

## Synopsis of the Indo-Pacific Genus *Solegnathus* (Pisces: Syngnathidae)

C. E. Dawson

(Received January 26, 1982)

**Abstract** Available information on the solegnathines or "pipehorses" is summarized from the literature and known museum specimens. Within *Solegnathus* Swainson, the subgenus *Solegnathus* (discontinuous superior trunk and tail ridges) includes *S. hardwickii* (Gray) (Australia, S. China Sea, western Japan), *S. lettiensis* Bleeker (Australia, Indonesia), *S. spinosissimus* Günther (Australia, New Zealand) and *S. robustus* McCulloch (an Australian endemic). A second subgenus, *Runcinatus* Whitley (continuous superior ridges), is represented by one Australian species, *S. dunckeri* Whitley. *Solegnathus guentheri* Duncker is considered a junior synonym of *S. lettiensis*, and *S. robustus naso* Whitley is referred to the synonymy of *S. spinosissimus*. A key to subadults and adults is provided, together with comprehensive synonymies, diagnoses and illustrations for all species.

The solegnathines or "pipehorses," reaching lengths of more than 500 mm, are among the largest pipefishes and, in China at least, dried specimens have been used in the preparation of medicines and aphrodisiacs (Chen, 1935). Despite their rather impressive size and reported pharmaceutical value, the taxonomy, distribution and biology of solegnathines are poorly known. The genus was last treated systematically by Duncker (1915) but he perpetuated, or failed to recognize, errors of earlier workers, and failed to clearly distinguish the five species included in his report. Although nominal species have been variably treated by subsequent workers, available keys, diagnoses and illustrations are largely inadequate for ready identification of species or individual specimens. In an effort to resolve some of these problems I here summarize available information on the genus *Solegnathus*. Since few young and no early juveniles are available, the key and diagnoses are based on subadult and adult features. Although this work is based on the majority of known material, significant gaps remain in knowledge of intraspecific variation, distribution, preferred habitat, ecological requirements, and general biology of the solegnathines.

### Methods and materials

Methods are those of Dawson (1977). Measurements are in millimeters (mm); total length (TL) is approximate since the head, in preserved specimens, is often angled a little

ventrad from the longitudinal body axis and the distal part of the tail cannot always be straightened completely. Proportional data are largely referred to head length (HL); color descriptions are from dried specimens or those preserved in alcohol; descriptions of branchial skeletons are from cleared and stained material. As used here, the term "venter" refers to the ventral surface of head or body. Observations on morphology of scutella and surface ornamentation are best made in the anterior postdorsal region (ca. tail rings 14~20), due to the conveniently smaller and usually less complex study area. Synonymies are intended to be complete but some references may have been omitted inadvertently. Distribution is based largely on material examined; depth is in meters (m). Abbreviations for geopolitical divisions of Australia are: NSW—New South Wales, Qld.—Queensland, SA—South Australia, Tas.—Tasmania, Vic.—Victoria, WA—Western Australia. In Material examined, dried specimens are indicated by an asterisk (\*), damaged specimens by "dam."

Abbreviations for repositories of material examined follow: AMS—Australian Museum, Sydney; ANSP—Academy of Natural Sciences of Philadelphia; BMNH—British Museum (Natural History), London; CSIRO—CSIRO, Fisheries Laboratory, Cronulla; GCRL—Gulf Coast Research Laboratory Museum; MNHN—Muséum National d'Histoire Naturelle, Paris; NMNZ—National Museum of New Zealand,

Wellington; NMV—National Museum of Victoria, Melbourne; QM—Queensland Museum, Brisbane; RMNH—Rijksmuseum van Natuurlijke Historie, Leiden; SAM—South Australian Museum, Adelaide; TFDA—Tasmanian Fisheries Development Authority, Hobart; USNM—National Museum of Natural History, Smithsonian Institution; WAM—Western Australian Museum, Perth; ZMA—Zoölogisch Museum, Amsterdam.

*Solegnathus* Swainson

*Solegnathus* Swainson, 1839: 195, 333 (type-species by original designation: *Sygnathus* (sic) *Hardwickii* Gray, 1830).

*Solenognathus*. Agassiz, 1846: 344 (emendation).

*Castelnaulina* Fowler, 1907: 426 (as subgenus of *Solenognathus*; type-species by original designation: *Solenognathus spinosissimus* Günther, 1870).

*Runcinatus* Whitley, 1929: 356 (type-species by original designation: *Solegnathus dunckeri* Whitley, 1927).

**Diagnosis.** Superior trunk and tail ridges continuous or discontinuous near rear of dorsal-fin base, not arched dorsad below dorsal-fin base; inferior trunk ridge confluent with inferior tail ridge; lateral trunk ridge continuous with lateral tail ridge, confluent with superior tail ridge or ending midlaterally on 13th~19th tail ring; venter of trunk V-shaped, median ridge not enlarged or keel-like. Snout long, compressed laterally; median dorsal snout ridge poorly defined, not continued on interorbital; orbital ridges prominent, not elevated strongly dorsad; interorbital usually a little concave; opercle without a distinct longitudinal ridge; pectoral-fin base protruding laterad, usually with a short spine, without distinct longitudinal ridges. Eyes with spinous bony platelets on sclera; opercular membrane with or without similar platelets (Fig. 1a); nares single-pored bilaterally. Body surfaces (except membranes) tuberculate to spinulose; scutella prominent, conical or with an elevated median ridge; trunk and anterior tail rings with a low knob or short spine near middle of superior and inferior ridges; posterior angles of rings without enlarged spines; head and body without elongate spines or dermal flaps. Dorsal-fin origin between anterior margin

of last trunk ring and middle of 3rd tail ring, usually at or behind anterior margin of 1st tail ring; dorsal-fin base not elevated; pectoral fin broadly rounded; caudal fin absent. Tail prehensile; ventral surface of distal 20~33 rings membranous, usually with more or less distinct, transverse, fleshy pads; the superior ridges of distal tail rings often somewhat elevated, the margins denticulate to serrate. Trunk rings 21~27, total rings 72~86, total subdorsal rings 8.5~12.25, dorsal-fin rays 30~51, pectoral-fin rays 22~26, anal-fin rays typically 4. Head length ca. 5.1~7.6 in TL, snout length 1.5~1.9 in HL, length of dorsal-fin base 1.0~1.9 in HL. Brood area of males located on venter of anterior 14~20 tail rings; eggs deposited in 5~9 transverse rows of open membranous compartments; without protective lateral plates or fleshy pouch-folds. Trunk depth usually somewhat greater in adult females than in adult males of similar length. Without odontoid processes in jaws (Dawson and Fritzsche, 1975). Ceratohyals 1~5, 1st hypobranchials and infrapharyngobranchials 1, 2 present; epibranchials and basibranchials 2, 3 absent; other branchial elements present or absent (single specimens of each species except *S. lettiensis* examined).

**Relationships.** Duncker (1915) and Herald (1943) included *Solegnathus*, *Phyllopteryx* Kaup and *Phycodurus* Gill in the subfamily Solegnathinae on the basis of the shared combination of caudal location of the male brood area, eggs carried in open membranous compartments without protection of pouch-folds or plates, and absence of caudal fin. Representatives of these genera also have long, laterally compressed, snouts, single-pored nares, relatively high numbers of pectoral-fin rays (19~26), 4 anal-fin rays and share the presence of a knob or spine near the middle of the principal ridges of trunk and anterior tail rings. The latter character is also shared with other urophorine (tail-pouch) genera (e.g. *Haliichthys*, *Hippocampus*) and suggests an alternate to the evolutionary sequence from pipefish to seahorse proposed by Herald (1959). This character occurs in only a few genera, but it is represented in the three nominal subfamilies of urophorine syngnathids (Solegnathinae, Syngnathinae, Hippocampinae). As noted previously (Dawson and Allen, 1978; Dawson, 1981), current subfamily diagnoses,

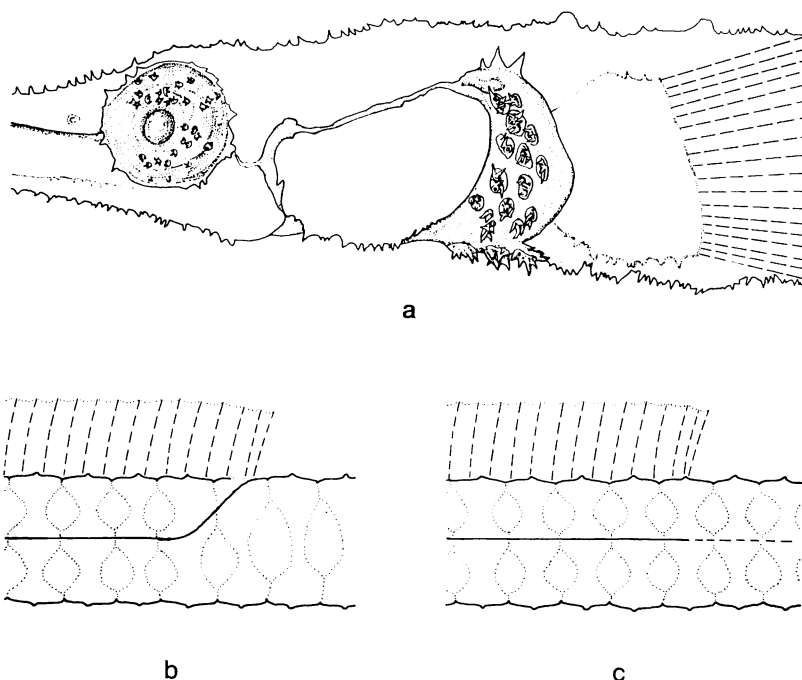


Fig. 1. Diagrams illustrating spinous bony platelets on eye in all species of *Solegnathus* and platelets occurring on opercular membrane in some species (a), together with lateral configuration of principal body ridges in the subgenera *Solegnathus* (b) and *Runcinatus* (c).

based largely on the location and morphology of the male brood area, are inadequate. Pending further study, I retain *Solegnathus* in the Solegnathinae.

**Comparisons.** Within the Solegnathinae, *Solegnathus* differs from *Phycodurus* and *Phyllopteryx* in having tuberculate to spinulose rather than essentially smooth body surfaces, in having a clearly prehensile tail, and in the presence of spiny platelets on the eye (absent in *Phycodurus* and *Phyllopteryx*). *Solegnathus* shares the confluent inferior trunk and tail ridges with *Phycodurus* (discontinuous in *Phyllopteryx*), but lacks the elevated dorsal-fin base, long spines and leaf-like dermal flaps characteristic of both *Phycodurus* and *Phyllopteryx*.

Among other pipefishes, *Solegnathus* shares spinulose surfaces only with the recently described *Hypselognathus horridus* (Dawson and Glover, in press), but this species lacks scutella (present in *Solegnathus*) and has a 10-rayed caudal fin and a brood pouch with protective

plates and folds (absent in *Solegnathus*). Species of *Solegnathus* are apparently the only synnathids with spinous bony platelets on the eye, but platelets on the opercular membrane also occur in the tail-pouch genus *Bhanotia* (see Dawson, 1978). In this genus, platelets are absent in juveniles and develop ontogenetically, in both ornamentation and abundance, with increasing SL. Developmental sequence of platelets is unknown in species of *Solegnathus*, due to the absence of small specimens in available study material.

**Nomenclature.** Fowler (1907) based the subgenus *Castelnauina* solely on the difference between the spiny ridge margins of its type-species (*S. spinosissimus*) and the more or less tuberculate margins of *Solegnathus hardwickii*. This alone is not sufficient for subgeneric distinction, since small specimens of *S. hardwickii* may be somewhat spiny. Whitley (1929) distinguished *Runcinatus* from *Solegnathus* on the basis of differences in configuration of the principal body ridges and on the laterally ex-

panded brood area of mature males. The latter feature may be shared with *Solegnathus* (see *S. hardwickii*) but differences in ridge configuration are distinctive. In *Solegnathus* (Fig. 1b), the superior trunk and tail ridges are discontinuous near rear of dorsal-fin base and the continuous lateral trunk and tail ridges are confluent with the superior tail ridge. *Runcinatus* (Fig. 1c) differs in having confluent superior ridges and the continuous lateral ridges end midlaterally on the 13th~19th tail ring. Fritzsche (1980) considered differences in the branchial skeleton to be useful in characterizing urophorine genera, and differences noted here could support recognition of three subgenera: *Solegnathus* (lacking 1st basibranchial and 2nd hypobranchials), *Castelnaulina* (with 1st basibranchial and 2nd hypobranchials), and *Runcinatus* (with 1st basibranchial but without 2nd hypobranchials). However, this serves little useful purpose at this time and I consider it most practical to recognize only the two species groups which differ in configuration of principal body ridges. Although recently included in a key to genera (Dawson, 1980a), *Runcinatus* is here treated as a subgenus in order to emphasize similarities with *Solegnathus*.

