STUDIES ON THE FAUNA OF CURAÇAO AND OTHER CARIBBEAN ISLANDS: No. 62.

THE SHALLOW WATER HOLOTHURIANS OF CURAÇAO, ARUBA AND BONAIRE

by

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The holothurians from the southern end of the Caribbean area are incompletely known. CLARK (1919) discussed a few specimens taken from Tobago, British West Indies, and DEICHMANN (1926) prepared a report on the holothurians from the Barbados-Antigua Expedition. ADA TEN BROEKE (1927) listed 7 holothurians from Curaçao, collected by C. J. VAN DER HORST. This list constituted the first mention of holothurians from the area. CLARK (1933) listed one additional specimen in his "Handbook of the Littoral Echinoderms of Porto Rico and the Other West Indian Islands". ENGEL (1939), included three additional sea cucumbers in his report on the echinoderms which were gathered by P. WAGENAAR HUMMELINCK. Neither ENGEL (1939) nor TEN BROEKE (1927) described their specimens. I have found three additional species new to the fauna of the above islands. Two of these specimens, *Thyoneria cognata* and *Trachythonidium occidentale* are the first Dendrochirota to be reported from the Netherlands Antilles.

After this report has been completed, ELISABETH DEICHMANN (1963) produced a short survey of the 'Shallow water Holothurians known from the Caribbean Waters' in which several new data are to be found gathered from material which was collected by WAGENAAR HUMMELINCK in 1948/49 and 1955.

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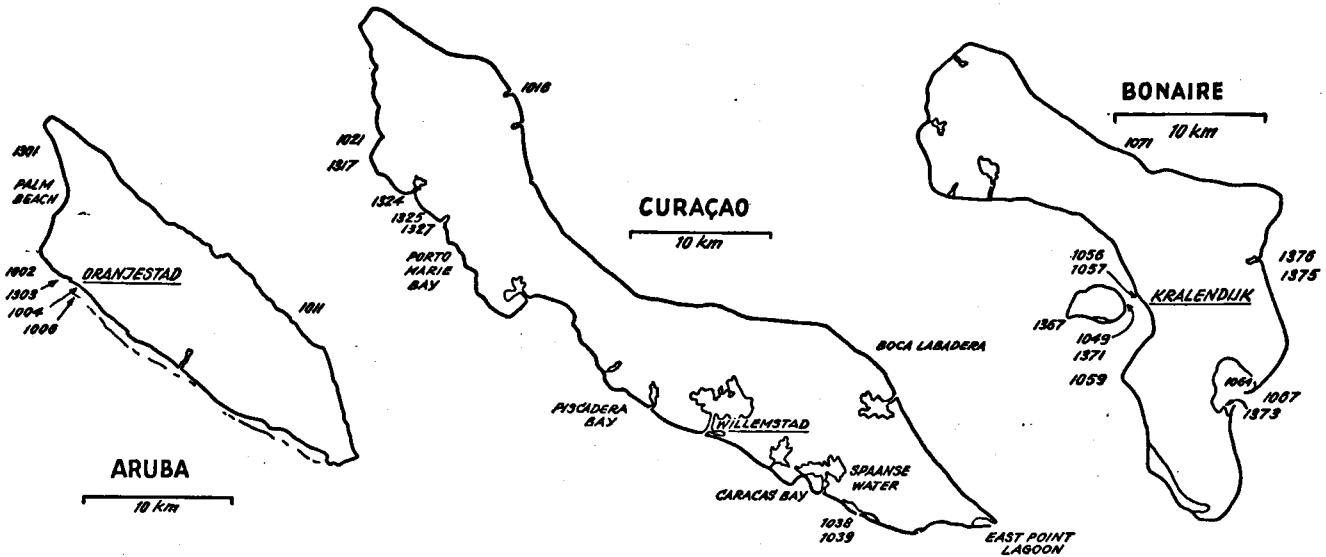


Fig. 22. Localities on ARUBA, CURAÇAO and BONAIRE, mentioned in this paper. (Cf. Table 10.)

1002 Punta Braboe
1004 Oranjestad, lagoon
1006 Oranjestad, reef
1011 Boca Prins
1016 Boca Grandi
1021 Santa Cruz bay
1038 Fuik, lagoon
1039 Fuik, lagoon
1049 Klein Bonaire, east coast
1056 Playa Lechi
1057 Kralendijk
1059 Punt Vierkant
1064 Lac, Poejito
1067 Lac, Cay
1071 Boca Onima
1301 Malmok
1303 Oranjestad, reef
1317 Playa Frankie
1324 Santa Marta bay
1325 Sint Jan, lagoon
1327 Sint Jan bay
1367 Klein Bonaire, west point
1371 Klein Bonaire, east coast
1373 Lac, Soerebon, reef
1375 Boca Washikemba
1376 Lagoen

TABLE 10.

OCCURRENCE OF SHALLOW WATER HOLOTHURIA AT ARUBA, CURAÇAO AND BONAIRE
according to

TEN BROEKE, 1927, cf. ENGEL, 1939, coll. C. J. VAN DER HORST in 1920 . . . = 1
ENGEL, 1939, coll. P. WAGENAAR HUMMELINCK in 1930 and 1936. . . . . = 2
DEICHMANN, 1963, coll. P. WAGENAAR HUMMELINCK in 1948/49 and 1955 . . = 3
TIKASINGH, 1963, coll. E. S. TIKASINGH in 1959 . . . . . = 4

