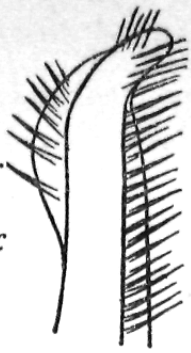
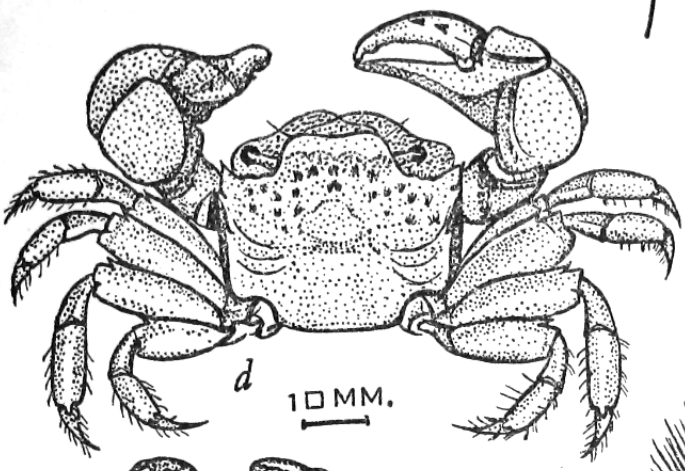
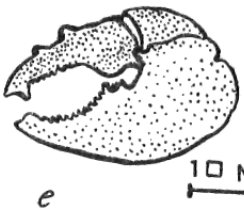
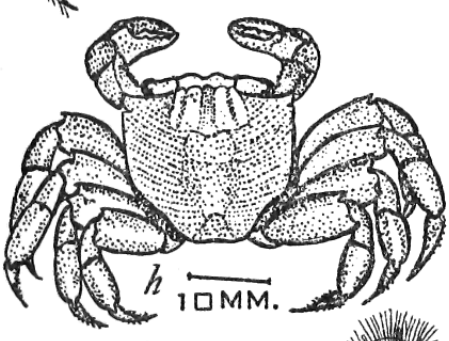
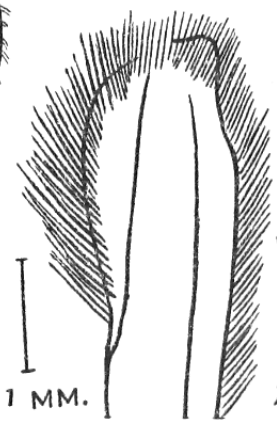
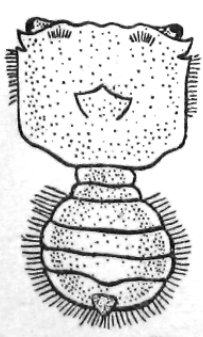


