Lobsters—Identification, World Distribution, and U.S. Trade

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Introduction

Lobsters are valued throughout the world as prime seafood items wherever they are caught, sold, or consumed. Basically, three kinds are marketed for food, the clawed lobsters (superfamily Nephropoidea), the squat lobsters (family Galatheidae), and the spiny or nonclawed lobsters (superfamily Palinuroidea).

The U.S. market in clawed lobsters is dominated by whole living American lobsters, *Homarus americanus*, caught off the northeastern United States and southeastern Canada, but certain smaller species of clawed lobsters from other parts of the world are also sold, usually frozen or canned. Squat lobsters are sold as frozen tails. Spiny lobsters have no claws and therefore the market for them is confined to the tails which are mainly sold frozen. These come from many parts of the world.

This paper summarizes basic information on the world catch of lobsters, outlines the world distribution of species in the trade, and provides illustrated keys (see box) for identification of the species as they are found in U.S. markets.

The World Catch

The average annual world catch of lobsters for the 7-year period 1975-82 was 401.74 million pounds or roughly one-third of 1 percent of the annual world fishing catch exclusive of marine mammals (Anonymous, 1979a, 1981a, 1983a, 1984; figures converted from metric tons to pounds to conform with U.S. fishery statistics). This total includes clawed lobsters, spiny and flat lobsters, and squat lobsters or langostinos (Tables 1 and 2).

Fisheries for these animals are decidedly concentrated in certain areas of the world because of species distribution, and this can be recognized by noting regional and species catches. The Food and Agriculture Organization of the United Nations (FAO) has divided the world into 27 major fishing areas for the purpose of reporting fishery statistics. Nineteen of these are marine fishing areas, but lobster distribution is restricted to only 14 of them, i.e. the relatively shallow coastal waters of continents and islands, shoal platforms, and certain seamounts (Fig. 1 and 2). Moreover, the world distribution of these animals can also be divided roughly into temperate, subtropical, and tropical temperature zones. From such partitioning, the following facts regarding lobster fisheries emerge.

Clawed lobster fisheries (superfamily Nephropoidea) are concentrated in the temperate North Atlantic region, although there is minor fishing for them in cooler waters at the edge of the continental platform in the Gulf of Mexico, Caribbean Sea (Roe, 1966), western South Atlantic along the coast of Brazil, and Indian Ocean (Venema, 1984). A collateral but less extensive fishery for

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Lobster Keys and Color Figures

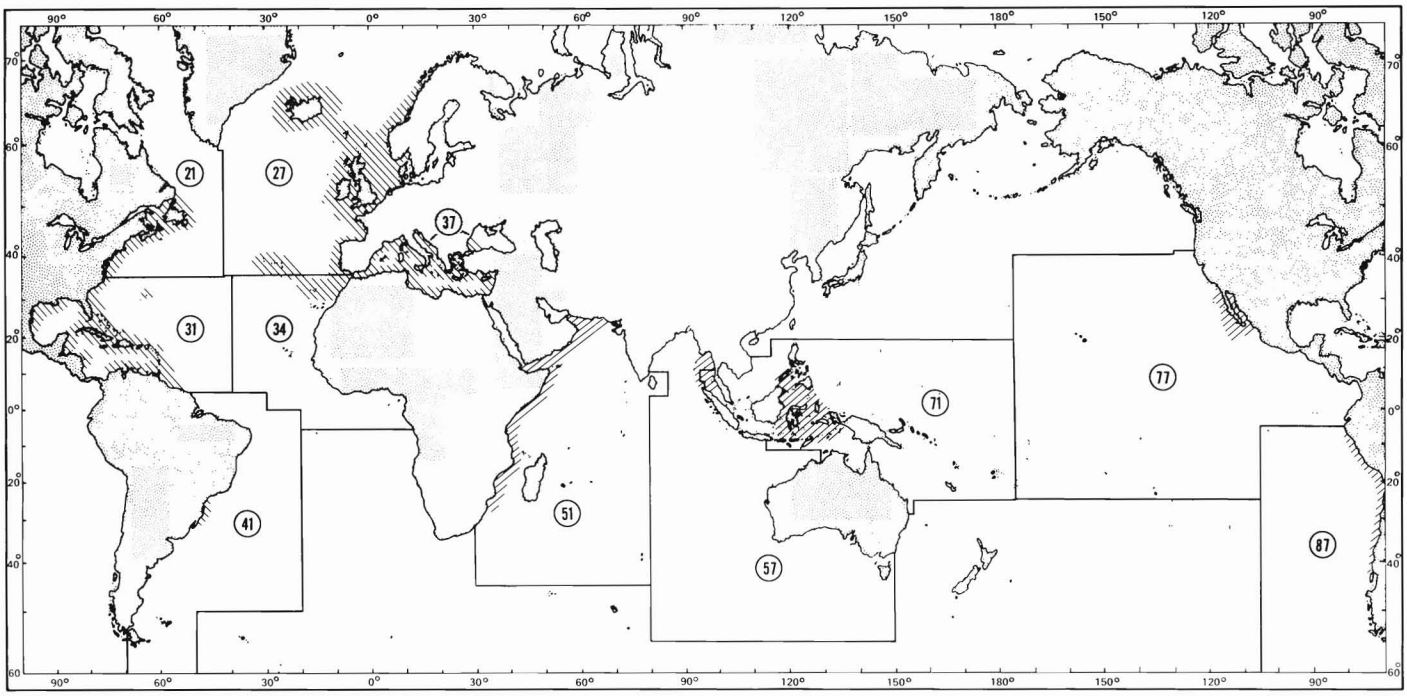


Figure 1.—Contrasting diagonal hatching indicates major fishing areas of world for clawed lobsters (FAO fishing areas 21, 27, 31, 34, 41, 51, 57, and 71 in the Atlantic Ocean, Mediterranean Sea, Indian Ocean, and East Indies) and squat lobsters (FAO fishing areas 77 and 87 in the eastern Pacific). See also Tables 1, 2, and 3.

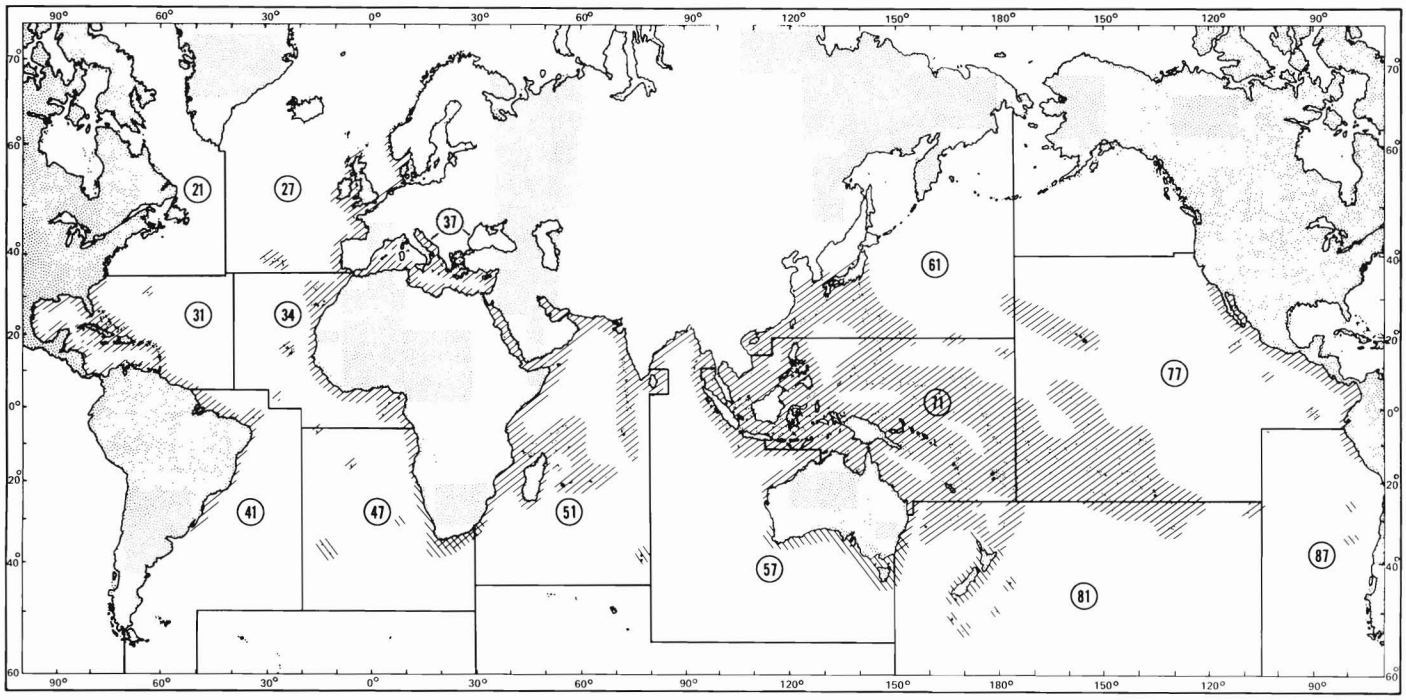


Figure 2.—Major fishing areas of the world for spiny and flat lobsters. Contrasting diagonal hatching indicates distribution of warm-water species (FAO fishing areas 21, 27, 31, 34, 37, 41, 47, 51, 57, 61, 71, 77, and 81) and of coldwater species in the southern hemisphere (FAO fishing areas 47, 51, 57, 81, and 87). See also Tables 1, 2, and 3.

Table 1.—Nominal worldwide landings of lobsters and squat lobsters in millions of pounds by species and major fishing areas for statistical purposes (FAO), 1975-82 (see also Figures 1 and 2). Rounded totals differ slightly from those in Table 2.

Species	Fishing area	1975	1976	1977	1978	1979	1980	1981	1982	$\bar{x}$
Galatheids										
Squat lobsters or langostinos	77, 87	79.06	138.15	95.61	88.24	69.66	27.11	51.70	29.62	72.39
Clawed lobsters										
American lobster, *Homarus americanus*	21	68.75	67.08	71.02	76.70	84.76	81.24	85.36	89.69	78.08
European lobster, *H. gammarus*	27, 37	3.27	4.10	4.25	3.94	3.79	4.40	4.05	4.14	3.99
Southern langoustine, *Metanephrops andamanicus*	51			0.53		0.41	0.63	0.31	0.48	0.30*
Norway lobster, *Nephrops norvegicus*	27, 34, 37	89.81	94.22	96.92	99.33	98.97	96.07	102.42	106.07	97.98
Group totals		161.83	165.40	172.72	179.97	187.93	182.34	192.14	200.38	180.35
Spiny lobsters										
Tropical										
Caribbean spiny lobster, *Panulirus argus*	31, 41	53.91	60.17	59.41	69.30	70.61	65.97	66.41	66.39	64.02
Panulirus spp.										
Western Indian Ocean	51	8.59	13.92	8.37	3.22	3.59	4.87	2.39	1.81	5.85
Australia and East Indies	71	8.61	6.01	8.20	6.78	8.21	6.01	5.39	6.91	7.02
Central and East Pacific	77, 87	4.90	5.14	3.89	3.60	4.54	5.70	7.00	7.39	5.27
Group totals		76.01	85.24	79.87	82.90	86.95	82.55	81.19	82.50	82.15
Subtropical										
Panulirus spp.,										
West Africa (partly tropical)	34	0.07	0.38	0.10	0.97	0.58	0.26	0.43	0.49	0.41
Natal spiny lobster, *Palinurus delagoae*	51	0.12	0.13	0.04	0.16	0.23	0.34	0.32	0.25	0.20
Western red lobster, *Panulirus cygnus*	57	18.21	19.25	20.46	23.68	25.21	23.61	21.92	24.03	22.05
Panulirus spp., Australia and East Indies (partly tropical)	57	0.37	2.15	0.61	0.65	0.54	0.29	1.77	1.17	0.94
Green spiny lobster, *Jasus verreauxi*	57, 81	7.84	7.93	7.04	7.09	7.35	7.60	9.87	10.82	8.19
Japanese spiny lobster, *Panulirus japonicus*	61	2.72	2.73	2.78	2.45	2.64	2.64	2.63	2.84	2.68
Group totals		29.36	32.57	31.03	35.00	36.55	34.74	36.94	39.60	34.47
Temperate										
Panulirus spp.										
Northwestern Europe	27	1.11	0.85	0.56	1.06	0.64	0.89	0.61	0.90	0.83
Northwestern Africa	34	1.99	0.65	2.82	2.95	3.59	3.17	1.02	1.16	2.17
Mediterranean Basin	37	2.20	2.13	1.85	2.35	1.91	1.82	2.43	2.30	2.12
Gilchrist's spiny lobster, *Palinurus gilchristi*	47	2.89	2.14	3.66	3.29	2.02	0.43	0.75	0.82	2.00
Cape spiny lobster, *Jasus lalandii*	47	16.40	13.66	15.68	15.87	14.95	14.31	15.25	11.16	14.66
Red spiny lobster, *J. edwardsii*	81	7.31	8.16	7.79	8.27	9.85	10.00	9.98	10.50	8.98
Juan Fernandez spiny lobster, *J. frontalis*	87	0.10	0.11	0.07	0.05	0.09	0.04	0.06	0.11	0.08
Group totals		32.00	27.70	32.43	33.84	33.05	30.66	30.10	26.95	30.84
Flat lobsters										
Slipper lobsters	51, 57, 71, 81	0.30	0.26	0.71	0.63	0.64	0.95	0.98	1.28	0.72
Grand totals		378.56	449.32	412.37	420.58	414.78	358.35	393.05	380.33	400.92

*Average of 5 years

squat lobsters (family Galatheidae) is located in a region under influence of the great temperate current along the western side of South America. The average annual catch of clawed lobsters over the 7-year period 1975-82 (Table 1) was 45 percent of the 401.74 million pound average annual world lobster catch for that period, and the comparable squat lobster catch was 18 percent. Meat yields (tails) of the latter, however, amount to only about 10 percent of their total weight.

Fisheries for lobsters of the superfamily Palinuroidea (i.e. the spiny lobsters, family Palinuridae, and flat lobsters, family Scyllaridae) include about 30 species associated with tropical, subtropical, or temperate climatic regions that are commonly represented in the world catch. There is marked inequality in the contribution of various species to the total catch of this group, and many of the species are not recognized separately in the annual summaries (Tables 1-3). The average annual catch of the group as a whole during the 1975-82 period amounted to 37 percent of the world lobster catch; therefore, though rich in species, spiny lobsters contributed less to world production than did the clawed lobster group.

Probably because of the influence of temperature on the ranges of the commonly exploited spiny and flat lobster species, there are great differences in catches recorded from the different climatic zones (Tables 1-3). Fifty-five percent of the average annual spiny-flat lobster catch during 1975-82 came from the tropical zone, 23 percent from the subtropics, and 21 percent from temperate waters. In the trade, these groups are usually classed as warm water (tropical-subtropical) and cold water (temperate) lobsters. Flat lobsters form almost an afterthought in this discussion, only 0.5 percent of the average annual 1975-82 catch.

From these data it is evident that the temperate waters of the world are more productive of lobsters than are the tropics or their fringes, and this conclusion is reflected in both the specific catches and statistical totals for the major fishing areas. But in all three climatic zones, one or two species stand out above their neighbors in volumes caught: *Homarus americanus* and *Nephrops norvegicus* in the temperate

North Atlantic, *Panulirus argus* in the western tropical Atlantic, *Panulirus cygnus* in the Australasian subtropics, and *Jasus lalandii* in the South African temperate region.

A second level of species landed can also be seen in Tables 1 and 3. These are harder to point out in Table 1 because many of the species caught are not identified precisely enough to be singled out in the FAO statistics, but they are indicated by Morgan (1980) in Table 3: *Panulirus laevicauda* in the American tropical Atlantic and *P. polyphagus* in southern and southeastern Asia; perhaps subtropical *Panulirus inflatus* in the Central American Pacific and *P. japonicus* in Japan; and *Jasus edwardsii* in New Zealand, *P. novaehollandiae* in Australia, as well as somewhat lower amounts of *Palinurus elephas* in Europe, and *P. gilchristi* in South Africa, from what can collectively be regarded as temperate waters.

Table 2.—Nominal worldwide landings of lobsters and squat lobsters in millions of pounds by major fishing areas for statistical purposes (FAO), 1975-82, according to latest published revisions (see also Figures 1 and 2). Rounded totals differ slightly from those in Table 1.

