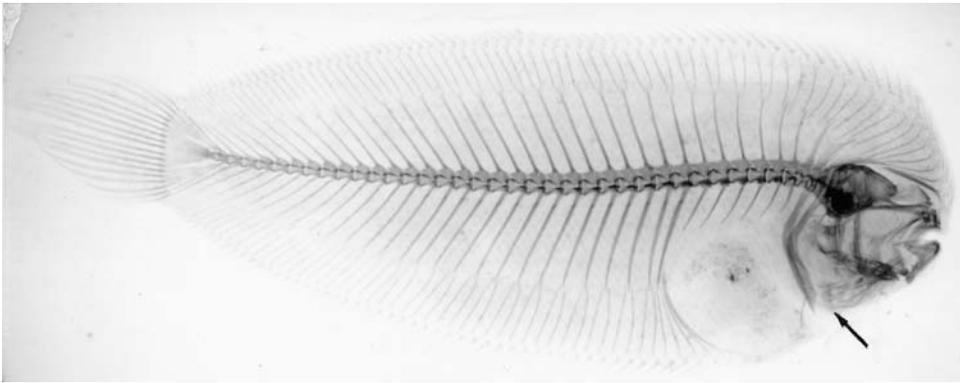


Figure 5. X-ray of holotype of *Solea melanosticta*. Arrow indicates position of ventral end of urohyal bone.

compared to average of 2.3 for the two specimens of *heraldi*). One other difference is the failure of the anterior nostril of *melanostictus* to reach the edge of the lower eye when laid back, as may be seen in Figure 4. The most convincing difference of the two species is the branching of the dorsal, anal, and pelvic rays of *heraldi*, in contrast to the unbranched rays of the holotype of *melanostictus*. Small juveniles of species of *Aseraggodes* have simple dorsal and anal rays that become branched with growth, so this difference is obviously not size-related. There are no scales or cirri on the fin rays of the dorsal and anal fins beyond the squamation of the fin base, but each of the rays of the dorsal and anal fins, and the pelvic fins as well, is continued by a cirrus-like structure distally.

We also provide as Figure 5 an x-ray of the holotype of *Aseraggodes melanostictus*. It shows 38 vertebrae, hence one more than the count for the two specimens of *heraldi*. This cannot be considered as a major difference because the vertebral counts of species of *Aseraggodes* usually vary by two or three vertebrae. The holotype of *melanostictus* has 11 dorsal pterygiophores anterior to the fourth neural spine, compared to 12 for *heraldi* (6 between the second and third neural spines, compared to 5 for *melanostictus*). However, this also cannot be regarded as a reliable diagnostic difference. More revealing from the x-rays is the shape of the urohyal bone (Figs. 2, 5). The ventroanterior margin of the urohyal in *heraldi* is concave, with no trace of an angle, whereas it is distinctly angular in *melanostictus*, the angle nearly 90°.

We do not expect *Aseraggodes heraldi* to be restricted to the Marshall Islands; however, we have found no specimens of this species except the two type specimens from Kwajalein Atoll.

Norman (1926: 290, fig. 12) reported *Aseraggodes melanostictus* from three specimens, 130–132 mm total length, from the *Endeavour* collections taken off Gladstone, Queensland. Chabanaud (1930b) realized these specimens represented a new species and described the one available specimen at the British Museum of Natural History (now the Natural History Museum) as *A. normani*.

Schultz (1943: 59) reported a sole, USNM 115223, 45 mm in total length, from Hull Island, Phoenix Islands of which he wrote, "may be a specimen of *Aseraggodes melanostictus* (Peters)." This specimen, 35 mm SL, was obtained on loan from the National Museum of Natural History. It has 74 dorsal rays, 52 anal rays, 66 lateral-line scales, and 37 vertebrae. The body is more slender than that of *heraldi* (depth 2.8 in SL), and the upper eye is almost entirely anterior to the lower. We have reidentified it as *A. whitakeri* Woods.

Kami (1975: 121) recorded two specimens of a sole, 57 and 62 mm, from Agana Bay, Guam that he identified as *Aseraggodes melanostictus* that could have been *heraldi*. Unfortunately, the specimens are no longer present in the fish collection of the University of Guam (T.J. Donaldson, pers. comm.). Randall (1985: 479) listed *A. melanostictus* in a checklist of the fishes of the Society Islands, but no specimens from French Polynesia now present in the Bishop Museum can be identified as either *melanostictus* or *heraldi*.