**Distribution.** Distribution of *Solegnathus* is presently uncertain but occurrence in western Indian Ocean or Indian waters is highly questionable. The genus is apparently best represented in the Australia-New Zealand area, wherein all five recognized species occur, but it is also firmly recorded from Indonesia as well as from the South China Sea and Japan. Most collections with acceptable data are by trawlers in depths of 12~232 m, but one species (*S. spinosissimus*) is not uncommonly found in 3 m at Tasmania. There are a number of cases where specimens have been stranded after storms on Australian beaches. There are no useful data available on preferred substrate or other ecological parameters.

**Key to subadults and adults of species of *Solegnathus***

- 1a. Superior trunk and tail ridges discontinuous near rear of dorsal-fin base (Fig. 1b); confluent lateral trunk and tail ridges continuous with superior tail ridge; opercular membrane with or without spinous platelets; distal half or more of tail not largely dark brown (subgenus *Solegnathus*) .....2
- 1b. Superior trunk and tail ridges confluent (Fig. 1c); lateral trunk and tail ridges not continuous with superior tail ridge; opercular membrane without spinous platelets; distal half or more of tail largely dark brown (subgenus *Runcinatus*)..*S. dunckeri*
- 2a. Sides of opercular membrane without spinous platelets; body surfaces mostly tuberculate (Fig. 2a); without a strong truncate spine under pectoral fin .....3
- 2b. Sides and venter of opercular membrane with spinous platelets (Fig. 1a); body surfaces clearly spinulose (Fig. 2b, c); with a short, strong spine under upper 5~8 pectoral-fin rays .....4
- 3a. Trunk rings 24~26 (usually 25~26); total rings 78~83 (usually 79~83); length of dorsal-fin base averages 1.1 in HL; without spinous platelets on opercular membrane; without dark blotches on side of body ..... *S. hardwickii*
- 3b. Trunk rings 21~24 (usually 21~23); total rings 72~79 (usually 72~78); length of dorsal-fin base averages 1.4 in HL; sometimes with 1~3 platelets on venter of opercular membrane; usually with dark blotches on side of body.....*S. lettiensis*
- 4a. Snout depth 5.6~10.1 in snout length; anterior postdorsal part of tail not strongly oval in cross-section, the rings without short longitudinal ridges between principal ridges and elevated median ridge on scutella (Fig. 2b).....*S. spinosissimus*
- 4b. Snout depth 3.7~4.5 in snout length; anterior postdorsal part of tail strongly oval in cross-section, with short ridges between principal ridges and elevated median ridge on scutella (Fig. 2c) ..... *S. robustus*

***Solegnathus (Solegnathus) hardwickii* (Gray)**  
(Figs. 3, 4)

*Syngnathus* (sic) *Hardwickii* Gray, 1830: pl. 89, fig. 3 (in part, "India").  
*Syngnathus hardwickii*. Richardson, 1846: 202 (listed, seas of China and India); Sawyer, 1953: 51 (ref.).  
*Solenognathus Hardwickii*. Kaup, 1853: 230

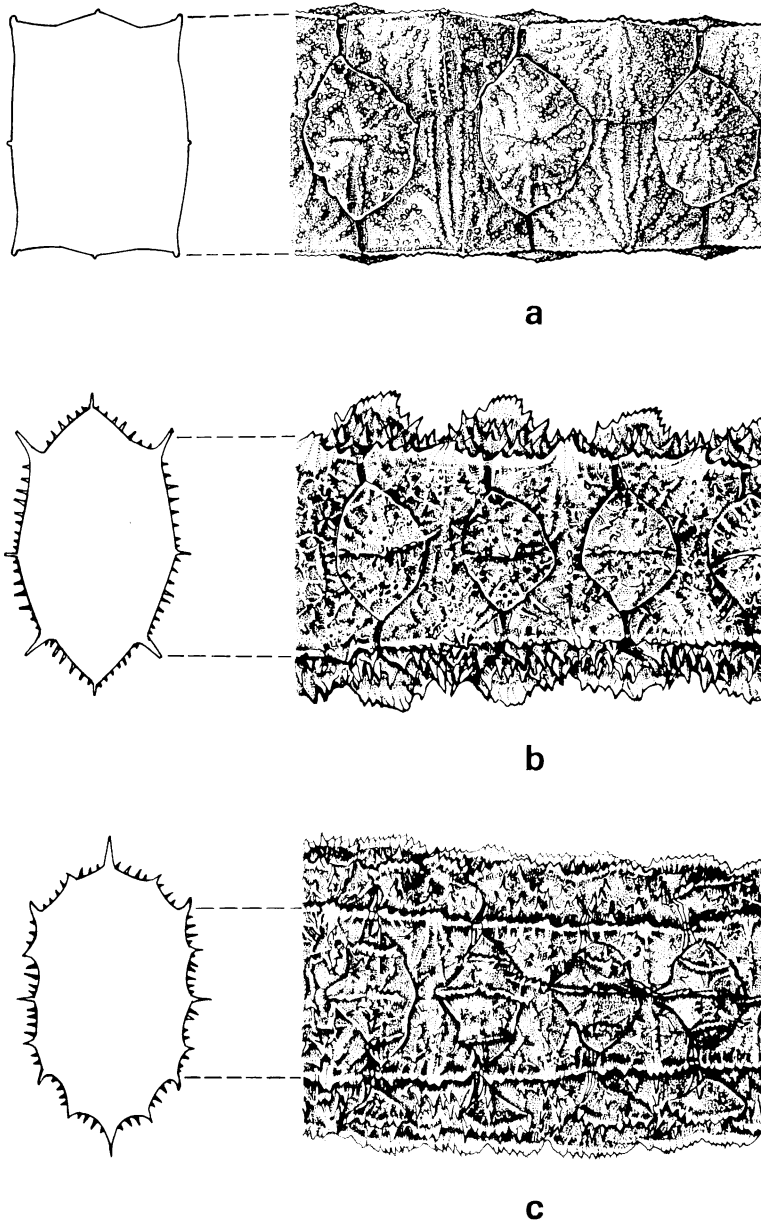


Fig. 2. Cross-sectional diagrams (left) and delineations of lateral aspect of anterior postdorsal rings (right) in *Solegnathus (Solegnathus) hardwickii* (a), *S. (S.) spinosissimus* (b) and *S. (S.) robustus* (c).

(n. comb., India and China); Kaup, 1856: 20 (synon.; descr.; "common in Indian Ocean, especially in China Sea"); Duméril, 1870: 530 (descr. from Gray's fig., comparisons); Duncker, 1909: 235 (counts; questionably, Australia); Duncker, 1912: 232 (type-

species of *Solenognathus*).

*Solegnathus polyprion* Bleeker, 1853: 25 (orig. descr., China); Kaup, 1856: 20 (jr. syn. of *S. Hardwickii*).

*Solegnathus (sic) polyprion*. Bleeker, 1857: 22 (listed).

*Solenognathus polyprion*. Bleeker, 1859: 265 (compiled); Bleeker, 1860a: 73 (compiled); Duméril, 1870: 195 (descr., China and Mauritius); Bleeker, 1878: 17 (compiled); Hubrecht, 1879: 52 (listed).

*Solenognathus hardwickii*. Günther, 1870: 195 (in part, China specimens only; descr.); Bleeker, 1873: 126 (compiled); Günther, 1880: 682 (ref.); Chen, 1935: 16, pl. 2, fig. 4 (synon., descr., common in China Sea); Lao et al., 1962: 231, fig. 195 (descr., South China Sea).

*Solenognathus asperrimus* Philippi, 1896: 384 (orig. descr., China Sea); Duncker, 1915: 64 (jr. syn. of *S. Hardwicki*).

*Solegnathus spinosissimus*. Fowler, 1907: 426 (misident.; "Victoria," Austr.).

*Solenognathus Hardwicki*. Duncker, 1915: 64 (synon.; descr.; China, not belonging to Australian fauna).

*Syngnathus hardwicki*. Jordan, 1919: 205 (type-species of *Solegnathus*).

*Solenognathus guntheri*. Fowler, 1922: 445 (misident.; "Victoria," Austr.).

*Syngnathoides hardwickii*. Chu, 1931: 98 (n. comb., synon. and refs. compiled).

*Solegnathus hardwickii*. Fowler, 1935: 236, fig. 45 (synon., characters, China); Smith, 1963: 523, pl. 77, fig. c (refs., counts, Mauritius occurrence doubtful).

*Solegnathus fasciatus*. Whitley, 1936: 25 (misident.; Lindeman I., Qld.).

*Solegnathus guntheri*. Kamohara, 1943: 131 (misident.; Okinoshima, Japan); Matsubara, 1955: 429 (compiled in key); Kamohara, 1964: 24 (compiled); Lindberg and Legeza, 1965: 262 (ref.).

*Solegnathus hardwicki*. Mauge, 1980: 97, fig. 1 (remarks on Paris Mus. specimens).

*Solenognathus hardwicki*. Mauge, 1980: 98 (descr. of specimen reportedly from Mauritius).

**Diagnosis.** Superior trunk ridge not confluent with superior tail ridge; opercular membrane without bony platelets; body surfaces mainly tuberculate; total rings usually 79~83; sides of trunk without prominent dark blotches.

**Description.** Rings 24~26+53~57, total subdorsal rings 10.0~12.25, dorsal-fin rays 40~51, pectoral-fin rays 23~26. Head length ca. 6.6~7.6 in TL. Other proportional data, based on 13 specimens 46.9~63.8 (x=57.1) mm HL, follow: snout length in HL 1.6~1.8 (1.7), snout depth in snout length 6.4~9.7 (7.5), length of dorsal-fin base in HL 1.0~1.3 (1.1), anal ring depth in HL 2.8~5.9 (4.1), trunk depth in HL 2.0~2.8 (2.4), pectoral-fin length in HL 6.0~7.4 (6.5). See Tables 1~3 for additional counts.

Dorsum of trunk and anterior half of tail flat to a little concave; trunk scutella mainly conical, without an elevated median ridge; scutella of dorsum and venter of anterior post-dorsal rings not clearly elevated and keel-like

Table 1. Frequency distributions of trunk, tail and total rings in species of *Solegnathus*.

Species	Trunk rings							Tail rings												
	21	22	23	24	25	26	27	47	48	49	50	51	52	53	54	55	56	57	58	59
<i>S. hardwickii</i>				1	13	7								1	4	5	3	8		
<i>S. lettiensis</i>	1*	4	2	3								1*	2	1	2	3	1			
<i>S. spinosissimus</i>				11	49	33	2					3	15	9	20	16	18	4	9	1
<i>S. robustus</i>					9	10*	2	2	4	7	5	3*								
<i>S. dunckeri</i>					5*	11	1						1	1	2	1	5	5*	2	

Species	Total rings														
	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86
<i>S. hardwickii</i>							1	3	4	5	6	2			
<i>S. lettiensis</i>	1*		1	1		4	2	1							
<i>S. spinosissimus</i>					6	10	13	11	15	18	12	2	8		
<i>S. robustus</i>		2	6	8	3	1*	1								
<i>S. dunckeri</i>						1	1		2	1	8*	2		1	1

\* Holotype.