Major fishing area		1975	1976	1977	1978	1979	1980	1981	1982	$\bar{x}$
Atlantic, northwest	21	68.75	66.82	71.02	76.70	84.76	81.24	85.32	89.69	78.04
" northeast	27	87.69	90.14	89.16	95.21	95.70	92.48	104.79	104.79	94.42
" west central	31	46.89	47.65	43.36	52.36	55.09	50.75	47.51	47.01	48.83
" east central	34	3.18	1.34	5.12	4.55	5.13	6.21	2.28	2.30	3.76
Mediterranean and Black Seas	37	8.42	10.89	12.22	10.85	8.65	7.41	6.52	8.06	9.13
Atlantic, southwest	41	10.26	16.16	16.25	16.90	15.67	15.21	18.90	19.38	16.09
" southeast	47	19.29	15.80	19.35	19.17	16.96	14.74	16.02	12.00	16.67
Indian Ocean, western	51	10.32	15.82	8.83	3.19	4.23	5.86	3.03	2.58	6.73
" " eastern	57	26.13	29.08	27.90	31.22	32.95	31.26	33.34	35.78	30.96
Pacific, northwest	61	2.72	2.73	2.78	2.45	2.64	2.64	2.63	2.84	2.68
" west central	71	8.88	6.21	8.81	7.27	8.84	6.87	6.21	8.01	7.64
" east central	77	3.68	4.27	4.07	3.65	9.69	25.20	38.65	22.87	14.01
" southwest	81	7.65	8.47	8.10	8.61	9.81	10.31	10.33	10.88	9.27
" southeast	87	79.16	138.27	95.70	88.29	64.60	7.65	20.11	14.26	63.51
Annual totals		383.02	453.65	412.67	420.42	414.72	357.83	391.04	380.45	401.74

Table 3.—Common species of spiny lobsters, their areas of significant fishery, and approximate catch in millions of pounds, 1976 (adapted from Morgan, 1980).

Species	Areas of significant fishery	Catch
Tropical		
Panulirus argus	Florida, Bahamas, Caribbean, Brazil	50.25
P. echinatus	None	
P. gracilis	Ecuador, Panama	0.60
P. guttatus	None	
P. homarus[1]	East Africa, Indonesia	0.88
P. laevicauda	Brazil	6.61
P. longipes[2]	None	
P. ornatus	New Guinea, East Africa	1.19
P. penicillatus	Reunion, Pacific Islands, Galapagos	0.88
P. polyphagus	Pakistan, India, Southeast Asia	8.16
P. regius	West Africa	0.99
P. versicolor	None	
Subtotal		69.58
Subtropical		
Jasus verreauxi	Eastern Australia, New Zealand	0.28
Palinurus charlestoni	Cape Verde Islands	0.01
P. delagoae	Southeast Africa	0.13
P. mauritanicus	Mauritania, West Africa	0.33
Panulirus cygnus	Western Australia	19.62
P. inflatus	West Mexico, Guatemala	3.31
P. interruptus	California	0.27
P. japonicus	Japan, South China Sea	2.65
P. marginatus	Hawaii	0.02
P. pascuensis	Easter Island	0.01
P. stimpsoni	Hong Kong	0.02
Subtotal		26.65
Temperate		
Jasus edwardsii	New Zealand	8.16
J. frontalis	Juan Fernandez Island	0.11
J. lalandii	Southwest Africa	13.67
J. novaehollandiae	South and southeast Australia	7.72
J. paulensis	St. Paul and New Amsterdam Islands	1.98
J. tristani	Tristan da Cunha	0.01
Palinurus elephas	U.K., France, Spain, Italy	3.31
P. gilchristi	South Africa	2.14
Subtotal		37.10
World total		133.33

[1]Three subspecies.
[2]Two subspecies.

U.S. Trade

Domestic landings of American lobsters averaged 36.6 million pounds annually over the 1975-84 period (Table 4), and annual imports over the same period amounted to 18.4 million pounds of fresh and frozen lobster plus 2.1 million pounds of canned meat (Tables 5 and 6), for an average annual total of 47.1 million pounds on the U.S. market. It is noteworthy that there has been a fairly steady increase in production over this 10-year span and a variable though increasing value in constant dollars, but the fact remains that there is tremendous fishing pressure on the species (Dow, 1980).

Domestic production of spiny lobsters alone averaged 6.2 million pounds annually during 1975-84, both landings and value in constant dollars remaining

Table 4.—Lobster landings in the United States, 1975-84, in millions of pounds, millions of dollars[1], and constant dollars.[2]

Year	American lobster	Million dollars	Constant dollars	Spiny lobster	Million dollars	Constant dollars
1975	29.0	$49.1	$30.46	7.7	$ 9.9	$6.14
1976	31.5	52.0	30.50	5.6	9.3	5.45
1977	31.8	57.9	31.90	6.7	11.2	6.17
1978	34.4	64.6	33.06	4.6	9.7	4.96
1979	37.1	72.3	33.26	6.3	12.8	5.89
1980	37.0	75.2	30.47	6.9	14.8	6.00
1981	37.5	86.5	31.75	6.6	19.4	7.12
1982	39.4	90.9	31.44	6.4	16.1	5.57
1983	44.2	106.8	35.79	5.2	13.7	4.59
1984	44.0	114.3	36.74	6.3	17.3	5.56
$\bar{x}$	36.6		32.54	6.2		5.75

[1]1975-77 from "Fisheries Statistics of the U.S.," Statistical Digest; 1978-84 from "Fisheries of the United States," Curr. Fish. Stat., U.S. Dep. Commer., NOAA, Natl. Mar Fish. Serv., Wash., D.C.
[2]Constant dollars based on 1967 = 100, from "Basic Economic Statistics," Bur. Econ. Stat., Inc., Wash., D.C., 39(4)April 1985.

fairly stable, but that production was dwarfed by average annual imports of 41.5 million pounds of fresh and frozen lobster and a relatively small amount of canned meat, 0.2 million pounds over the same period (Tables 4-6). This impressive annual total of 47.9 million pounds on the U.S. market represents about one-third of the average annual world production of these lobsters (148.18 million pounds) during 1975-82 (Table 1).

Contrast this level of activity with that reported by Chace and Dumont (1949) for the domestic spiny lobster fishery as world fishery momentum began to build after World War II. Annual domestic production then was about 1.0 million pounds. The chief sources for imports were Cuba, the Bahamas, Mexico, South Africa, and later Australia and New Zealand. The United States imported 5.6 million pounds in 1941, 3.3 million pounds in 1945, but 7.8 million pounds in 1948. Domestic production today is more than 6 times that in 1948, and imports are greatly augmented (Tables 4 and 5).

Some Differences Between Lobsters and Shrimps

How can one be sure that a "lobster tail" in a market is that of a true lobster of marine origin and not that of a shrimp, prawn, freshwater crayfish, or crawfish?

Common names used for lobsters in commerce can be misleading. Animals other than lobsters are sometimes given combinations of the name "lobster," such as "lobster shrimp," etc. Conversely, some lobsters bear the names "crawfish" or "crayfish." The differences are sometimes subtle, but the following contrasts may be helpful in making the distinctions.

Lobsters and crayfishes have tail fans in which the middle member (telson) is flattened, bladelike, broad, and sweepingly curved on its terminal edge (Fig. 3). Shrimps, prawns, "lobster shrimps," etc., have tail fans in which this member is drawn to an acute or relatively narrow point. Lobsters have tails (abdomens) that are more or less flattened from top to bottom (wider than deep, i.e. dorsoventrally depressed) whereas shrimps, prawns, and "lobster shrimps" have tails (abdomens) that are narrowed from side to side (deeper than wide, i.e. laterally compressed).

Spiny lobsters and their relatives the flat lobsters have tail fans in which hind parts of the flattened branches are pliable and translucent whereas both clawed lobsters and freshwater crayfishes bear tail fans in which the flattened branches are firm and opaque throughout their length. The clawed lobsters and freshwater crayfishes are not at all easy to distinguish on the basis of tails alone, but as a rule the large-clawed American lobster and much smaller freshwater crayfishes are marketed whole and therefore can be distinguished by size alone. Smaller species of clawed lobsters can be distinguished by the blunt ridges on tails alone.

Squat lobsters or langostinos have tail fans in which the hind edge of the broad middle member is deeply notched in the midline (Fig. 3f). The edge is thus bilobed. Tails of these species are always small.

The following keys are offered as an aid in identifying the tails of lobsters of marine origin in U.S. trade. Species determination is normally based on the entire animal and therefore the difficulties experienced in identifying lobsters from sometimes obscure or variable characters of the tails alone does not necessarily bring validity of the species into question. For those unfamiliar with taxonomic keys of this kind, an explanation of their structure and use is in order.

Each key is composed of numbered and lettered couplets of more or less contradictory statements. To identify a particular lobster tail, one begins with the first couplet and selects the statement (part a or b) which best describes the specimen at hand. From that statement, a guide number at its end leads to the indicated next numbered couplet, etc., until the identity (family, genus, or species name) is finally reached. The couplets usually lead from very great contrasts to less obvious ones; therefore the numbered sequences should be helpful until familiarity is established. The numbers in parentheses indicate the previous couplet used in each case, so that if it is obvious that a wrong choice has been made at some point, steps can be retraced to the questionable couplet without starting at the beginning once more. To make the keys as simple as possible, each named major grouping is

Table 5.—United States imports of fresh and frozen lobster (American includes fresh cooked meat) 1975-84 in millions of pounds, millions of dollars[1], and constant dollars.[2] Squat lobsters included with American lobsters.

Year	American lobster	Million dollars	Constant dollars	Spiny lobster	Million dollars	Constant dollars
1975	15.7	$31.5	$19.54	42.3	$157.1	$ 97.46
1976	15.9	36.2	21.23	48.5	204.5	119.94
1977	15.0	33.9	18.68	45.0	216.4	119.23
1978	13.2	33.8	17.30	43.0	222.5	113.87
1979	16.5	39.1	17.99	44.4	259.4	119.32
1980	14.4	40.5	16.41	36.6	230.2	93.27
1981	17.9	53.1	19.49	38.0	255.7	93.87
1982	19.1	56.4	19.51	35.4	259.2	89.66
1983	25.4	88.0	29.49	38.4	276.0	92.49
1984	30.4	112.9	36.29	43.0	322.7	103.73
$\bar{x}$	18.4		21.59	41.5		104.28

[1]1975-77 from "Fisheries Statistics of the U.S.," Statistical Digest; 1978-84 from "Fisheries of the United States," Curr. Fish. Stat., U.S. Dep. Commer., NOAA, Natl. Mar Fish. Serv., Wash., D.C.
[2]Constant dollars based on 1967 = 100, from "Basic Economic Statistics," Bur. Econ. Stat., Inc., Wash., D.C., 39(4)April 1985.

Table 6.—United States imports of canned lobster meat (American includes fresh cooked meat) 1975-84 in millions of pounds, millions of dollars[1], and constant dollars.[2] Squat lobsters included with American lobsters.

Year	American lobster	Million dollars	Constant dollars	Spiny lobster	Million dollars	Constant dollars
1975	2.0	$10.5	$6.51	0.11	$0.43	$0.27
1976	2.1	10.9	6.39	0.72	3.0	1.76
1977	2.5	14.2	7.82	0.34	1.4	0.77
1978	2.3	15.2	7.78	0.13	0.46	0.24
1979	1.8	10.9	5.01	0.14	0.74	0.34
1980	2.1	12.5	5.06	0.09	0.31	0.13
1981	2.9	19.7	7.23	0.22	0.77	0.28
1982	3.3	25.8	8.92	0.05	0.23	0.08
1983	1.1	8.0	2.68	0.13	0.63	0.21
1984	0.4	2.0	0.64	0.02	0.10	0.03
$\bar{x}$	2.1		5.80	0.20		0.41

[1]1975-77 from "Fisheries Statistics of the U.S.," Statistical Digest; 1978-84 from "Fisheries of the United States," Curr. Fish. Stat., U.S. Dep. Commer., NOAA, Natl. Mar. Fish. Serv., Wash., D.C.
[2]Constant dollars based on 1967 = 100, from "Basic Economic Statistics," Bur. Econ. Stat., Inc., Wash., D.C., 39(4)April 1985.

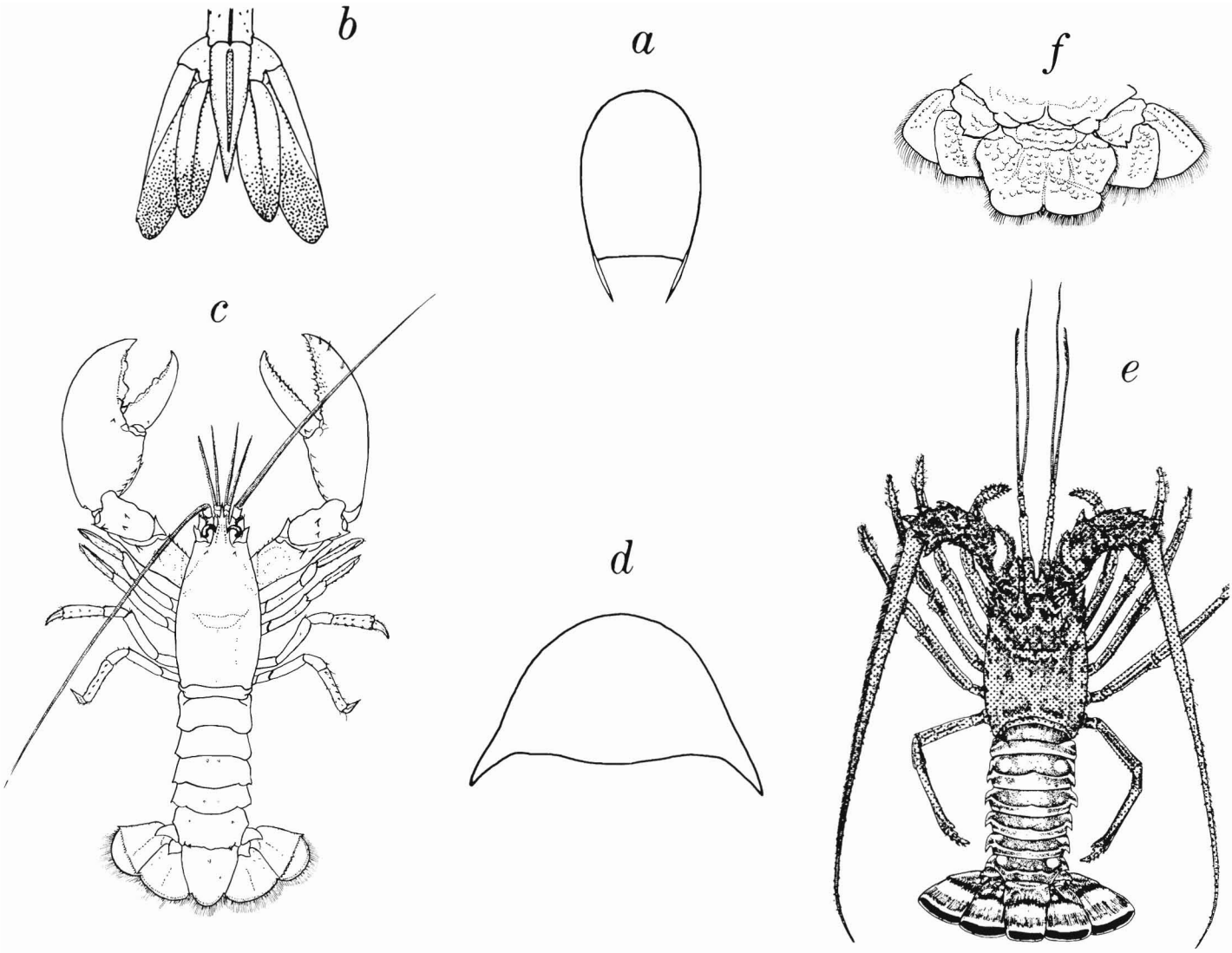


Figure 3.—Some diagnostic features of shrimps and lobsters in U.S. trade: *a*, Cross section outline of shrimp tail showing more or less narrowed (compressed) shape; *b*, tail fan of shrimp; *c*, American lobster, upper surface (adapted from Herrick, 1911); *d*, cross section outline of lobster tail showing more or less flattened (depressed) shape; *e*, spiny lobster, upper surface showing tail in solid tones and remainder of body screened (adapted from Manning, 1978); *f*, tail fan of squat lobster.

treated separately as a subset. In that way the keys form a nested series proceeding from generalities (families and genera) to particulars (species). Family and generic names are given in center headings for speedy reference. Diagrams and color plates are included as supplements to the keys.