Aseraggodes firmisquamis, new species
Figure 6, Table 1

HOLOTYPE: BPBM 30652, 31.8 mm, Palau, outside barrier reef southwest of Koror, coral reef and sand, 6 m, rotenone, J.E. Randall, E.S. Helfman, O. Custer, and S. Yachad, 12 June 1968.

DIAGNOSIS: Dorsal rays 66; anal rays 49, scales partially embedded; lateral-line scales 74; vertebrae 10 + 26; dorsal pterygiophores anterior to fourth neural spine 12; body depth 2.4 in SL; head length 3.9 in standard length; snout slightly overlapping lower lip; tubular anterior nostril reaching lower eye when depressed posteriorly; ventral edge of head with a series of about 20 prominent lappet-like cirri; caudal peduncle absent; depth at base of caudal fin 2.0 in head length; longest dorsal ray 1.5 in head length; caudal fin rounded, 3.5 in SL; large irregular white spots on head, body, and fins, and three rows of blackish spots on body.

DESCRIPTION: Dorsal rays 66; anal rays 49 (but some posterior rays probably missing due to an abnormality or a healed injury); dorsal rays unbranched; anal rays finely branched at tips, except first 5 and last 14 rays; caudal rays 18, the middle 14 branched; pelvic rays 5, the tips of the middle three rays branched; lateral-line scales on ocular side 74, including 11 anterior to upper end of gill opening; scales above lateral line on ocular side to dorsal-fin base about 26; scales below lateral line to anal-fin base about 31 (scales difficult to count because of being partially embedded); vertebrae 10 + 26; 3 dorsal pterygiophores, including erisme, before tip of second neural spine; space between second and third neural spines with 6 pterygiophores; space between third and fourth neural spines with 3 pterygiophores (hence a total of 12 dorsal pterygiophores anterior to fourth neural spine). Ventroanterior margin of the urohyal forming an angle of about 80°, the corner slightly rounded.

Body oval and elongate, the depth 2.4 in SL; body thin, the width (thickness) 5.45 in body depth; head length 3.9 in SL; dorsal profile of head above upper lip much more convex than ventral profile; snout long, its length 2.7 in head length; eyes elevated and small, the diameter 6.25 in head length; eyes separated by a narrow concave space, the least vertical interorbital width 9.8 in head length; upper eye in advance of lower, a vertical at posterior edge of upper eye (edge of dark eyeball) passing through anterior edge of pupil of lower eye; upper end of gill opening at level of a line passing about a half eye diameter below lower eye; no caudal peduncle (based on position of last dorsal ray relative to base of uppermost caudal ray; posterior part of anal fin and lower part of caudal fin abnormal or healed from an injury); depth at base of caudal fin 2.0 in head length.

Mouth inferior, the jaws strongly curved; front of upper lip slightly overlapping lower lip when mouth closed; maxilla extending to below front edge of pupil of lower eye, the upper-jaw length 2.8 in head length; jaws with a band of close-set, incurving teeth only on blind side, in a maximum of about four rows, narrowing to one or two rows anteriorly in jaws; anterior nostril a tapering tube anterior to upper edge of lower eye, just reaching a vertical at anterior edge of eye when laid back, its length nearly equal to eye diameter; posterior nostril an oblique slit in labial groove directly in front of lower fourth of lower eye; anterior nostril of blind side a membranous tapering tube anterior to upper fourth of lower eye, nearly reaching anterior cutaneous part of orbit when depressed posteriorly; posterior nostril a slit in labial groove at base of ventral half of lower eye; presumed anterior nostril of blind side a slender membranous tube just above upper lip about one-third jaw length from front of upper lip; posterior nostril of blind side not detected.

Scales partially embedded and strongly adherent, the cteni difficult to detect on ocular side of body except anteriorly where a maximum of 7 were counted; most scales on remainder of body without cteni, or with only very small ones; scales of blind side also partly embedded but more typically ctenoid; scales progressively smaller anteriorly on head, losing cteni, and reduced to very small isolated tubercles on fleshy edge of snout; a broad zone of close-set fleshy papillae above and below jaws and a short distance posterior to jaws on blind side; eyes separated by three rows of scales, with three or four rows of small scales extending onto medial and anterior edges of eyes; anterior edge of snout with a series of fine cirri; ventral edge of head with about 20 prominent lappet-like cirri; no cirri detected on opercle at edge of gill opening on either side. Lateral line straight on both sides along middle of body, on ocular side in alignment with upper eye when projecting forward; an indistinct supratemporal branch of lateral line on blind side of head, visible as a narrow channel containing a series of tiny papillae, continuing dorsally two to three scale rows below dorsal fin to about middle of body; base of dorsal and anal fins with a scaly sheath of two to three rows of scales; scales continuing a short distance out on anterior dorsal rays and adjacent membranes on both sides, with progressively fewer scales posteriorly, none after about

