

Iridoteuthis iris (Cephalopoda: Sepiolidae): New Records from the Central North Pacific and First Description of the Adults¹

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ABSTRACT: *Iridoteuthis iris* (Berry, 1909) was originally described from a unique specimen collected in the main Hawaiian Islands, but the holotype is no longer extant. New material was collected from the southern Emperor-northern Hawaiian Ridge seamounts, extending the known range of *I. iris* by about 3200 km. The new samples are described, including the first description of adults.

THE SPECIES COMPOSITION of the cephalopod fauna around the Hawaiian Archipelago is well known relative to that of many other areas. Some species records, however, are from unique specimens and/or juvenile individuals. Such is the case with the sepiolid *Iridoteuthis iris* (Berry, 1909), which was described from a single juvenile collected from the steamer *Albatross* near the island of Molokai in the main Hawaiian Islands.

Iridoteuthis iris has remarkably large fins and eyes, a huge ventral shield, and a broad dorsal commissure between the head and mantle. Berry (1909) originally named the species *Stoloteuthis iris*, based on similarities to *S. leucoptera* from the Atlantic. Naef (1912) thought the species was different enough from *Stoloteuthis* to be placed in a new genus, *Iridoteuthis*, basing his decision largely on the size and shape of the fins, the broad dorsal commissure and nuchal fold, and the large head and eyes. In his monograph of the Hawaiian cephalopods, however, Berry (1914) stood by his original designation, but kept *Iridoteuthis* as a subgenus. This taxonomic uncertainty remained because the animal described by Berry (1909) was small and presumed to be a juvenile. The holotype is no longer extant (Sweeney et al. 1988), and the species was not seen again until 1984, when

another individual was collected in Mamala Bay off the island of Oahu (ca. 60 km from the type location) in a bottom dredge from the vessel *Janthina*. This specimen was photographed (Figure 1) and subsequently lost (B. Burch, per. comm., Honolulu).

Recently, a series of cruises to the southern Emperor-northern Hawaiian Ridge (SE-NHR) seamounts by the Southwest Fisheries Center Honolulu Laboratory aboard the NOAA ship *Townsend Cromwell* produced 45 of these sepiolids, including juveniles and adults. This report provides the first description of the adults and extends the known range of *Iridoteuthis iris* by about 3200 km, from the Hawaiian Islands to the southern Emperor seamounts.

DISTRIBUTION

The material was collected during six cruises from March 1978 to June 1986 at four seamounts in the SE-NHR: Southeast (SE) and Northwest (NW) Hancock, Colahan, and Kammu seamounts (Figure 2). These seamounts lie 2400 to 3200 km northwest of the type location. The summit depths range from 260 m at SE Hancock to 350 m at Kammu. Collections were made with several types of open trawls, including a Marinovich herring trawl, Isaacs-Kidd midwater trawl (IKMT), Cobb pelagic trawl, and Nor'Eastern bottom trawl. Target sampling depths over the seamount ranged from 73 to 305 m. Sampling was also conducted in waters away from the seamount during two cruises to SE Hancock

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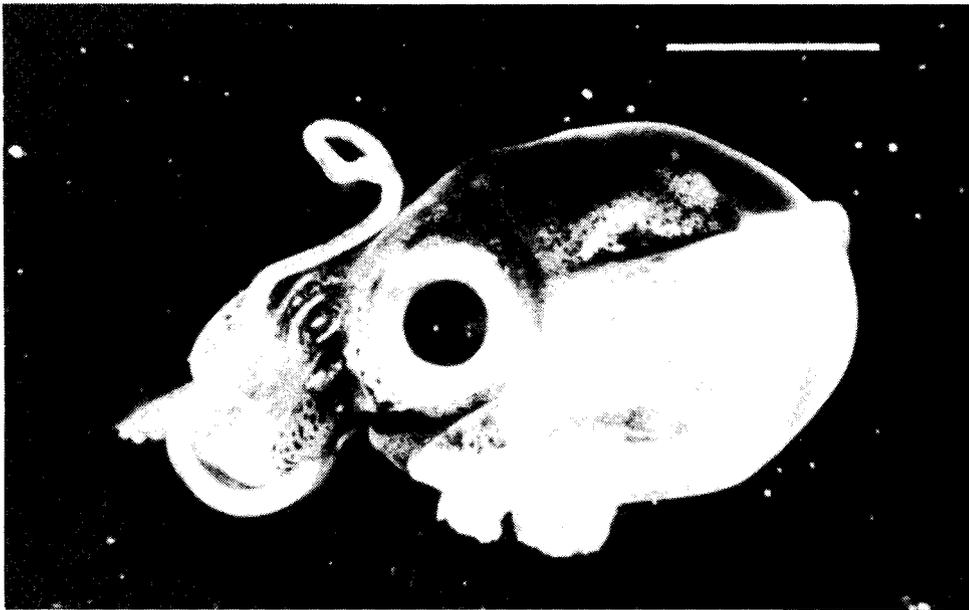


FIGURE 1. *Iridoteuthis iris* collected off Oahu, Hawaii, in 1984. Scale bar = 10.0 mm. (Photo by T. Burch.)