Localities (with HUMMELINCK's Station numbers) and Habitat	*Isostichopus badionotus*	*Fossothuria cubana*	*Microthele parvula*	*Brandiothuria arenicola*	*Brandiothuria impatiens*	*Selenkothuria glaberrima*	*Semperothuria surinamensis*	*Ludwigothuria grisea*	*Ludwigothuria mexicana*	*Ludwigothuria floridana*	*Euapta lappa*	*Chiridota rotifera*	*Trachythyonidium occidentale*	*Thyoneria cognata*	*Synaptula hydriformis*
Aruba															
Malmok (1301)			3		3					3 4		4	4		
sheltered open beach															
Palm Beach				4						4			4	4	
open beach															
Oranjestad, Punta Braboe (1002) .						2	2			2					
sheltered open shore															
Oranjestad, Reef (1006, 1303) . .			3	3	3		3			2 3					
sheltered open beach															
Oranjestad, Lagoon (1004). . . .										2 3 4					
open lagoon															
Boca Prins (1011)						2									
exposed narrow bay.															
Curaçao															
Santa Cruz Bay (1021)	2										4	2			
sheltered open bay															
Spaanse Put, Playa Frankie (1317)			3	3	3	3		3							
sheltered open beach															
Santa Marta Bay (1324).			4		4	3 4	4	4							
open bay															
Sint Jan Bay (1327)								3							
open bay															
Sint Jan, Lagoon (1325).							3								
open lagoon															
Porto Marie Bay				4											
open bay															
Piscadera Bay									3						
enclosed lagoon															
Caracas Bay	1			1		1					1				
sheltered open bay															
Boca Spaanse Water						1	1								
sheltered narrow bay															
Spaanse Water.	1 3 4	1 3		1					1 4						
enclosed lagoon															
Fuik, Bay	4														
open bay															
Fuik, Lagoon (1038, 1039)	4	3 4	3		3		3		3 4						
enclosed lagoon															
East Point Lagoon	4		4		4				4						
enclosed lagoon															
Boca Labadera.						1									
exposed narrow bay															

TABLE 10. (*continued*)

Localities (with HUMMELINCK's Station numbers) and Habitat	*Isostichopus badionotus*	*Fossothuria cubana*	*Microthele parvula*	*Brandiothuria arenicola*	*Brandiothuria impatiens*	*Selenkothuria glaberrima*	*Semperothuria surinamensis*	*Ludwigothuria grisea*	*Ludwigothuria mexicana*	*Ludwigothuria floridana*	*Euapta lappa*	*Chiridota rotifera*	*Trachythyonidium occidentale*	*Thyoneria cognata*	*Synaptula hydriformis*
Boca Grandi (1016) . . . . . exposed narrow bay					2										
Klein Bonaire															
West Point (1367) . . . . . open shore												3			
East Coast (1049, 1371) . . . . . sheltered open beach				3		3		3				3			
Bonaire															
Kralendijk, Playa Lechi (1056, 1057) sheltered open shore	2 3					3		3				2			
Punt Vierkant (1059) . . . . . open shore						3									
South Coast . . . . . open shore								3				2			
Lac, Soerebon Lagoon (1373). . . open lagoon									3						
Lac, Soerebon Reef (1373) . . . . open shore												3			
Lac, Cay (1067) . . . . . open lagoon				3											
Lac, Poejito (1064) . . . . . enclosed lagoon									2 4						3
Boca Washikemba (1375) . . . . exposed narrow bay						3									
Lagoen (1376) . . . . . exposed narrow bay						3									
Boca Onima (1071) . . . . . exposed narrow bay						3									

The opportunity to study the holothurians from Aruba, Bonaire and Curaçao came in the Fall of 1959, when the author was awarded a grant from The Netherlands Institute for International Cultural Relations to study the endoparasitic gastropods of the holothurians of these islands. It soon became apparent to the author that there were no satisfactory keys or descriptions of holothurians of the Netherlands Antilles. Such keys and descriptions are the subject of this report.

Most of my time was spent in Curaçao, but I made trips of a shorter duration to Bonaire and Aruba. I found a diving mask and snorkel to be an indispensable asset. The holothurians could be studied in their natural habitat, and this entire study was done from live animals. The colors, for example, were studied from

live specimens. The length given in this report was also taken from live holothurians and refers to material taken from the Netherlands Antilles only.

The majority of the specimens collected were deposited in the reference collection at the Caribbean Marine Biological Institute. In addition, a small collection has been deposited in the Invertebrate Collections at Oregon State University.

The author wishes to express his gratitude to several people for their help and cooperation. Among these are: Dr. and Mrs. TRON SOOT-RYEN (Curaçao), Mr. and Mrs. PAUL DE BUISONJÉ (Bonaire), and Mr. and Mrs. E. J. VAN DER KUIP (Aruba). Moreover, I am grateful to Dr. SOOT-RYEN for many helpful suggestions and to Mr. HERMAN VERBRUGGE, for accompanying me on many of my collecting trips. Appreciation is extended to Dr. IVAN PRATT, (Department of Zoology, Oregon State University) for reading the manuscript, to Dr. ELISABETH DEICHMANN (Museum of Comparative Zoölogy at Harvard College) for giving me her opinion on several taxonomical questions, and to Dr. P. WAGENAAR HUMMELINCK (Zoölogisch Laboratorium, Utrecht) for preparing the table on the 'Occurrence of Shallow Water Holothuria at Aruba, Curaçao and Bonaire' and for drawing the corresponding map (Fig. 22).

KEY TO THE SHALLOW WATER HOLOTHURIANS OF ARUBA, BONAIRE AND CURAÇAO

1a Pedicels (tube feet) wanting. Spicules consist of anchor and anchor plates or 6-spoked wheels . . . . . Order Apoda 12

1b Pedicels present; abundant on ventral side, but sometimes scattered on the entire surface 2

2a Tentacles 10, dendritic, irregular branching 13

2b Tentacles not dendritic, but peltate, the branching arising near tip of tentacles . . . . . Order Aspidochirota 3

3a Gonads in two tufts. Delicate C-shaped bodies present (Figs. 23–25). Dense layer of tables of uniform size, with small disk and well-developed spire . . . . . *Isostichopus badionotus* (Selenka)

3b Gonads in a single tuft. C-shaped bodies not present . . . 4

4a Deposits in the form of tables and buttons. Tables well developed. Buttons knobbed (Figs. 26–29). . . . . *Fossothuria cubana* (Ludwig)

4b Tables variously developed. Buttons when present, smooth 5

5a Generally small forms. Ventral surface somewhat flattened with numerous pedicels. Large, thin buttons with small holes; complete layer of tables. Greenish-yellow in color (Figs. 30–33) . . . . . *Microthele parvula* (Selenka)

5b Medium size to large forms. Generally cylindrical 6

6a Buttons small, smooth 7

6b Buttons absent. 8

7a Tables large with about 8 marginal holes; disk somewhat squarish; spire short with numerous spines. Buttons with three pairs of large holes. Skin rough; color brown and mottled (Figs. 39–41) *Brandtothuria impatiens* (Forskål)