Keys for Identification of Lobster Tails (Abdomens) in U.S. Trade

The keys are mostly based on upper surface, side plates, tail fan, and color. Common names, geographic ranges, and depth ranges of species are given in summary form. Common names often vary with language and locality. The names given are those employed in the references section, and the listing is not exhaustive. Symbols entered after species names denote economic importance as follows:

* Commonly of economic importance.
† Minor or probable economic importance.
‡ No known economic importance but included for completeness.

Lobster or Shrimp Tail?

1a Middle member (telson) of tail fan flattened, bladelike, broad, and sweepingly curved on hind margin (but notched in middle in one group)...Lobster; go to Keys for Identification of Lobster Tails in U.S. Trade, page 7.

1b Middle member (telson) of tail fan more or less triangular, not broad and sweepingly curved on hind margin but drawn to an acute or relatively narrow point...Shrimp; of no further concern in this paper.

Key to Families of Lobsters

1a Middle broad blade of tail fan with median notch in hind margin, forming rounded lobe to either side of midline ..... squat lobsters, Galatheidae

1b Middle broad blade of tail fan without median notch in hind margin, its edge gently curved or evenly rounded 2

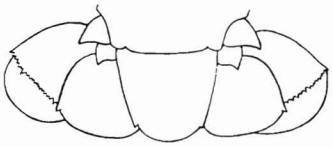


Figure 4.—Tail fan of clawed lobster (from Williams, 1974).

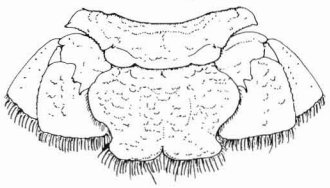


Figure 5.—Tail fan of squat lobster, Galatheidae.

Figure 6.—Tail fan of spiny or flat lobster.

2a (*1*) Flattened branches of tail fan hard and opaque throughout length (Fig. 4) . . . . clawed lobsters, Nephropidae

2b (*1*) Flattened branches of tail fan leathery or somewhat pliable and translucent in hind part, firm and opaque in forepart of length; spiny and flat or shovel-nosed lobsters 3

3a (*2*) Side plates (pleura) of segments 1-6 each ending in single downward projecting strong point tending to be swept obliquely backward; or rarely ending in 2 or 3 widely divergent short spines ..... spiny lobsters, Palinuridae

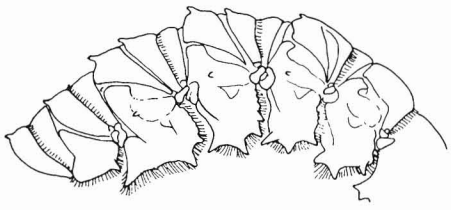


Figure 7a.—Side plates of the spiny lobster *Linuparus trigonus*.

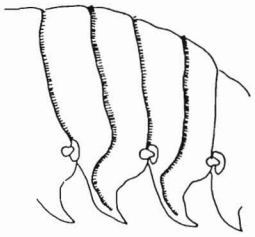


Figure 7b.—Side plates of the spiny lobster *Panulirus longipes* (from Holthuis, 1984).

3b (*2*) Side plates (pleura) of segments 2-6 with downward projecting irregular lobular edges, often bearing granules, tubercles or knobs, or noticeably flattened, with side plates projecting laterally ..... flat or shovel-nosed lobsters, Scyllaridae

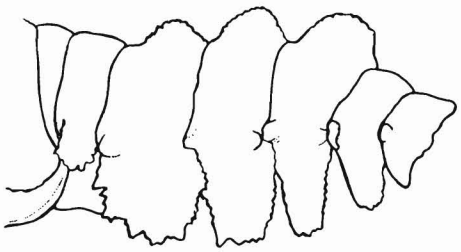


Figure 8a.—Side plates of the flat lobster *Scyllarides haanii* (from Holthuis, 1984).

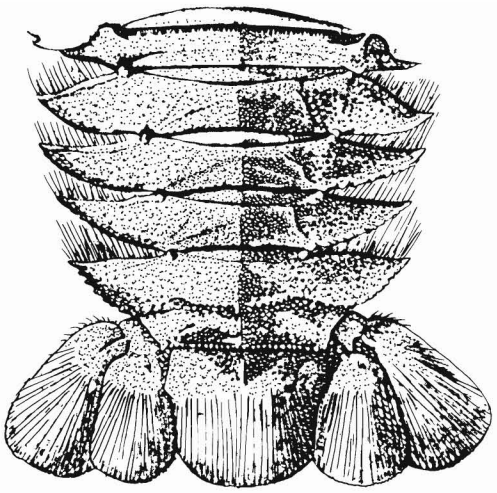


Figure 8b.—Side plates of the flat lobster *Ibacus novemdentatus* (from Holthuis, 1984).

Key to Tails of Clawed Lobsters, Nephropidae

1a Segments smooth, without grooves; no ridges separating arched back plates (terga) from projecting side plates (pleura); robust. Dark bluish green to brownish olive mottled with very dark greenish black spots, often almost black; side plates with reddish tips, orange to whitish below. American lobster. Northwestern Atlantic, Labrador to Cape Hatteras and rarely beyond, low tide mark - 180 m . . . *Homarus americanus* (H. Milne Edwards)* Also European lobster. Northeastern Atlantic, Lofoten Is., Norway, to Azores and Morocco, Mediterranean and Black seas, low tide mark - 60 m . . . . . *H. gammarus* (Linnaeus)* (These two species are impossible to distinguish on basis of tails alone.)

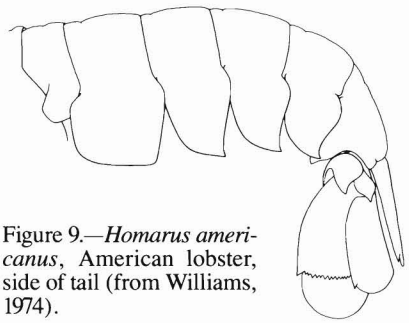


Figure 9.—*Homarus americanus*, American lobster, side of tail (from Williams, 1974).

1b Segments smooth or grooved, but blunt ridge separating arched back plates (terga) from projecting side plates (pleura) 2

2a (*1*) Arched back plates with broad, shallow, hairy grooves interrupted at median line and extending to strongly developed side plates 3

2b Arched back plates not bearing transverse, shallow, hairy grooves 4

3a (*2*) Segment 6 spineless. Pinkish with dark orange-red spots. Norway lobster or scampi. Iceland and western Norway to Morocco, western and central Mediterranean Sea, including Adriatic Sea, 20-824 m, usually 100-300 m . . . . . *Nephrops norvegicus* (Linnaeus)*

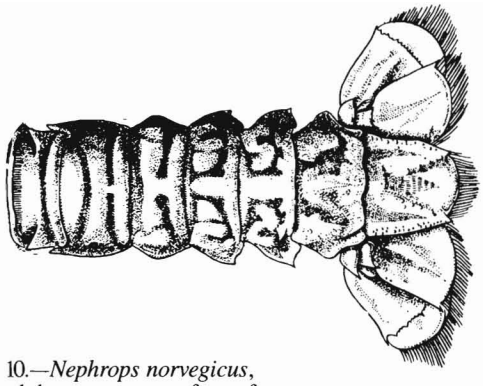


Figure 10.—*Nephrops norvegicus*, Norway lobster, upper surface of tail (adapted from Holthuis, 1950).

3b Segment 6 with small sharp median spine on hind margin and similar spine to either side of it at rear extremity of side plates; ridge separating arched back plates from side plates ending on each side of segment 6 in small spine. Pinkish or reddish, eggs blue. Indian Ocean off South Africa and Mozambique; Andaman Sea and East Indies, 102-503 m ..... *Metanephrops andamanicus* Wood Mason†

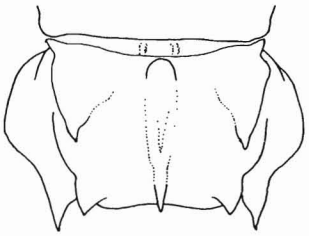


Figure 11.—*Metanephrops andamanicus*, upper surface of segment 6.

4a (*2*) Low ridge along median line of arched back plates; side plates on segment 2 triangular, tip slender and pointed downward. Variable pink or red, posterior margin of back plates whitish, whitish band on side plates ..... *Nephropsis*‡ (Florida lobsterette, New Jersey to French Guiana, including Gulf of Mexico and Caribbean Sea, 130-830 m, usually 300-500 m, *Nephropsis aculeata* Smith. (Other rare species could be confused with this species: i.e., *N. rosea* Bate; back plates pale pink, side plates reddish or darker pink; Bermuda, Bahamas, Gulf of Mexico, and Caribbean Sea to French Guiana, 421-1,262 m, usually 550-750 m; or *N. neglecta* Holthuis; red or orange-red; Straits of Florida and Dry Tortugas through Caribbean Sea to Guianas, 655-1,270 m, usually 800+ m).

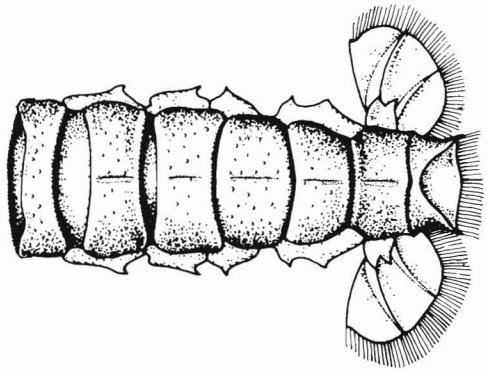


Figure 12.—*Nephropsis aculeata*, Florida lobsterette, upper surface of tail (adapted from Manning, 1978).

4b Arched back plates lacking median ridge 5

5a (*4*) Ridge separating arched back plates from side plates lacking spines or spinules. Pale orange to brownish pink with posterior whitish band on back plates, plates wider in young than adults, side plates white or with brownish orange center. Caribbean lobsterette. Bahamas and south Florida through Gulf of Mexico and Caribbean Sea to French Guiana, 229-703 m, usually 250-600 m ..... *Metanephrops binghami* (Boone)†

5b Ridge separating arched back plates from side plates bearing 1 or more tiny spines or spinules. Pinkish to orange. Red lobsterette, lagostim, langostinha. East coast of South America roughly between 23° and 30° S (Brazil, from State of Rio de Janeiro to Santa Catarina) ..... *Metanephrops rubellus* (Moreira)†

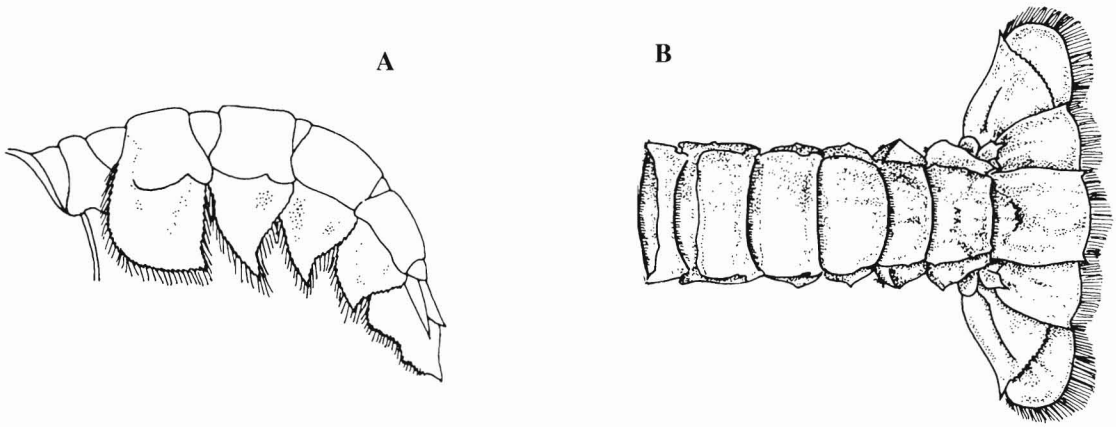


Figure 13.—*Metanephrops binghami*, Caribbean lobsterette: A, Side of tail; B, upper surface of tail (from Manning, 1978).

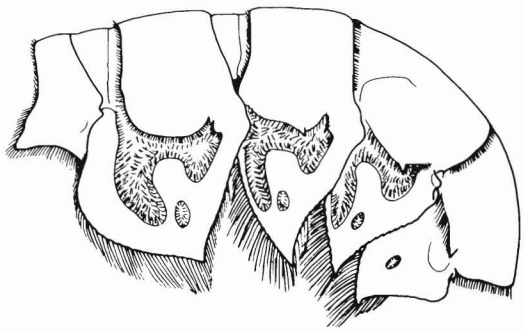


Figure 14.—*Metanephrops rubellus*, side of tail.

Key to Genera of Spiny Lobsters, Palinuridae

1a Segments 2-5 bearing 4-sided design on arched back plates 2

1b Segments 2-5 with arched back plates smooth to variously ornamented, but never bearing 4-sided design 3

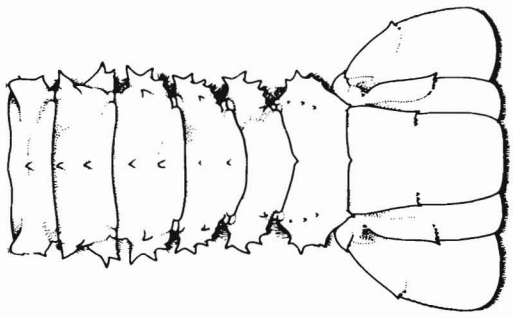


Figure 15.—*Linuparus*, upper surface of tail (from Holthuis, 1984).

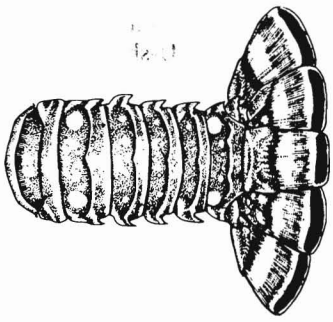


Figure 16.—*Panulirus*, upper surface of tail (from Manning, 1978).

2a (*1*) Segments 4-6 with side plates (pleura) bearing more than 2 marginal points (sometimes blunt) ..... *Linuparus*

2b Segments 4-6 with side plates (pleura) bearing only 2 slender spines (shorter in males than in females and decidedly unequal on 6) ..... *Puerulus*

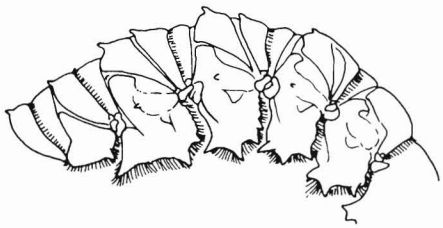


Figure 17.—*Linuparus*, side of tail.

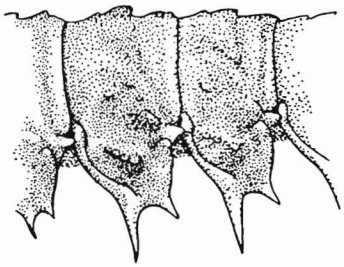


Figure 18.—*Puerulus*, side of tail (from Ramadan, 1938).

3a (*1*) Central blade of tail fan with broad hardened basal plate and series of smaller scales or plates along sides behind it, first one long, slender, and undivided, followed by series of diminishing scales (all may be spine-tipped) ..... *Jasus*

3b Central blade of tail fan with broad hardened basal plate but usually smooth sides behind it; in one or two species with series of diminishing scales along sides but these never spine tipped and never with first one long, slender, and undivided 4

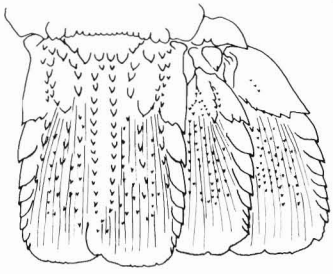


Figure 19.—*Jasus*, upper surface of tail fan.

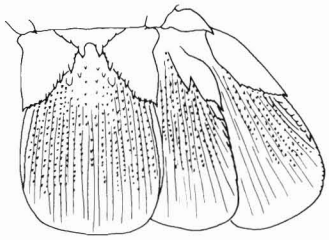


Figure 20.—*Panulirus*, upper surface of tail fan.

4a (*3*) Segment 6 with roughened, subspinose patch of sharp tubercles on upper surface; transverse grooves on arched back plates interrupted in middle, deeply etched or reduced to shallow depression, continuous on segments 2-5 with hind groove of side plate; latter groove irregularly U-shaped, hooking forward and upward; various colors given below ..... *Palinurus*

4b Segment 6 smooth to somewhat uneven but not bearing subspinose patch of sharp tubercles on upper surface; transverse grooves on arched back plates, if present, continuous or not continuous on segments 2-5 with foregroove of side plate; various colors given below ..... *Panulirus*

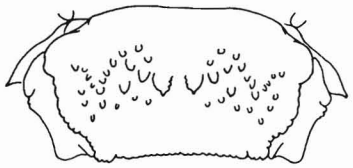


Figure 21.—*Palinurus*, upper surface of segment 6.