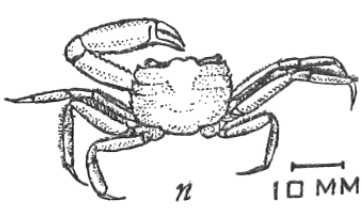


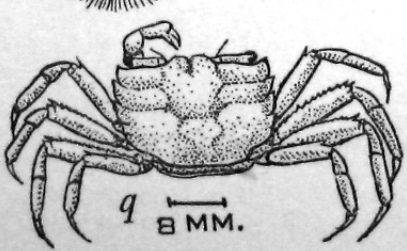


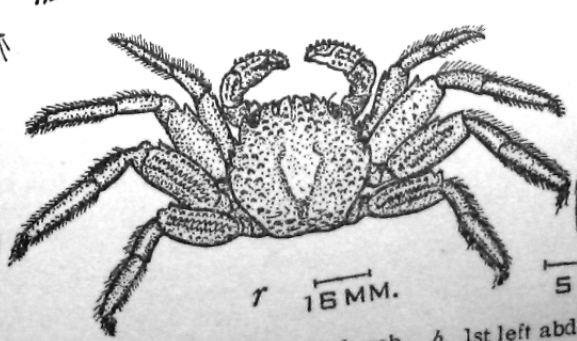


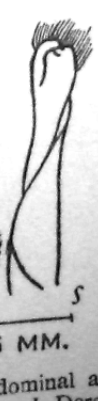












Sesarma (*Sesarma*) *quadrata* (Fabricius): *a*. Dorsal view of crab. *b*. 1st left abdominal appendage of male. *c*. Tip of same, enlarged. *Sesarma* (*Sesarma*) *oceanica* de Man: *d*. Dorsal view of crab. *e*. Cheliped, external view. *f*. 1st left abdominal appendage of male. *g*. Tip of same, enlarged. *Sesarma* (*Sesarma*) *taeniolata* White: *h*. Dorsal view of crab. *i*. 1st left abdominal appendage of male. *j*. Tip of same, enlarged. *Sesarma* (*Sesarma*) *minuta* de Man: *k*. Dorsal view of female, with abdomen extended. *l*. Cheliped of female. *m*. 3rd walking leg. *Metaplax indica* (Milne-Edwards): *n*. Dorsal view of male. *o*. 1st left abdominal appendage of male. *p*. Tip of same, enlarged. *Metaplax distincta* Milne-Edwards: *q*. Dorsal view of female. *Plagusia depressa tuberculata* (Lamarck): *r*. Dorsal view of crab. *s*. 1st left abdominal appendage of male.

In the anterior male abdominal appendages, there is a minute tooth at the extreme end of the broad tip. There are hairs along both the borders. This species has been previously recorded from Karachi. This is the first record from Bombay State.

Metaplax distincta Milne-Edwards

(Plate 16)

Metaplax distinctus, de Man, *Journ. Linn. Soc. London* (*Zool.*) xxii, p. 158 (1887).
Metaplax distincta, Henderson, *Trans. Linn. Soc. London* (*Zool.*) v, p. 391 (1893).
Alcock, *Journ. As. Soc. Bengal* lxix, p. 432 (1900).

The present collection is represented by a female from Karwar. It measures :

length of carapace	... 18 mm.
breadth of carapace	... 24 mm.

In this species the carapace is slightly less than three-fourths as long as broad. The lower border of the orbit in the male is prolonged to the level of the second notch in the lateral border. The lobules of the infra-orbital ridge are from 25 to 30 ; the lobules of the orbital portion (10-12) are small, and gradually decrease in size from within outward. The anterior border of the meropodites of the legs is armed, in the first and last pairs with a subterminal spine, in the middle two with several spines. The male abdomen consists of seven separate segments.

Colour a uniform grey.

In the specimen in the present collection, a small vestige of a fifth tooth is indicated, on careful examination, by a nick in the lateral borders. The posterior borders of the legs are microscopically beaded. The front is bow-shaped and obliquely deflexed. There is no tomentum on the legs. The carapace, on the front half and the sides, is granular.

This species has been previously recorded from Madras, Coconada, Mergui, and the Nicobars. This is the first record from the west coast of India.

Subfamily PLAGUSIINAE

Genus **Plagusia** Latreille

Plagusia depressa tuberculata (Lamarck)

(Plate 16)

Plagusia squamosa, Alcock and Anderson, *Journ. As. Soc. Bengal* lxiii, p. 202 (1894).
Plagusia depressa var. *squamosa*, Alcock, *Journ. As. Soc. Bengal* lxix, p. 438 (1900).
Borradaile, *Fauna Geog. Maldive Laccadive Archipel.* (5) i, p. 432 (1903).
Pillai, *Bull. Central Inst. Travancore* ii, p. 38 (1951).
Plagusia depressa var. *tuberculata*, Kemp, *Mem. Ind. Mus.* v, p. 241 (1915-1924).
Montgomery, *Journ. Linn. Soc. London* (*Zool.*) xxxvii, p. 457 (1931).

Rathbun, *U. S. Nat. Mus. Bull.* 97 p. 334 (1917).
Tesch, *Siboga Exped. Rep.* xxxix, p. 129 (1918).
Tweedie, *Bull. Raffles Mus. Singapore*, 12, p. 69 (1936).
Suvatti, *Dept. of Fisheries, Bangkok, Thailand*, p. 158 (1950).

The present collection is represented by a male from Kodinar. It measures :

length of carapace	...	52 mm.
breadth of carapace	...	55 mm.

This crab is distinguished by the absence of a true front, so that the antennular fossae are visible in a dorsal view as deep clefts in the anterior border of the carapace. The regions of the carapace are distinct, and covered with flat pearly or squamiform tubercles. The antero-lateral borders are cut into four teeth. The chelipeds are massive, and have tubercles on the upper surface of the palm and finger arranged in longitudinal rows.

Colour reddish brown.

The specimen in the present collection is sparsely covered with weeds.

The anterior male abdominal appendages are stout, with a blunt tip covered with a thick brush of hairs.

The use of Herbst's name *squamosa* by Alcock, Stebbing, and others has been criticized by Laurie.

Distribution: Indo-Pacific, extending to the west coast of America.