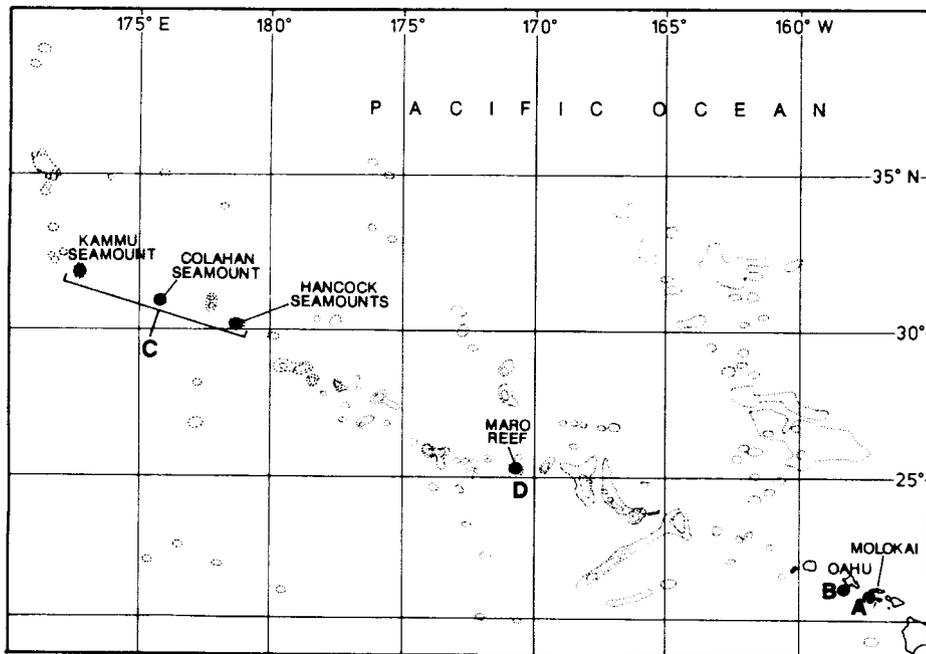


FIGURE 2. Collection locations for *Iridoteuthis iris*. A. Berry (1909) holotype locality, Molokai, Hawaii; B. Burch sample, Oahu, Hawaii; C, material for present study, southern Emperor-northern Hawaiian Ridge seamounts; D, additional material from Maro Reef.