7b Tables with disk reduced to 4 central holes and a few marginal holes. Buttons with 3 pairs of small holes (Figs. 34–38). . . . . *Brandtothuria arenicola* (Semper)

8a Deposits in the form of branched rods with curved ends. Tables absent (Figs. 42–43) . . . . . *Selenkothuria glaberrima* (Selenka)

8b Tables present 9

9a Tables lacking disk; top flat with 8 spines forming a Maltese cross, single or double (Figs. 44–46) . . . . . *Semperothuria surinamensis* (Ludwig)

9b Tables with disk; top with 8 horizontal and 4 upright spines 10

10a Besides scattered tables, small, oval, perforated plates with 2 to 4 large holes; a row of smaller ones around these; edge of plate often scalloped with short blunt teeth. Single stone canal. Medium size holothurians (Figs. 47–50) . . *Ludwigothuria grisea* (Selenka)

10b Numerous stone canals. Deposits in the form of rosettes. Large holothurians 11

11a Skin thick. Color uniform dark brown to black (light brown in young animals); ventral side pink to rose in color. Small rosettes which become transformed to biscuit-shaped plates with minute holes (Figs. 51–56) . . . . . *Ludwigothuria mexicana* (Ludwig)

11b Skin not thick. Small rosettes, chiefly 3-lobed which do not develop into biscuit-like plates; some may become oval buttons with four holes. Color gray to grayish-yellow; sometimes mottled; sometimes brown. Rosettes abundant (Figs. 57–61) . . . . *Ludwigothuria floridana* (Pourtalès)

12a Deposits in the form of anchor and anchor plates. Bridge across posterior end of anchor plates. Numerous complex miliary grains . . . . . *Euapta lappa* (J. Müller)

12b Deposits in the form of 6-spoked wheels; wheels collected in heaps; besides scattered curved rods (Fig. 62) . . . . *Chiridota rotifera* (Pourtalès)

13a Tables present in integument; two-pillared with short spire. Disk of tables with 2 large holes and 6 smaller ones; outline of disk irregular with several projections (Figs. 63–69). . . . . *Trachythyonidium occidentale* (Ludwig)

13b No tables in integument. Deposits in the form of perforated smooth plates (Figs. 70–72) *Thyoneria cognata* (Lampert)

DESCRIPTION OF HABITATS

(Partly based on WAGENAAR HUMMELINCK, 1953)

Aruba

ORANJESTAD (approx. 500 m East) — Open lagoon; exposed to wave action; sandy bottom; clear waters.

Ludwigothuria floridana.

Poos CHIKITOE (approx. 1.3 km S of Hotel Aruba Caribbean on Palm Beach) — Open beach; considerable wave action; sandy with occasional rocky areas; eel grass roots in clumps.

Brandtothuria arenicola, Ludwigothuria floridana, Trachythyonidium occidentale, Thyoneria cognata.

MALMOK BEACH — Open beach; considerable wave action; sandy; rocky areas; some eel grass.

Ludwigothuria floridana, Chiridota rotifera, Trachythyonidium occidentale.

Curaçao

EAST POINT LAGOON — Enclosed lagoon; not exposed to wave actions; relatively quiet waters; clear; rocky shore line; great depth only a few meters from shore; some mangrove.

Isostichopus badionotus, Microthele parvula, Brandtothuria impatiens, Ludwigothuria mexicana.

FUIK BAY — Rocky, open bay; rough; clear waters.
Isostichopus badionotus (one young specimen).

FUIK LAGOON — Enclosed lagoon; not exposed to wave action; clear quiet waters; muddy sand; some eel grass near reef; some mangrove.
Isostichopus badionotus, Fossothuria cubana, Ludwigothuria mexicana.

BOCA SANTA MARTHA — Open bay; considerable wave action; often quite rough; rocky.
Microthele parvula, Brandtothuria impatiens, Selenkothuria glaberrima, Ludwigothuria grisea, Semperothuria surinamensis.

ST. KRUIS BAY — Protected open bay; exposed to wave action; sandy, with rocks; some rock pools on south side. Sand was removed from this beach and transported to other parts of the island, but was subsequently replaced; hence this habitat has been considerably disturbed by man.
Euapta lappa.

SPAANSE WATER — Enclosed lagoon; quite large with many bays, inlets, and islands; often rough; muddy sand.
Isostichopus badionotus, Ludwigothuria mexicana.

PORTO MARIE BAY — Open bay; exposed to considerable wave action; rocky with sand.
Brandtothuria arenicola.

Bonaire

LAC — Huge landlocked lagoon; considerable wave action; sandy; some eel grass and some mangrove.
Ludwigothuria mexicana.