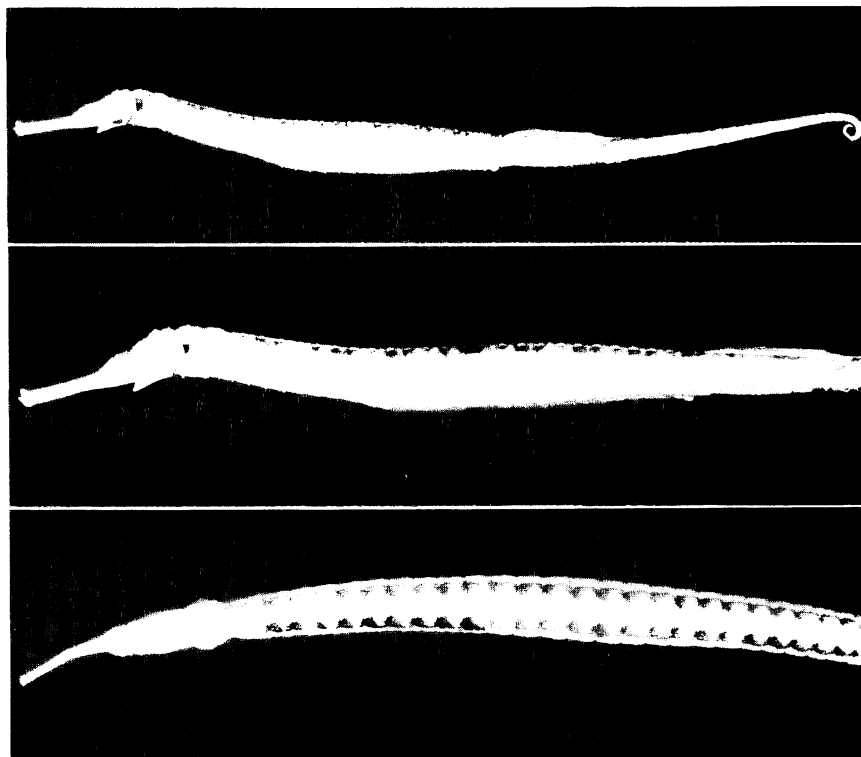


Fig. 3. *Solegnathus (Solegnathus) hardwickii*. Top and middle: Lateral aspect of adult male, 440 mm TL (GCRL 16335). Bottom: Dorsum of head and trunk of adult female, 475 mm TL (CSIRO 1753).

in lateral aspect (Fig. 2a); body surfaces not clearly spinulose, more or less tuberculate; usually with a short median dorsal spine on snout, just anterior of vertical through nares; without a strong spine under upper 5~8 pectoral-fin rays; dorsal-fin origin from middle of last trunk ring to posterior margin of 1st tail ring. Branchial skeleton lacking 1st basibranchial and 2nd hypobranchials.

Usually with a faint, dark, diagonal bar on side of snout and across eye; superior ridges of trunk and anterior third of tail margined, dorsolaterally, with dark brown or black (Fig. 3); sides and venter of anterior half of tail sometimes with 2~4 faint dusky bars (3~4 rings wide) separated by narrower pale interspaces; head and body elsewhere mainly pale; fins hyaline.

**Comparisons.** This species can only be confused with *S. lettiensis* from which it differs in having somewhat higher numbers of trunk rings, total rings and total subdorsal rings (Tables 1,

3). *Solegnathus hardwickii* has a shorter snout than *S. lettiensis* (compare Figs. 3, 5) and a lower length of dorsal-fin base in HL ratio (averages 1.1 versus 1.4). Spiny platelets have not been found on opercular membranes of examined *S. hardwickii* (present at symphysis in some *S. lettiensis*) and this species lacks the dark lateral blotches which are usually present in *S. lettiensis*.

**Remarks.** The specific name is derived from Gray's (1830) illustration, captioned "*Sygnathus Hardwickii* n. India," which is a composite of the head of a *Sygnathoides biaculeatus* (Bloch), the body and anterior tail portion of a *Solegnathus*, and a distal tail portion invented by the artist (Fig. 4). The date of Gray's figure has usually been given as 1832 but Sawyer (1953) shows the correct date to be 1830. Günther (1870) listed two British Museum specimens (a-b) as "types" but these unregistered, dried, fish (now 320~350 mm TL) do not in any way agree with the original plate. The Museum

Table 2. Frequency distributions of dorsal- and pectoral-fin rays in species of *Solegnathus*.

Species	Dorsal-fin rays																					Pectoral-fin rays					
	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	22	23	24	25	26
<i>S. hardwickii</i>											1	1	4	3	5	4	1		1		1	1		4	20	7	3
<i>S. lettiensis</i>								1*							1	1		1		1			5	3	4*		
<i>S. spinosissimus</i>					7	7	30	23	16	12	1	3	1										14	91	63	7	
<i>S. robustus</i>	1		7	6	7*																		5	27*	7*		
<i>S. dunckeri</i>											1	2	1	6	5*			1					5*	12*	9	3	

\* Holotype.

Table 3. Frequency distributions of total subdorsal rings in species of *Solegnathus*.

Species	Total subdorsal rings																	
	8.00	8.25	8.50	8.75	9.00	9.25	9.50	9.75	10.00	10.25	10.50	10.75	11.00	11.25	11.50	11.75	12.00	12.25
<i>S. hardwickii</i>										2	2	3	4	5*	2		1	1
<i>S. lettiensis</i>						1*		1	2	2	3	2	2					
<i>S. spinosissimus</i>				1	3	5	9	9	22	8	21	13	5	5	1	1		
<i>S. robustus</i>	1		2	7	3	2	6*											
<i>S. dunckeri</i>								1	1	5		5*	3	2				

\* Holotype.





Fig. 4. Reproduction of the original illustration of *Sygnathus* (sic) *Hardwickii* from Gray (1830).

does however have an incomplete, dried, specimen (BMNH 1981.6.22.1) which almost exactly replicates the body and anterior tail portion of Gray's illustration in size and configuration. Most of the head and pectoral ring are lost or damaged, the distal part of the tail is missing, fins are lost or damaged and overall length is ca. 377 mm. There are 25 trunk rings, 26 tail rings remain, dorsal-fin base originates at the anterior margin of the 1st tail ring and extends across a total of 11 tail rings, body surfaces are tuberculate, and the lateral ridge is confluent with the superior tail ridge. Sex is uncertain but the anterior part of the tail is expanded somewhat laterad, thereby suggesting that it is a male. There is little doubt that this specimen, labeled "China," was the model for the middle portion of Gray's illustration, and it is here considered the presumptive holotype of *Solegnathus hardwickii*. Gray's indication of India as the type locality, evidently representing a further error in his illustration, may have originated with the use of an Indian specimen of *Sygnathoides biaculeatus* as the model for the illustrated head.

Six adult males of *Solegnathus hardwickii* (296~428 mm TL) have the brood area extending below the anterior 16~19 tail rings and maximum numbers of transverse egg-compartments are 5~8. One male (424 mm TL) has a total of about 150 compartments, whereas the number approaches 200 in a 428 mm fish. Although evidently somewhat smaller than the presumptive holotype, none of the other examined specimens have the tail clearly expanded laterad in the brood area. There are 20~27 ( $\bar{x}=24.5$ ) modified distal tail rings in 12 specimens examined; the ventral membrane is not clearly thickened, the transverse pads are little developed anteriorly and none are exceptionally swollen or enlarged.

Although body surfaces are essentially tuber-

culate in most subadult- adult specimens, some fish have small denticulations on principal ridges of trunk and anterior tail rings, and a few minute spinules on other body surfaces. These variations are, however, always inconspicuous and never approach the clearly spiny conditions (Fig. 2b, c) found in *S. spinosissimus* and *S. robustus*. The smallest specimens examined (196~235 mm) have finely spinulose surfaces on side of snout and opercle, and there are somewhat enlarged spines on dorsum of head, opercle and pectoral-fin base. Additionally, the median projection on principal ridges of the trunk and anterior tail rings is somewhat enlarged, sometimes triangular in lateral aspect, and scutella of some tail rings are keeled rather than conical.

**Distribution.** Günther (1870) found no evidence that *S. hardwickii* occurs in Indian waters and there are no subsequent collections known from India or the western Indian Ocean. Duméril (1870), Bleeker (1878) and Mauge (1980) discussed or listed a specimen in the Paris collection (MNHN 9225) which reportedly came from Mauritius. In the absence of other Indian Ocean material (W of 115°E), I consider this to be a highly suspect locality record, in all probability, based on a mislabeled specimen of eastern Indian Ocean or Pacific origin. Similarly, I believe that specimens from "South America" (MNHN 6043) are labeled incorrectly, and that the New Caledonia locality of another (MNHN 8137) is questionable. Fowler (1907) reported two specimens (as *S. spinosissimus*) as "evidently . . . from Victoria (Austr.)" and subsequently (1922) reidentified these as *S. guntheri*. These fish (ANSP 33154, 33161) are conspecific with *S. hardwickii* but, in the absence of other specimens of this species from southern Australian waters, the Victoria locality is questionable. I have not seen the two other specimens, without locality data, mentioned by

Fowler (1922). Although I have not seen the specimen, Kamohara's (1943) record of *S. guentheri* from the east coast of Japan is referred to *S. hardwickii* due to the relatively short snout (snout length 1.7 in HL), presence of 12 subdorsal rings and apparent lack of dark lateral blotches on the trunk. Duncker (1915) excluded *S. hardwickii* from the Australian fauna but I find no distinctive differences between Australian specimens and those from other areas.

Distribution of *S. hardwickii* is presently unclear, but it may be described from the literature and material examined as follows: Western Australia (ca. 115°57'E), the Arafura Sea, Queensland and New South Wales (Aust.), South China Sea, Japan (off Okinoshima I., ca. 132°32'E), and from ca. 28°18'S to ca. 32°43'N. Depth range of trawled Australian specimens is 12.2~100 m.

**Material examined.** Thirty-three specimens, 196~490 mm TL, including presumptive holotype.

Presumptive holotype: BMNH 1981. 6. 22. 1. (damaged, dried, overall length now ca. 377 mm), "China."

Other material: ARAFURA SEA: AMS I. 21950-002 (1, 381). AUSTRALIA, WA: CSIRO CA. 1753 (1, 475), GCRL 16335 (1, 440), WAM P. 26227-002 (2, 446~488). Qld.: AMS E. 1793 (2, 376~393), AMS E. 2590 (1, 424), AMS E. 2591 (1, 396), AMS E. 2622 (1, 410), AMS E. 2797 (1, 428), AMS IA. 6562 (1\*, 456), AMS IB. 8096 (1\*, 490), QM I. 12022 (1, 380), QM I. 12024 (1, 420), QM I. 12571 (3, 196~234). NSW: AMS IB. 2761 (1\*, 434). SOUTH CHINA SEA, Macao: MNHN 6044 (1, 404). LOC. UNCERTAIN: BMNH uncat. (2\*, 320~350), BMNH 1851. 12. 27. 382 (1\*, 410), MNHN 6042 (2, dam.), RMNH 2770 (2\*, 235~270, syntypes of *Solegnathus polyprion*), USNM 4892 (1, 385) and USNM 4895 (1, 385), all labeled "China." LOC. QUESTIONABLE: ANSP 33154 (1, dam.), ANSP 33161 (1, dam.), Victoria (Aust.). MNHN 6043 (2, dam.), South America. MNHN 8137 (1, dam.), New Caledonia. MNHN 9225 (1, dam.), Ile Maurice (Mauritius). USNM 12522 (1\*, dam.), no loc. data.

*Solegnathus (Solegnathus) lettiensis* Bleeker  
(Fig. 5)

*Solenognathus lettiensis* Bleeker, 1860b: 3 (orig. descr.; Letti I. (Banda Sea, Indonesia)).

*Solenognathus lettiensis*. Duméril, 1870: 530 (descr. compiled); Hubrecht, 1879: 51 (listed); Duncker, 1915: 66 (characters); Lindberg, 1971: 127, fig. 483 (fig. only).

*Solenostomus lettiensis*. Günther, 1870: 516 (lapsus calami, diagnosis).

*Solegnathus lettiensis*. Weber and de Beaufort, 1922: 66, fig. 28 (in key, descr.); Fowler, 1928: 112 (incorrect synonym, characters).

*Solenognathus hardwickii*. Günther, 1870: 195 (misident., in part; sp. "d" only, Houtman's Abrolhos (WA)); Macleay, 1882: 300 (descr. compiled).

*Solegnognathus* (sic) *Hardwickii*. Saville-Kent, 1897: 186 (misident., in part; Houtman's Abrolhos, ref. only).

*Solenognathus guntheri* Duncker, 1915: 65 (orig. descr.; Houtman's Abrolhos, WA).

*Solegnathus guntheri*. Weber and de Beaufort, 1922: 66, fig. 29 (in key, descr., Strait of Madura).

*Solegnathus guntheri*. McCulloch, 1929: 94 (compiled); Munro, 1958: 90, fig. 627 (characters); Whitley and Allan, 1958: 5 (compiled); Whitley, 1964: 38 (compiled); Hutchins, 1979: 93 (Rottneest I., WA).