TABLE I

Tritotcauthis iris: MATERIAL EXAMINED AND CAPTURE DATA

MANTLE LENGTH (mm)	SEX	CRUISE	STATION	DATE	LAT. (°N)	LONG. (°E)	SEAMOUNT	TIME	GEAR	MAXIMUM DEPTH FISHER (m)
5.5	—	TC 85-01	122	14 Feb. 1985	29.48.1	179.05.2	SE Hancock	0400	IKMT	238
6.0	—	TC 85-01	139	15 Feb. 1985	29.49.0	179.04.0	SE Hancock	2018	IKMT	209
6.5	—	TC 85-01	130	14 Feb. 1985	29.48.0	179.02.9	SE Hancock	2035	IKMT	218
6.9	—	TC 84-05	114	23 July 1984	29.47.0	179.06.0	SE Hancock	2241	IKMT	209
7.0	—	TC 85-01	139	15 Feb. 1985	29.49.0	179.04.0	SE Hancock	2018	IKMT	209
7.0	—	TC 85-01	139	15 Feb. 1985	29.49.0	179.04.0	SE Hancock	2018	IKMT	209
7.9	—	TC 82-05	58	18 Oct. 1982	31.02.2	175.51.7	Colahan	1016	Nor'Eastern	291
7.9	F	TC 85-01	119	13 Feb. 1985	29.47.3	179.03.5	SE Hancock	2256	IKMT	236
8.0	M	TC 86-06	63	11 Feb. 1986	29.46.5	179.03.6	SE Hancock	2059	Marinovich	202
8.0	M	TC 86-06	63	11 Feb. 1986	29.46.5	179.03.6	SE Hancock	2059	Marinovich	202
8.5	M	TC 84-05	104	21 July 1984	29.48.6	179.04.4	SE Hancock	2209	IKMT	225
8.5	F	TC 83-03	5	15 Aug. 1983	31.57.4	173.07.8	Kammu	2245	Cobb	150
8.5	M	TC 86-06	63	11 Feb. 1986	29.46.5	179.03.6	SE Hancock	2059	Marinovich	202
9.5	M	TC 83-03	5	15 Aug. 1983	31.57.4	173.07.8	Kammu	2245	Cobb	150
9.5	F	TC 85-01	123	14 Feb. 1985	29.47.9	179.02.2	SE Hancock	0503	IKMT	218
10.0	F	TC 85-01	119	13 Feb. 1985	29.47.3	179.03.5	SE Hancock	2256	IKMT	236
10.0	M	TC 86-06	63	11 Feb. 1986	29.46.5	179.03.6	SE Hancock	2059	Marinovich	202
10.0	F	TC 86-06	63	11 Oct. 1986	29.46.5	179.03.6	SE Hancock	2059	Marinovich	202
10.5	F	TC 83-03	5	15 Aug. 1983	31.57.4	173.07.8	Kammu	2245	Cobb	150
10.5	F	TC 84-05	104	21 July 1984	29.48.6	179.04.4	SE Hancock	2209	IKMT	225
10.5	M	TC 86-06	63	11 Oct. 1986	29.46.5	179.03.6	SE Hancock	2059	Marinovich	202
10.7	F	TC 83-03	5	15 Aug. 1983	31.57.4	173.07.8	Kammu	2245	Cobb	150
11.0	F	TC 84-05	114	23 July 1984	29.47.0	179.06.0	SE Hancock	2241	IKMT	209
11.1	M	TC 82-05	58	18 Oct. 1982	31.02.2	175.51.7	Colahan	1016	Nor'Eastern	291
11.2	F	TC 85-01	130	14 Feb. 1985	29.48.0	179.02.9	SE Hancock	2035	IKMT	218
11.5	M	TC 86-06	63	11 Oct. 1986	29.46.5	179.03.6	SE Hancock	2059	Marinovich	202
11.5	M	TC 86-06	63	11 Feb. 1986	29.46.5	179.03.6	SE Hancock	2059	Marinovich	202
11.5	F	TC 84-05	93	16 July 1984	29.47.7	179.06.2	SE Hancock	2051	IKMT	150
12.0	M	TC 84-05	94	16 July 1984	29.48.1	179.05.7	SE Hancock	2239	IKMT	220
13.0	F	TC 84-05	104	21 July 1984	29.48.6	179.04.4	SE Hancock	2209	IKMT	225
13.2	M	TC 83-03	5	15 Aug. 1983	31.57.4	173.07.8	Kammu	2245	Cobb	150
13.8	F	TC 86-05	96	8 Sept. 1986	29.48.0	179.01.9	SE Hancock	0202	Marinovich	230
15.0	M	TC 85-03	138	14 July 1985	29.47.8	179.01.7	SE Hancock	0029	Marinovich	245
15.2	F	TC 86-05	96	8 Sept. 1986	29.48.0	179.01.9	SE Hancock	0202	Marinovich	230
15.5	F	TC 84-05	114	23 July 1984	29.47.0	179.06.0	SE Hancock	2241	IKMT	209
18.5	M	TC 86-06	63	11 Oct. 1986	29.46.5	179.03.6	SE Hancock	2059	Marinovich	202
18.9	M	TC 85-01	132	14 Feb. 1985	29.48.1	179.03.0	SE Hancock	2330	IKMT	216
19.5	M	TC 86-06	63	11 Oct. 1986	29.46.5	179.03.6	SE Hancock	2256	IKMT	202
21.3	F	TC 85-01	119	13 Feb. 1985	29.46.5	179.03.6	SE Hancock	2059	Marinovich	202
21.7	M	TC 78-03	31	9 Sept. 1978	30.16.5	178.42.3	NW Hancock	1324	Nor'Eastern	300
24.1	M	TC 85-01	132	14 Feb. 1985	29.46.5	179.03.6	SE Hancock	2330	IKMT	216
25.5	F	TC 82-05	58	18 Oct. 1982	31.02.2	175.51.7	Colahan	1016	Nor'Eastern	291
28.4	F	TC 82-05	58	18 Oct. 1982	31.02.2	175.51.7	Colahan	1016	Nor'Eastern	291
30.0	F	TC 82-05	58	18 Oct. 1982	31.02.2	175.51.7	Colahan	1016	Nor'Eastern	291

Seamount. No sepiolids were taken in the latter tows, indicating that *Iridoteuthis iris* belongs with other seamount-associated species, such as the lightfish, *Maurolicus muelleri*, and the lophogastrid mysid, *Gnathophausia longispina* (Boehlert 1988). Table 1 presents the material examined and summarizes the capture data.