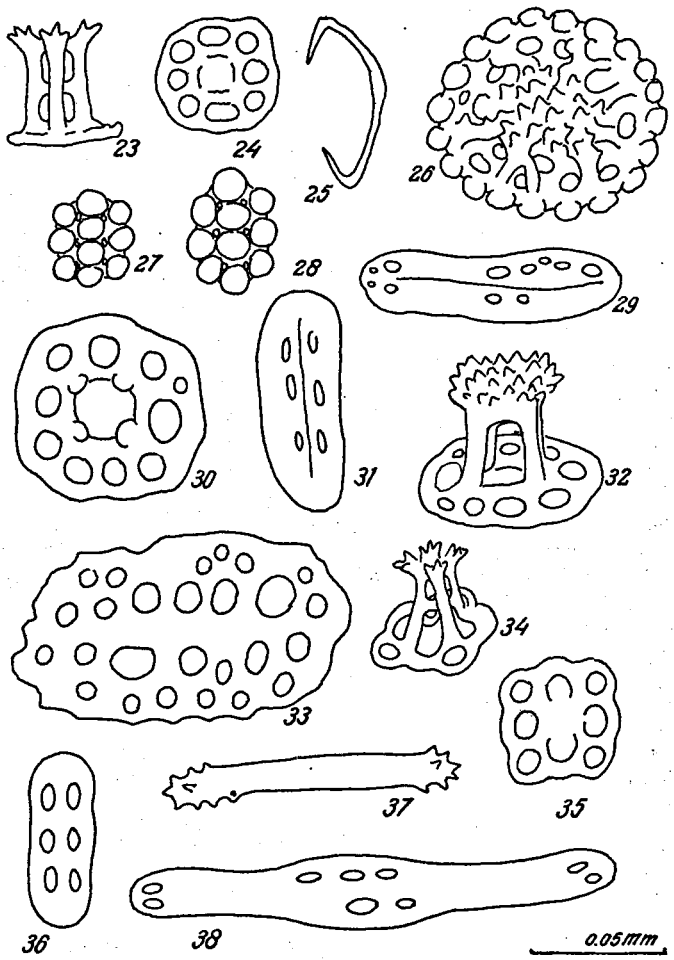
Order ASPIDOCHIROTA

Family STICHOPODIDAE

Isostichopus badionotus (Selenka) Figs. 23–25

Stichopus badionotus SELENKA, 1867, p. 316, pl. 18 fig. 26. CROZIER, 1916, p. 297–356; 1918, p. 379–389. TEN BROEKE, 1927, p. 164. DEICHMANN, 1930, p. 80, pl. 5 fig. 30–36; 1957, p. 4–5, fig. 1–4. CLARK, 1933, p. 109. ENGEL, 1939, p. 6, 11.
Stichopus macroparenthesis CLARK, 1922, p. 61, pl. 1 fig. 1–7; 1933, p. 110. DEICHMANN, 1930, p. 82, pl. 5 fig. 37–43.
Isostichopus badionotus, DEICHMANN, 1958, p. 279–280.

Large holothurians, average 28 cm long, but up to 50 cm or more in length. Wide color variation; from a greenish-yellow to a dark brown. Tube feet in three bands; in older specimens the middle row tends to split into two bands. Tube feet sometimes brown,



Figs. 23–25. *Isostichopus badionotus* (Selenka): 23, table; 24, disk of table; 25, C-shaped body.

Figs. 26–29. *Fossothuria cubana* (Ludwig): 26, "degenerate" table; 27–28, buttons; 29, supporting rod from tube feet.

Figs. 30–33. *Microthele parvula* (Selenka): 30, disk of table; 31, button; 32, spire of table; 33, supporting plate from tube feet.

Figs. 34–38. *Brandtothuria arenicola* (Semper): 34, spire of table; 35, disk of table; 36, button; 37, supporting rod from tentacle; 38, supporting rod from tube feet.

sometimes yellow. Dorsal appendages consist of warts ending in papillae. Spicules consist of a dense layer of tables with small disks and scattered C-shaped bodies. C-shaped bodies larger than the length of the tables, particularly in young animals.

Several specimens examined, from CURAÇAO, Spaanse Water, Fuik Bay (juvs.), Fuik Lagoon and East Point Lagoon.
Type: Museum of Comparative Zoölogy, Massachusetts. Type locality: Florida.

This is the holothurian with the widest color variation of all those examined. From a single area (Spaanse Water) and from a single day's collection, I found specimens that were yellow-brown, a light brown, a chocolate brown and almost black in color. I found the base of the papillae to be of a darker color than the body color. This may become large so as to give the appearance of dark circular spots on the dorsum. These colored areas may become so large finally joining with each other forming dark patches. Indeed these patches may cover the entire dorsal area.

Together with *Ludwigothuria mexicana*, *Isostichopus badionotus* is the largest species of holothurians in the area. Also like *Ludwigothuria mexicana*, its external surface is the habitat for the gastropod, *Balcis*.

During unfavorable conditions these animals shed large patches of their skin with much sticky mucus. When placed in an aquarium, the damaged parts are quickly healed (overnight in one case), leaving only a slight trace of the damaged region.

I. badionotus makes no effort to conceal itself for these are commonly found in the open areas of the lagoons. I did not find them at St. Kruis, but they were quite common at Fuik Lagoon and Spaanse Water.

Family HOLOTHURIIDAE

Fossothuria cubana (Ludwig) Figs. 26–29

Holothuria cubana LUDWIG, 1875, p. 104, pl. 7 fig. 34. TEN BROEKE, 1927, p. 164. DEICHMANN, 1930, p. 54, pl. 1 fig. 1–8; 1939, p. 130. CLARK, 1933, p. 100–101. *Fossothuria cubana*, DEICHMANN, 1958, p. 321.

Small to medium size animals (average 8.0 cm). Body cylindrical, skin thin, parchment-like, rough to the touch but not necessarily rigid; light brown bands on dorsal side between which are narrow gray bands; occasional darker spots together with a series of darker gray spots. Tube feet numerous. but tiny. Dorsal papillae also

tiny. Tentacles small, light colored. Spicules of buttons and tables. Buttons numerous, knobbed, usually with 3 pairs of holes, but occasionally with 2 pairs or 4 pairs. A uniform layer of large tables with knobbed edge and low spire which gradually forms a hemispherical reticulum. Tube feet with end plate and flat supporting rods; supporting rods flat, plate-like with small holes irregularly placed.

One specimen examined, from CURAÇAO, Fuik Lagoon.
Type: Vienna Museum. Type locality: Cuba.

The single specimen taken by the author was found at Fuik Lagoon, buried among sand and lying under a rock. The body color blended well with the background, and hence is easily missed by the casual observer.

It is very rough to the touch, because of the densely packed spicules just under the skin.

Microthele parvula (Selenka) Figs. 30–33

Mülleria parvula SELENKA, 1867, p. 314, pl. 17 fig. 17–18.
Holothuria parvula, DEICHMANN, 1930, p. 70, pl. 4 fig. 14–22; 1957, p. 12–13. CLARK, 1933, p. 103. KILLE, 1937, p. 93–94; 1942, p. 55–66, pl. 1.
Holothuria captiva, CROZIER, 1914, p. 8–20; 1915, p. 196–202; 1917a, p. 510–513; 1917c, p. 560–566; 1920, p. 57–59.
Microthele parvula, DEICHMANN, 1958, p. 288.

Small specimens (average 3.4 cm); largest one found was 6.5 cm. Greenish yellow to a light brown in color. Ventral side somewhat flattened with numerous, yellow tube feet. Dorsum arched with many low warts. Spicules consist of a layer of tables and buttons. Disk of tables with a large, single, central hole and 8 to 12 marginal holes; spire of tables with many fine projections on top. Buttons large, thin, oval, with small holes, three pairs or more. Supporting rods and end plates in tube feet. Cuvierian organs present.