Key to the Identification of the Marine Crabs of Bombay State

1.	Mouth frame (buccal cavity) triangular (Oxystomata)	2.	
	Mouth frame (buccal cavity) more or less quadrate	10.	
2.	Carapace short, leaving the first two or three abdominal segments exposed. Last two pairs of legs dorsal in position, ending in hook-like dactyli (Dorippidae)	*Dorippe astuta*	p. 409
	Abdomen not visible dorsally. Legs normal in position	3.	
3.	Inhalant branchial openings in front of chelipeds. Gills nine. Male genital openings coxal (Calappidae)	4.	
	Inhalant branchial openings at bases of third maxillipeds. Gills less than nine. Male genital openings sternal (Leucosiidae)	6.	
4.	External maxillipeds not closing the buccal cavity completely, palp not concealed. Legs not adapted for swimming (Calappinae) ...	*Calappa lophos*	p. 404
	External maxillipeds completely covering the buccal cavity, palp concealed. Legs natatory, distal joints flattened and expanded (Matutinae).	5.	
5.	A distinct spine at the angle of the hand where it comes in contact with the external angle of the arm. Carapace covered with minute red dots ...	*Matuta lunaris*	p. 405
	Only a tubercle at the angle of the hand where it touches the external angle of the arm. Carapace covered with red spots, rings and vermicular lines	*Matuta planipes*	p. 406

6.	Carapace convex and subglobular, its surface smooth and polished	7.
	Carapace rhomboidal, its margins with large spines and tubercles	*Arcania septemspinosa* p. 408
7.	Front narrow. Exopodites of external maxillipeds narrow, with the outer margins straight (*Leucosia*)	8.
	Front broad. Exopodites of external maxillipeds broad, their outer borders forming a semicircle (*Philyra*)	9.
8.	Carapace longer than broad	*Leucosia pubescens* p. 406
	Carapace broader than long	*Leucosia sima* p. 407
9.	Carapace smooth, its regions hardly defined ...	*Philyra globosa* p. 407
	Regions of carapace forming independent swellings, covered with large granules ...	*Philyra corallicola* p. 408
10.	Last pair of legs modified, situated dorsally. Female genital openings coxal. First pleopod present in female. Gills usually numerous (Dromiacea)	11.
	Last pair of legs normal, rarely reduced, and only exceptionally dorsal in position. Female genital openings sternal. First pleopod absent in female. Gills few (Brachygnatha) ...	12.
11.	Last pair of legs shorter than the first two pairs.	*Dromia dormia* p. 401
	Last pair of legs longer than the first two pairs...	*Pseudodromia integrifrons* p. 402
12.	Carapace triangular, narrowed in front, usually with a distinct rostrum. Orbits generally incomplete (Oxyrhyncha)	13.
	Carapace broad in front, rostrum reduced or wanting. Orbits well developed (Brachyrhyncha).	19.
13.	Carapace flat, weakly calcified. Male genital openings on last thoracic sternite (Hymenosomidae)	*Elamena cristatipes* p. 409
	Carapace not flat, strongly calcified. Male genital openings on fifth coxopodites ...	14.
14.	Basal antennal joint well developed, generally fused with epistome and sometimes also with the sides of the rostrum. Chelipeds usually not vastly larger than legs (Maiidae)	15.
	Basal antennal joint very small, not fused with epistome or front. Chelipeds usually much longer and more massive than legs (Parthenopidae) ...	18.
15.	Eyes without true orbits. Eyestalks very short or obsolescent, concealed beneath a supraocular spine or sunk in the sides of a large rostrum (Acanthonychinae)	*Menaethius monoceros* p. 410
	Orbits partly defined. Postocular process present, hollowed for the partial retraction of the short eyestalks (Pisinae)	16.
	Orbits complete enough to entirely conceal the cornea dorsally (Maiinae)	17.
16.	Rostral spines long and divergent, separate from their base	*Hyastenus planasius* p. 411
	Rostral spines short, fused in their basal half ...	*Doclea gracilipes* p. 412
17.	Carapace armed with five long spines in the middle line. Rostral spines long and divergent, simple	*Paramithrax (Chlorinoides) aculeatus* p. 413
	Carapace with tubercles, but without spines, in the middle line. Rostral spines short, each with a small accessory spine on its outer border ...	*Schizophrys aspera* p. 414