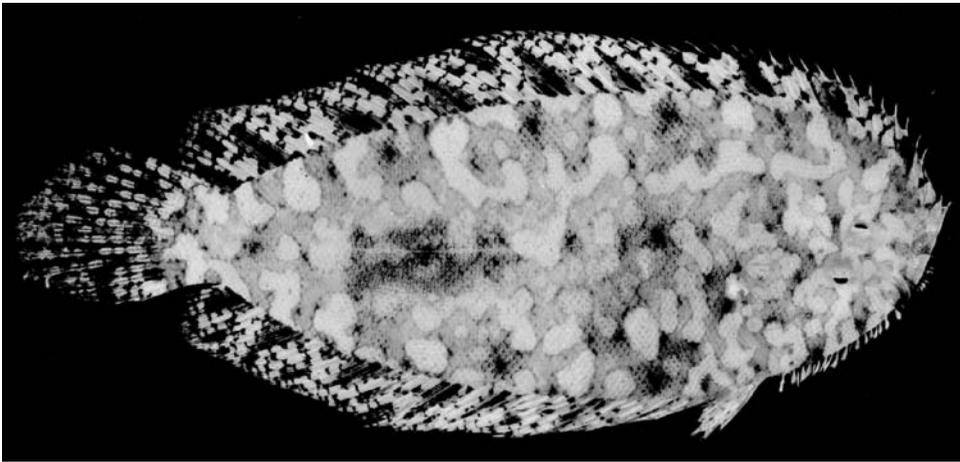


Figure 6. Holotype of *Aseraggodes firmisquamis*, BPBM 30652, 31.8 mm SL Palau.

twentieth ray; a thin membranous ridge basally on dorsal and anal rays, reduced posteriorly, none with cirri on membrane edges.

Origin of dorsal fin (base of first ray) anterior to upper eye, the predorsal length 4.5 in head length; first dorsal ray (the tip free) 2.65 in head length; longest dorsal ray 1.45 in head length; origin of anal fin below base of twentieth dorsal ray, the preanal length 3.8 in SL; anus anterior to first anal ray; genital papilla small, at dorsoposterior edge of anus; first anal ray 2.7 in head length; longest anal ray 1.5 in head length; caudal fin rounded, 3.55 in SL; pelvic fins on ventral edge of body, their origins adjacent; prepelvic length 4.25 in SL; second and third

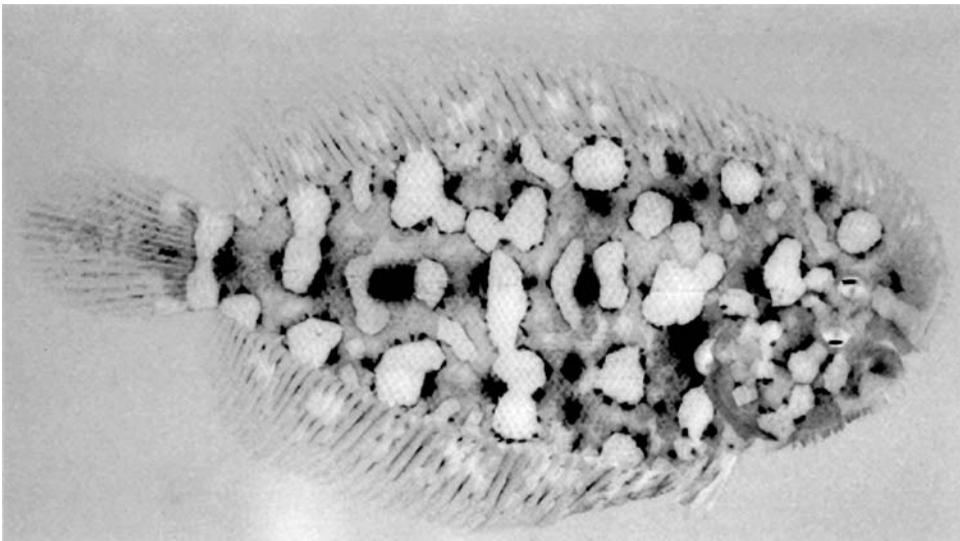


Figure 7. *Aseraggodes smithi*, ROM 76582, 22.5 mm SL, Palau (Richard Winterbottom).

pelvic rays of ocular side longest, reaching slightly posterior to base of fourth anal ray, 2.2 in head length.