Recently, three additional specimens were collected near Maro Reef (25°22.4' N, 170°20.1' W) in the Northwestern Hawaiian Islands. Maro Reef is closer than the seamounts to the type location in the main islands, about 1400 km to the southeast.

DESCRIPTION

All samples were fixed in 10% formalin in seawater, subsequently preserved in 50% isopropanol, and then measured. The measurements are based on Roper and Voss (1983) and are diagrammed in Figure 3. Table 2 contains representative measurements of the morphometric parameters for 10 adults. Morphometric indices were computed by dividing each measurement by the corresponding dorsal mantle length (ML). Material has been deposited in the U.S. National Museum of Natural History, Washington, D.C. (museum numbers 817136 to 817138).

Body (Figure 4) short and muscular; mantle rounded at posterior end; pronounced bulge medially on dorsal mantle; dorsal commissure between head and mantle broad, extending to near lateral midpoint of eye; ventral mantle with large shield (about 80% ventral mantle length), which nearly covers funnel and eyes from below; shield with anterior medial indentation; large, internal photophore with two large internal pores. **Head** broad and short, dominated by large eyes with circular lids that overlap the cornea all around. The morphometric indices for the head and body are summarized in Table 3. **Funnel** large and sometimes swollen near tip; funnel organ trilobed, accessory pads oval, locking apparatus smooth, groove oval but slightly curved and broader at anterior end.

Fins very large; rounded-oblong with

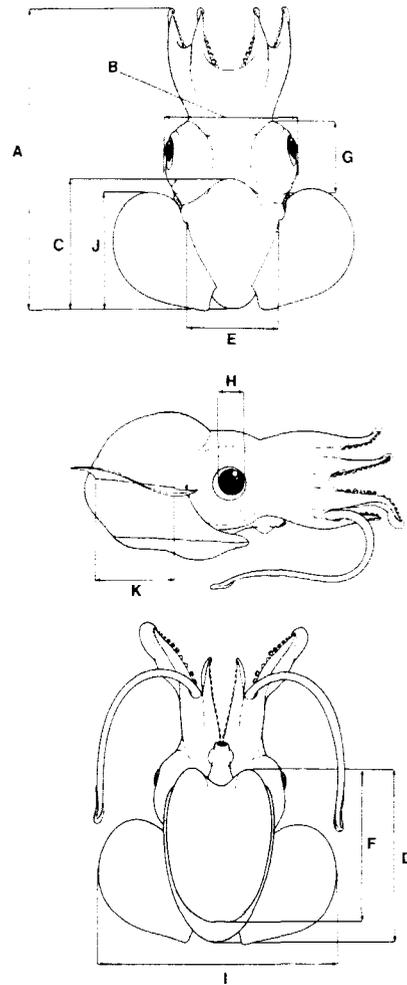


FIGURE 3. Location of *Iridoteuthis iris* measurements. A, total length; B, head width; C, dorsal mantle length; D, ventral mantle length; E, mantle width; F, shield length; G, eye diameter; H, eye lens diameter; I, fin width; J, fin length; K, fin base length. Measurements of arms and tentacles were made on oral surface from beak to arm or tentacle tip.

pointed posterior margins; base small relative to fin length; plane of attachment nearly medial on lateral surface of mantle. The morphometric indices for the fins are summarized in Table 3.