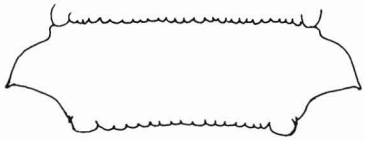


Figure 22.—*Panulirus*, upper surface of segment 6.

Key to Species of *Jasus* (Adapted from George and Kensler, 1970)

1a Arched back plates of segments smooth, without scale-like (squamiform) sculpture. Green, larger adults yellowish brown. Packhorse, green, eastern, common or smooth-tailed spiny lobster. New Zealand (mainly in warmer waters off North Island), New South Wales, and adjacent coast of southeastern Australia ..... *J. verreauxi* (H. Milne Edwards)*

1b Arched back plates of segments with obvious scale-like (squamiform) sculpture 2

2a (*1*) Squamiform sculpture covering more than 45 percent of arched back plate surface along midline 3

2b Squamiform sculpture covering less than 45 percent of arched back plate surface along midline 5

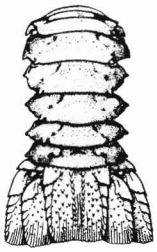


Figure 23.—*Jasus verreauxi*, packhorse, green, or eastern lobster, upper surface of tail (from Kensler, 1967).

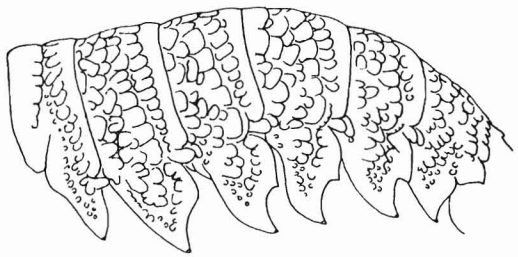


Figure 24.—*Jasus lalandei*, Cape spiny lobster, oblique view, side and upper surface of tail (adapted from George and Kensler, 1970).

3a (*2*) Foremargin of transverse groove on segment 1 sculptured (may be lightly so). Cape spiny lobster. South Africa, (1 reported occurrence off Portugal), intertidal to 90 m. ..... *J. lalandii* (H. Milne Edwards)* (Color Fig. 78 a-b.)

3b Foremargin of transverse groove on segment 1 without sculpture 4

4a (*3*) Sculpture covering almost entire upper surface of segments 2-6; squames (scales) numerous and in 4-5 transverse rows (only extreme forward part of segments smooth on each segment). Southern spiny lobster. Tasmania, and southern Australia from Sydney to Freemantle ..... *J. novaehollandiae* Holthuis* (Color Fig. 78 c.)

4b Sculpture not covering entire upper surface of segments 2-6; squames (scales) fewer, larger, and in 2-3 rows only on each segment. Red spiny lobster. North and south islands of New Zealand, and Chatham, Bounty, Antipodes and Aukland Islands to east and south... *J. edwardsii* (Hutton)* (Color Fig. 78 d-e.)

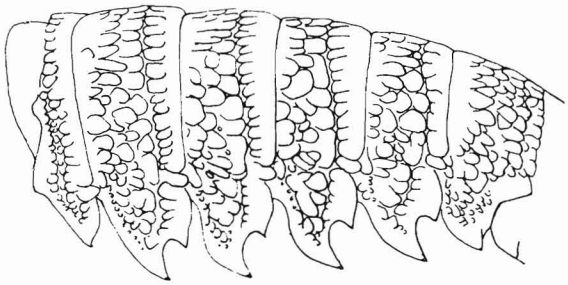


Figure 25.—*Jasus novaehollandiae*, southern spiny lobster, oblique view, side and upper surface of tail (adapted from George and Kensler, 1970).

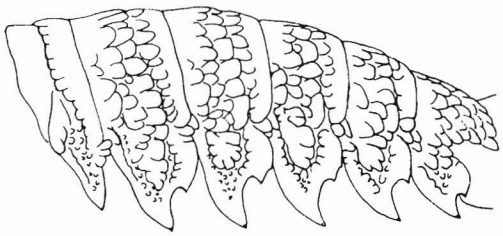


Figure 26.—*Jasus edwardsii*, red spiny lobster, oblique view, side and upper surface of tail (adapted from George and Kensler, 1970).

5a (*2*) First segment perfectly smooth, no squamiform sculpture on either side of transverse groove; following segments with sculpture restricted to 1 transverse row of large squames in front of transverse groove plus some very small squames before and behind this row, remainder smooth. Red with fine but dense reticulations of yellow. Juan Fernandez spiny lobster. Juan Fernandez and Islas de los Desventurados off Chile ..... *J. frontalis* (H. Milne Edwards)†

5b First segment with forepart perfectly smooth but with sculpture present in narrow band behind transverse groove 6

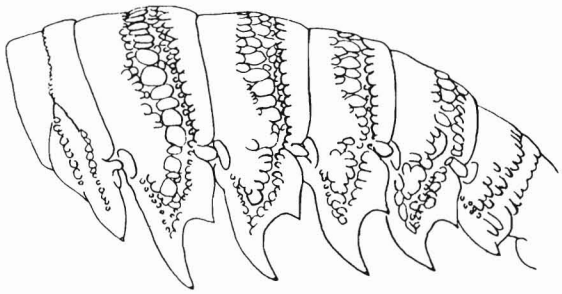


Figure 27.—*Jasus frontalis*, Juan Fernandez spiny lobster, oblique view, side and upper surface of tail (adapted from George and Kensler, 1970).

6a (*5*) Segments 2-6 each with large, broad squames arranged in 2 or 3 rows; rather wide transverse smooth area along front and back margins of each segment, even in fully stretched position; 2 unequal teeth on side plates directed backward. Reddish purple with small white spots; apexes of lateral segmental joints paler in color and pale spot near foremargins halfway between median line and lateral joints in rear segments, spots become elongate, forming oblique as well as median streaks on 6. South Atlantic around Tristan da Cunha, Gough Isl., and Vema Seamount ..... *J. tristani* Holthuis†

6b Segments 2-6 sculptured as above except squames more numerous, both before and behind transverse groove on segments 2-5; 2 teeth on side plates, stronger foretooth straight, hind tooth blunt and distinctly serrate behind. Dark purple to reddish, smooth areas white speckled, larger tooth on side plates white tipped with "horn colored" point, lateral joints whitish. South Indian Ocean around St. Paul and Amsterdam Isl. ..... *J. paulensis* Heller†

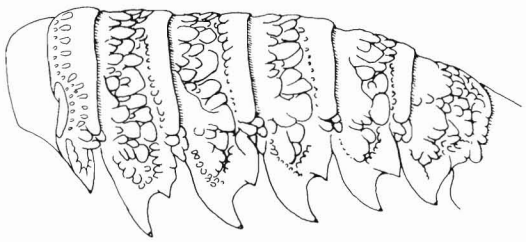


Figure 28.—*Jasus tristani*, Tristan da Cunha spiny lobster, oblique view, side and upper surface of tail (adapted from George and Kensler, 1970).

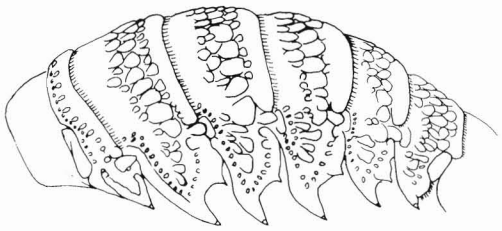


Figure 29.—*Jasus paulensis*, St. Paul spiny lobster, oblique view, side and upper surface of tail (adapted from George and Kensler, 1970).

Key to Species of *Linuparus*

1a Low but distinct spines or tubercles in median line on segments 1-4, small median tooth on hind margin of segments 5 and 6. Upper surface reddish-brown, side plates dull white. Western Indian Ocean from Kenya to Natal, 216-375 m ..... *L. somniosus* Berry and George†

1b Low spines or tubercles in median line on segments 1 and 2, sometimes on 3, but absent on segment 4. No median tooth on hind margin of segments 5 and 6. Upper surface bright reddish to ivory 2

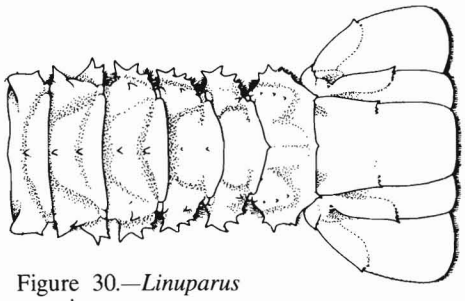


Figure 30.—*Linuparus somniosus*, upper surface of tail (from Holthuis, 1984).

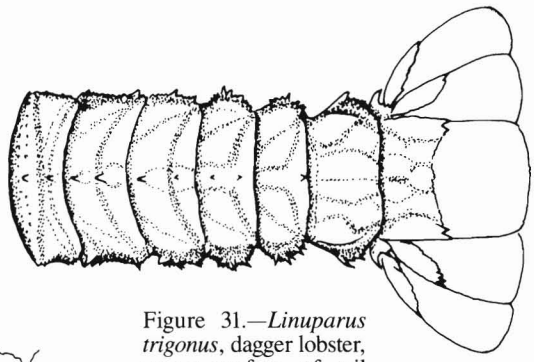


Figure 31.—*Linuparus trigonus*, dagger lobster, upper surface of tail (adapted from Ho and Yu, 1979).

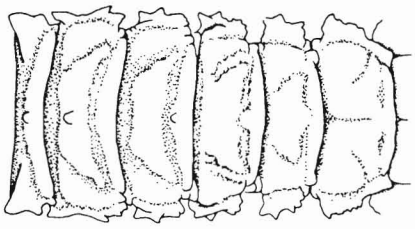


Figure 32.—*Linuparus sordidus*, upper surface of tail.

2a (*1*) Upper surface feebly granulated, or smooth and pitted, feebly setose. Mainly bright red with yellowish and brown or blue patches, ivory white in Australia. Dagger lobster. Japan, Yellow, East, and South China Seas, eastern Australia, 70-318 m ..... *L. trigonus* (von Siebold)† (Color Fig. 78 f-g.)

2b Upper surface coarsely granulated and covered with short, thick setose pile. Yellowish. South China Sea to northwestern Australia, 310-328 m ..... *L. sordidus* Bruce‡

Key to species of *Palinurus*

1a Segments with transverse grooves virtually nonexistent, represented by shallow depressions, hairs in grooves sparse and inconspicuous; side plates of segment 2 with 1 small spine on foremargin. Reddish mauve with contrasting irregular patches of ivory. Natal spiny lobster. Southwestern Indian Ocean, Natal to Mozambique, southeastern Madagascar, 0-530 m, usually 180-324 m ..... *P. delagoae* Barnard*

1b Segments with transverse grooves on segments 2-5, interrupted at midline 2

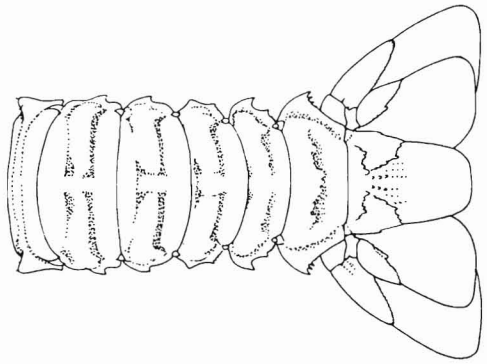


Figure 33.—*Palinurus delagoae*, Natal spiny lobster, upper surface of tail (from Holthuis, 1984); color pattern not shown.

2a (*1*) Segments 2-5 with transverse grooves rather irregularly broad, partly interrupted by incomplete median keel, grooves thickly hairy; side plates of segment 2 spineless on foremargin. Pinkish orange with irregular white patches. Gilchrist's spiny lobster. Coast of South Africa, False Bay to Natal, 55-102 m ..... *P. gilchristi* Stebbing† (Color Fig. 78 h-i.)

2b Segments 2-5 with transverse grooves prominently interrupted by protuberance or non-grooved space at midline; grooves not hairy or very slightly hairy 3

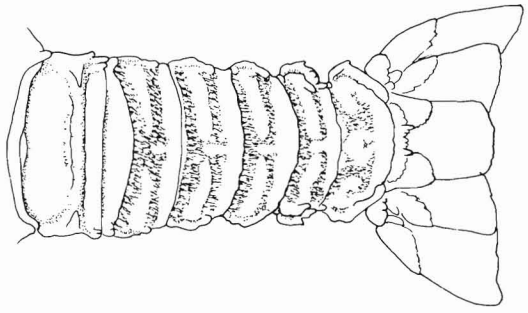


Figure 34.—*Palinurus gilchristi*, Gilchrist's spiny lobster, upper surface of tail (adapted from Berry and Plante, 1973); color pattern not shown.

3a (*2*) Side plates of segments 2-5 with 1-3 small spines on hind margin, that of segment 5 with 1 and sometimes a rudimentary 2nd spine. Upper surface more or less evenly pink, or violet-red to violet-brown, with marblings of white spots often strongly tinted with mauve. Pink spiny lobster. Eastern Atlantic from southwestern Ireland to southern Senegal, western Mediterranean, 60-400 (usually around 200) m ..... *P. mauritanicus* (Gruvel)†

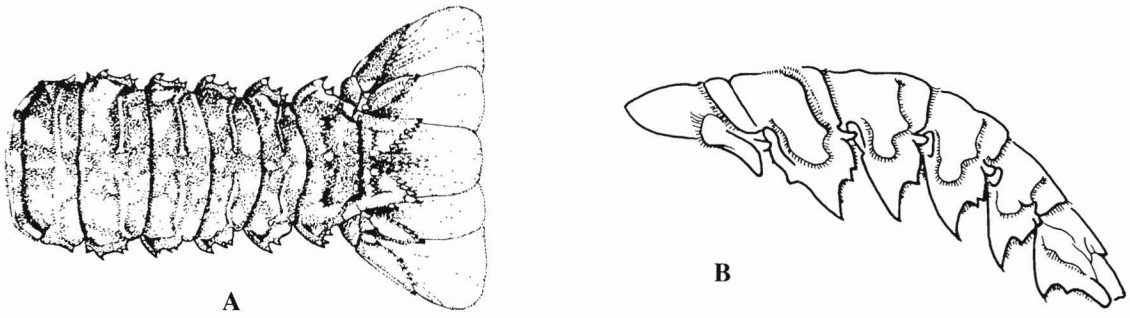


Figure 35.—*Palinurus mauritanicus*, pink spiny lobster: A, upper surface of tail (from Holthuis, 1981); B, side of segments 1-6.

3b Side plates of segments 2-5 with 3-4 small spines on hind margin, segment 5 with 3 spines 4

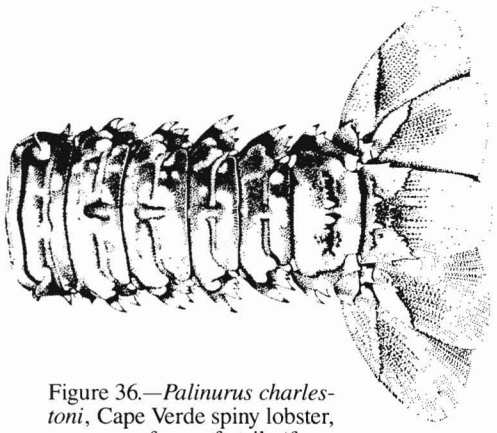


Figure 36.—*Palinurus charlestoni*, Cape Verde spiny lobster, upper surface of tail (from Holthuis, 1981).

4a (*3*) Vermillion red violet, clear white spots symmetrically distributed on each side of midline, most numerous on hind part of each segment, and round or oval spot behind each groove. Cape Verde spiny lobster. Cape Verde Isl., 50-300 m ..... *P. charlestoni* Forest and Postel† (May not be easily distinguishable from *P. mauritanicus*.)