18. Carapace broadly triangular, not laterally expanded	*Lambrus* (*Platylambrus*) *prensor*	p. 415
Carapace pentagonal, with large lateral vaulted expansions which completely conceal the legs ...	*Cryptopodia angulata*	p. 415
19. Palp of external maxillipeds inserted at or near the antero-internal angle of the merus. Carapace usually transversely oval	20.	
Palp of external maxillipeds inserted at the summit of the antero-external angle of the merus. Carapace usually squarish ...	47.	
20. Last pair of legs flattened for swimming (Portunidae)	21.	
Last pair of legs not flattened (Goneplacidae and Xanthidae)	28.	
21. Antero-lateral borders of carapace cut into nine teeth	22.	
Antero-lateral borders of carapace cut into six teeth (*Charybdis*)	24.	
Antero-lateral borders of carapace cut into five teeth (*Thalamita*)	27.	
22. Teeth on antero-lateral borders equal in size ...	*Scylla serrata*	p. 416
Last tooth on antero-lateral borders enlarged in the form of a long spine (*Neptunus*) ...	23.	
23. No spine on the posterior border of the arm of the chelipeds	*Neptunus* (*Neptunus*) *sanguinolentus*	p. 417
A spine at the far end of the posterior border of the arm of the chelipeds	*Neptunus* (*Neptunus*) *pelagicus*	p. 418
24. No spine on the posterior border of the arm of the chelipeds (subgenus *Goniosoma*) ...	25.	
A spine at the end of the posterior border of the arm of the chelipeds	*Charybdis* (*Goniohellenus*) *hoplites*	p. 423
25. Teeth on antero-lateral borders subequal in size. Large or medium-sized crabs	26.	
Last tooth on antero-lateral borders longer than the rest. Small crabs	*Charybdis* (*Goniosoma*) *callianassa*	p. 421
Second tooth on carapace rudimentary ...	*Charybdis* (*Goniosoma*) *orientalis*	p. 422
26. First tooth on antero-lateral borders anteriorly truncated and notched. Sixth abdominal tergum of male with curved and gradually convergent sides. One or two inconspicuous denticles near the far end of the posterior border of the propodites of the last pair of legs. A brown cross on the carapace	*Charybdis* (*Goniosoma*) *cruciata*	p. 419
First tooth on the antero-lateral borders acute. Sixth abdominal tergum of the male with its sides parallel or even slightly divergent. Posterior border of the propodites of the last pair of legs strongly serrated throughout. Four whitish spots on the carapace	*Charybdis* (*Goniosoma*) *lucifera*	p. 420
First tooth on the antero-lateral borders acute. Sixth abdominal tergum of male with its sides parallel. Posterior border of propodites of last pair of legs serrated in a large part of its extent. Legs with annular bands	*Charybdis* (*Goniosoma*) *annulata*	p. 420

27. Teeth on antero-lateral borders subequal in size ... ... *Thalamita crenata* p. 423
Fourth tooth on antero-lateral borders rudimentary ... ... *Thalamita prymna* p. 424

28 A. (part, family Goneplacidae) :
Carapace hairy, edge of front distinctly curved ... 29.
Carapace not hairy, edge of front cut straight and square ... ... *Eucrate crenata dentata* p. 437

28 B. (part, family Xanthidae) :
Ridges defining the efferent branchial channels either absent, or confined to the posterior part of the buccal cavity (Hyperolissa) ... ... 30.
Ridges defining the efferent branchial channels continued up to the anterior border of the buccal cavity (Hyperomerista) ... ... 41.

29. Antero-lateral borders with three teeth ... *Litocheira angustifrons* p. 438
Antero-lateral borders with two teeth ... *Litocheira setosa* p. 439

30. The front and antero-lateral borders form a convex arch, postero-lateral borders strongly convergent. Male abdomen with five segments (segments 3–5 fused) ... ... 31.
Carapace nearly quadrilateral (arch of front and antero-lateral borders less convex). Male abdomen with seven segments ... ... *Galene bispinosa* p. 431

31. Carapace convex both fore and aft, and from side to side ... ... 32.
Carapace convex fore and aft, flat from side to side ... ... 37.

32. Antero-lateral borders entire, crested ... 33.
Antero-lateral borders cut into teeth, not crested... 36.

33. Carapace smooth, hardly any indication of regions (*Atergatis*) ... ... 34.
Carapace granular, regions well indicated ... *Platypodia cristata* p. 427

34. Edges of antero-lateral borders sharp, forming a ridge at the lateral epibranchial angles ... 35.
Edges of antero-lateral borders thick and blunt, without any ridge ... ... *Atergatis roseus* p. 426

35. Carapace with a smooth, even surface ... *Atergatis integerrimus* p. 425
Carapace with the surface lumpy ... ... *Atergatis floridus* p. 426

36. Fingers of chelipeds with broad, hoof-like extremities ... ... *Etisus lævimanus* p. 431
Fingers of chelipeds pointed ... ... *Actaea savignyi* p. 432

37. Antero-lateral borders prolonged beneath the orbit to the angle of the buccal cavity ... *Medaeus granulosus* p. 430
Antero-lateral borders not prolonged beyond the orbit ... 38.