TABLE 2
Iridoteuthis iris: REPRESENTATIVE ADULT MEASUREMENTS

PARAMETERS MEASURED	MEASUREMENTS OF MALES (mm)					MEASUREMENTS OF FEMALES (mm)				
Dorsal mantle length	8.5	10.5	11.5	15.5	24.1	9.5	11.0	13.0	15.5	28.4
Total length	19.5	33.5	31.0	41.0	60.1	24.0	24.5	28.5	32.0	46.6
Head width	12.5	15.5	14.5	18.0	20.2	13.5	14.6	15.0	17.3	17.4
Ventral mantle length	13.0	18.0	20.0	24.5	30.0	13.5	16.9	20.0	21.5	29.8
Mantle width	7.0	10.0	11.0	13.5	16.2	7.5	9.4	10.5	11.4	15.0
Shield length	11.5	15.0	17.0	20.5	24.8	12.3	14.4	17.0	20.9	26.9
Eye diameter	7.5	10.5	11.0	13.5	15.7	6.7	9.5	10.0	11.5	14.5
Eye lens diameter	3.0	3.5	3.0	4.4	4.5	2.5	1.7	3.5	2.0	3.4
Fin width	26.5	29.5	28.5	37.0	42.5	21.3	23.5	29.0	32.1	36.0
Fin length	12.5	16.0	16.0	19.0	21.8	12.4	13.5	16.5	17.7	18.4
Fin base	6.0	6.5	8.0	19.5	12.2	6.2	6.9	7.0	8.4	7.7
Tentacle club length	4.5	4.0	5.0	6.5	7.1	3.5	4.0	6.0	6.0	9.5
Tentacle length	21.0	30.0	29.0	26.0	41.5	11.0	26.0	35.0	31.0	51.8
Length arm I	6.0	5.5	14.0	19.5	23.2	7.5	7.5	9.0	10.3	13.9
Length arm II	6.0	5.5	14.0	19.5	23.3	8.0	7.5	9.0	10.4	15.5
Length arm III	7.5	8.5	15.0	22.5	28.2	9.0	7.5	10.0	13.8	14.9
Length arm IV	6.0	4.5	11.0	15.0	20.1	8.0	7.9	9.5	11.4	16.3

Tentacles long and slender; stalk bare; tentacular organ (keel) present on aboral margin of stalk, just proximal to club. *Tentacle club* (Figure 5) diameter slightly greater than stalk, with two distinct sucker fields; distal half covered with crowded, minute suckers numbering 14–25 ($\bar{x} = 19.1 \pm 2.4$ SD) across; number of suckers independent of body size from at least 8 mm ML; proximal suckers slightly larger and less dense, numbering 6–14 ($\bar{x} = 10.7 \pm 1.7$ SD) across; no obvious sexual dimorphism. Figure 5 shows scanning electron micrographs of large and small suckers from the club of an 11.5-mm ML individual; the outer ring is composed of flattened plates surrounded by a toothless border, and the inner ring bears several knobs.

Arms (Figure 6) short and muscular; extensive web present between all but ventral pairs; all arms with aboral keels that may over-reach arm tips in males; male arm formula III > I \approx II > IV, female and juvenile arm formula III > I \approx II \approx IV; armature consists of bi-serial globular suckers bearing smooth rings; suckers on short pedicels; marginal trabeculae sometimes present; sexual dimorphism obvious in individuals larger than about 8 mm ML; protective membranes more developed in females. Table 3 summarizes the arm length indices. A more detailed description of arma-

ture in *I. iris* larger than 8 mm ML follows:

- Arm I. Male: 20 to 28 suckers ($\bar{x} = 24.4 \pm 2.5$); suckers present at arm tips; one series (7–9 suckers) relatively reduced distally.
Female: 18 to 32 suckers ($\bar{x} = 28.3 \pm 3.3$); no suckers on arm tips.
- Arm II. Male: 22 to 31 suckers ($\bar{x} = 25.1 \pm 1.9$); proximal two-thirds with 10–14 suckers (slightly enlarged toward middle of arm) and distal third with 12–16 smaller ones.
Female: 24 to 45 suckers ($\bar{x} = 39.0 \pm 4.9$), largest at base and decreasing gradually to tip.
- Arm III. Male: 24 to 31 suckers ($\bar{x} = 27.1 \pm 2.5$); dorsal series with several greatly enlarged suckers in middle portion of arm, proximal to “naked” region bearing only short pedicels, no suckers; 12–15 suckers proximal to naked area and 9–16 distal; aboral keel greatly enlarged.