*Solegnathus guentheri*. Whitley, 1948: 14 (emendation, compiled); Shiino, 1972: 62 (Günther's pipefish).

**Diagnosis.** Superior trunk ridge not confluent with superior tail ridge; opercular membrane without bony platelets on sides, platelets sometimes present on venter; body surfaces mainly tuberculate; total rings usually 72~78; sides of trunk usually with prominent dark blotches.

**Description.** Rings 21~24+51~56, total subdorsal rings 9.0~10.75, dorsal-fin rays 37~49, pectoral-fin rays 22~24. Head length ca. 5.5~7.4 in TL. Other proportional data, based on 6 specimens, 49.7~79.5 ( $\bar{x}$ =66.9) mm HL follow: snout length in HL 1.5~1.6 (1.6), snout depth in snout length 7.6~9.5 (8.7), length of dorsal-fin base in HL 1.3~1.5 (1.4), anal ring depth in HL 4.7~5.5 (5.2), trunk depth in HL 2.4~3.0 (2.7), pectoral-fin length in HL

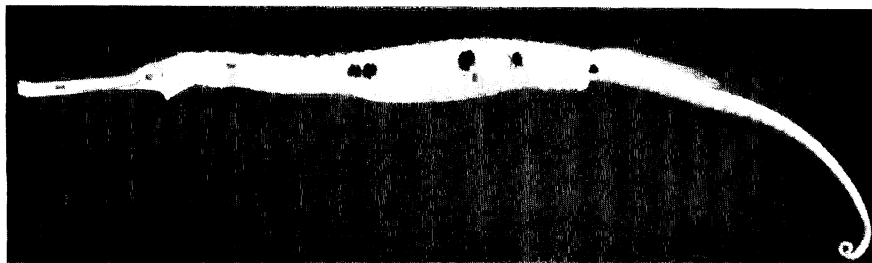


Fig. 5. *Solegnathus (Solegnathus) lettiensis*. Adult female, 392 mm TL (NMV A. 1828).

6.7~9.8 (8.2). See Tables 1~3 for additional counts.

Dorsum of trunk and anterior half of tail flat to a little concave; trunk scutella essentially as in *S. hardwickii* (Fig. 2a); scutella of dorsum and venter of anterior postdorsal rings a little elevated but not clearly keel-like; body surfaces not spinulose, more or less tuberculate; without a strong short spine under upper 5~8 pectoral-fin rays; venter of opercular membrane sometimes with a few bony platelets; with or without a short median dorsal spine before nares; dorsal-fin origin from anterior margin of 1st tail ring to distal fourth of 2nd.

Coloration variable in study material; the holotype and some dried specimens without persistent markings. An Indonesian fish (ZMA 115.452) lacks markings on head but retains brown blotches (1~2 rings wide), separated by 2~3 ring pale interspaces, on sides of trunk and anterior part of tail. There are 7 blotches on the left side, 8 on the right and most extend from the superior ridge to just below the lateral ridge (see Weber and de Beaufort, 1922: fig. 29). Most Australian examples have 2~6 near black spots or blotches on sides of trunk and anterior part of tail (Fig. 5), and spots usually extend a little below the lateral ridge. The recently collected specimen illustrated here also has hyaline fins, a dark lateral stripe on snout, dusky shading on venter of middle third of tail, and faint, dark margined, ocelli between lateral blotches and between lateral and superior trunk ridges.

**Comparisons.** This species is most similar to *S. hardwickii* from which it mainly differs in having somewhat fewer trunk and total rings, in some proportional values and in coloration. Further study may show that the presence of

platelets on the symphysis of the opercular membrane is a consistent distinguishing feature of *S. lettiensis*. For further comparisons see key, diagnoses and this section under *S. hardwickii*.

**Remarks.** The holotype of *S. lettiensis* (RMNH 7254), now ca. 315 mm TL, has a badly damaged opercular membrane, the head is almost detached from the body, there are 23 modified distal tail rings and no color markings persist. Measurements (mm) of this presumably immature specimen follow: HL 49.7, snout length 31.0, snout depth 4.0, length of dorsal-fin base 33.6, anal ring depth 9.9, trunk depth 18.8, pectoral-fin length 6.3 (see Tables 1~3 for counts). There are no bony platelets on remaining lateral portions of the opercular membrane and the membrane is completely destroyed at the symphysis.

Duncker (1915) described *S. guentheri* from a single dried, presumably female, specimen from Western Australia. The description fails to clearly distinguish *S. guentheri* from either *S. hardwickii* or *S. lettiensis* and some authors (Fowler, 1922; Kamohara, 1943) have apparently considered *guentheri* to be a replacement name or a senior synonym of *hardwickii*. Duncker further confused his description by assuming incorrectly that specimens discussed as *S. hardwickii* by Waite (1895) were conspecific with the holotype of *S. guentheri*, when these were, in fact, representatives of the species subsequently described as *S. dunckeri*. Duncker estimated the total length of the holotype of *S. guentheri* as 460~470 mm and reported 42 dorsal-fin rays, 24+53 rings and 11 total subdorsal rings. This specimen (BMNH 1844.2.15.76) has a rather long snout, but it is now in 3 pieces and cannot be measured accurately. Body surfaces

and scutella are similar to those of *S. hardwickii* and *S. lettiensis*, and traces persist of 5~6 dark spots on the side. The opercular membrane, pectoral and anal fins are missing, dorsal-fin rays cannot be counted accurately, and there are 10.25 total subdorsal rings. This specimen is here considered conspecific with *S. lettiensis* due to the low numbers of trunk and total rings and the seemingly long snout. Although there is some variation in persistent color markings, I find no substantial characters which serve to distinguish Australian specimens with long snout and low trunk ring counts from *S. lettiensis*.

One to three small bony platelets are present on the venter of the opercular membrane in four well-preserved specimens, but their presence or absence cannot be determined accurately in dried or poorly preserved material. The median dorsal preanial spine is rather prominent in the holotype and variously prominent, reduced or indistinguishable in other material. There are 22~25 ( $\bar{x}$ =23.4) modified distal tail rings in 5 examined specimens, the ventral membrane is not clearly thickened and transverse pads are not exceptionally swollen or enlarged. There are no brooding males in the study material.

**Distribution.** Presently known from Indonesia (ca. 07°~08°20'S) and Western Australia (ca. 23°~35°S). One Australian specimen was found stranded on the beach, two others were trawled in 146 and 172~180 m.

**Material examined.** Thirteen specimens, 315~510 mm TL, including holotype.

Holotype: RMNH 7254 (315 mm TL), Letti I. (ca. 08°20'S, 127°57'E), Indonesia.

Other material: INDONESIA, Strait of Madura: ZMA 115.452 (1, 390). AUSTRALIA, WA: AMS IB. 1381 (1\*, 470), BMNH 1844. 2. 15.76 (dried and damaged holotype of *S. guentheri*), NMV A. 1828 (1, 392), WAM P. 1131 (1\*, 315), WAM P. 1218 (1\*, dam.), WAM P. 1219 (1\*, dam.), WAM P. 3021 (1\*, dam.), WAM P. 3373 (1\*, 510), WAM P. 7220 (1, 442), WAM P. 7874 (1, 400), WAM P. 27350-001 (1, 485).

*Solegnathus (Solegnathus) spinosissimus* Günther (Fig. 6)

*Solenognathus spinosissimus* Günther, 1870: 195 (orig. descr., Tas.); Hutton, 1872: 69 (characters); Klunzinger, 1872: 44 (listed); Klunzinger,

1879: 420 (compiled); Macleay, 1882: 301 (compiled); Johnston, 1883: 134 (common; Derwent, Tas.); Johnston, 1890: 37 (compiled); Lucas, 1890: 39 (compiled); Waite, 1895: 220, 222, 226, pl. 17, figs. 5, 8 (descr.; notes on brooding male); Waite, 1898: 50 (note, NSW); Waite, 1899: 61, fig. 5 (descr. of male brood area, eggs, and 35 mm hatchling); Steindachner, 1901: 516 (Chatham I.); Fowler, 1907: 426 (type-species of *Castelnaulina*); Duncker, 1909: 235 (synon., descr., distr.); Duncker, 1915: 65 (synon., descr., distr.); Whitley, 1955: 119 (ref.).

*Solenognathus fasciatus* Günther, 1880: 30, pl. 14, fig. b [orig. descr.; 120 fms off Twofold Bay (NSW)]; Macleay, 1884: 61 (compiled); Waite, 1895: 220, 226, pl. 17, figs. 6, 7 (comparisons, characters); Waite, 1898: 50 (note, NSW); Waite, 1899: 62 (ref.); Duncker, 1909: 235 (jr. syn. of *S. spinosissimus*).

*Solegnathus (sic) spinosissimus*. Saville-Kent, 1897: 186, color pl. 6 (note, Tas.).

*Solegnathus spinosissimus (sic)*. Hutton, 1904: 52 (compiled).

*Solegnathus fasciatus*. Waite, 1904: 19 (compiled); McCulloch, 1911: 27 (compared with *S. spinosissimus*; notes on eggs and brood area; in key; Bass Strait and Disaster Bay, NSW); McCulloch, 1921: 38, fig. 99c (in key; perhaps synonymous with *S. spinosissimus*); Lord, 1923: 64 (compiled); Lord and Scott, 1924: 40 (compiled); Lord, 1927: 13 (compiled); Whitley, 1927: 293 (in key); McCulloch, 1929: 94 (compiled); Scott, 1934: 39~41 (Tas.); Whitley, 1936: 25 (in part, synonym and refs. only); Scott, 1939: 138, 142 (in key); Munro, 1958: 90, fig. 625 (characters, range); Whitley and Allan, 1958: 51 (range); Scott, 1961: 58, 60 (in key); Scott, 1963: 17, fig. 6 (descr.; notes on eggs, brood area and prehensile tail rings); Whitley, 1964: 38 (compiled); Scott, 1979: 111 (meristic and morphometric data, coloration).

*Solegnathus spinosissimus*. Waite, 1904: 19 (compiled); Waite, 1907: 14 (compiled); McCulloch, 1911: 27 (in key); Waite, 1912: 318 (compiled); McCulloch, 1921: 38 (in key; on beaches after storms); Lord, 1923: 64 (compiled); Lord and Scott, 1924: 40 (compiled); Lord, 1927: 13 (compiled); Phillipps, 1927: 11 (compiled); Whitley, 1927: 293 (in

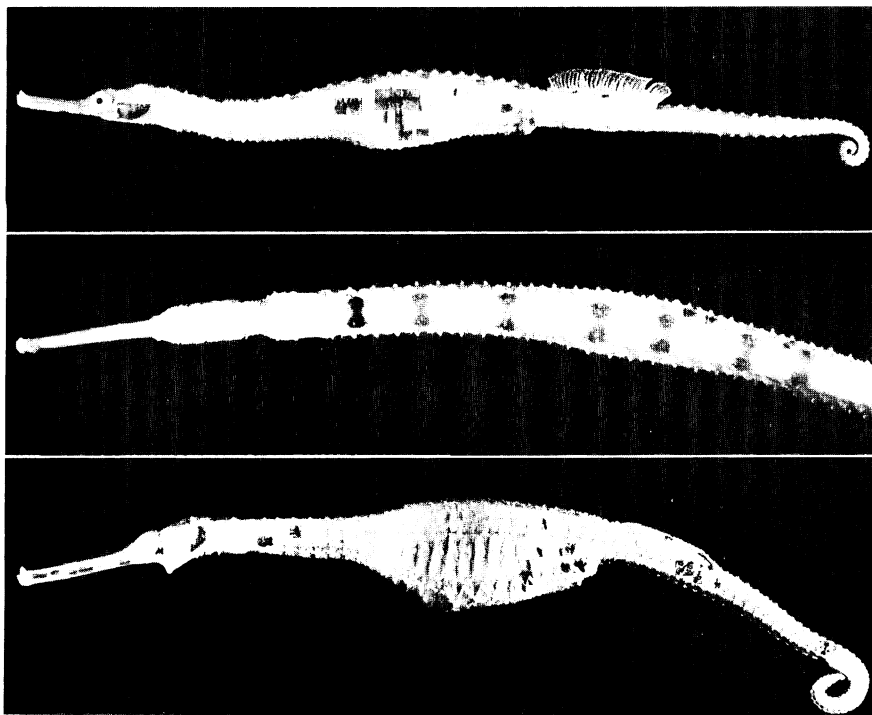


Fig. 6. *Solegnathus (Solegnathus) spinosissimus*. Top: Adult male, 373 mm TL (GCRL 17555). Middle: Dorsum of head and trunk of adult male, 336 mm TL (GCRL 17503). Bottom: Adult female, 388 mm TL (GCRL 16317).

key); McCulloch, 1929: 94 (compiled); Scott, 1934: 40 (Tas.); Scott, 1939: 139, 142 (in key); Whitley, 1955: 119 (ref.); Munro, 1958: 90, fig. 626 (characters, range); Whitley and Allan, 1958: 51 col. pl., fig. 3 (range); Scott, 1961: 58 60 (in key); Scott, 1962: 120, fig. (in key, characters, distr.); Scott, 1963: 19 (ref.); Whitley, 1964: 38 (compiled); Scott et al., 1974: 137, 138, fig. (in key, characters); Dawson, 1980b: 284, fig. 3 (diagnosis, notes).