4b Color somewhat variable. Brownish red to brownish violet, covered with darker spots and with symmetrical white or yellow blotches on segments 1-5. Common spiny lobster. Mediterranean, except southeastern part, and Atlantic coast of Europe from Western Norway, British Isles, and Morocco to Azores, below low tide mark to 70 m ..... *P. elephas* (Fabricius)†

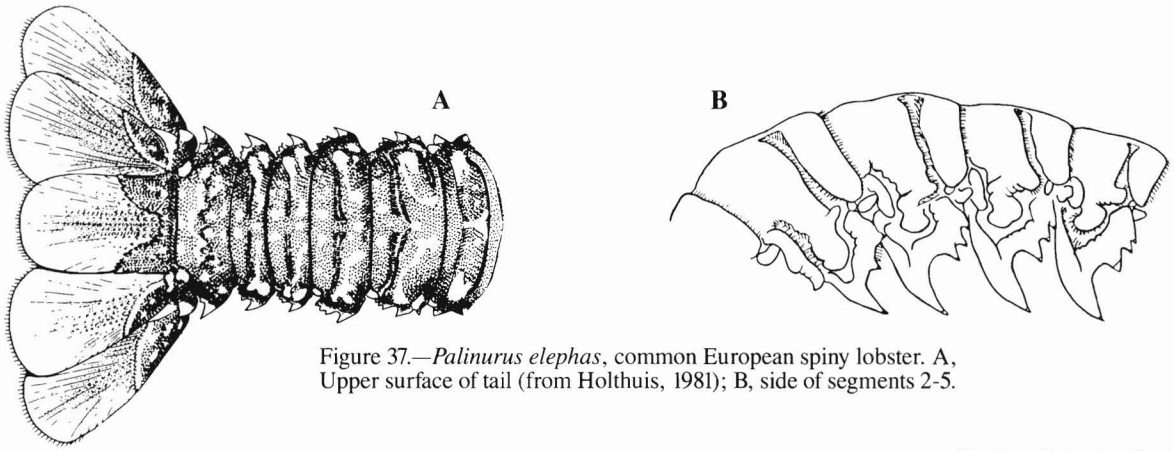


Figure 37.—*Palinurus elephas*, common European spiny lobster. A, Upper surface of tail (from Holthuis, 1981); B, side of segments 2-5.

Key to Species of Panulirus

1a Transverse groove on segments 2-5, sometimes faint; or sunken hairy areas, most prominent on segments 2-3 2

1b No transverse groove on segments 2-5, or shallow transverse hairy band on segments 2-3 only 14

2a (*1*) Transverse groove more or less continuous from side to side on at least some of segments 2-5, sometimes faint 3

2b Transverse groove obviously interrupted in middle on segments 2-5, or sunken area interrupted in middle on segments 2-3 11

3a (*2*) Foremargin of transverse grooves 2-5 scalloped. Olivaceous, bluish or brownish-red, speckled and dotted with yellow, lateral spot and indistinct transverse yellow line on each segment. Scalloped spiny lobster. Southwestern Indian Ocean and western Arabian Sea to East Indies, Japan and northwestern Australia, possibly Tahiti, to 90 m, usually 1-5 m ..... *P. homarus* (Linnaeus)* (Color Fig. 78 j.)

3b Foremargin of transverse grooves 2-5 not scalloped 4

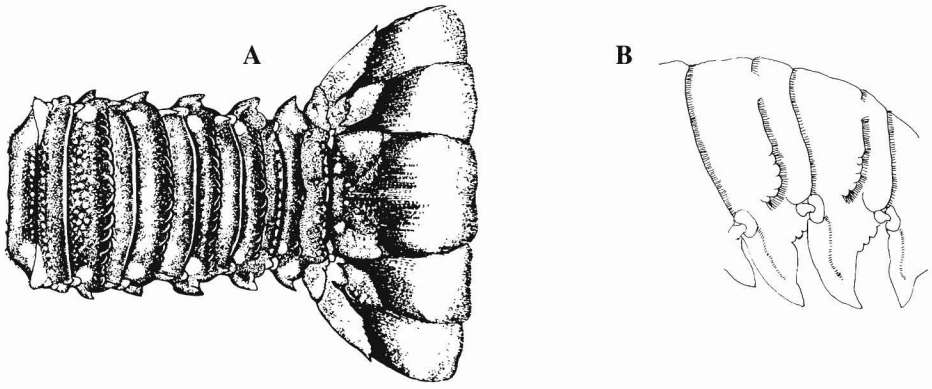


Figure 38.—*Panulirus homarus*, scalloped spiny lobster: A, Upper surface of tail; B, side of segments 2-3 (from Holthuis, 1984).

4a (*3*) Segment 2 with 2 transverse bands, front band may be broad and indistinct, fine, short, dense hairs sometimes present 5

4b Segment 2 with 1 transverse groove, either hairy or not so 6

5a (*4*) Foremargin of side plates on segments 2-5 lacking teeth. Pink to pale red, moderate number of spots. Western red lobster. Western Australia from Northwest Cape to Hamlin Harbor, usually 0-90 m, occasionally 120 m ..... *P. cygnus* George* (Color Fig. 78 k-l.)

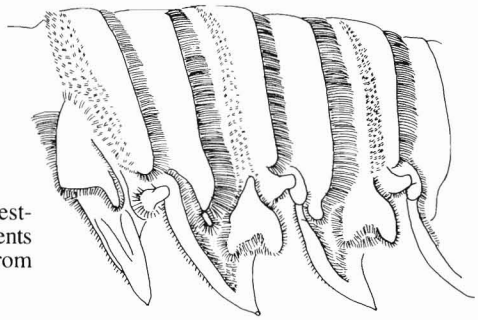


Figure 39.—*Panulirus cygnus*, western red lobster, side view of segments 1-3 and adjacent parts (adapted from George and Holthuis, 1965).

5b Foremargin of side plates on segments 2-5 bearing distinct small teeth. Bluish green, olive black, green brown or red, more or less mottled with yellow or with very fine dots on sides, largest spots on segment 1. Pronghorn spiny lobster, variegated crayfish, red lobster. Indo-Pacific from southeast Africa and Red Sea through East Indies and northern Australia, Japan and Polynesia, to Clipperton, Clarion, Cocos, Galapagos and Revilla Gigedo Isl., to about 16 m, usually 1-4 m ..... *P. penicillatus* (Olivier)† (Color Fig. 78 m-n.)

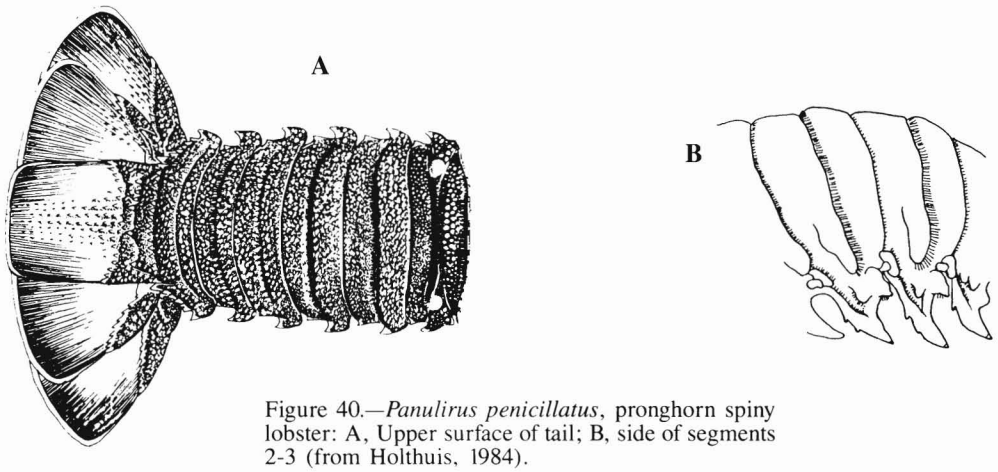


Figure 40.—*Panulirus penicillatus*, pronghorn spiny lobster: A, Upper surface of tail; B, side of segments 2-3 (from Holthuis, 1984).

6a (*4*) Transverse groove on segments 2 and 3 narrowly separated from groove on side plate 7

6b Transverse groove on segments 2 and 3 connected to groove on side plate 8

7a (*6*) Transverse groove of segment 4 narrowly separated from corresponding groove on side plate. Dark reddish, few pale spots on forward segments and lateral spot behind each segmental joint. Ise-ebi, Japanese spiny lobster. Japan, Ryukyus, Taiwan, Korea, east China ..... *P. japonicus* (Von Siebold)†

7b Transverse groove of segment 4 joining corresponding groove on side plate. Dark blue, white spots on forepart of segment 1, following segments with row of pale dots on forepart, narrow white band along hind margin, and broader band in front of groove; lateral white spots behind segmental joints. Easter Island spiny lobster, langosta, crayfish, ura. Easter and Pitcairn Isl., to 5 m ..... *P. pascuensis* Reed†

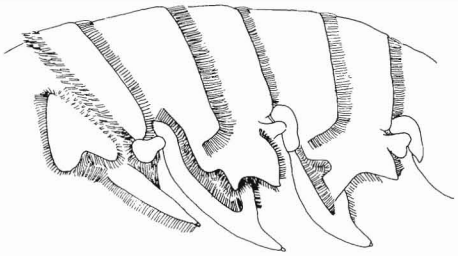


Figure 41.—*Panulirus japonicus*, Japanese spiny lobster, side view of segments 1-3 and adjacent parts (adapted from George and Holthuis, 1965).

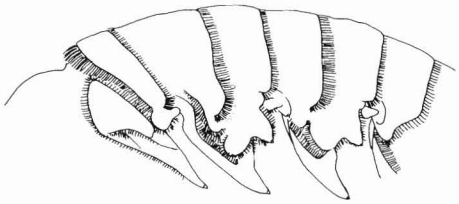


Figure 42.—*Panulirus pascuensis*, Easter Island spiny lobster, side view of segments 1-3 and adjacent parts (adapted from George and Holthuis, 1965).

8a (*6*) Blue-green, thickly covered with bold light spots; foremargin of side plates 2-5 bearing very small teeth. Spotted spiny lobster, Spanish lobster, sand lobster. Bermuda, Bahamas, and Caribbean Sea to Brazil, to 20 m ..... *P. gutattus* (Latreille)‡ (Color Fig. 78 o, 79 a.)

8b Transversely banded or spotted, some species with large ocellated spots to sides; foremargin of only segment 2 bearing very small teeth, sometimes smooth 9

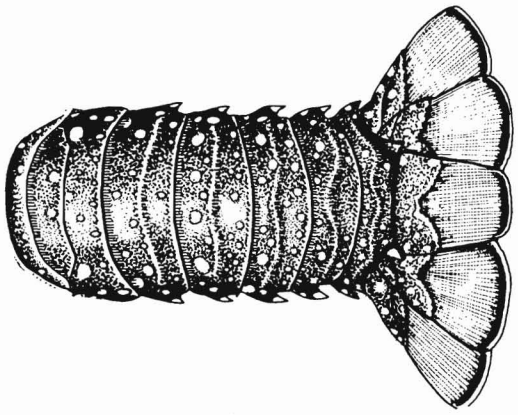


Figure 43.—*Panulirus guttatus*, spotted spiny lobster, upper surface of tail (from Manning, 1978).

9a (*8*) Yellow or reddish brown to green or bluish, conspicuous ocellated yellow spot to either side of each segment, largest on segments 2 and 6; tail fan with terminal broad black band. Segment 2 with transverse groove, often faint in middle section. Caribbean spiny lobster. Western Atlantic from Bermuda and North Carolina to Rio de Janeiro, Brazil, 2 rare occurrences on African Ivory Coast, to 90 m, rarely 450 m .... *P. argus* (Latreille)* (Color Fig. 79 b-c.)

9b Purple with transverse bands of yellow, or wine colored to indigo or purplish red, largest spots to side 10

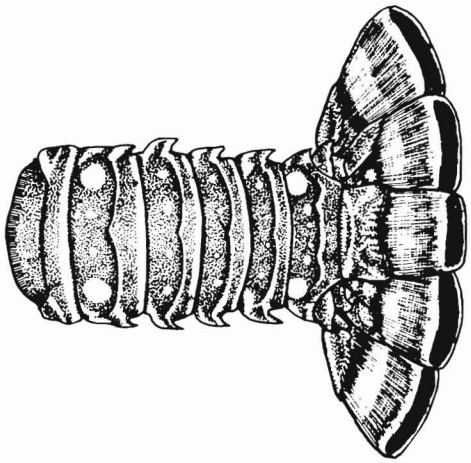


Figure 44.—*Panulirus argus*, Caribbean spiny lobster, upper surface of tail (from Manning, 1978).

10a (*9*) Purple with bold but pale transverse bands of yellow, single spot on each segment along either side. Hawaiian spiny lobster. Hawaii, to 140 m ..... *P. marginatus* (Quoy and Gaimard)† (Color Fig. 79 d-e.)

10b Violaceous or indigo to purplish red or reddish brown, profuse scattering of small yellowish white spots, larger ocellated spot on each segment in row along side, tail fan reddish toward hind margin and bearing white marginal line in purple band. Longlegged spiny lobster, two subspecies, white whiskered and spotted-legged. Indo-West Pacific from Zanzibar to Japan, New Hebrides, and Tahiti, to 36 m, usually 1-18 m ..... *P. longipes* (A. Milne Edwards)‡ (Color Fig. 79 f-g.)

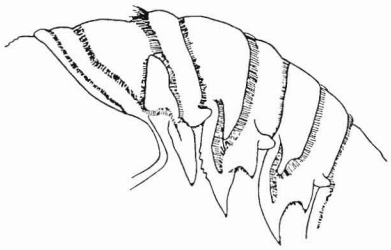
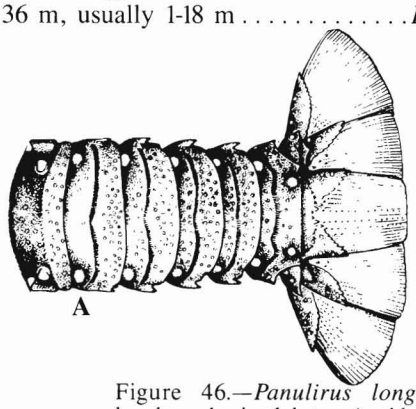


Figure 45.—*Panulirus marginatus*, Hawaiian spiny lobster, side view of segments 1-3 and adjacent parts (adapted from George and Holthuis, 1965).



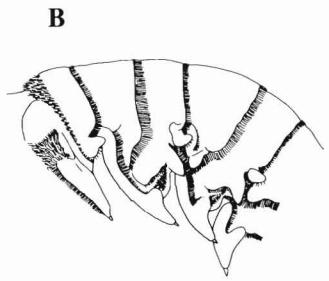


Figure 46.—*Panulirus longipes*, longlegged spiny lobster: A, side view of segments 1-3 and adjacent parts (adapted from George and Holthuis, 1965); B, upper surface of tail (from Holthuis, 1984).

11a (*2*) Side plates of segments 2-5 with no more than 1 large tooth on hind margin. Brown more or less strewn with small whitish spots except single larger spot at base of side plates. Brown spiny lobster. Atlantic islands; Fernando de Noronha, Atol de Rocas, St. Paul's Rocks, St. Helena, Ascension, Canary and Cape Verde Isl., also northeastern Brazil from Ceará to Pernambuco, shoreline to 35 m ..... *P. echinatus* Smith‡

11b Side plates of segments 2-5 with series of small teeth on lobe of hind margin 12

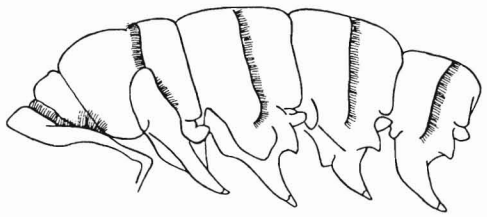


Figure 47.—Panulirus echinatus, brown spiny lobster, side of tail.

12a (*11*) Segments 2-6 with indistinct sunken hairy areas, forming broad groove interrupted in middle on 2 and 3. Drab or red without pale bands but with many fine spots, sides with short white vertical lines and conspicuous white spots on each segment; tips of side plates white; lower side of first segment bearing white spot surrounded by dark color on each half. Hong Kong spiny lobster. South China Sea, Shanghai to Hong Kong, Amoy ..... *P. stimpsoni* Holthuis† (Sunken hairy areas on segments 2 and 3 of small to moderate sized *P. versicolor* (Latreille) and *P. regius* de Brito Capello resemble those of *P. stimpsoni*, but color greenish and strikingly banded; go to 13b, 18a, or 19b.)

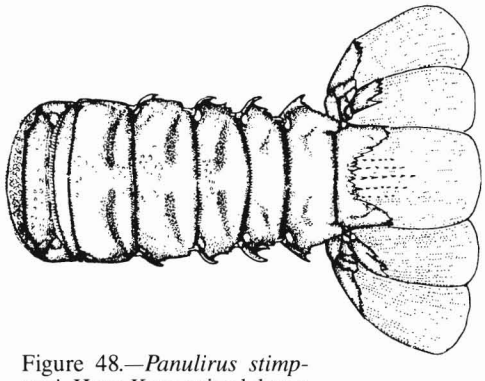


Figure 48.—*Panulirus stimpsoni*, Hong Kong spiny lobster, upper surface tail (adapted from Ho and Yu, 1979).