Over 100 specimens examined, from CURAÇAO, Boca Santa Martha and East Point Lagoon.
Type: Museum of Comparative Zoölogy, Massachusetts. Type locality: Florida.

Microthele parvula is one of the few species of holothurians which multiplies by transverse fission. I found several specimens with regenerating oral or anal ends. They are found under pieces of rocks and corals in shallow water and are gregarious.

CLARK (1933) pointed out that they may possess peculiar 'anal teeth'. I did not find such structures for these specimens. A fluorescent green pigment is present in the skin and is quite noticeable in its preserving fluid.

This is the first record on this holothurian in any of the three islands. They were quite common. The most spectacular feature is the presence of copious and very sticky, white Cuvierian organs. A slight pressure on this animal elicits the ejection of a great quantity of these.

Brandtothuria arenicola (Semper) Figs. 34–38

Holothuria arenicola SEMPER, 1868, Holothurien, p. 81, pl. 20 & 30 fig. 13. DEICHMANN, 1930, p. 66, pl. 4 fig. 1–9. CLARK, 1933, p. 102. ENGEL, 1939, p. 10.
Holothuria vagabunda, TEN BROEKE, 1927, p. 164 (see ENGEL, 1933).
Brandtothuria arenicola, DEICHMANN, 1958, p. 290–293.

Small to medium sized (10 cm). Body spindle-shaped. Color gray with large patches of light brown areas towards posterior end, in indistinct rows. Tentacles small, light colored. Appendages scattered, mainly tube feet; in indistinct bands on ventral; very small papillae on dorsal; appendages pinkish. Spicules of tables, buttons, and rods. Tables with small disk; 4 central holes and from few to many subterminal ones; disk nearly square; spire short to tall with varying number of teeth, and with two cross beams. Buttons small with 3 to 5 pairs of small holes. Ventral feet with end plate and straight supporting rods; rods with perforations at ends, but sometimes laterad, becoming buttons. Dorsal appendages with similar, but curved supporting rods.

Three specimens examined, from CURAÇO, Porto Marie Bay, and ARUBA, Palm Beach.
Type: Germany (?). Type locality: Bohol, Philippines.

DEICHMANN (1930) described its color as 'variable', the color being dependent on the locality. She recorded its color as varying from "gray, sand colored, with large dark patches in two series along the dorsal side, to gray with numerous small stains irregularly scattered on the entire surface; in some cases the specimens are entirely rust color, as if they had been in contact with iron, and in others they are almost black".

I have found two specimens which were gray, but which possessed two rows of brown spots on the dorsal surface. Both specimens were found lying under rocks and buried in sand.

Brandtothuria impatiens (Forskål) Figs. 39–41

Fistularia impatiens FORSKÅL, 1775, p. 121, pl. 39 fig. B.
Holothuria impatiens, DEICHMANN, 1930, p. 64, pl. 3 fig. 17–18; 1939, p. 131; 1957, p. 7–8, fig. 14–15. CLARK, 1933, p. 102; 1942, p. 385. ENGEL, 1939, p. 6 & 11.
Brandtothuria impatiens, DEICHMANN, 1958, p. 291, 293–294, pl. 1 fig. 14–15.

Medium size (15 cm) holothurians. Body color, mottled gray with many small purple spots on dorsum; anterior end much darker than the rest of the body. Appendages numerous; dorsal appendages low and conical, some with concentric brown lines. Spicules consisting of tables and buttons with supporting rods in the appendages; tables nearly square, with 8 terminal holes (generally); spire short, ends with numerous short spines. Buttons oval, with 3 pairs of large, elongated holes. Ventral feet with large flat supporting rods and large end plate. Dorsal appendages with slightly curved, supporting rods. Entire body rough to touch. Large Cuvierian organs.

Three specimens examined, from CURAÇAO, East Point Lagoon and Boca Santa Martha.
Type: Not known. Type locality: Red Sea.

These holothurians are commonly found under rocks, both in lagoons and in the open bay. The author cannot quite agree with CLARK's (1933) statement that it is "somewhat gregarious and it is not uncommon to find several under one sheltering fragment", for I have found only 3 specimens in the Netherlands Antilles.
The many spicules in the integument makes this animal quite rough to touch.

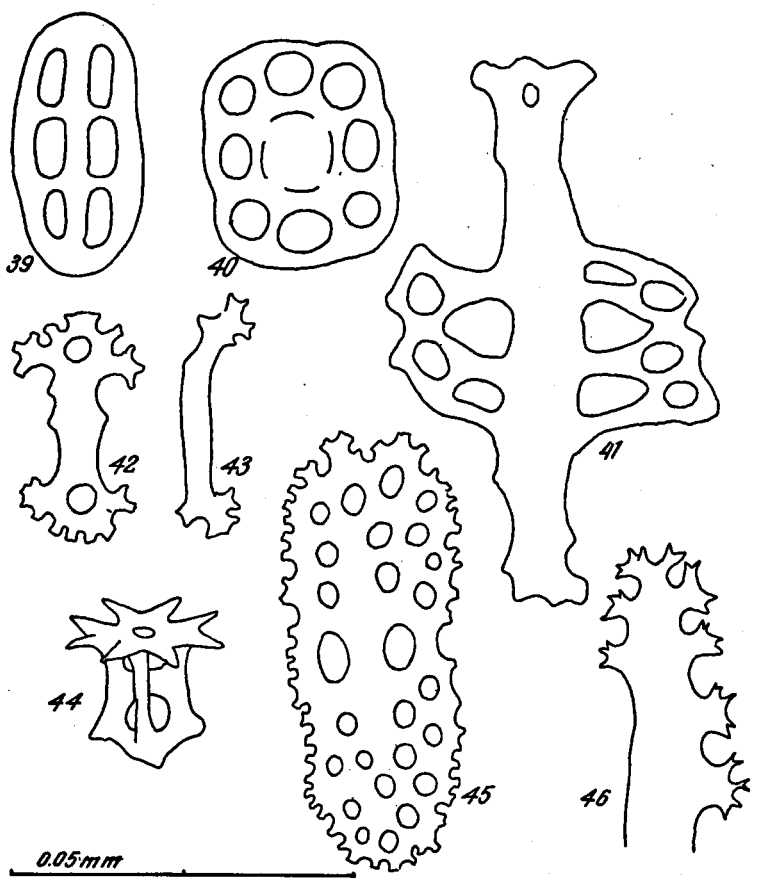
Selenkothuria glaberrima (Selenka) Figs. 42–43

Holothuria glaberrima SELENKA, 1867, p. 328, pl. 18 fig. 57–58. TEN BROEKE, 1927, p. 164. DEICHMANN, 1930, p. 69, pl. 4 fig. 10–13; 1957, p. 12. CLARK, 1933, p. 104.
Selenkothuria glaberrima, DEICHMANN, 1958, p. 315.