*Solegnathus robustus naso* Whitley, 1941: 17 (orig. descr.; Auckland fish market, New Zealand); Dawson, 1980b: 283 (note).

*Solegnathus (sic) spinosissimus*. Scott, 1980: 106 (listed).

*Solegnathus (sic) fasciatus*. Scott, 1980: 107 (listed).

**Diagnosis.** Superior trunk ridge not confluent with superior tail ridge, opercular membrane with bony platelets on sides and venter, body surfaces spinulose, total rings 76~84, snout depth more than 5.5 in snout length, without supplemental ridges between scutella

and principal body ridges (Fig. 2b).

**Description.** Rings 24~27+51~59, total subdorsal rings 8.75~11.75, dorsal-fin rays 34~42, pectoral-fin rays 23~26. Head length ca. 5.1~7.2 in TL. Other proportional data, based on 55 Australian specimens, 25.4~65.1 ( $\bar{x}$ =54.1) mm HL, follow: snout length in HL 1.6~1.8 (1.7), snout depth in snout length 5.6~9.1 (7.2), length of dorsal-fin base in HL 1.0~1.7 (1.4), anal ring depth in HL 2.7~5.7 (4.1), trunk depth in HL 1.6~3.7 (2.2), pectoral-fin length in HL 5.9~8.1 (6.9). See Tables 1~3 for additional counts.

Dorsum of trunk and anterior half of tail flat to a little convex; trunk scutella not conical, generally with an elevated, spiny or serrate, median ridge; scutella of dorsum and venter of anterior postdorsal rings clearly elevated and keel-like in lateral aspect (Fig. 2b); body surfaces spinulose, densely so in smaller specimens; without well-developed spiny or serrate ridges between scutella or between scutella and principal body ridges; median marginal spines on principal

ridges of each ring of trunk and anterior half of tail enlarged, those on superior and inferior ridges angled laterad; without a prominent preanarial spine on dorsum of snout; with a strong, truncate, spine under upper 5~8 rays of adpressed pectoral fin; anterior postdorsal part of tail not clearly oval in cross-section; dorsal-fin origin from anterior margin of 1st tail ring to anterior fourth of 3rd. Branchial skeleton with reduced or poorly ossified 2nd hypobranchials.

Coloration plain, with 7 dark bars on dorsum of trunk (Fig. 6), or with bars reduced to one or more pairs of dark to indistinct bilateral spots or blotches; venter and lower part of side of last 2~4 trunk rings often dusky; fins hyaline.

**Comparisons.** The combination of lateral and ventral platelets on the opercular membrane, a truncate spine under the pectoral fin, ridged scutella and spinulose body surfaces distinguishes *S. spinosissimus* from all congeners except *S. robustus*. This species has a more slender snout than *S. robustus* (snout depth in snout length 5.6~10.1 versus 3.7~4.5), lacks short supplemental ridges on body surfaces (compare Fig. 2b, c), and a strongly convex dorsum (present in *S. robustus*), and the anterior postdorsal part of the tail is not oval in cross-section (clearly so in *S. robustus*). Among other congeners, spinulose surfaces occur only in *S. dunckeri* but spinules in that species are usually shorter and less abundant than in *S. spinosissimus*.

**Remarks.** The syntypes of *Solegnathus spinosissimus* (BMNH 1860. 11. 29. 55~56) consist of two dried, presumably female, specimens; one ca. 340 mm TL, the other, lacking some distal tail rings, has an overall length of about 290 mm. The complete fish has 25+54 rings, 34 dorsal-fin rays and 9.75 total subdorsal rings. The damaged specimen has 25 trunk rings and 10.0 total subdorsal rings. The holotype of *S. fasciatus* (BMNH 1897. 5. 14. 462) is a presumptive female (300 mm TL) with 25+56 rings, 10.5 total subdorsal rings, 41 dorsal and 24 pectoral-fin rays. Duncker (1909, 1915) synonymized *S. fasciatus* with *S. spinosissimus* and I also find the type material of these nominal species to be conspecific.

I find no significant geographical variation in examined Australian specimens but some differences are noted in compared material from New Zealand. Proportional data based on 14

fish (50.0~89.5 ( $\bar{x}$ =71.9) mm HL), show the New Zealand specimens to have a more slender snout than Australian material (snout depth in snout length averages 8.5 versus 7.2) and the length of dorsal-fin base in HL ratio is somewhat higher (averages 1.7 versus 1.4). Whitley (1941) described *Solegnathus robustus naso* from a damaged fish (ca. 455 mm TL) purchased in the market at Wellington, New Zealand. This specimen (AMS I. 14837), now dried and varnished, has a broken snout and the post-dorsal portion of the tail is separated from the remainder. The snout is long (estimated at 1.6 in HL), platelets persist in the opercular membrane, there are 26+58 rings and the specimen is conspecific with *S. spinosissimus*. Whitley's (1941) name (*naso*) is available for the New Zealand population of *S. spinosissimus* should it be proven subspecifically distinct from the Australian population.

Spiny platelets are present on sides and venter of the opercular membrane in all examined material. In some specimens, platelets extend forward on the gular membrane, and platelets are sometimes found on the basal membranes of pectoral and dorsal fins. There are 25~32 ( $\bar{x}$ =28.9) modified distal tail rings in 49 specimens examined; the ventral membrane is essentially thin throughout in some specimens, whereas it is thickened and transverse pads are swollen or enlarged in others (Fig. 6). The brood area is below the anterior 14~19 ( $\bar{x}$ =16.7) tail rings in 11 specimens examined and maximum numbers of transverse egg-compartments are 5~9. The brood area is not expanded laterally nor compressed dorsoventrally. As determined from the presence of a membranous ventral surface in the brood area, the smallest examined mature male is 206 mm TL, the remainder 315~483 mm TL. Mature females usually have a strikingly deep trunk (Fig. 6).

The small male noted above (AMS E. 5480) is also atypical in having low counts (not in Tables) of 50 tail rings, 32 dorsal-fin rays and 22 rays in each pectoral fin. It also lacks a strong spine on the pectoral-fin base (usually present in small fish) and dorsum and venter of the anterior postdorsal rings are clearly convex. This specimen agrees with *S. spinosissimus* in other features but it may represent an undescribed taxon.

**Distribution.** Known only from Australia

and New Zealand. Among examined Australian material, there is one sample from off Brisbane, Qld. (ca. 27°S). All others with adequate data are from the states of New South Wales, Victoria and Tasmania. Absence of confirmed records from South Australia suggests that this species is replaced by *S. robustus*, but additional collections are required to determine the western limits of *S. spinosissimus* along the southern Australian coast. Examined New Zealand material is from both North Island and South Island, and there is one literature record from Chatham I. (Steindachner, 1901). Collection data include one stranded specimen, one "dropped by fish hawk," and 21 trawl samples in 29~232 m. I am advised that the species is not uncommon in depths of 2~3 m near the Derwent River, Tasmania (pers. com., P. Last).

**Material examined.** One hundred and sixteen specimens, 162~488 mm TL, including two syntypes.

Syntypes: BMNH 1860. 11. 28. 55~56 (2\*, one incomplete, one 340 mm TL), Tasmania.

Other material: AUSTRALIA, Qld.: AMS I. 15538-001 (2, 375~389). NSW: AMS I. 1211 (1, 407), AMS I. 3214 (1, dam.), AMS I. 4015 (1, 344), AMS I. 4018 (1, 362), AMS I. 4262 (1, 437), AMS I. 9305 (1, 460), AMS I. 9905 (1, dam.), AMS I. 9906 (1, dam.), AMS I. 9911 (1, 384), AMS I. 10808 (1, 316), AMS I. 12268 (1, 412), AMS I. 13842 (1, 376), AMS I. 14859 (1\*, dam.), AMS I. 16566-002 (1, 270), AMS I. 16566-003 (1, 293), AMS I. 16566-004 (1, 345), AMS I. 17321-001 (1, 387), AMS I. 18839-004 (1, 269), AMS IA. 3657 (1, 342), AMS IA. 6891 (1, 385), AMS IA. 7506 (1\*, dam.), AMS IA. 8060 (1, 410), AMS IA. 1289-91 (3\*, dam.), AMS IB. 651 (1\*, dam.), AMS IB. 2025 (1\*, 270), AMS IB. 2540 (1, 407), AMS IB. 4333 (6, 260~415), BMNH 1897. 5. 14. 462 (1, 300, holotype of *S. fasciatus*), GCRL 17498 (1, 337), GCRL 17503 (1, 336), GCRL 17555 (1, 373), USNM 176896 (2, 349~392), WAM P. 1064 (1\*, 390). Vic.: AMS E. 2985 (1, 379), AMS E. 3021 (1, 362), AMS E. 3022 (1, 315), NMV A. 189 (2, 303~350), NMV A. 558 (1, 226), NMV A. 1441 (1, 246), NMV A. 1473 (2, 267~360), NMV A. 1507 (2, 312~349), NMV A. 2031 (1, 310), NMV A. 2032 (1, 350), NMV A. 2033 (3, 342~390), NMV A. 2034 (1, 390), NMV A. 2035 (3, 315~365), NMV A. 2036 (1, 221), NMV A. 2042 (7, 285~

400), NMV R. 11957 (1, 360). Tas.: AMS E. 1202 (1, 364), AMS E. 5480 (2, 206~247), AMS I. 43 (1, 347), AMS I. 10776 (1, 359), AMS I. 10777 (1, 343), AMS I. 10779 (1, 403), AMS I. 10793 (1, 162), AMS I. 21304-008 (2, 216~304), AMS IA. 1228 (1, 390), BMNH 1911. 4. 1. 56 (1, 380), MNHN A. 833 (1, 240), NMV A. 1341 (1, 369), TFDA uncat. (4, 293~395), WAM P. 10291 (1, 392). Loc. unknown: AMS I. 3038 (1, 357), NMV A. 2043 (1, 411), NMV A. 2044 (1, 332), WAM P. 27304-001 (1, 335). NEW ZEALAND, North I.: AMS IB. 8374 (1\*, dam.), BMNH 1913. 12. 4. 9 (1, 333), NMNZ P. 900 (1, 305), NMNZ P. 1928 (1, 375), NMNZ P. 2490 (1, 455), NMNZ P. 5260 (1, 418), NMNZ P. 6085 (1, 483). South I.: AMS I. 15350-001 (1\*, 283), GCRL 16317 (2, 388~400), NMNZ P. 1188 (7, 286~482), NMNZ P. 7240 (1, 424). Loc. unknown: AMS I. 14837 (dried and damaged holotype of *S. robustus naso*).

*Solegnathus (Solegnathus) robustus* McCulloch  
(Fig. 7)

?*Solenognathus spinosissimus* (not of Günther)  
Zietz, 1908: 299 (Port Lincoln, SA).

*Solegnathus robustus* McCulloch, 1911: 28, pl. 9, fig. 2 (orig. descr.; off Flinders I., SA); Waite and Hale, 1921: 312, fig. 50 (synon., descr.); McCulloch, 1929: 94 (compiled); Scott, 1934: 40 (notes, Bass Strait); Scott, 1939: 139, 142 (characters in key, Tas.); Munro, 1958: 90, fig. 628 (characters, range); Whitley and Allan, 1958: 51 (range); Scott, 1961: 58, 60 (characters in key); Scott, 1962: 120, fig. (in key, characters, range); Scott, 1963: 19 (ref.); Whitley, 1964: 38 (compiled); Scott et al., 1974: 137, fig. (in key, characters, range).