12b Segments 2-6 deeply or shallowly grooved (but not with sunken areas as above) 13

13a (*12*) Transverse grooves of segments 2-6 deep, broadly interrupted in midline, continuous with grooves on side plates of segments 2-6. Red to nearly black. California spiny lobster, red lobster. Central California to near southwest tip of Baja California Sur, usually 2-30 m, occasionally to 70 m ..... *P. interruptus* (Randall)† (Color Fig. 79 h-i.)

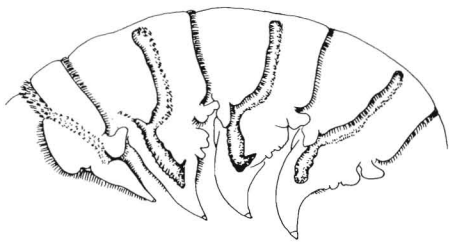


Figure 49.—*Panulirus interruptus*, California spiny lobster, side of tail.

13b Transverse grooves of segments 2-6 shallow, broadly interrupted in midline, not continuous with grooves on side plates of segments 2-3. Bluish or olivaceous green; transverse yellow band on each segment bordered with blue in front and on hind margin, or band of white bordered by dark green or brown band on hind margin, yellow or white spot near base of side plates; sometimes marked with violet. Royal spiny lobster. West Africa from Morocco at about lat. 28°N to beyond Cape Fria, Namibia, below low tide mark to 40 m, usually 5-15 m ..... *P. regius* (de Brito Capello)† (Color Fig. 79 j-k.)

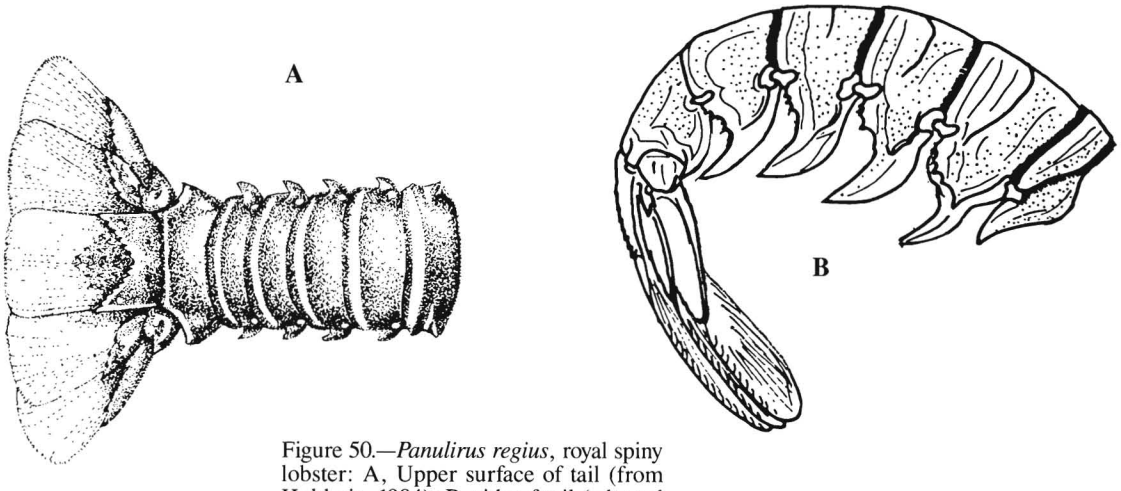


Figure 50.—*Panulirus regius*, royal spiny lobster: A, Upper surface of tail (from Holthuis, 1984); B, side of tail (adapted from Beaubrun, 1978).

14a (*1*) Yellow color on upper surface restricted to spots or marbling, no sharply defined continuous transverse bands of yellow 15

14b Distinctly yellow or whitish transverse band near hind margin of segments 1-3 or 1-6 16

15a (*14*) Color greenish; diagonal patches of bluish and yellow or white, and a broad dark band across middle of segments. Ornate spiny lobster. Indo-West Pacific; South Africa and Red Sea to Taiwan, Okinawa, and southern Japan, Indonesia, Melanesia, and Australia, 1-8, occasionally 25 m ..... *P. ornatus* (Fabricius)†
(Color Fig. 79 l-m.)

15b Segments 1-3 greenish on forepart, dirty red on hind part and provided with line of yellow dots near hind margin, yellow spots on sides; last 3 segments dull green with broad, deep red band on hind part, also with yellow dots. Smoothtail spiny lobster. Bermuda, southern Florida, Yucatan, and West Indies to northeastern Brazil, to 45 m ..... *P. laevicauda* (Latreille)*
(Color Fig. 79 n-o.)

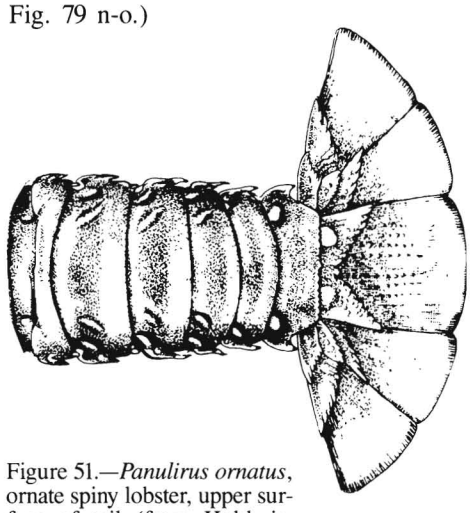


Figure 51.—*Panulirus ornatus*, ornate spiny lobster, upper surface of tail (from Holthuis, 1984).

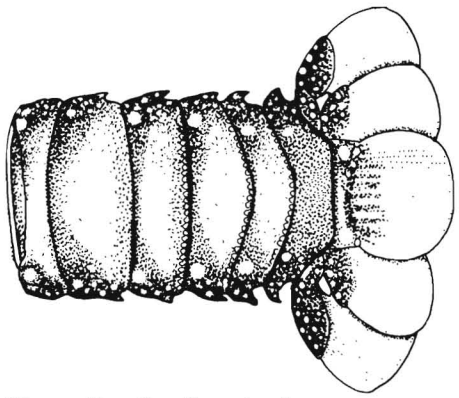


Figure 52.—*Panulirus laevicauda*, smoothtail spiny lobster, upper surface of tail (from Manning, 1978).

16a (*14*) Indigo blue with fine transverse line near hind margin of segments 1-3, segments 4-6 without transverse line but with bold and regularly placed yellow spots. Langosta, blue, or caribe lobster. Southwestern Baja California Sur, littoral of entire Gulf of California to western Gulf of Tehuantepec ..... *P. inflatus* (Bouvier)‡
(Color Fig. 80 a-b.)

16b Greenish (sometimes) mixed with blue, brown, or black; transverse yellow or white stripe on all segments 17

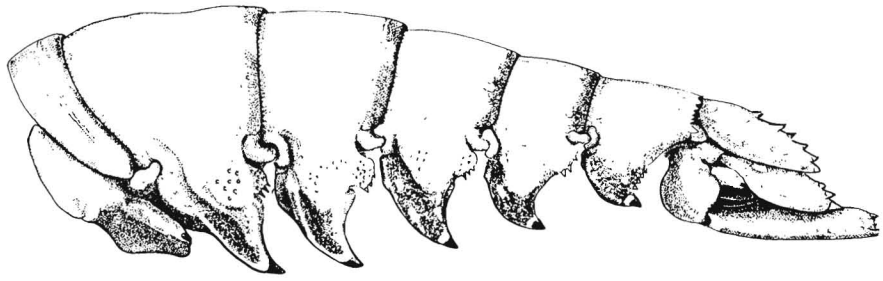


Figure 53.—*Panulirus inflatus*, blue or caribe lobster, side of tail (from Holthuis and Villalobos, 1961).

17a (*16*) Transverse pale band on hind margin of each segment or brown band with white line running through it. Mud spiny lobster. Indo-West Pacific, east Africa through East Indies, to Japan and northern Australia, to 90 m, usually less than 40 m ..... *P. polyphagus* (Herbst)*

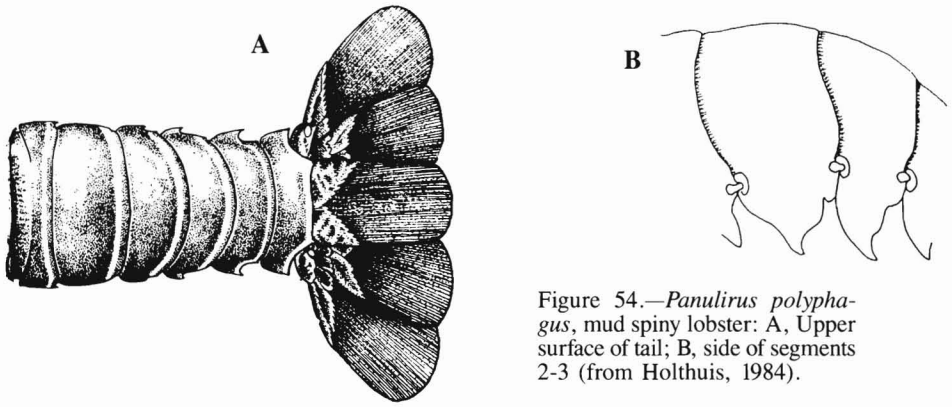


Figure 54.—*Panulirus polyphagus*, mud spiny lobster: A, Upper surface of tail; B, side of segments 2-3 (from Holthuis, 1984).

17b Transverse bold yellow or white stripe near hind margin of each segment bounded by dark band on either side 18

18a (*17*) Lacking yellowish spot at side of each segment or at base of middle member of tail fan. Painted spiny lobster. Indo-West Pacific, east Africa and Red Sea to Japan and Polynesia, to 16 m ..... *P. versicolor* (Latreille)‡ (Color Fig. 80 c-d.)

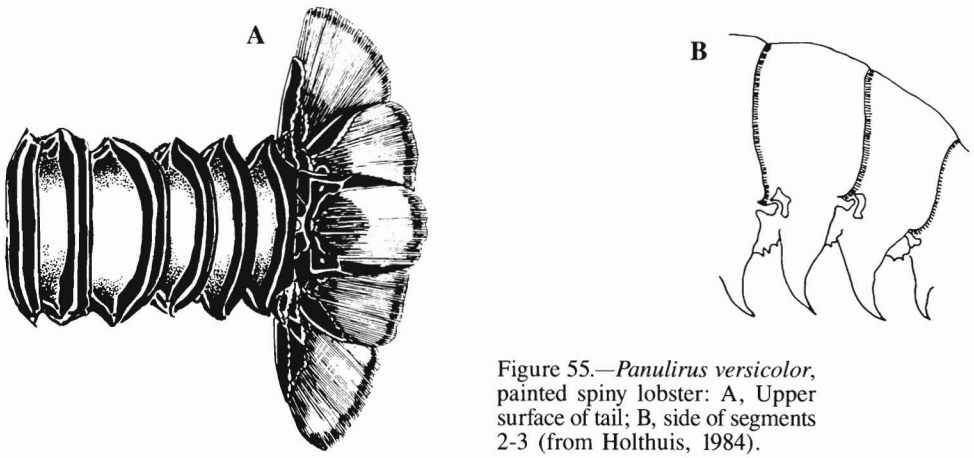


Figure 55.—*Panulirus versicolor*, painted spiny lobster: A, Upper surface of tail; B, side of segments 2-3 (from Holthuis, 1984).

18b Large yellowish spot at side of each segment and spots on middle member of tail fan 19

19a (*18*) Dark bluish or brownish green; whitish band on hind part of each segment flanked by darker band before and behind it, side plates with similar band connected to transverse bands on segments 2-5 and with white line on forepart of each and near segmental joint as well as foreside of segment 1; 4 basal spots in curved row across middle member of tail fan. Langosta verde, playa. Southern Sinaloa to northern Peru, Galapagos Isl., to 18+ m..... *P. gracilis* Streets†
(Color Fig. 80 e-f.)

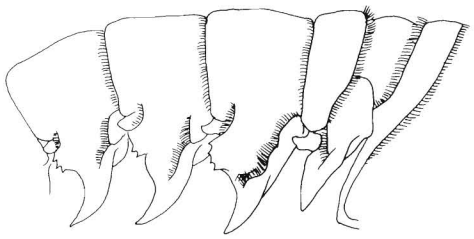


Figure 56.—*Panulirus gracilis*, langosta verde, side of tail.

19b Dark band in front of transverse yellow band continued boldly onto side plates 1-5. Bluish or olivaceous green; tiny flecks of yellow across rear half of each segment and yellow spot near base of side plates; sometimes marked with violet; spots at sides on middle member of tail fan. Royal spiny lobster. West Africa from about lat. 23°N to beyond Cape Fria, Namibia, 40+ m..... very large *P. regius* (de Brito Capello)*
(Shallow transverse grooves or patches are obliterated in large adults making them appear to have almost smooth back plates.)
(Color Fig. 79 j-k.)

Key to Species of *Puerulus*

The species of *Puerulus* look like miniatures of *Linuparus*, but marginal spines on the side plates are 2 in number, rather than 3, and far longer in females than in males. The species cannot easily be distinguished on the basis of tails alone, but the color pattern of some species is distinctive. All are from the western Indo-Pacific.

1a Underside of segment 1 with transverse ridge bearing a moderately developed spine toward either side and a barely perceptible raised area to either side near midline; transverse ridges on underside of segments 2-5 lacking spines; side plates of segments 3-5 with front spine swept downward and backward, much longer in female than in male. Lesser Sunda Isl., Moluccas and Philippines, 520-683 m..... *P. velutinus* Holthuis‡

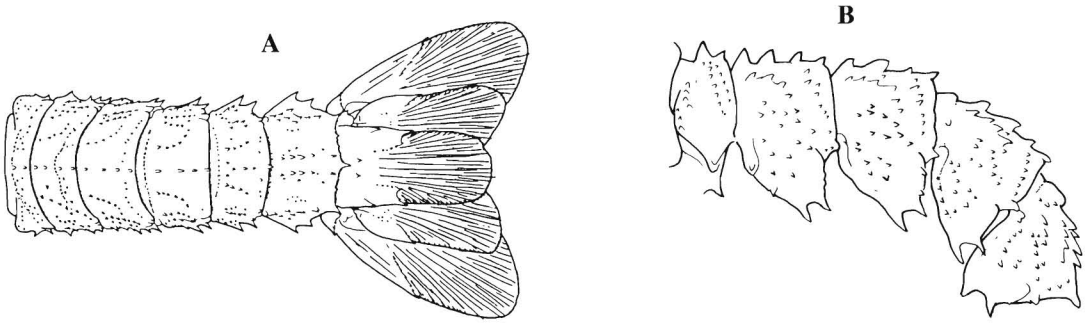


Figure 57.—*Puerulus velutinus*: A, Upper surface of tail; B, side of segments 1-5.

1b Underside of segment 1 with transverse ridge bearing 4 well-developed sharp spines; transverse ridges on segments 2-5 often with a spine to either side of midline 2

2a (*1*) Underside of segment 6 bearing 12 prominent, slender spines. Basically white with red patches and red at bases of white spines. Western Indian Ocean, East Indies, and Japan, 274-536 m ..... *P. angulatus* (Bate)†

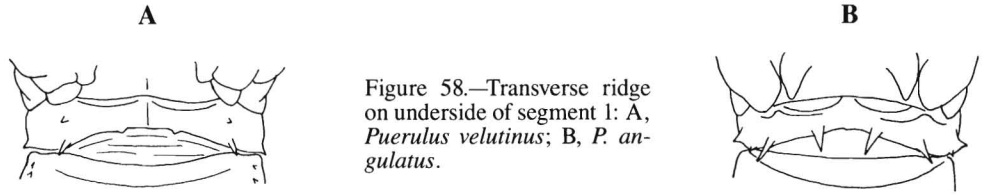


Figure 58.—Transverse ridge on underside of segment 1: A, *Puerulus velutinus*; B, *P. angulatus*.