Color of holotype in alcohol uniform light brown on both ocular and blind sides (no trace of pale or dark markings); fin rays pale yellowish, the membranes translucent.

No record was made of life color, but a black and white photograph was taken (Fig. 6): body with large irregular dark-edged white spots, similar roundish white spots of pupil to eye size, and three rows of black spots of pupil size or smaller, each within a blackish area: one row of black spots on back just below dorsal fin, one just above anal fin, and one along lateral line; a very large elongate blackish area in middle of lateral line; head colored like body, but irregular white spots smaller and closer together; dorsal and anal fins mainly white with small black spots on rays and a series of blackish blotches along base; caudal fin colored like body basally, the rays of rest of fin banded with white and blackish; pelvic fins white with a few small dusky spots; large cirri ventrally on head white.

ETYMOLOGY: Named *firmisquamis* from the Latin *firmus* meaning strong or durable, and *squama* for scale, in reference to the firmly adhering scales.

REMARKS: The holotype is an immature female. This species is regrettably described from this one specimen, but its scale structure alone differentiates it from the known species of the genus. Its low count of 66 dorsal rays is encountered in only two other species from the Pacific, *Aseraggodes bahamondei* Randall & Meléndez from the South Pacific, unique in having 39–40 vertebrae, and *A. normani* Chabanaud, a species of New South Wales and southern Queensland that attains at least 116 mm SL. The latter usually has 35 vertebrae (one of five with 36 as in *firmisquamis*), and all have 10 or 11 dorsal pterygiophores anterior to the fourth neural spine (12 in *firmisquamis*). More important, *normani* has three branches to the lateral line on the ocular side of the head (no branching in *firmisquamis*), and its ocular-side pelvic fin is connected by membrane to the genital papilla.

Aseraggodes smithi Woods

Figure 7, Table 1

Aseraggodes smithi Woods in Schultz et al. 1966: 73, fig. 151 (type locality, Rongerik Atoll, Marshall Islands).

DIAGNOSIS: Dorsal rays 64–67; anal rays 42–44; dorsal and anal rays not branched; caudal rays 18, the middle 14 branched; lateral-line scales of ocular side 64–67; lateral line extending forward nearly to upper eye, with a ventral branch on head following the edge of the preopercle; vertebrae 10 + 23–24; dorsal pterygiophores anterior to fourth neural spine 14–15; body depth 2.4–2.5 in

SL; head length 3.55–3.65 in SL; snout long, 2.6–2.95 in head length; interorbital space narrow, 13.7–20.8 in head length; caudal peduncle very short, 19.5–23.2 in head length; tubular anterior nostril anterior to upper edge of lower eye, just reaching cutaneous edge of lower orbit when depressed posteriorly; only two rows of scales in interorbital space, none extending onto medial edges of eyes; anterior edge of snout of largest specimen (23 mm SL) with a series of 12 conspicuous lappet-like cirri; ventral margin of head with 20 similar cirri, the longest on chin about equal to pupil diameter; no cirri on opercular edge of either side of gill opening; jaws of blind side surrounded by a zone of small papillae; dorsal and anal rays long, the longest dorsal ray 2.5–3.0 in head length; no sheath of scales over base of dorsal and anal fins (at most one row of scales over basal part of rays; caudal fin rounded and moderately long, 3.2–3.45 in SL; pelvic fins long, reaching base of third or fourth anal ray, 1.65–1.9 in head length; color of ocular side when fresh light gray with large irregular dark-edged white spots on head and body, scattered small whitish spots, fewer small black spots, a black spot the size of eye on lateral line in middle of body and a double black spot on lateral line in middle of posterior half of body.