*Solenognathus robustus*. Duncker, 1915: 66 (descr. compiled).

*Solegnathus (sic) robustus*. Scott, 1980: 107 (listed).

**Diagnosis.** Superior trunk ridge not confluent with superior tail ridge, opercular membrane with bony platelets on sides and venter, body surfaces spinulose, total rings 73~78, snout depth less than 5 in snout length, with supplemental ridges between scutella and principal body ridges (Fig. 2c).

**Description.** Rings 25~27+47~51, total subdorsal rings 8.0~9.5, dorsal-fin rays 30~34,

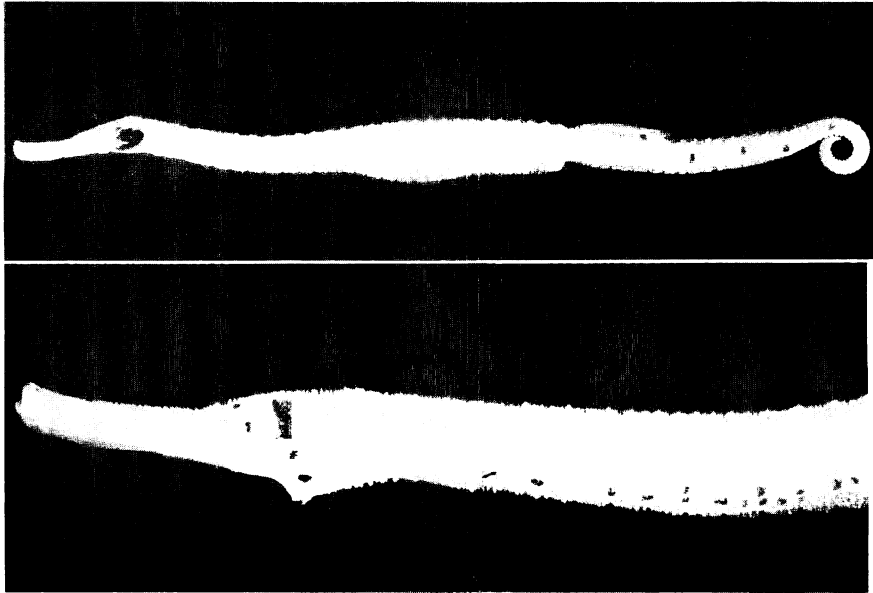


Fig. 7. *Solegnathus (Solegnathus) robustus*. Top: Adult female, 310 mm TL (SAM F. 4678). Bottom: Adult female, holotype, 298 mm TL (AMS E. 945).

pectoral-fin rays 23~25. Head length ca. 6.3~7.6 in TL. Other proportional data, based on 16 specimens 41.0~49.3 ( $x=45.0$ ) mm HL follow: snout length in HL 1.7~1.9 (1.8), snout depth in snout length 3.7~4.5 (4.0), length of dorsal-fin base in HL 1.1~1.5 (1.3), anal ring depth in HL 3.4~4.5 (3.9), trunk depth in HL 1.6~2.9 (2.3), pectoral-fin length in HL 5.0~6.8 (5.7). See Tables 1~3 for additional counts.

Dorsum of trunk and anterior half of tail strongly convex; trunk scutella not conical, with a somewhat elevated, spiny or serrate, median ridge; scutella of dorsum and venter of anterior postdorsal rings (Fig. 2c) somewhat arcuate, keel-like, but not strongly elevated in lateral aspect; body surfaces densely spinulose, with short diagonal and longitudinal ridges between scutella and between scutella and principal body ridges; median marginal spines on principal ridges of trunk and anterior half of tail not greatly enlarged, those on superior and inferior ridges not angled strongly laterad; without a prominent preanial spine on dorsum of snout; with a short truncate spine under upper 5~8 pectoral-fin rays; anterior postdorsal part of tail clearly oval in cross-section; dorsal-fin origin from anterior fourth of 1st tail ring to middle of 2nd; 2nd hypobranchials present.

Coloration largely pale to near white, without prominent markings except for dusky to dark brown shading on lower half of last 2~3 trunk rings in some specimens; fins hyaline. Among recently preserved fish, some specimens have diffuse dusky shading on side of snout and the dorsum and upper part of sides are sprinkled lightly with brown microchromatophores. The dorsum, in most of these fish, has minute, bilateral, spots (ca. 1~2 mm diameter) formed by concentrations of brownish chromatophores about the bases of the median marginal spines on the superior ridges of some rings. Arrangement of spots is irregular; in one specimen, paired spots persist on rings 2, 6, 10, 13, 21, 25, 29, 33 and 41.

**Comparisons.** The combination of bony platelets on sides and venter of the opercular membrane, a strong spine under the pectoral fin, ridged scutella, spinulose body surfaces and low numbers of dorsal-fin rays (30~34 versus 37~51) distinguishes *S. robustus* from all congeners except *S. spinosissimus*. For further comparisons, see this section under *S. spinosissimus*.

**Remarks.** The holotype of *S. robustus* is a well-preserved adult female without persistent markings, with ca. 31 modified distal tail rings



and with dorsal-fin origin at the anterior margin of the 2nd tail ring. Measurements (mm) follow: TL 298, HL 47.3, snout length 27.1, snout depth 6.0, length of dorsal-fin base 32.3, pectoral-fin length 7.0 (see Tables 1~3 for counts).

The opercular membrane is densely covered with spinous platelets in *S. robustus* and they often extend forward on the gular membrane; similar platelets are usually present on the basal membranes of the pectoral and dorsal fins. There are 26~31 ( $\bar{x}$ =28.1) modified distal tail rings in 13 specimens examined; the ventral membrane is usually thick and transverse pads are rather swollen or enlarged. The brood area, neither expanded laterad nor compressed dorsoventrally, is below the anterior 16~18 tail rings in six examined males (314~350 mm TL) and there are 5~7 transverse rows of egg-compartments.

**Distribution.** This species is an Australian endemic, presently known from the vicinity of Flinders I. in the Bass Strait (ca. 148°E) to the vicinity of Point Weyland in the Great Australian Bight (ca. 134°38'E). There are few specimens in collections and limits of distribution are uncertain. Available data indicate occurrence in 42~68 m.

**Material examined.** Twenty-three specimens, 270~350 mm TL, including holotype.

Holotype: AMS E. 845 (298 mm TL, adult female), southern Australia, off Flinders I., 67.7 m, 30 Aug. 1909, "Endeavour."

Other material: Australia, SA: GCRL 17865 (3, 270~333), GCRL 17866 (3, 304~323), SAM F. 44 (1, 340), SAM F. 711 (2, 310~360), SAM F. 3878 (4, 289~305), SAM F. 4678 (1, 310), SAM F. 4679 (4, 303~337), SAM F. 4680 (4, 331~350).

*Solegnathus (Runcinatus) dunckeri* Whitley

(Fig. 8)

?*Solenognathus* sp. Etheridge, 1888: 32 (listed, Lord Howe I.).

?*Solenognathus spinosissimus*. Ogilby, 1889: 72 (frequently stranded after storms, Lord Howe I.).

*Solenognathus hardwickii*. Waite, 1895: 221, pl. 17, figs. 2~4, 7 (misident., descr.).

*Solenognathus* (sic) *Hardwickii*. Saville-Kent, 1897: 186 (misident., in part; Moreton Bay,

ref. only).

*Solegnathus hardwickii*. Waite, 1904: 19 (misident., compiled); McCulloch, 1911: 28 (in key); McCulloch, 1921: 38 (in key, not common); Scott, 1979: 113 (ref.).

*Solegnathus guntheri*. McCulloch and Whitley, 1925: 137 (misident., compiled).

*Solegnathus dunckeri* Whitley, 1927: 293, 294, pl. 24, fig. 1 (in key, orig. descr., Lord Howe I.); Whitley, 1929: 356 (type-species of *Runcinatus* Whitley); Munro, 1958: 90, fig. 629 (characters, range); Grant, 1972: 80 (notes, range); Allen et al., 1976: 390 (refs., Lord Howe I.); Grant, 1978: 156 (coloration, range); Scott, 1979: 113 (ref.).

*Runcinatus dunckeri*. Whitley, 1929: 356 (n. comb.; Grafton, NSW); Marshall, 1964: 121, pl. 28, fig. 131 (descr., range); Marshall, 1966: 177, pl. 28, fig. 131 (descr. notes; employed as file by islanders); Carcasson, 1977: 80 (compiled).

*Solegnathus (Runcinatus) dunckeri*. McCulloch, 1929: 94 (n. comb., compiled); Whitley and Allan, 1958: 51 (range); Whitley, 1964: 38 (compiled).

**Diagnosis.** Superior trunk ridge confluent with superior tail ridge; opercular membrane without bony platelets; body surfaces mainly spinulose; total rings 77~86; distal half of tail largely dark brown.

**Description.** Rings 25~27+52~59, total subdorsal rings 9.75~11.25, dorsal-fin rays 40~47, pectoral-fin rays 23~26. Head length ca. 6.2~7.4 in TL. Other proportional data, based on 8 specimens 53.1~67.7 ( $\bar{x}$ =60.0) mm HL, follow: snout length in HL 1.7~1.9 (1.8), snout depth in snout length 6.7~8.6 (7.6), length of dorsal-fin base in HL 1.0~1.4 (1.2), anal ring depth in HL 2.4~3.5 (3.1), trunk depth in HL 1.5~2.4 (1.9), pectoral-fin length in HL 6.3~6.8 (6.5). See Tables 1~3 for additional counts.

Dorsum of trunk and anterior half of tail usually a little concave; trunk scutella essentially conical, without a distinct median ridge; scutella of dorsum and venter of anterior postdorsal rings usually a little elevated but not clearly keel-like in lateral aspect; body surfaces largely spinulose; without a strong short spine under upper 5~8 pectoral-fin rays; opercular membrane without bony platelets; usually with a

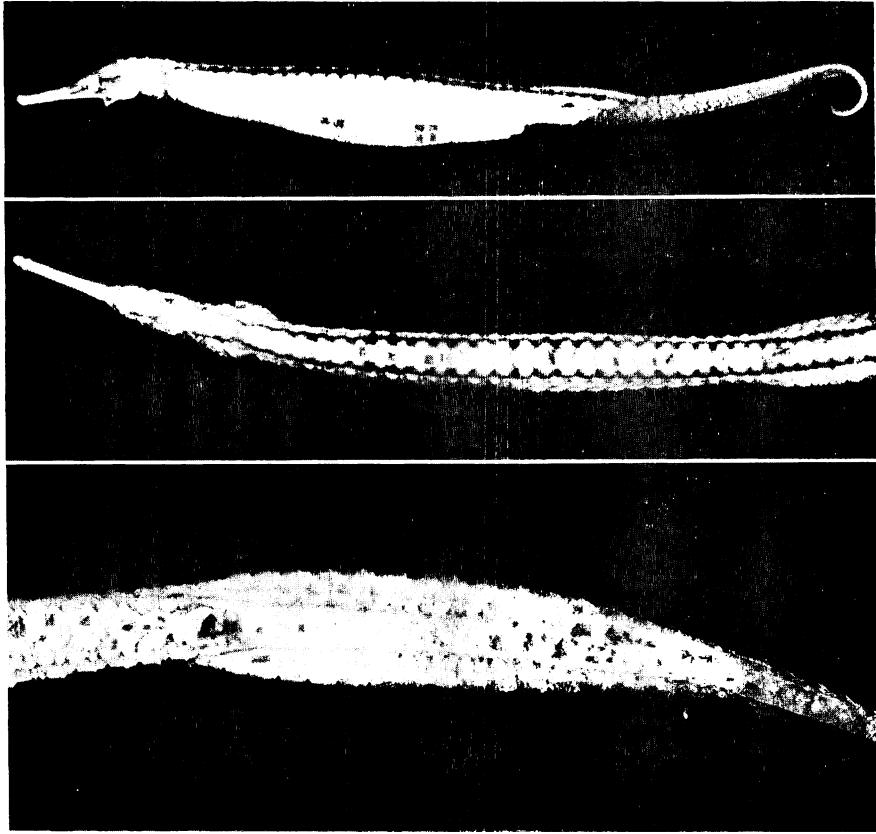


Fig. 8. *Solegnathus (Runcinatus) dunckeri*. Top: Adult female, 376 mm TL (AMS IB. 7521). Middle and bottom: Dorsal aspect of head, trunk and anterior tail rings and ventral aspect of brood area of adult male, 470 mm TL (AMS I. 16489-001).

short, irregularly truncate, median dorsal spine before nares; dorsal-fin origin from anterior fourth of last trunk ring to posterior fourth of 1st tail ring; lateral trunk and tail ridges confluent (Fig. 1c), usually straight, terminating midlaterally on 13th~19th tail ring. Branchial skeleton lacks 2nd hypobranchials.