2b Underside of segment 6 bearing 6 or 8 short spines or rudiments of them, sometimes almost completely absent 3

3a (*2*) Underside of segment 6 with a posteriorly directed pair of spines on hind margin; side plates of segments 3-5 with front spine swept downward and backward but each with broad indentation at base of front margin, longer in female than in male. Basically orange with bright red spines. Western Indian Ocean from Natal and Somali Republic to Saya de Malha Bank, 34-320 m ..... *P. carinatus* Borradaile‡

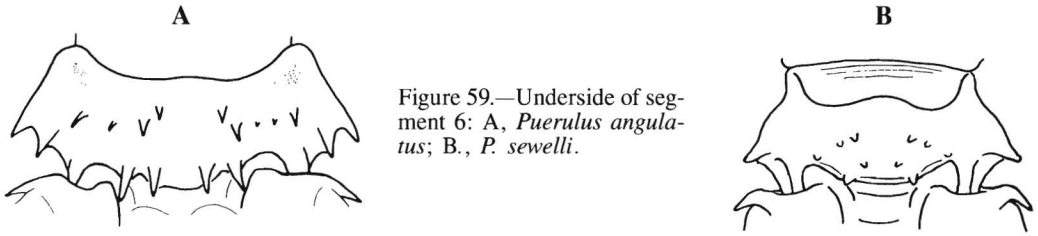


Figure 59.—Underside of segment 6: A, *Puerulus angulatus*; B., *P. sewelli*.

3b Underside of segment 6 with at most a pair of low tubercles on hind margin. Whip lobster. Gulf of Aden, Arabian Sea along India to Andaman Sea, 73-1,309 m ..... *P. sewelli* Ramadan†

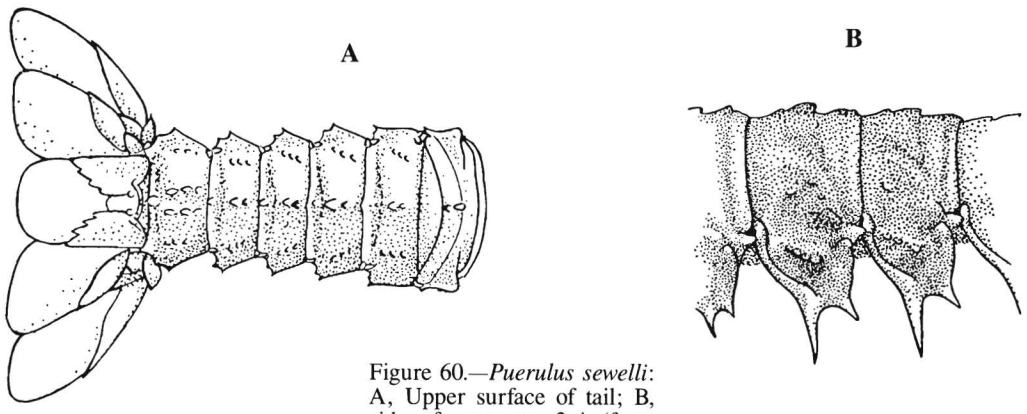


Figure 60.—*Puerulus sewelli*: A, Upper surface of tail; B, side of segments 3-4 (from Ramadan, 1938).

Key to Genera and Some Species of Flat, Locust, Slipper, and Spanish or Shovel-nosed Lobsters, Scyllaridae

1a Segments somewhat flattened but side plates directed downward 2

1b Segments so greatly flattened that side plates project laterally 3

2a (*1*) Segment preceding tail fan with small, acute, median spine extending beyond hind edge (may be broken). Brown, tan or gray, with transverse lines of granules and purple or bluish-black dots. Flathead locust lobster, northern shovel-nosed lobster, Moreton Bay bug. Queensland and northwestern Australia, Taiwan and Indonesia to Red Sea, Mediterranean (rare) and east Africa; 0-140 m . . . . . *Thenus orientalis* (Lund)† (Color Fig. 80 g.)

2b Segment preceding tail fan with hind edge smooth, or with imperceptible median spine not extending beyond hind edge . . . . . *Scyllarides*

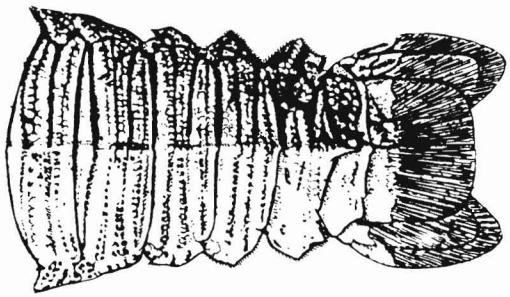


Figure 61.—*Thenus orientalis*, flathead locust lobster, upper surface of tail (from Holthuis, 1984).

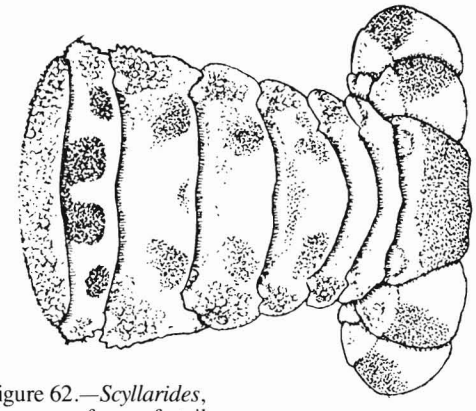


Figure 62.—*Scyllarides*, upper surface of tail (from Manning, 1978).

3a (*1*) Side plates of segment 2 with front edge spread almost straight to side, upper surface relatively smooth, not sculptured with pebble-like pattern . . . . . *Ibacus ciliatus*‡ (Several species may be sold in undetermined amounts; among them are the pinkish fan lobster, *Ibacus ciliatus* (Von Siebold) and *I. ciliatus pubescens* Holthuis, Hong Kong, Philippines, Taiwan and Japan, about 70-225 m; the pale orange, pink-stippled, smooth fan lobster, *I. novemdentatus* Gibbes, southern Mozambique and Kenya to Taiwan and Japan, to 295 m; the pinkish, salmon-colored southern shovel-nosed lobster or Balmain bug, *I. peronii* Leach, southern Australia, 35-135 m.)

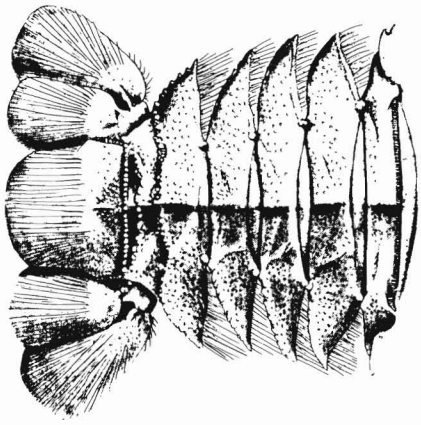


Figure 63.—*Ibacus*, fan or shovel-nosed lobsters, upper surface of tail (adapted from Holthuis, 1984).

3b Side plates of segment 2 with front edge angled obliquely forward, upper surface sculptured with pebble-like and scale-like pattern. Tan mottled with brown and red, but no enlarged red spots on segment 1. Sculptured slipper lobster. Atlantic Ocean from south Florida to Brazil, Indo-West Pacific from East Africa to Polynesia, 10+ m ..... *Parribacus antarcticus* (Lund)‡ (Other species may be sold in undetermined amounts.)

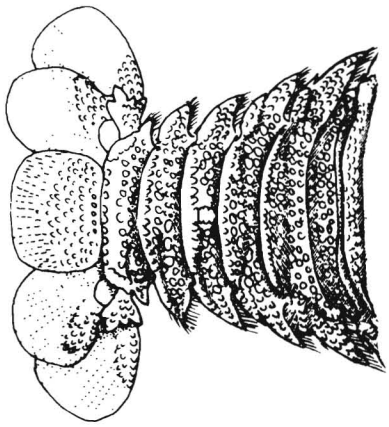


Figure 64.—*Parribacus antarcticus*, sculptured slipper lobster, upper surface of tail (from Manning, 1978).

Key to Species of *Scyllarides*, Flat Lobsters

1a Smooth part of segment 1 with no more than 1 red or reddish spot to each side of midline, median spot very diffuse if present at all 2

1b Smooth part of segment 1 without distinct spot, or more often with 3 or more red or reddish spots of varying size and intensity 4

2a (*1*) Red spots on segment 1 small and irregular; segments 3-4 distinctly humped. Humpbacked locust lobster. Mauritius, Red Sea, Malay Archipelago to Japan, Lord Howe Isl., off central eastern Australia (rare) ..... *S. haanii* (De Haan)‡

2b Red spots on segment 1 bold and distinct; segments 3-4 not distinctly humped 3

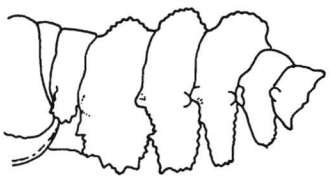


Figure 65.—*Scyllarides haanii*, humpbacked locust lobster, side view of tail (from Holthuis, 1984).

3a (*2*) Side plates of segment 2 with convex margins. Brazil ..... *S. brasiliensis* Rathbun‡ (Color Fig. 80 h-i.)

3b Side plates of segment 2 with lower half of hind margin distinctly concave. Sao Paulo, Brazil ..... *S. deceptor* Holthuis‡

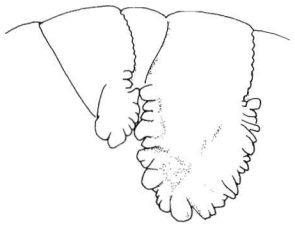


Figure 66.—*Scyllarides brasiliensis*, side view of segment 2.

Figure 67.—*Scyllarides deceptor*, side view of segment 2.

4a (*1*) Segment 1 with 3 similar sized spots in line transversely 5

4b Segment 1 with spots either missing or not as above in size, shape, or intensity 7

5a (*4*) Segments 2-4 not strongly humped along midline. Brownish red to dark red. Red locust lobster. West Africa from northern Senegal to southern Angola, 2-70 m, rarely 200 m . . . . . *S. herklotsii* (Herklots)‡ (Color Fig. 80 j-k.)

5b Segments 2-4 with humplike ridge along midline rather strongly set off from remainder of surface 6

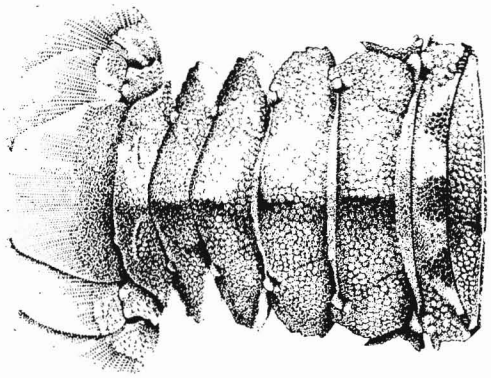


Figure 68.—*Scyllarides herklotsii*, red locust lobster, upper surface of tail (from Holthuis, 1981).

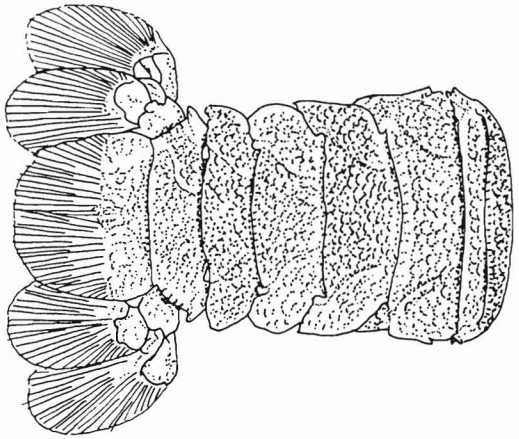


Figure 69.—*Scyllarides squammosus*, locust lobster, upper surface of tail (adapted from description of Holthuis, 1984).

6a (*5*) Segment 1 with median spot diffuse, not surrounded by ring of yellow; pale red blotches on body surface, marbled with brown or gray; side plates of segment 2 toothed on margin. Locust lobster. Indo-Pacific and north of Clipperton Isl., at least 3-53 m . . . . . *S. squammosus* (H. Milne Edwards)‡

6b Segment 1 with spots placed widely apart and nearly equal in size; yellowish brown. Gulf of Aqaba and Red Sea . . . . . *S. tridacnophaga* Holthuis‡

7a (*4*) Segment 1 with median spot (sometimes divided) more or less circular and bold 8

7b Segment 1 with median spot irregular; diffuse, missing, small, oval, broken into a patch of small spots, or broadly horseshoe-shaped 9

8a (*7*) Segments 2-4 with prominent, narrowed hump in midline; no partly hidden median red spot on smooth forward surface of segments 2-5. Ridged slipper lobster. Bermuda, Cape Lookout, N.C., to Florida and around Gulf of Mexico to Yucatan, 2-20 m, rarely to 100 m . . . . . *S. nodifer* (Stimpson)‡

8b Segments 2-4 with low hump in midline scarcely set off from surrounding surface; small partly hidden median red or reddish spot on smooth forward surface of segments 2-5. Surinam, 42-80 m ..... *S. delfosi* Holthuis‡

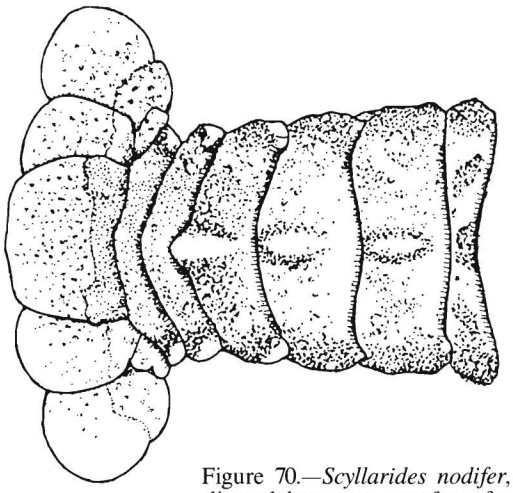


Figure 70.—*Scyllarides nodifer*, ridged slipper lobster, upper surface of tail (from Manning, 1978).

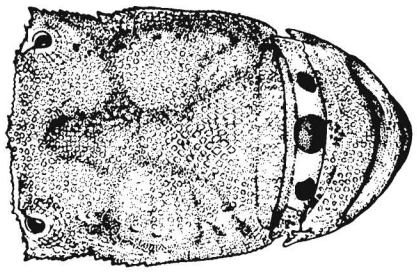


Figure 71.—*Scyllarides delfosi*, upper surface of body including head and part of tail (from Manning, 1978).

9a (*7*) Segment 1 with central bold, broadly horseshoe-shaped spot enveloping tiny and fainter median spot behind it. Spanish slipper lobster. Bermuda, Gulf of Mexico, south Florida and Caribbean Sea, less than 1 m to rarely 180 m ..... *S. aequinoctialis* (Lund)‡ (Color Fig. 80 l-m.)

9b Segment 1 with median area not ornamented as above 10

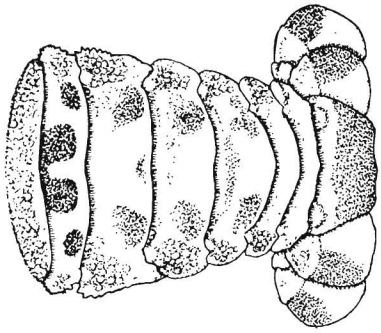


Figure 72.—*Scyllarides aequinoctialis*, Spanish slipper lobster, upper surface of tail (from Manning, 1978).

10a (*9*) Segment 1 with minute median spot but large lateral spot to each side, or lacking spots altogether; side plates of segment 2 with foremargin strongly convex, variably spined and tipped by backward pointing tooth, row of teeth diminishing from tip to base of hind margin. Reddish, dull brown, or greenish with oblique light brown slash toward sides. Cape locust lobster. Southern Africa, 87-380 m ..... *S. elisabethi* (Ortmann)† (Color Fig. 80 n-o.)

10b Segment 1 with median spot variously shaped but not minute; side plates of segment 2 not as above, either toothed on foremargin, blunt tipped, or with large tooth on hind margin 11

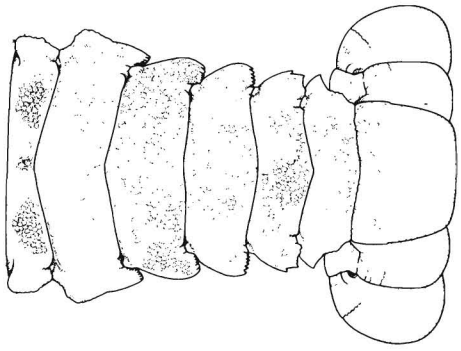


Figure 73.—*Scyllarides elisabethi*, Cape locust lobster, upper surface of tail (from Holthuis, 1984).

11a (*10*) Segment 1 with median oval dark red spot, often surrounded by clear ring of yellow; side plates of segment 2 with foremargin coarsely toothed but hind margin not so. Mediterranean locust lobster. Mediterranean Sea, Portugal to Gambia, Azores, Madeira, Canary and Cape Verde Isl., to 100 m, usually 4-10 m ..... *S. latus* (Latreille)†

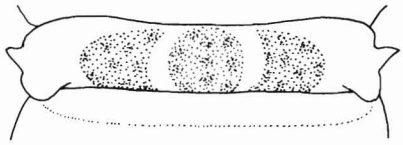


Figure 74.—*Scyllarides latus*, Mediterranean locust lobster, upper surface of segment 1 (adapted from Holthuis, 1981).