38. Fingers of chelipeds blunt-tipped (*Leptodius*) ... 39.
Fingers of chelipeds sharp ... *Xantho* (*Lophoxanthus*) *scaberrimus baccalipes* p. 427

39. Five teeth on antero-lateral borders ... *Leptodius crassimanus* p. 429
Four teeth on antero-lateral borders ... 40.

40. Carapace only slightly areolated ... ... *Leptodius exaratus* p. 428
Carapace completely areolated (as in *Actaea*) ... *Leptodius euglyptus quadrispinosus* p. 429

41. Fronto-orbital border half, or less than half, the greatest breadth of the carapace ... ... 42.
Fronto-orbital border just $\frac{3}{4}$rd the greatest breadth of the carapace ... ... 44.
Fronto-orbital border more than $\frac{3}{4}$th the greatest breadth of the carapace ... ... *Eriphia laevimana smithii* p. 437

42. Basal antennal joint not reaching the front ... *Myomenippe hardwickii* p. 432

Basal antennal joint broadly in contact with front ... ... 43.

43. Antero-lateral borders thin and sharp ... *Epixanthus frontalis* p. 434

Antero-lateral borders not thin and sharp ... *Ozius rugulosus* p. 433

44. Carapace hairy, regions well defined (*Pilumnus*). 45.

Carapace not tomentose, regions ill defined ... 46.

45. A subhepatic spine, just below the outer orbital angle ... ... *Pilumnus vespertilio* p. 434

No subhepatic spine ... ... *Pilumnus longicornis* p. 435

46. Indications of areolation on the carapace anteriorly, front bilobed ... *Heteropanope laevis* p. 436

Carapace without any trace of regions, front cut straight and square ... ... *Eurycarcinus orientalis* p. 436

47. Small crabs living as commensals, mostly in bivalve molluscs (Pinnotheridae) ... 48.

Free living crabs ... ... 49.

48. Dactylus of external maxillipeds in the female does not extend to the apex of the propodite. Dactyli of third and fourth legs in the female 1¼ times as long as those of the first and second. Colour pink ... ... *Pinnotheres placunae* p. 503

Dactylus of external maxillipeds in the female reaches to the end of the propodite. Dactyli of third and fourth legs in the female twice as long as those of the first two. Colour yellow ... *Pinnotheres vicajii* p. 505

49. Orbits wider, often much wider, than front. External maxillipeds meeting, or nearly so, in the middle line. Carapace squarish or transversely oblong (Ocypodidae) ... ... 50.

Front at least as wide as, usually wider than, orbit. A large, rhomboidal gap between the external maxillipeds. Carapace square (Grapsidae) ... ... 62.

50. A hairy-edged pouch between the bases of the second and third pairs of legs (Ocypodinae) ... 51.

No pouch between the second and third pairs of legs ... ... 57.

51. Chelipeds slightly unequal in both sexes. Cornea large, ventral, occupying the greater part of the surface of the eyestalks (*Ocypoda*) ... 52.

Chelipeds in the female equal and small; in the male one is vastly larger than the other. Eyes small, terminal on the long slender eyestalks (*Gelasimus*) ... ... 54.

52. A stridulating ridge on the inner surface of the palm. Eyestalks prolonged beyond the eyes as a style ... ... 53.

No stridulating ridge on the palm. Eyestalks not prolonged beyond the eyes ... ... *Ocypoda cordimana* p. 507

53. Antero-lateral angles of carapace pronounced ... *Ocypoda ceratophthalma* p. 506

Antero-lateral angles of carapace rounded ... *Ocypoda rotundata* p. 508

54. Front $\frac{1}{5}$th to $\frac{1}{6}$th the greatest breadth of the carapace ... ... *Gelasimus annulipes* p. 508

Front less than $\frac{1}{15}$th the greatest breadth of the carapace ... ... 55.