Usually with a diagonal, dark, lateral bar from posterior third of snout to upper margin of opercle, sometimes with diffuse, dusky, dorsolateral shading from posterior margin of orbit to origin of superior trunk ridge. Trunk and subdorsal portion of tail with prominent, near-black, stripe along upper margin of side and side of dorsum; the median dorsal area pale or dusky; stripe variously narrow to rather wide (Fig. 8), sometimes with short ventrolateral extensions to upper scutella on side of trunk. Sides and venter of remainder of tail dusky to

near-black, the dorsum pale, dusky or dark throughout. Basal third of dorsal fin sometimes with faint dusky shading, pectoral fins hyaline.

**Comparisons.** Dark coloration of the tail and configuration of the principal body ridges (Fig. 1c) distinguish *S. dunckeri* from all congeners. The relatively short snout, dark dorsolateral stripe, and absence of platelets in the opercular membrane are shared with *S. hardwickii*, but body surfaces are finely spinulose in *S. dunckeri* and essentially tuberculate in *S. hardwickii*. Compared to congeners with spinulose surfaces (*S. spinosissimus*, *S. robustus*), *S. dunckeri* lacks bony platelets on the opercular membrane, the spine under the pectoral fin, and the ridged or keeled scutella common to these species. Furthermore, the surface spinules are small in *S. dunckeri* and surfaces fail (in subadults and adults) to approach the spiny conditions (Fig. 2b, c) of *S.*

*spinosissimus* and *S. robustus*.

**Remarks.** The holotype of *Solegnathus dunckeri* (AMS I. 14336) is a brooding male with the sides expanded laterad in the brood area of the tail and with about 6 transverse rows of membranous egg-compartments. The lateral ridge terminates bilaterally on the 15th tail ring, there are about 28 modified distal tail rings, and the dorsal fin originates on the posterior fourth of the last trunk ring. Measurements (mm) follow: TL ca. 462, HL 67.7, snout length 40.4, snout depth 4.8, length of dorsal-fin base 63.6, anal ring depth 19.1, trunk depth 33.6, pectoral-fin length 10.0 (see Tables 1~3 for counts).

The distal termination of the lateral ridge is sometimes indistinct and difficult to determine, and bilateral variation of 1~3 rings is not uncommon. Among 36 lateral ridges examined, termination was on the 13th~19th tail ring ( $\bar{x}=15.6$ ). There was one unilateral anomaly wherein the superior ridge was discontinuous behind the dorsal fin, the anterior extremity of the superior tail ridge was deflected somewhat ventrad, but it was not confluent with the lateral ridge which terminated on the 16th tail ring.

The anterior part of the tail is laterally expanded (Fig. 8) and dorsoventrally compressed over the brood area of mature males. These modifications are most pronounced over the anterior 2/3 of the brood area where the sides angle outward at about 45° between the superior and lateral tail ridges. Below, the ventral surface is essentially flat between the inferior ridges, but concave and angled a little dorsad between the inferior and lateral ridges. Depth in maximum breadth ratio of the brood area is 1:1.4 in a 470 mm TL male and brood area extends below the anterior 16~17 tail rings in 10 specimens examined (337~470 mm TL). There are 21~32 ( $\bar{x}=26.9$ ) modified distal tail rings in 10 specimens examined, the ventral membrane is thin anteriorly and transverse pads are poorly developed.

A 178 mm TL juvenile (GCRL 17502) has a somewhat enlarged bilateral spine, angled dorsolaterally, a little before the median dorsal preanial spine, on dorsolateral margin of the snout. Other spines on head and on margins of principal body ridges are relatively larger and more prominent than those of larger specimens.

**Distribution.** An endemic Australian species known from Lord Howe I. (31°33'S, 159°05'E), Queensland and New South Wales (ca. 26°25'~32°19'S). At least one specimen was found stranded on the beach; trawl depths for four collections are 75~137.2 m.

**Material examined.** Twenty-four specimens, 178~470 mm TL, including holotype.

Holotype: AMS I. 14336 (462 mm TL, adult male), Lord Howe I., 1918, P. Pedley.

Other material: AUSTRALIA, Qld.: AMS I. 11090 (1, 400), QM I. 5227 (1, 435), QM I. 5298 (1, 400), QM I. 6770 (1, 412), QM I. 8096 (1, 380), QM I. 8297 (1, 425), QM I. 14545 (1, 330). NSW: AMS I. 16489-001 (1, 470), AMS IA. 3779 (1\*, dam.), AMS IA. 6394 (1, 421), AMS IB. 1800 (1, 435), AMS IB. 2364 (1, 420), AMS IB. 6744 (1\*, dam.), AMS IB. 7521 (1, 376), AMS IB. 7909 (1\*, dam.), GCRL 17499 (1, 310), GCRL 17500 (1, 337), GCRL 17501 (1, 330), GCRL 17502 (1, 178), QM I. 8266 (1, 427), QM I. 12023 (1, dam.). Lord Howe I.: AMS IA. 2428 and IA. 2429 (2\*, not measured).

#### Acknowledgements

I thank the curators and assistants of the referenced museums for expediting loans and for hospitality and assistance rendered during visits to their institutions. For permission to examine type material in their care, special thanks are due M. L. Bauchot and M. Desoutter (MNHN), M. Boeseman and M. J. P. van Oijen (RMNH), J. Paxton and D. F. Hoese (AMS) and A. C. Wheeler (BMNH). Gift specimens were generously provided by C. J. M. Glover (SAM), J. Moreland (NMNZ, retired), and J. Paxton. Copies of important early literature were kindly provided by Wm. Fink (Museum of Comparative Zoology, Harvard Univ.), C. J. M. Glover, J. Paxton and A. C. Wheeler. Gray's illustration is reproduced by permission of the Trustees of the British Museum (Natural History). This study was facilitated and supported in part by a NSF travel grant for participation in the 1981 International Conference on Systematics and Evolution of Indo-Pacific Fishes (hosted by AMS).

#### Literature cited

Agassiz, J. L. R. 1846. Nomenclatoris zoologici. Index universalis, . . . etc. Soloduri, viii+393 pp.

- Allen, G.R., D.F. Hoese, J.R. Paxton, J.E. Randall, B. C. Russell, W. A. Starck II, F. H. Talbot and G. P. Whitley. 1976. Annotated checklist of the fishes of Lord Howe Island. Rec. Aust. Mus., 30(15): 365~454.
- Bleeker, P. 1853. Bijdrage tot de kennis der Troskieuwige visschen van den Indischen Archipel. Verh. Bat. Gen., 26(5): 1~30.
- Bleeker, P. 1857. Index specierum . . . etc. Verh. Bat. Gen., 26(6): 1~24.
- Bleeker, P. 1859. Enumeratio specierum piscium . . . etc. Act. Soc. Sci. Indo-Neerl., 6: i~xxxvi, 1~276.
- Bleeker, P. 1860a. Achtste bijdrage tot de kennis den vischfauna van Sumatra. Visschen van Benkoelen, Priaman, Tandjong, Palembang en Djambi. Act. Soc. Sci. Indo-Neerl., 8: 1~88.
- Bleeker, P. 1860b. Twaalfde bijdrage tot de kennis der vischfauna van Amboina. Act. Soc. Sci. Indo-Neerl., 8: 1~4.
- Bleeker, P. 1873. Mémoire sur la fauna ichthyologique de Chine. Ned. Tijdschr. Dierk., 4: 113~154.
- Bleeker, P. 1878. Contribution à la faune ichthyologique de l'île Maurice. Verh. Akad. Amsterdam, 18: 1~23.
- Carcasson, R. H. 1977. A field guide to the coral reef fishes of the Indian and west Pacific oceans. Wm. Collins Sons, London, 320 pp.
- Chen, J. T. F. 1935. A preliminary review of the lophobranchiate fishes of China. Biol. Bull. Norm. Coll. Shiang Chyn Univ., Canton, 1: 1~22.
- Chu, Y. T. 1931. Index piscium Sinensium. Biol. Bull. St. John's Univ., Shanghai, 1: i~iv, 1~290.
- Dawson, C. E. 1977. Synopsis of syngnathine pipefishes usually referred to the genus *Ichthyocampus* Kaup, with description of new genera and species. Bull. Mar. Sci., 27(4): 595~650.
- Dawson, C. E. 1978. Review of the Indo-Pacific pipefish genus *Bhanotia*, with description of *B. nuda* n. sp. Proc. Biol. Soc. Wash., 91(2): 392~407.
- Dawson, C. E. 1980a. *Kimblaesus*, a new pipefish genus (Syngnathiformes: Syngnathidae) from Australia, with a key to genera of pipefishes with continuous superior ridges. Aust. J. Mar. Freshwater Res., 31: 517~523.
- Dawson, C. E. 1980b. Synopsis of the pipefishes (Syngnathidae) of New Zealand. Rec. Nat. Mus. New Zealand, 1(17): 281~291.
- Dawson, C. E. 1981. Review of the Indo-Pacific pipefish genus *Doryrhamphus* Kaup (Pisces: Syngnathidae), with descriptions of a new species and a new subspecies. Ichthyol. Bull., J. L. B. Smith Inst. Ichthyol., 44: 1~27.
- Dawson, C. E. and G. R. Allen. 1978. Synopsis of the "finless" pipefish genera (*Penetopteryx*, *Apterygocampus* and *Enchelyocampus*, gen. nov.). Rec. West. Aust. Mus., 6(4): 391~411.
- Dawson, C.E. and R.A. Fritzsche. 1975. Odontoid processes in pipefish jaws. Nature, 257:390.
- Dawson, C. E. and C. J. M. Glover. In press. *Hypselognathus horridus*, a new species of pipefish (Syngnathidae) from South Australia. Proc. Biol. Soc. Wash.,
- Duméril, A. 1870. Histoire naturelle des poissons ou ichthyologie générale. Tome second. Ganoides, dipnés, lophobranches. Paris, 624 pp.
- Duncker, G. 1909. Pisces, I. Teil: Syngnathidae. In: Michaelson, W. and R. Hartmeyer, eds.: Die Fauna Südwest-Australiens, 2. Jena, (pp. 233~250).
- Duncker, G. 1912. Die Gattungen der Syngnathidae. Mitteil. Naturh. Mus. Hamburg, 29: 219~240.
- Duncker, G. 1915. Revision der Syngnathidae. Erster Teil. Mitteil. Naturh. Mus. Hamburg, 32: 9~120.
- Etheridge, R., Jr. 1888. Progress report. Lord Howe Island collecting party, August-September, 1887. Appendix 10. In: Ramsay, E. P.: Report to the Trustees for 1887. Ann. Rept. Aust. Mus., 1888: 1~34.
- Fowler, H. W. 1907. A collection of fishes from Victoria, Australia. Proc. Acad. Nat. Sci. Phila., 59: 419~444.
- Fowler, H. W. 1922. Notes on hemibranchiate and lophobranchiate fishes. Proc. Acad. Nat. Sci. Phila., 73(3): 437~448.
- Fowler, H. W. 1928. The fishes of Oceania. Mem. Bernice P. Bishop Mus., 10: i~iii, 1~540.
- Fowler, H. W. 1935. A synopsis of the fishes of China. Part V continued. Hong Kong Nat., 6(1): 62~77.
- Fritzsche, R. A. 1980. Revision of the eastern Pacific Syngnathidae (Pisces: Syngnathiformes), including both recent and fossil forms. Proc. Calif. Acad. Sci., 42(6): 181~227.
- Grant, E. M. 1972. Guide to fishes. Dept. of Primary Industries, Brisbane, 472 pp.
- Grant, E. M. 1978. Guide to fishes. 4th ed. Dept. of Harbours and Marine, Brisbane, 768 pp.
- Gray, J. E. 1830. Illustrations of Indian zoology of new and hitherto unfigured Indian animals from the collection of General Hardwicke. Vol. 1, part 4. London.
- Günther, A. 1870. Catalogue of fishes in the British Museum. Vol. 8, Taylor and Francis, London, 549 pp.
- Günther, A. 1880. Report on the shore fishes