11b Segment 1 with median patch of spots, variable in density 12

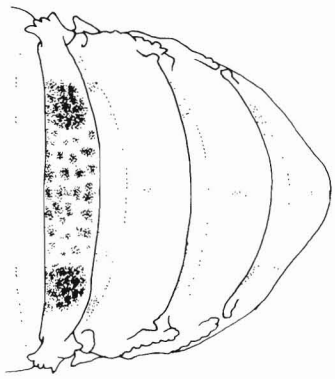


Figure 75.—*Scyllarides astori*, upper surface of segments 1-4.

12a (*11*) Median patch of red spots on segment 1 most dense in median area, often on yellowish background; segments 3-4 not definitely humped. Galapagos Isl., also off southern Baja California, to at least 15 m ..... *S. astori* Holthuis‡

12b Median patch of red spots on segment 1 irregular and indistinct, not on yellow background; segments 3-4 definitely humped on upper side. Easter Isl. ..... *S. roggeveeni* Holthuis‡

Key to Species of Galatheidae, Squat Lobsters

Squat lobsters have very small tails, hence the distinguishing characters are minute and better seen with a magnifying glass than with the unaided eye. Common names in this group are not standardized and vary from country to country.

1a Segments 2, 3, and 4 with tiny spines on front edge of arched back plate. Yellow. Langostino amarillo. Central Chile, fishery extends from Caldera (lat. 27°S) to Calbuco (about lat. 42°S) at mainly 125-200 m, but occurs in shallower and deeper water ..... *Cervimunida johni* Porter*

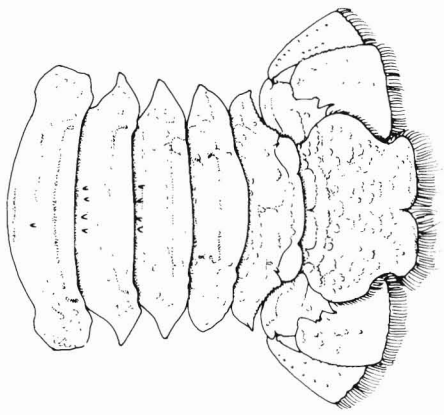


Figure 76.—*Cervimunida johni*, langostino amarillo, upper surface of tail.

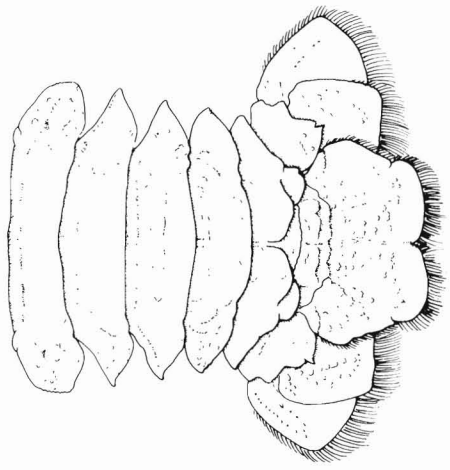


Figure 77.—*Pleuroncodes monodon*, camaroncillo roho or langostino colorado, upper surface of tail.

1b Arched back plates spineless ..... *Pleuroncodes*
(Two species of this genus occur in vast swarms in the eastern Pacific; differences between them are obscure. The langostino colorado (red) or zanahoria (Chile), camaroncillo rojo (Peru), *P. monodon* (H. Milne Edwards)*, ranges from Lobos de Afuera Isl., Peru, to Ancud, Prov. of Chiloe, Chile; fishery same as given above for *C. johni*. The red or pelagic crab, *P. planipes* Stimpson, which has no present use in fisheries, occurs in extensive surface concentrations in the California Current off southern and Baja California, ranging for a distance of at least 1,000 miles southwestward; a bottom dwelling phase ranges along the western side of Baja California and in the lower Gulf of California at 60-365 m).

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The keys for identification contain information from a variety of sources other than those cited above. To avoid the complications of citing references in the keys, these sources as well as those given in the text are placed under selected subject headings: Color, biology, fishery statistics, general summary, systematics, and zoogeography. The list is biased toward fishery statistics, systematics, and zoogeography since these are the main topics of concern, but many of the references contain general information from each of the categories listed.

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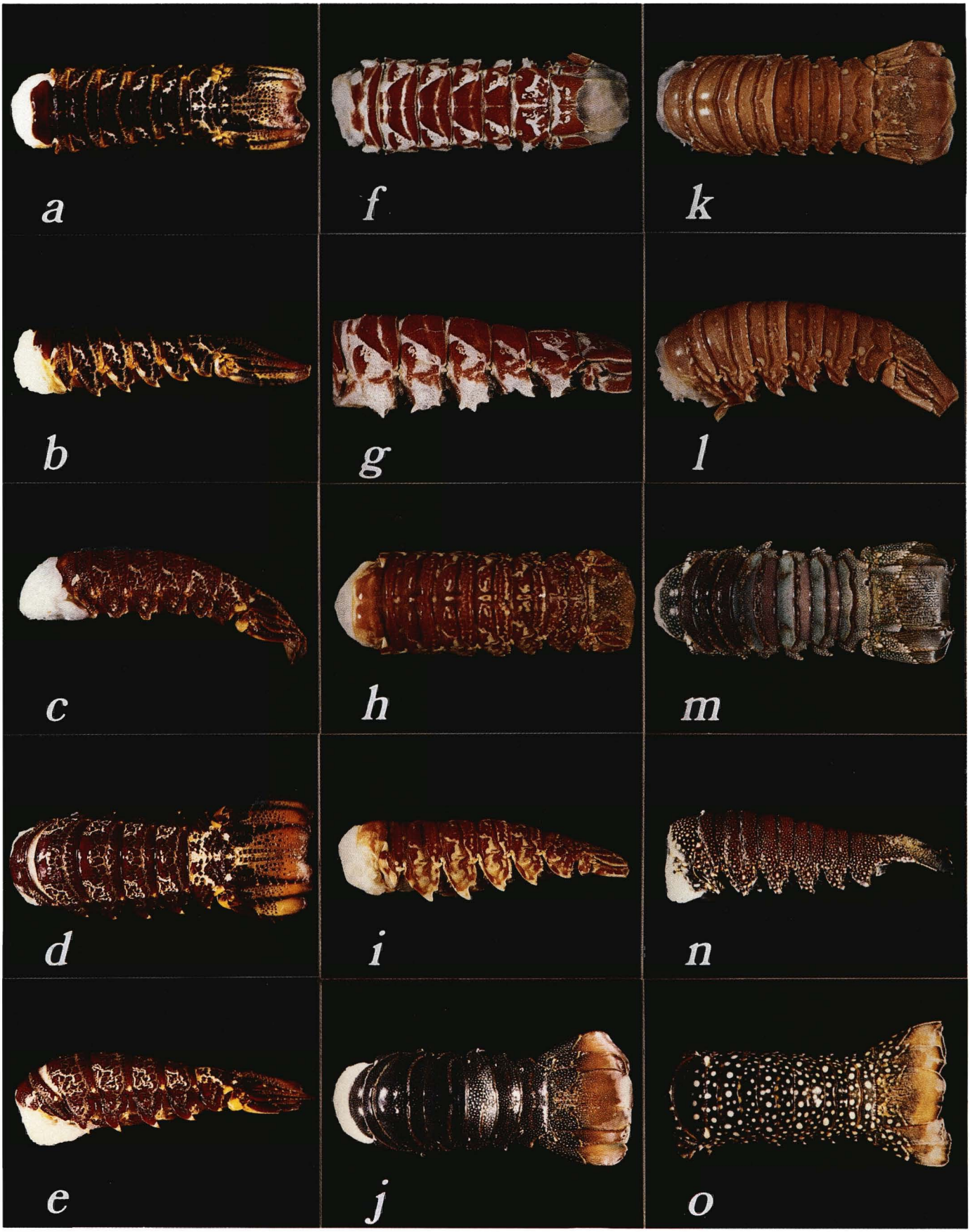

Figure 78.—Frozen lobster tails from market (hues vary): a-b, *Jasus lalandii*; c, *J. novaehollandiae*; d-e, *J. edwardsii*; f-g, *Linuparus trigonus*; h-i, *Palinurus gilchristi*; j, *Panulirus homarus*; k-l, *P. cygnus*; m-n, *P. penicillatus*; o, *P. guttatus*.

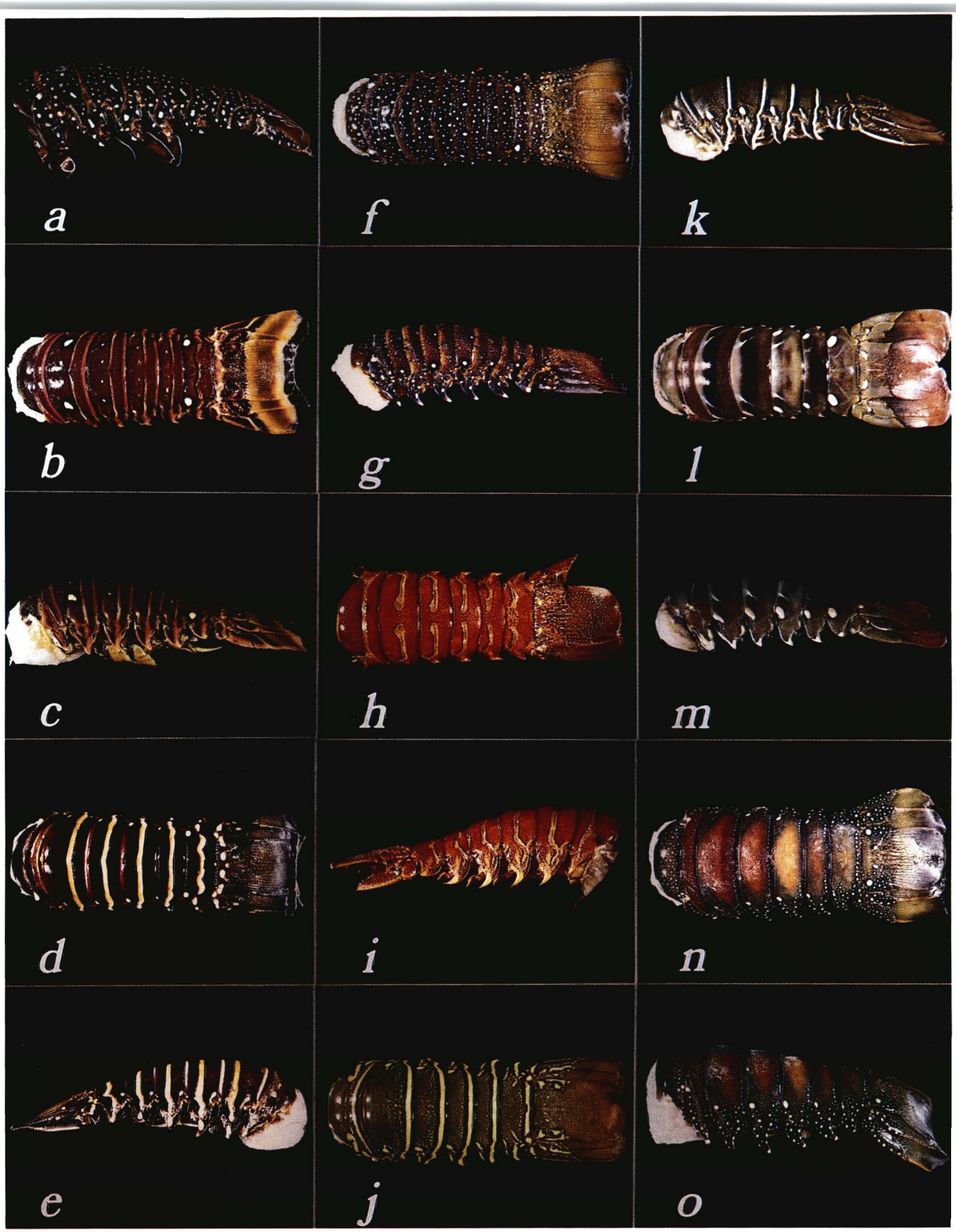

Figure 79.—Frozen lobster tails from market (hues vary): a, *Panulirus guttatus*; b-c, *P. argus*; d-e, *P. marginatus*; f-g, *P. longipes*; h-i, *P. interruptus*; j-k, *P. regius*; l-m, *P. ornatus*; n-o, *P. laevicauda*.

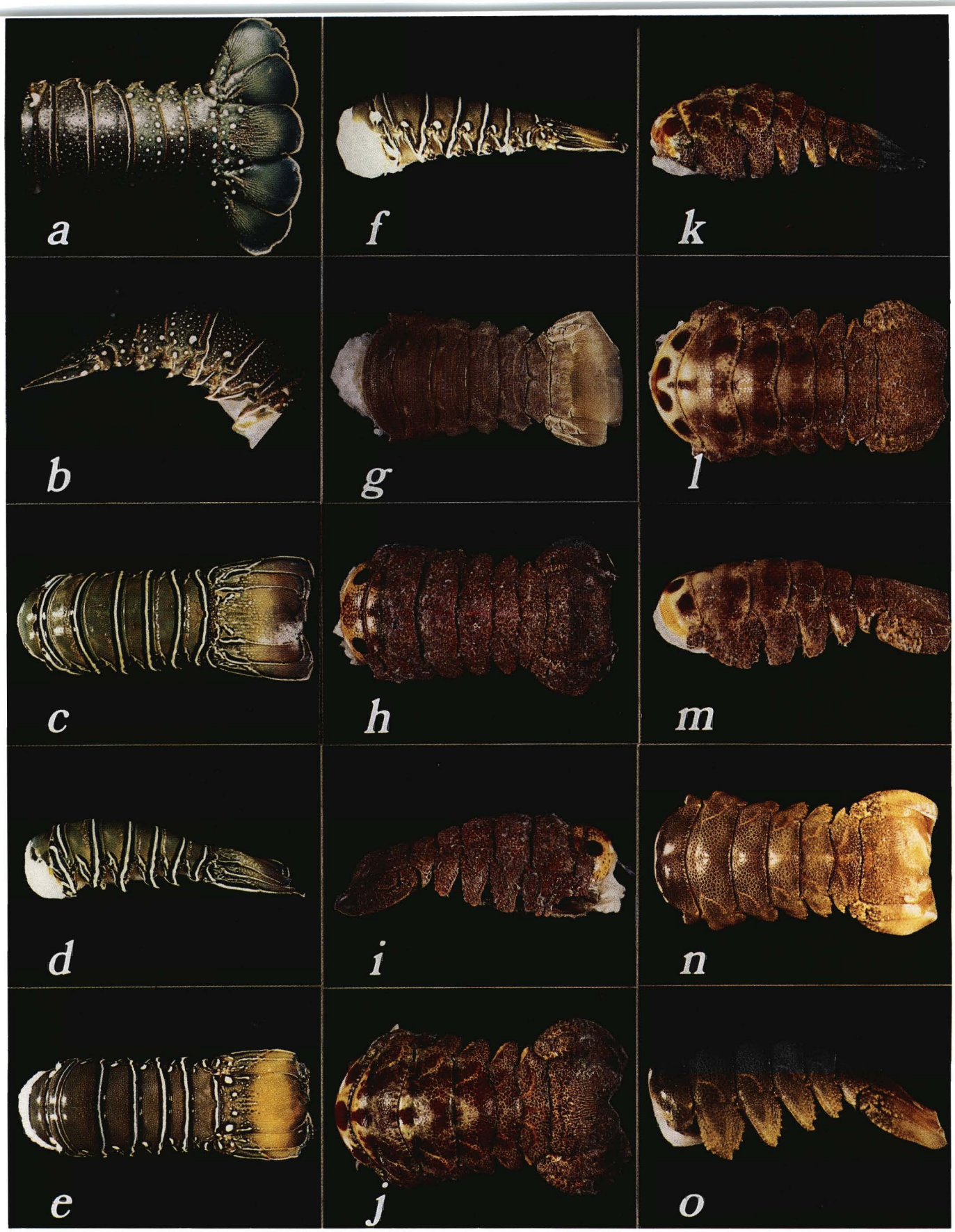

Figure 80.—Frozen lobster tails from market (hues vary): a-b, *Panulirus inflatus* (from M. Hendrickx); c-d, *P. versicolor*; e-f, *P. gracilis*; g, *Thenus orientalis*; h-i, *Scyllarides brasiliensis*; j-k, *S. herklotsii*; l-m, *S. aequinoctialis*; n-o, *S. elisabethi*.