55. Inner border of the arm of the larger male cheliped ends in a sharp tooth or spine ... 56.

Arm of the larger male cheliped ends in a constricted lobe, but there is no sharp tooth on its inner border ... ... *Gelasimus dussumieri* p. 510

56. Cutting edge of the thumb of the cheliped with a single, smooth curve ... .. *Gelasimus marionis* p. 509

Cutting edge of the thumb of the cheliped scalloped into two lobes ... ... *Gelasimus marionis nitidus* p. 510

57. Membranous spaces (tympana) on meropodites of legs. Fourth abdominal segment of male fringed with bristles ... ... *Dotilla myctiroides* p. 511

No tympana on legs. Abdomen normal (Macrophthalminae) ... ... 58.

58. Eyestalks projecting beyond the antero-lateral angles of the carapace ... ... *Macrophthalmus sulcatus* p. 513

Eyestalks not projecting beyond the antero-lateral angles of the carapace ... ... 59.

59. Sides of carapace convergent posteriorly ... *Macrophthalmus pectinipes* p. 512

Sides of carapace divergent posteriorly ... *Macrophthalmus pacificus* p. 514

Sides of carapace parallel ... ... 60.

60. Four teeth on the lateral borders of the carapace ... ... *Macrophthalmus latreillei* p. 513

Three teeth on the lateral borders of the carapace ... ... 61.

61. Carapace $\frac{2}{3}$rd as long as broad. Front $\frac{1}{7}$th the breadth of the carapace ... ... *Macrophthalmus depressus* p. 514

Carapace $\frac{3}{4}$ths as long as broad. Front $\frac{1}{4}$th the breadth of the carapace ... ... *Macrophthalmus crinitus* p. 515

62. Antennules fold beneath the front in the usual manner ... ... 63.

Antennules fold longitudinally in deep notches in the front, visible dorsally ... ... *Plagusia depressa tuberculata* p. 523

63. No oblique hairy ridge on the external maxillipeds ... ... 64.

An oblique hairy ridge on the external maxillipeds ... ... 68.

64. A very wide gap between the third maxillipeds, exopodites of these narrow. Male abdomen occupying all the space between the bases of the last legs (Grapsinae) ... ... 65.

A moderate gap between the third maxillipeds, exopodites of these broad. Male abdomen does not occupy the whole space between the bases of the last pair of legs (Varuninae) ... 67.

65. Front less than half the greatest breadth of the carapace ... ... *Grapsus strigosus* p. 515

Front more than half the greatest breadth of the carapace (*Metopograpsus*) ... ... 66.

66. Front not laminar, sinuous. Fine transverse markings on the post-frontal region. Last segment of male abdomen triangular ... *Metopograpsus messor* p. 516

Front straight and laminar. No transverse markings on the post-frontal region. Last segment of male abdomen three-lobed ... *Metopograpsus maculatus* p. 517

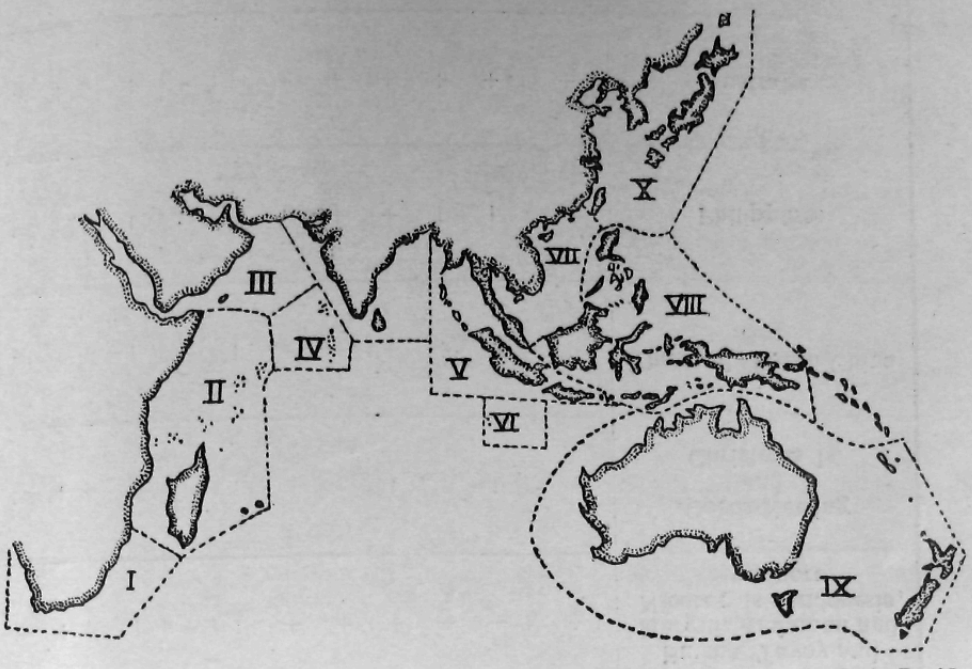
67. Last three joints of legs compressed and plumed for swimming. No fleshy lobe at the base of the fingers of the chelipeds ...	*Varuna litterata*	p. 518
Legs hairy but not compressed. A fleshy lobe at the base of the fingers of the chelipeds ...	*Pseudograpsus intermedius*	p. 519
68. Carapace nearly square. Pterygostomian regions with a sieve-like reticulation (*Sesarma*) ...	69.	
Carapace much broader than long. No reticulation on the pterygostomian regions (*Metaplax*).	70.	
69. No teeth on the lateral borders behind the orbital angles. Two oblique pectinated ridges on the palms of the male chelipeds. Upper surface of the dactylus in the male with a milled ridge of 11–19 lamellae	*Sesarma* (*Sesarma*) *quadrata*	p. 520
One tooth on the lateral borders behind the orbital angles. One pectinated ridge on the palms of the chelipeds. A milled crest with 40-60 teeth on the dactylus of the male ...	*Sesarma* (*Sesarma*) *taeniolata*	p. 521
Two teeth on the lateral borders behind the orbital angles. A granular (not pectinate) ridge on the palms of the chelipeds. Dactylus without any milled ridge	*Sesarma* (*Sesarma*) *oceanica*	p. 520
One tooth on the lateral borders behind the orbital angles. No pectinate crests on the palms of the chelipeds. Posterior borders of the meropodites of the legs serrated near the carpus. Extremely small crabs	*Sesarma* (*Sesarma*) *minuta*	p. 522
70. Third to fifth segments of the male abdomen fused	*Metaplax indica*	p. 522
Male abdomen with seven separate segments ...	*Metaplax distincta*	p. 523