- procured during the voyage of H. M. S. Challenger in the years 1873–1876. Challenger Repts. (Zoology), 1(6): 1~82.
- Herald, E. S. 1943. Studies on the classification and relationships of the American pipefishes. Ph. D. dissertation, Stanford Univ., 339 pp.
- Herald, E. S. 1959. From pipefish to seahorse—a study of phylogenetic relationships. Proc. Calif. Acad. Sci., 4th ser., 29(13): 465~473.
- Hubrecht, A. A. W. 1879. Catalogue des collections formées et laissées par M. P. Bleeker. Leiden, 71 pp.
- Hutchins, B. 1979. The fishes of Rottnest Island. Creative Research, Perth, 103 pp.
- Hutton, F. W. 1872. Fishes of New Zealand—catalogue with diagnoses of the species. Gov't Printer, Wellington, xvi+133 pp.
- Hutton, F. W. 1904. Index faunae Novae Zelandiae. Dulau & Co., London, 372 pp.
- Johnston, R. M. 1883. General and critical observations on the fishes of Tasmania; with a classified catalogue of all known species. Proc. Roy. Soc. Tasmania, 1882: 53~144.
- Johnston, R. M. 1890. Further observations upon the fishes and fishing industries of Tasmania, together with a revised list of indigenous species. Proc. Roy. Soc. Tasmania, 1890: 22~46.
- Jordan, D. S. 1919. The genera of fishes, part II, from Agassiz to Bleeker, 1833–1858, twenty-six years, with the accepted type of each. A contribution to the stability of scientific nomenclature. Leland Stanford Jr. Univ. Publs., Univ. Ser., i~ix + 163~284 + i~xiii pp.
- Kamohara, T. 1943. Some unrecorded and two new fishes from Prov. Tosa, Japan. Bull. Biogeogr. Soc. Japan, 13(17): 125~137.
- Kamohara, T. 1964. Revised catalogue of fishes of Kōchi Prefecture, Japan. Rept. Usa Mar. Biol. St., 11(1): 1~99.
- Kaup, J. J. 1853. Uebersicht der Lophobranchier. Arch. Naturg., Berlin, 19: 226~234.
- Kaup, J. J. 1856. Catalogue of lophobranchiate fish in the collection of the British Museum. Taylor and Francis, London, 76 pp.
- Klunzinger, C. B. 1872. Zur Fischfauna von Süd-Australien. Arch. Naturgesch., Berlin, 38(1): 17~47.
- Klunzinger, C. B. 1879. Die v. Müller'sche Sammlung australischer Fische in Stuttgart. Sitzber. Akad. Wiss. Wien, 80(1): 325~430.
- Lao, S. C., Y. L. Lo, C. Y. Shih, P. Chin, F. C. Lee, C. Y. Yeh, C. Y. Shao, P. L. Suan and T. L. Yong (eds.). 1962. Fishes of the South China Sea. Science Press, Peking, xxxvii+1184 pp.
- Lindberg, G. U. 1971. Fishes of the world—a key to families and a checklist. (1974 English trans. by H. Hardin). John Wiley & Sons, New York, 545 pp.
- Lindberg, G. U. and M. I. Legeza. 1965. Fishes of the Sea of Japan and adjacent parts of the Sea of Okhotsk and Yellow Sea. Acad. Sci. USSR, 2: 1~391. (1969 English trans., Israel Program Sci. Transl.).
- Lord, C. 1923. A list of the fishes of Tasmania. Pap. Proc. Roy. Soc. Tasmania, 1922: 60~73.
- Lord, C. 1927. A list of the fishes of Tasmania. J. Pan-Pac. Res. Inst., 2: 11~16.
- Lord, C. E. and H. H. Scott. 1924. A synopsis of the vertebrate animals of Tasmania. Oldham, Beddome & Meredith, Hobart, 96 pp.
- Lucas, A. H. S. 1890. A systematic census of indigenous fish, hitherto recorded from Victorian waters. Proc. Roy. Soc. Victoria, n. ser., 2: 15~47.
- Macleay, W. 1882. Descriptive catalogue of the fishes of Australia. Proc. Linn. Soc. New South Wales, 6: 202~387.
- Macleay, W. 1884. Supplement to descriptive catalogue of the fishes of Australia. Proc. Linn. Soc. New South Wales, 9: 1~64.
- Marshall, T. C. 1964. Fishes of the Great Barrier Reef and coastal waters of Queensland. Angus and Robertson, Sydney, 566 pp.
- Marshall, T. C. 1966. Tropical fishes of the Great Barrier Reef. Elsevier Publ. Co., New York, 239 pp.
- Matsubara, K. 1955. Fish morphology and hierarchy. Part II. Ishizaki-Shoten, Tokyo, i~v + 790~1605 pp.
- Mauge, A. L. 1980. Note sur la presence de *Solegnathus hardwicki* (Gray, 1832) dans les eaux de l'île Maurice (Pisces: Syngnathidae). Cybium, 3e série, 1980(9): 97~101.
- McCulloch, A. R. 1911. Report on the fishes obtained by the F. I. S. "Endeavour," on the coasts of New South Wales, Victoria, South Australia and Tasmania. Part I. Zoological results of the fishing experiments carried out by the F.I.S. "Endeavour," 1909–10, 1(1): 1~87.
- McCulloch, A. R. 1921. Check-list of the fish and fish-like animals of New South Wales. Part II. Aust. Zool., 2(2): 24~68.
- McCulloch, A. R. 1929. A check-list of the fishes recorded from Australia. Mem. Aust. Mus., 5(1): 1~144.
- McCulloch, A. R. and G. P. Whitley. 1925. A list of the fishes recorded from Queensland waters. Mem. Queensland Mus., 8(2): 125~182.
- Munro, I. S. R. 1958. Family Syngnathidae. Handbook of Australian fishes, 22. Aust. Fish.

- Newsletter, 17(4): 17~20.
- Ogilby, J. D. 1889. The reptiles and fishes of Lord Howe Island. Mem. Aust. Mus., 2(3): 51~74.
- Philippi, R. A. 1896. Peces nuevos de Chile. An. Univ. Mem. Cien. Lit., Santiago, 93~95: 375~390.
- Phillipps, W. J. 1927. A check list of the fishes of New Zealand. J. Pan-Pac. Res. Inst., 2(1): 9~15.
- Richardson, J. 1846. Report on the ichthyology of the seas of China and Japan. Rept. British Assoc. Adv. Sci., 1845: 187~320.
- Saville-Kent, W. 1897. The naturalist in Australia. Chapman & Hall, London, xv+302 pp.
- Sawyer, F. C. 1953. The dates of issue of J. E. Gray's "Illustrations of Indian Zoology" (London, 1830-1835). J. Soc. Bibliogr. Nat. Hist., 3(1): 48~55.
- Scott, E. O. G. 1934. Observations on some Tasmanian fishes, with descriptions of new species. Pap. Proc. Roy. Soc. Tasmania, 1933: 31~53.
- Scott, E. O. G. 1939. Observations on some Tasmanian fishes. Part IV. Pap. Proc. Roy. Soc. Tasmania, 1938: 139~159.
- Scott, E. O. G. 1961. Observations on some Tasmanian fishes: Part X. Pap. Proc. Roy. Soc. Tasmania, 95: 49~65.
- Scott, E. O. G. 1963. Observations on some Tasmanian fishes: Part XI. Pap. Proc. Roy. Soc. Tasmania, 97: 1~31.
- Scott, E. O. G. 1979. Observations on some Tasmanian fishes: Part XXV. Pap. Proc. Roy. Soc. Tasmania, 113: 99~148.
- Scott, E. O. G. 1980. Observations on some Tasmanian fishes: Part XXVI. Pap. Proc. Roy. Soc. Tasmania, 114: 85~144.
- Scott, T. D. 1962. The marine and fresh water fishes of South Australia. Gov't. Printer, Adelaide, 338 pp.
- Scott, T. D., C. J. M. Glover and R. V. Southcott. 1974. The marine and freshwater fishes of South Australia. 2nd ed. Gov't. Printer, South Australia, 392 pp.
- Shiino, S. M. 1972. List of English names of Japanese fishes with proposition of new names. Sci. Rept. Shima Marineland, 1: 1~210.
- Smith, J. L. B. 1963. Fishes of the family Syngnathidae from the Red Sea and the western Indian Ocean. Ichthyol. Bull. Rhodes Univ., 27: 515~543.
- Steindachner, F. 1901. Fische aus dem stillen Ocean ergebnisse einer Reise nach dem Pacific (Schauinsland 1896-97). Denkschr. Akad. Wiss. Wien, 70: 483~521.
- Swainson, W. 1839. The natural history and classification of fishes, amphibians and reptiles, or monocardian animals. Vol. 2. London, 449 pp.
- Waite, E. R. 1895. New or rare fishes from Maroubra, N. S. W. Proc. Linn. Soc. New South Wales, 2nd ser., 9: 215~227.
- Waite, E. R. 1898. Scientific report on the fishes. Sea Fisheries Rept. H.M.C.S. "Thetis" (New South Wales). Govt. Printer, Sydney, pp. 23~62.
- Waite, E. R. 1899. Scientific results of the trawling expedition of H.M.C.S. "Thetis," off the coast of New South Wales, in February and March, 1898. Mem. Aust. Mus., 4(1): 1~132.
- Waite, E. R. 1904. A synopsis of the fishes of New South Wales. Mem. New South Wales Nat. Club, 2: i~iv, 1~59.
- Waite, E. R. 1907. A basic list of the fishes of New Zealand. Rec. Canterbury Mus., 1(1): 1~39.
- Waite, E. R. 1912. Additions and corrections to the basic list of the fishes of New Zealand. Rec. Canterbury Mus., 1(4): 313~322.
- Waite, E. R. and H. M. Hale. 1921. Review of the lophobranchiate fishes (pipe-fishes and sea-horses) of South Australia. Rec. S. Aust. Mus., 1(4): 293~324.
- Weber, M. and L. F. de Beaufort. 1922. The fishes of the Indo-Australian Archipelago. IV. E. J. Brill, Leiden, 410 pp.
- Whitley, G. P. 1927. Studies in ichthyology. No. 1. Rec. Aust. Mus., 15(5): 289~304.
- Whitley, G. P. 1929. Additions to the check-list of the fishes of New South Wales. No. 2. Aust. Zool., 5(4): 353~357.
- Whitley, G. P. 1936. More ichthyological miscellanea. Mem. Queensland Mus., 11(1): 23~51.
- Whitley, G. P. 1941. Ichthyological notes and illustrations. Aust. Zool., 10(1): 1~50.
- Whitley, G. P. 1948. A list of the fishes of Western Australia. Fish. Bull. W. Aust. Fish. Dept., 2: 1~35.
- Whitley, G. P. 1955. Sidelights on New Zealand ichthyology. Aust. Zool., 12(2): 110~119.
- Whitley, G. P. 1964. A survey of Australian ichthyology. Proc. Linn. Soc. New South Wales, 89(1): 11~127.
- Whitley, G. P. and J. Allan. 1958. The sea-horse and its relatives. Georgian House, Melbourne, 84 pp.
- Zietz, A. 1908. A synopsis of the fishes of South Australia. Part II. Trans. Proc. Rept. Roy. Soc. South Austr., 32: 294~299.
- (Gulf Coast Research Laboratory Museum, Ocean Springs, Mississippi 39564, U.S.A.)

インド・太平洋産のヨウジウオ科 *Solegnathus* 属  
魚類

C. E. Dawson

文献と博物館標本に基づき、*Solegnathus* Swainson (スミツキヨウジ属) の分類を整理した。この属は、  
軀間部の上隆起線と尾部の上隆起線が不連続な *Solegnathus* 亜属と、両者が連続している *Runcinatus* 亜属に分類される。*Solegnathus* 亜属には *S. hardwickii* (Gray) (オーストラリア, 南シナ海, 日本西部), *S.*

*lettiensis* Bleeker (オーストラリア, インドネシア), *S. spinosissimus* Günther (オーストラリア, ニュージーランド), *S. robustus* McCulloch (オーストラリアの固有種) の4種が含まれる。*Runcinatus* 亜属はオーストラリア産の *S. dunckeri* Whitley 1種のみによって代表される。*S. guentheri* Duncker は *S. lettiensis* の, *S. robustus naso* Whitley は *S. spinosissimus* の, ジュニアアーシノニムと考えられる。