REMARKS: The holotype *Aseraggodes smithi* (USNM 141766, 18.5 mm SL) was examined by the first author. It was collected in 1946 by Leonard P. Schultz and Earl S. Herald on the ocean reef of Bock Island, Rongerik Atoll, Marshall Islands. No other specimens of this species were known until three (ROM 76582, 14.5–22.5 mm SL) were sent on loan from the Royal Ontario Museum in Toronto that had been collected by Richard Winterbottom and associates on the seaward side of Augulpelu Reef, Palau, in 6–10 m on 22 May 2004. The bottom was described as beach rock, with some coral, and coarse white sand showing ripple marks. The three specimens were identified as *smithi* primarily by the concordance of their meristic data with those of the holotype of *smithi*, in particular sharing the unique combination of 34 vertebrae and 15 dorsal pterygiophores before the fourth neural spine. One of the three specimens, 17 mm SL, was retained at the Bishop Museum as BPBM 39631.

Acknowledgments

We thank the staffs of the Division of Fishes of the National Museum of Natural History and the Centre for Biodiversity and Conservation Biology of the Royal Ontario Museum for the loan of specimens of *Aseraggodes*. Thanks are also due Richard Winterbottom for his photograph of *A. smithi* and to Vera Heinrich, Loreen R. O'Hara, and Sandra J. Raredon for x-rays.

References

- Chabanaud, P. 1930a. Revision du genre *Aseraggodes* Kaup. Zoologische Mededeelingen (Leiden) 13: 180–192.

- Chabanaud, P. 1930b. Description d'un nouvel *Aseraggodes* [Pisces, Soleidae] du Queensland. *Annals and Magazine of Natural History*, ser. 10, 5: 241–243.
- Clark, E. & A. George. 1979. Toxic soles, *Pardachirus marmoratus* from the Red Sea and *P. pavoninus* from Japan, with notes on other species. *Environmental Biology of Fishes* 4: 103–123.
- Kami, H. T. 1975. Check-list of Guam fishes, Supplement II. *Micronesica* 11: 115–121.
- Norman, J. R. 1926. Flatfishes. *In* Biological Results of the Fishing Experiments carried on by the F. I. S. "Endeavour" 1909–14. pp. 219–308. Ministry of Trade and Customs, Sydney.
- Ochiai, A. 1963. Fauna Japonica Soleina (Pisces). Biological Society of Japan, Tokyo. vi + 114 pp.
- Peters, W. C. H. 1877. Übersicht der während der von 1874 bis 1876 unter dem Commando des Hrn. Capitän z. S. Freiherrn von Schleinitz ausgeführten Reise S.M.S. Gazelle gesammelten und von der Kaiserlichen Admiralität der Königlichen Akademie der Wissenschaften übersandten Fische. Monatsberichte der Königlich preussischen Akademie zu Berlin. 1876: 831–854.
- Randall, J. E. 1985. Fishes. *In* B. Delesalle, R. Galzin & B. Salvat (eds.). Fifth International Coral Reef Congress, Tahiti, 27 May–1 June, 1985. Vol. 1: French Polynesian Coral Reefs, pp. 462–481.
- Randall, J. E. 2002. *Aseraggodes holcomi*, a new sole (Pleuronectiformes: Soleidae) from the Hawaiian Islands. *Pacific Science* 56: 247–253.
- Randall, J. E. & R. C. Meléndez. 1987. A new sole of the genus *Aseraggodes* from Easter Island and Lord Howe Island, with comments on the validity of *A. ramsaii*. *Bishop Museum Occasional Papers* 27: 97–105.
- Schultz, L. P. 1943. Fishes of the Phoenix and Samoan Islands collected in 1939 during the expedition of the U.S.S. "Bushnell". *Bulletin of the United States National Museum* 180: x + 316 pp.
- Schultz, L. P., L. P. Woods & E. A. Lachner. 1966. Fishes of the Marshall and Marianas Islands. *Bulletin of the United States National Museum* 202(3): vii + 176 pp.
- Studer, T. 1889. Die Forschungsreise S.M.S. "Gazelle" in den Jahren 1874 bis 1876 unter Kommando des Kapitän zur See Freiherrn von Schleinitz - I. Theil, Der Reisebericht. Hydrographisches Amt des Reichs-Marine-Amtes (Hrsg.), E.S. Mittler & Sohn, Berlin. 307 p.
- Wagemans, F., F. Chapleau & J. A. Cooper. 2002. Ontogeny of the epicranial portion of the dorsal fin in *Solea solea* and *Scophthalmus maximus* (Teleostei, Pleuronectiformes). *Ichthyological Research* 49: 89–92.