Geographic Distribution of Crabs occurring in the Bombay State, in the Indo-Pacific Region

The foregoing taxonomic account records 81 species and subspecies of crabs from different localities in the Bombay State. Perusal of similar account of crabs from different maritime countries of the Indo-Pacific region indicates that many of these species occur over an extensive range and are common in several areas in the region. Such wide geographic distribution is natural in marine crabs where inter-connecting oceans do not serve as barriers to dispersal except the thermal differences to some extent. It is, therefore, interesting to note what species and percentage of the total Brachyuran fauna of this State occur in other areas of the Indo-Pacific region. These are indicated below in Tables I and II.

The scattered localities where these species occur have been recorded by several authors such as Laurie (1907-1915), Barnard (1950), Borradaile (1902-1903), Estampador (1937), Tweedie (1935-1950), Miers (1876), Haswell (1882), Sakai (1936-1939), Shen (1931-1948), etc., in the Indo-Pacific region. While studying the Brachyuran fauna of the Australian coast, Montgomery had arbitrarily divided this region into several zones.

The same system of dividing regions has been followed here with a few modifications to suit the present study. The zones are as under :—



Text-figure 3. Map showing the different geographical areas in the Indo-Pacific Region with which the Crabs of the Bombay Coast have been compared.

I. South Africa.
II. East Coast of Africa, Madagascar, Mauritius, and Seychelles I.
III. Red Sea, Persian Gulf.
IV. Laccadives and Maldives.
V. Burma, Tavoy and Mergui, the Andaman and Nicobar Is., Indonesia and Singapore.
VI. Cocos-Keeling and Christmas Is.
VII. Thailand, South China Sea.
VIII. Philippines.
IX. Australia (including Torres Straits).
X. Japan, China.

Out of the 81 species and subspecies, three are new to science, and the geographic distribution of the remaining species can be studied from the table. It will be seen that 21 species occurring on the coasts of Bombay State are widely distributed throughout the Indo-Pacific region, ranging from South Africa in the west to Australia in the east. Eight species, though not occurring in South Africa, are found from the east coast of Africa to Australia. Nine species do not occur outside India and appear to be strictly confined to this region. Three species, viz. *Gelasimus annulipes* Latreille, *Plagusia depressa tuberculata* (Lamarck), and possibly *Grapsus strigosus* (Herbst), extend to the west coast of America. The occurrence of these leads us to another problem of distribution. Sewell (1947) states: ' Ocean currents provide a means of transportation for both bottom-dwelling and pelagic animals. Floating weeds and logs of wood