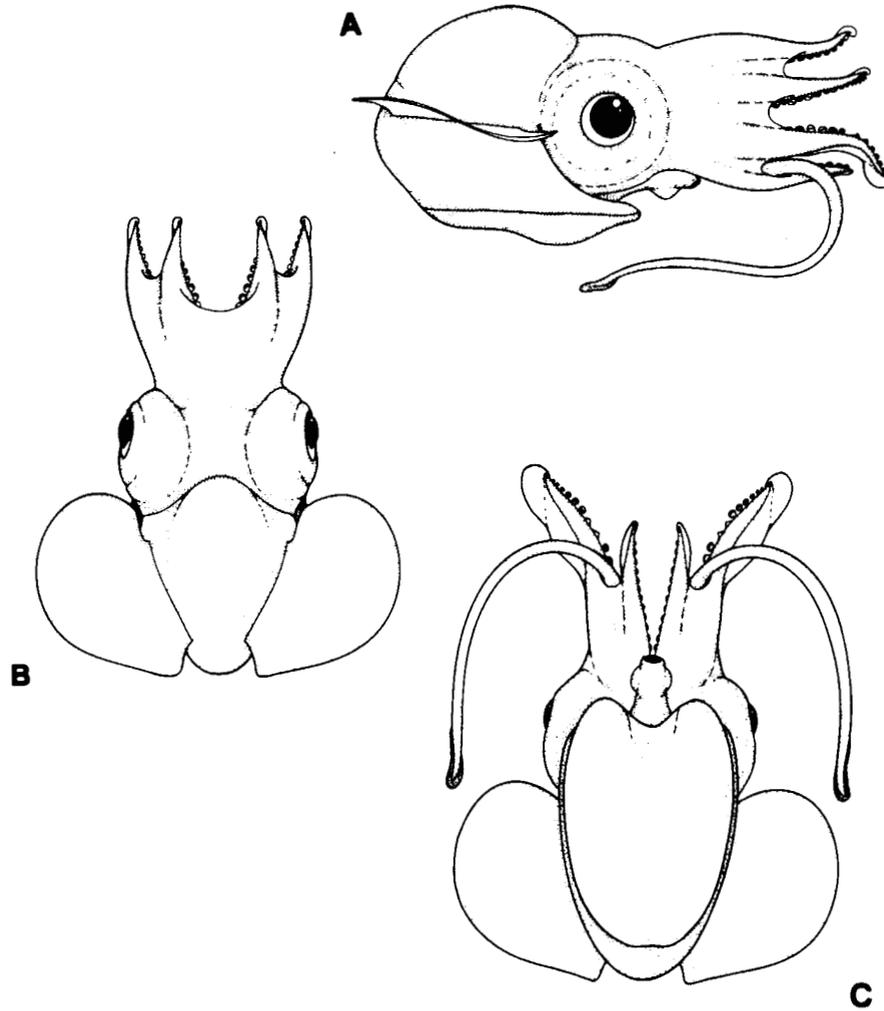


FIGURE 4. *Iridoteuthis iris* male, 24.1 mm dorsal mantle length. (A) lateral; (B) dorsal; (C) ventral.

Female: 18 to 27 suckers ($\bar{x} = 22.0 \pm 2.3$); proximal two-thirds with suckers, ending distally at small naked area; distal third with elongate trabeculae only.

Arm IV. Male: 80 to 106 suckers ($\bar{x} = 94.1 \pm 8.2$); proximal half of arm with 10–20 relatively large suckers; distal half

with 70+ small, crowded suckers in four rows.

Female: 14 to 55 suckers ($\bar{x} = 29.3 \pm 7.9$); proximal half of arm with 6–14 relatively large suckers; next quarter with 10–30 smaller suckers in somewhat regular rows; distal portion bears trabeculae.

TABLE 3
SUMMARY OF MORPHOMETRIC INDICES FOR *Iridoteuthis iris* (MINIMUM-MEAN-MAXIMUM)

MORPHOMETRIC PARAMETERS	TOTAL (<i>n</i> = 45) (5.5–30.0 mm ML)	MALE (<i>n</i> = 18) (8.0–24.1 mm ML)	FEMALE (<i>n</i> = 21) (7.9–30.0 mm ML)	JUVENILE (<i>n</i> = 7) (5.5–7.0 mm ML)
Mantle width	0.5-0.8-1.4	0.6-0.9-1.4	0.5-0.8-1.1	0.6-0.8-0.9
Ventral mantle length	1.0-1.4-1.8	1.2-1.5-1.8	1.0-1.4-1.8	1.1-1.3-1.5
Shield length	0.8-1.3-1.5	0.9-1.3-1.5	0.8-1.2-1.5	0.8-1.1-1.3
Head width	0.6-1.2-2.1	0.7-1.2-2.1	0.6-1.2-1.9	1.0-1.2-1.4
Eye diameter	0.5-0.7-1.0	0.6-0.8-1.0	0.5-0.7-1.0	0.6-0.7-0.7
Eye lens diameter	0.1-0.2-0.4	0.1-0.3-0.4	0.1-0.2-0.4	0.2-0.2-0.3
Fin width	1.3-2.1-3.1	1.6-2.3-3.1	1.3-2.1-2.8	2.0-2.1-2.4
Fin length	0.6-1.2-1.7	0.9-1.2-1.5	0.6-1.2-1.7	1.1-1.2-1.5
Fin base	0.3-0.6-1.3	0.4-0.6-1.3	0.3-0.6-1.2	0.5-0.6-0.6
Arm I	0.2-0.7-1.3	0.2-0.8-1.3	0.3-0.6-0.9	0.4-0.5-0.6
Arm II	0.2-0.7-1.3	0.2-0.8-1.3	0.3-0.6-0.9	0.4-0.5-0.6
Arm III	0.4-0.8-1.5	0.5-1.0-1.5	0.4-0.7-0.9	0.5-0.6-0.7
Arm IV	0.4-0.7-1.0	0.4-0.7-1.0	0.4-0.7-0.9	0.4-0.6-0.7