Medium sized (10 cm). Tentacles 20, dark and bushy. Mouth terminal. Body cylindrical. Soft skin; greenish-yellow in color. Single stone canal. Twenty polian vesicles. Cuvierian organs well developed. Spicules of straight to slightly curved rods in about equal numbers; many with short distinct spines; some with holes

at end of rods; others with ends branching, some may be Y-shaped. No tables or buttons present. Tube feet with large end plates.

Two specimens examined, from CURAÇAO, Boca Santa Martha.
Type: Museum of Comparative Zoölogy, Massachusetts. Type locality: Bahamas.



Figs. 39–41. *Brandtothuria impatiens* (Forskål): 39, button; 40, disk of table; 41, supporting rod from tube feet.
Figs. 42–43. *Selenkothuria glaberrima* (Selenka): rods from body wall.
Figs. 44–46. *Semperothuria surinamensis* (Ludwig): 44, table; 45, plate from tube feet; 46, rod from tube feet.

Selenkothuria glaberrima lives in shallow waters along the coast line where the waters are clean, and in constant motion. They are not necessarily gregarious, for I have found only a few specimens. Their bushy tentacles suggest that they might be plankton feeders, but direct confirmation of this is lacking. My specimens were found under slabs of rocks and pieces of corals, along with *Microthele parvula*. They are inconspicuous animals, for they blend very well with their background.

Semperothuria surinamensis (Ludwig) Figs. 44–46

Holothuria surinamensis LUDWIG, 1875, p. 111, pl. 7 fig. 27. DEICHMANN, 1926, p. 12–13, pl. 1 fig. 1a–1g; 1930, p. 63, pl. 3 fig. 12–15 & 19; 1938, p. 131. CLARK, 1933, p. 105.
Semperothuria surinamensis, DEICHMANN, 1958, p. 302–303.

Medium sized (10 to 15 cm). Body color, light brown with a series of purple spots on the dorsum. Dorsal papillae small, dull white. Tube feet dull white, but with yellow tips. No Cuvierian organs noticeable. Spicules consist of tables and bars. Tables without disk; base tapering and cone-shaped. Few slender, scattered bars; dentate. No buttons present.

Twelve specimens examined, from CURAÇAO, Boca Santa Martha.
Type: Würzburg Museum. Type locality: Surinam.

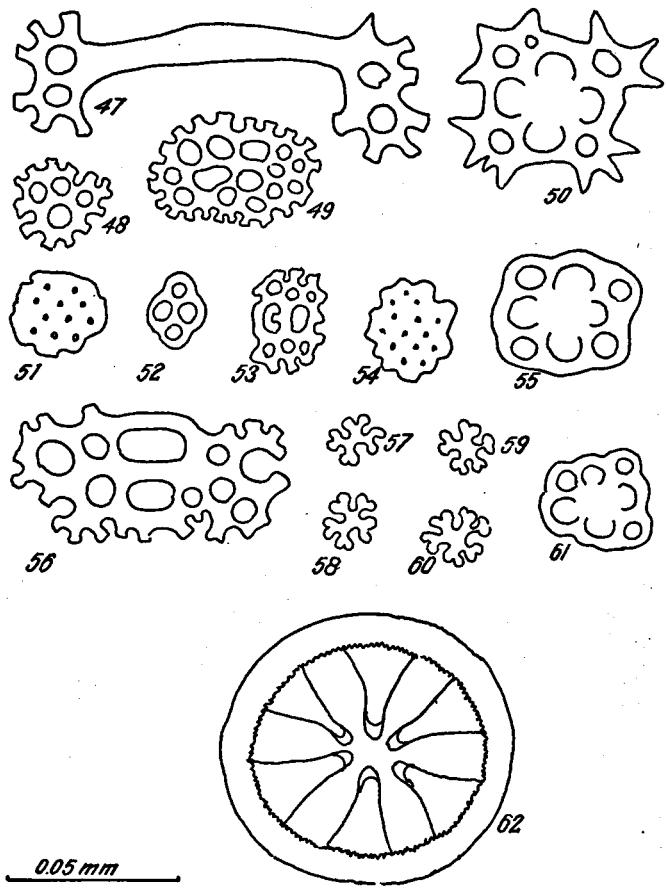
Like *Microthele parvula*, *Semperothuria surinamensis* also possesses the ability of multiplying by transverse fission. Several specimens were found with regenerating oral or anal ends. Although CLARK (1933) and DEICHMANN (1958) reported Cuvierian organs in these animals, I did not find such organs in the specimens which I collected. Further, CLARK stated that these holothurians possessed a peculiar fluorescent pigment. This also, I did not find in *Semperothuria* at Curaçao.

Ludwigothuria grisea (Selenka) Figs. 47–50

Holothuria grisea SELENKA, 1867, p. 328, pl. 18 fig. 52–56. DEICHMANN, 1926, p. 15; 1930, p. 76, pl. 5 fig. 1–4; 1957, p. 11–12. CLARK, 1933, p. 105.
Ludwigothuria grisea, DEICHMANN, 1958, p. 310–311.

Medium sized (10 cm.) Tentacles bushy; about 23 in number with 11 smaller, ventral ones, and with a gradual increase is size dorsally. Tube feet yellow, small, delicate, and in indistinct bands. Dorsal appendages are warts and papillae. Deep pink in color with

scattered, large darker spots. Several Polian vesicles. Single stone canal. Calcareous ring simple. Spicules consist of tables, plates, and rods. Tables with four central holes and from 7 to 12 terminal ones; disk with dentate margin; spire ending in 12 short spines.