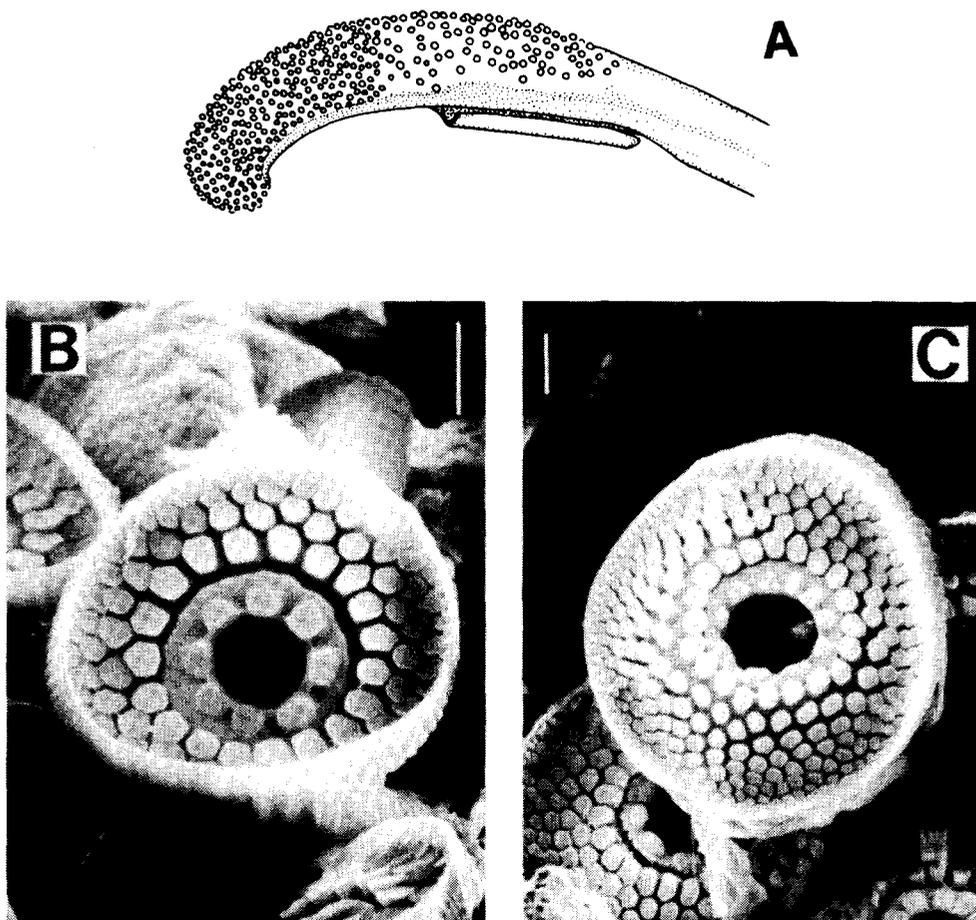


FIGURE 5. Tentacle club from *Iridoteuthis iris*. (A) 24.1 mm dorsal mantle length (ML). Scanning electron micrographs of suckers from 11.5-mm ML individual (scale bar = 10 μ m): (B) from distal field of small suckers; (C) from proximal field of large suckers.

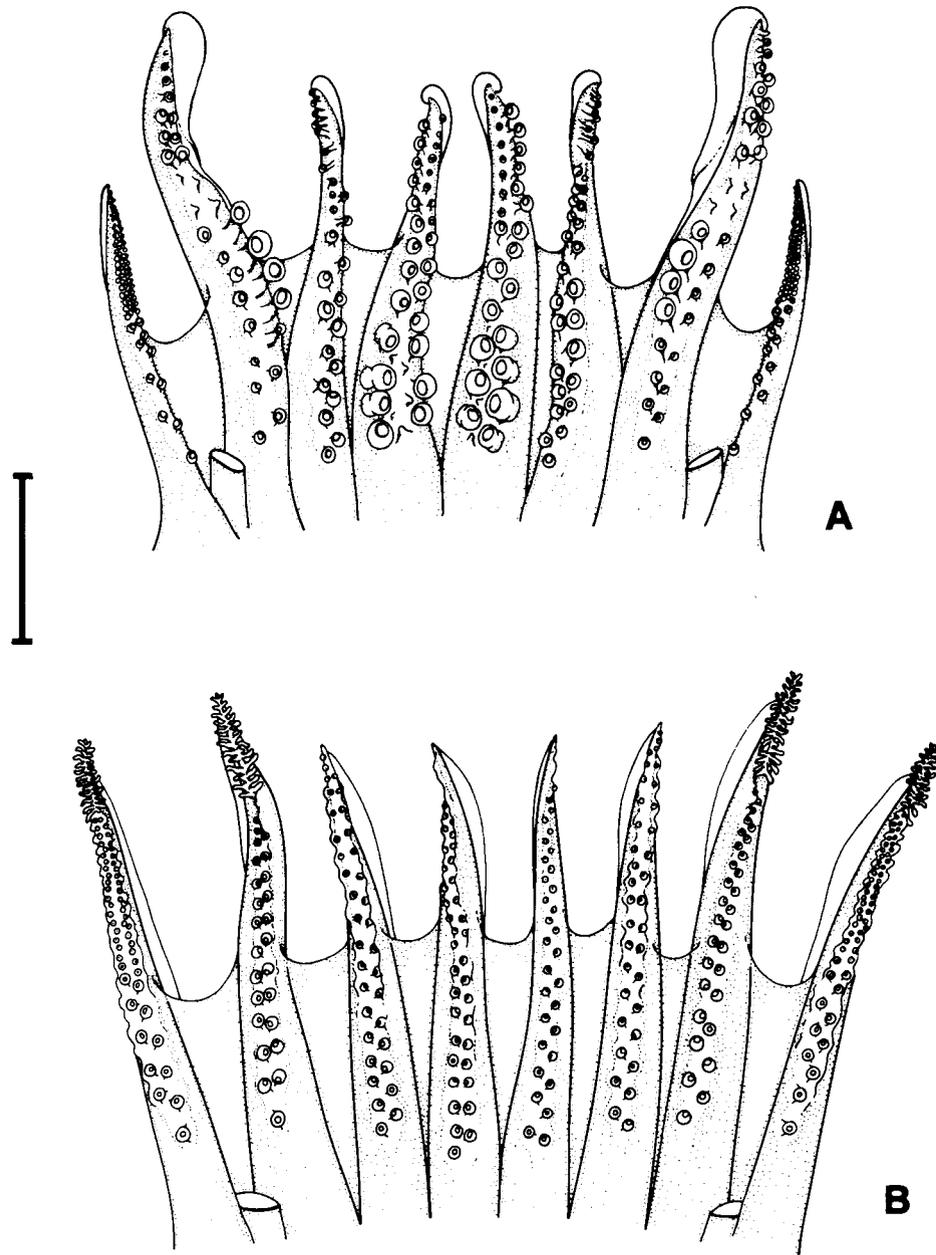


FIGURE 6. Oral views of *Iridoteuthis iris* arms. (A) 24.1-mm dorsal mantle length (ML) male; (B) 21.3-mm ML female. Dorsal arms are central. Scale bar = 5.0 mm.

DISCUSSION

The only other named species of this genus is *Iridoteuthis maoria* (Dell 1959) from the South Pacific. As in *I. iris*, this species has a broad dorsal mantle commissure and large middorsal bulge on the mantle, as well as very large eyes, ventral shield, and pointed fins; these may be valid generic characters. *Iridoteuthis maoria* males that we examined, however, had relatively smaller aboral keels on the arms than did male *I. iris*, and most of the enlarged suckers were on the second arms with a few on the third arms, the reverse of *I. iris*. The right dorsal arm of *I. maoria* is much thicker than the left, whereas in *I. iris* the dorsal arms are similar. In addition, the tentacle club suckers of *I. maoria* are relatively less numerous and dense.

We have compared the new material with *Stoloteuthis leucoptera* and agree with Naef's (1912) suggestion that this species is, indeed, different enough to be placed in *Iridoteuthis*. *Iridoteuthis* alone has a large middorsal bulge on the mantle, and relatively larger eyes and ventral shield than *Stoloteuthis*. In *Stoloteuthis*, unlike *Iridoteuthis*, the dorsal mantle commissure is relatively narrow, the males do not have greatly developed aboral keels on the third arms, there is no clear size difference between suckers on the tentacular clubs, and the fins are roughly semicircular and do not reach the posterior end of the mantle. In addition, male *Stoloteuthis* have only a few enlarged suckers on one set of arms, the second, whereas *Iridoteuthis* have enlarged suckers on the second and third arms, as well as other sexual dimorphism.

The identity of the new material remains tentative. Based solely on Berry's (1909) description and photographs taken of the individual collected off Oahu, the new samples from the SE-NHR seamounts appear to be identical to *Iridoteuthis iris*. Positive identity, however, must await further collections closer to the type locality in the main Hawaiian Islands.

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