Figs. 47–50. *Ludwigothuria grisea* (Selenka): 47, rod from tube feet; 48–49, plates; 50, disk of table.
Figs. 51–56. *Ludwigothuria mexicana* (Ludwig): 51–54 and 56, plates; 55, disk of table.
Figs. 57–61. *Ludwigothuria floridana* (Pourtalès): 57–60, rosettes; 61, disk of table.
Fig. 62. *Chiridota rotifera* (Pourtalès): 6-spoked wheel.

Plates with large holes; generally with 2 larger central holes, but sometimes with 3 and occasionally with 4; some plates may have short blunt spines forming a scalloped edge. Papillae with rods and end plates. Tube feet with end plate.

Twelve specimens examined, from CURAÇAO, Boca Santa Martha.
Type: Museum of Comparative Zoölogy, Massachusetts. Type locality: Haiti.

The name *grisea* suggests gray, but this seems to be true only for preserved specimens. The color in life was reddish, with yellow tube feet and some darker patches on the dorsum. In no situation did I find this animal to be gray. CLARK (1933) claimed that specimens living near muddy bottoms are dull, while those living where the water is in continuous motion are a 'flesh-red' in color. I did not collect specimens from muddy bottoms, but at Boca Santa Martha where there was continuous wave action, I collected specimens which certainly possessed spots of 'flesh-red' in these animals.

Ludwigothuria mexicana (Ludwig) Figs. 51–56

Holothuria mexicana LUDWIG, 1875, p. 101, pl. 7 fig. 47. DEICHMANN, 1930, p. 74, pl. 5 fig. 15–20; 1957, p. 9, fig. 21–38. CLARK, 1933, p. 107. ENGEL, 1939, p. 6 & 11.
Holothuria atra, TEN BROEKE, 1927, p. 164 (see ENGEL, 1939). WAGENAAR HUMMELINCK, 1933, p. 304.
Ludwigothuria mexicana, DEICHMANN, 1958, p. 311.

Large sized (average 30 cm). Color, black on dorsum, but shades of pink and rose on the ventral side. Body with blunt ends. Skin smooth, but thick, 7–8 mm when contracted. Tube feet scattered, usually retracted into pits; dorsally scattered papillae, rarely wart-like. Spicules of few tables and plates. Tables with small disks of 4 central holes and many marginal ones. Plates flat and 'biscuit shaped' with many perforations. Tube feet with scattered supporting rods.

About hundred specimens examined, from CURAÇAO, Fuik Lagoon, Spaanse Water, East Point Lagoon, and BONAIRE, Lac.
Type: Museum of Hamburg. Type locality: Gulf of Mexico.

This is one of the largest holothurians of the entire West Indian area and one of the largest the author has examined. One of its characteristic features is its accordion-like body. This was quite noticeable in contracted specimens, but one

can still see this feature in fully expanded animals. Neither CLARK (1933), nor DEICHMANN (1930) mentioned this feature in their discussion of *Ludwigothuria mexicana*.

Although one male spawned spontaneously at noon, October 22, when placed in an aquarium, only a small percentage of all adults examined had mature gonads.

Specimens collected at Fuik Lagoon and Spaanse Water harbored a commensal gastropod of the genus *Balcis*. About one out of every five of these sea-cucumbers was so infected. Moreover, two specimens taken from Fuik Lagoon, and two other specimens taken from Lac, Bonaire, harbored the pearl fish, *Carapus*. This is the first record of this fish in *Ludwigothuria mexicana*.

Ludwigothuria mexicana is commonly found in the lagoons in areas where the waters are relatively quiet. They are quite common and make no effort to conceal themselves. Many were found with various types of sea weeds on their dorsal sides, undoubtedly held by papillae and minute tube feet.

Ludwigothuria floridana (Pourtalès) Figs. 57-61

Holothuria floridana POURTALÈS, 1851, p. 12. DEICHMANN, 1930, p. 72, pl. 5 fig. 5–9; 1938, p. 131, fig. 1–8. CLARK, 1933, p. 107. ENGEL, 1939, p. 11.
Ludwigothuria floridana, DEICHMANN, 1958, p. 310–311.

Long and slender; average 20 cm in length. Color varies from gray to light brown to dark brown; the color is generally uniform, but sometimes mottled. Appendages are dorsal papillae and yellow ventral tube feet. Tentacles 20, yellow. Spicules consist of tables and small rosettes. Tables with small disk; four large holes in disk. Numerous simple rosettes mostly cloverleaf shaped, of which a few may develop into oval, four holed buttons.

Forty specimens examined, from ARUBA, lagoon near Oranjestad, Malmok and Poos Chikitoe on Palm Beach.
Type: Not known. Type locality: Florida.

This species of *Ludwigothuria* is sometimes confused with *L. grisea* and *L. mexicana*. The three species however, can easily be separated. *L. mexicana* is the largest (30 cm or more) and most robust of the three. Further, its skin is the smoothest and thickest, with very pronounced folding. *L. floridana* is intermediate in size (8–20 cm). Skin thinner and rougher. *L. grisea* is the smallest of the three (10 cm). Its dorsal appendages are pronounced conical papillae. The skin color is reddish with darker blotches and yellow tube feet. *L. mexicana* and *L. floridana* are generally lagoon dwellers, while *L. grisea* lives under slabs of rocks and corals out in the open bay. A spicule preparation will readily show the differences between the three.

Two types of *L. floridana* were found, one lying freely in the open lagoon near Oranjestad and the other buried in the sand among eel grass roots at Poos Chikitoe. The former was the larger (20 cm) and of a more uniform color. The latter measured from 8 to 10 cm in length and was mottled in color, but quite often gray. Spicule preparation of the two did not reveal any significant difference.

Order APODA

Family SYNAPTIDAE

Euapta lappa (J. Müller)

Synapta lappa J. MÜLLER, 1850, p. 134.
Synapta polii LUDWIG, 1875, p. 80, pl. 6 fig. 5.
Euapta lappa, TEN BROEKE, 1927, p. 164. DEICHMANN, 1930, p. 205; 1957, p. 17. CLARK, 1933, p. 118. ENGEL, 1939, p. 7.

Long, wormlike; approximately 35 cm in length. Spicules consist of anchor and anchor plates. Plates with six dentate holes and with a distinct bridge across the posterior end. Tentacles feathery with numerous digits. Color, brown with white to gray spots.

One specimen examined, from CURAÇAO, St. Kruis Bay.
Type: Not known. Type locality: Listed as 'West India'.

One of the characteristic features of this animal is its nocturnal habits. DEICHMANN (1957) quoted Wm. D. CLARKE as saying that it is inactive during the day, but becomes quite active during the night. I can substantiate this fact from my own observations. The one specimen I found, when placed in an aquarium promptly found a rock and went under it. During the night, however, I found it to be actively moving around. It was originally taken under a large rock in St. Kruis Bay.

Chiridota rotifera (Pourtalès) Fig. 62

Synapta rotifera POURTALÈS, 1851, p. 15.
Chiridota rotifera, STIMPSON, 1860, p. 134. LUDWIG, 1881, p. 41, pl. 3 fig. 1–15.
Chiridota rotifera, LUDWIG, 1892, p. 359. DEICHMANN, 1930, p. 212. CLARK, 1933, p. 122–123. ENGEL, 1939, p. 11.

Small holothurians; averages 6 cm in length, 4 mm in diameter. Pink in color. Spicules consist of 6-spoked wheels and small curved rods. Small, palmate tentacles.

Several specimens examined, from ARUBA, Malmok beach.
Type: Not preserved. Type locality: Florida.

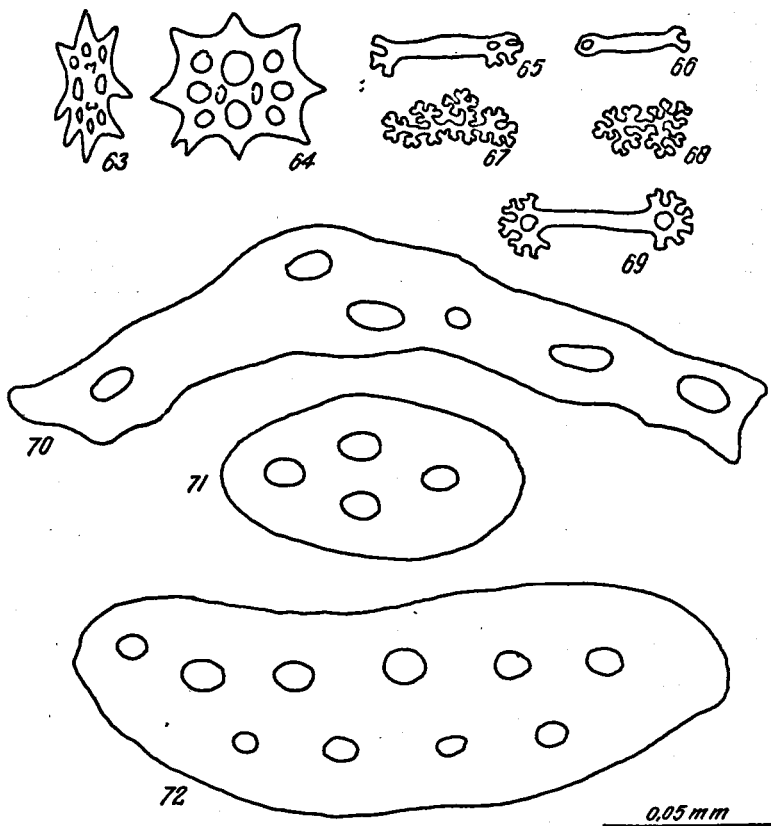
ENGEL (1939) reported that 31 specimens were taken from St. Kruis Bay by Wagenaar Hummelinck in 1930. However, on two separate occasions I looked in rock pools in this area, such as ENGEL mentioned, but failed to find a single specimen. The several specimens found at Malmok, Aruba, were taken at the waters edge, in sand. This constitutes the first record of this genus in Aruba.

Order DENDROCHIROTA

Family PHYLLOPHORIDAE

Trachythyonidium occidentale (Ludwig) Figs. 63–69

Thyonidium occidentale LUDWIG, 1875, p. 119.
Phyllophorus occidentale, DEICHMANN, 1930, p. 148, pl. 18 fig. 1–2.
Euthyonidium occidentalis, DEICHMANN, 1938, p. 380; 1941, p. 124.
Trachythyonidium occidentale, DEICHMANN, 1954, p. 402, fig. 68 no. 1–4.
Thyonidium constituta SLUITER, 1910, p. 340, fig. E; DEICHMANN, 1926, p. 124.



Figs. 63–69. *Trachythyonidium occidentale* (Ludwig): 63–64, disks of tables; 65–66, rods from tentacles; 67–68, rosettes from tentacles; 69, rod from tube feet.
Figs. 70–72. *Thyoneria cognata* (Lampert): 70–71, plates; 72, supporting plate.

Small holothurians; averages 4.0 cm long. Five pairs of large and five pairs of small tentacles. Calcareous ring with short projections. Feet small, somewhat more abundant on ventral surface. Color, dirty brown. Spicules of delicate tables; two-pillared; disk of tables dentate with 8 holes.

Two specimens examined, from ARUBA, Pos Chikitoe and Malmok.
Type: Würzburg. Type locality: Surinam.

Found buried in eel-grass patches. In Puerto Rico it is found under rocks. This is the first report of a Phyllophoridae taken from the Netherlands Antilles.

Family CUCUMARIIDAE

Thyoneria cognata (Lampert) Figs. 70–72

Semperia cognata LAMPERT, 1885, p. 251, fig. 51.
Thyone cognita, DEICHMANN, 1930, p. 169, pl. 15 fig. 1–4; 1939, p. 134–135.
Thyone cognata, CLARK, 1933, p. 115.
Thyoneria cognata, DEICHMANN, 1954, p. 398.

Small holothurians (5–10 cm). Body strongly bent with both sides tapering. Gray in color. Rough to touch. Tube feet in five distinct bands, but also present in interambulacra; yellow. Tentacles 10; dendritic. Spicules are smooth perforated plates; generally, elongated, with 2 rows of holes; 'button-like' plates are also present.

Two specimens examined, from ARUBA, Palm Beach.
Type: Museum of Berlin. Type locality: Cuba.

These holothurians were found buried in sand among the roots of eel grass, approximately 1.3 km south of the Hotel Aruba Caribbean on Palm Beach. This constitutes the first record of this family of holothurians in the Netherlands Antilles. Its color in life resembles that of its surroundings so closely that it propably has previously been missed by collectors.

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