TABLE I

Forms from the coast of Bombay State described in the present paper	South Africa	East coast of Africa, Madagascar, Mauritius, Seychelles I.	Red Sea, Persian Gulf	Laccadives and Maldives	Burma, Tavoy and Mergui, Andaman and Nicobar Is., Indonesia, Singapore	Cocos-Keeling and Christmas Is.	Thailand, South China Sea	Philippines	Australia	Japan, China
Dromia dormia (Linnaeus) ...	−	+	+	+	+	−	−	−	+	+
Pseudodromia integrifrons Henderson ...	−	+	+	−	+	−	+	−	+	+
Calappa lophos (Herbst) ...	−	+	+	−	+	−	+	−	+	+
Matuta lunaris (Forskal) ...	−	+	+	−	+	−	+	+	+	+
Matuta planipes Fabricius...	−	−	−	−	+	−	+	+	+	+
Leucosia pubescens Miers ...	−	−	+	−	+	−	+	−	+	−
Leucosia sima Alcock ...	−	−	+	−	−	−	−	−	−	−
Philyra globosa (Fabricius)...	−	−	−	−	+	−	−	−	+	−
Philyra corallicola Alcock...	−	−	−	−	−	−	−	−	−	−
Arcania septemspinosa (Fabricius)	−	−	+	−	+	−	+	−	−	+
Dorippe astuta Fabricius ...	−	−	−	−	+	−	+	+	+	−

Elamena cristatipes Gravely	−	−	−	−	−	−	−	−	−	−
Menaethius monoceros Latreille	+	+	+	+	+	+	+	+	+	+
Hyastenus planasius (Adams and White)	−	−	−	−	+	−	+	−	−	−
Doclea gracilipes Stimpson...	−	−	−	−	+	−	+	−	−	−
Paramithrax (*Chlorinoides*) *aculeatus* (Milne-Edwards)	−	−	−	−	+	−	+	−	+	−
Schizophrys aspera (Milne-Edwards)	+	+	+	+	+	+	−	−	+	+
Lambrus (*Platylambrus*) *prensor* Herbst ...	−	−	−	−	+	−	−	−	−	−
Cryptopodia angulata Milne-Edwards and Lucas ...	−	−	−	−	−	−	−	−	−	−
Scylla serrata (Forskal)	+	+	+	−	+	−	+	+	+	+
Neptunus (*Neptunus*) *sanguinolentus* (Herbst) ...	+	+	+	−	+	−	+	+	+	+
Neptunus (*Neptunus*) *pelagicus* (Linnaeus) ...	+	+	+	−	+	−	+	+	+	+
Charybdis (*Goniosoma*) *cruciata* (Herbst) ...	+	−	−	−	+	−	+	+	+	+
Charybdis (*Goniosoma*) *lucifera* (Fabricius) ...	−	−	−	−	+	−	+	−	−	+
Charybdis (*Goniosoma*) *annulata* (Fabricius) ...	+	+	−	−	+	−	+	−	−	+

TABLE I—(*Contd.*)

Forms from the coast of Bombay State described in the present paper	South Africa	East coast of Africa, Madagascar, Mauritius, Seychelles I.	Red Sea, Persian Gulf	Laccadives and Maldives	Burma, Tavoy and Mergui, Andaman and Nicobar Is., Indonesia, Singapore	Cocos-Keeling and Christmas Is.	Thailand, South China Sea	Philippines	Australia	Japan, China
Charybdis (*Goniosoma*) *callianassa* (Herbst) ...	−	−	−	−	+	−	+	−	−	−
Charybdis (*Goniosoma*) *orientalis* (Dana)	+	−	+	−	−	−	+	+	−	+
Charybdis (*Goniohellenus*) *hoplites* (Wood-Mason) ...	−	+	−	−	−	−	−	−	−	−
Thalamita crenata Milne-Edwards	+	+	+	−	+	+	+	+	+	+
Thalamita prymna (Herbst)	+	+	+	+	+	−	+	+	+	+
Atergatis integerrimus (Lamarck)	−	+	−	−	+	−	+	+	−	+
Atergatis floridus (Rumph)...	+	+	+	+	+	−	+	+	+	+
Atergatis roseus (Ruppell) ...	+	+	+	−	+	−	−	−	+	−
Platypodia cristata (Milne-Edwards)	−	+	+	+	−	+	−	−	−	−

Xantho (*Lophoxanthus*) *scaberrimus baccalipes* Alcock	–	–	–	–	–	–	–	–	–	–
Leptodius exaratus (Milne-Edwards)	–	+	+	–	+	–	+	+	+	+
Leptodius crassimanus Milne-Edwards	–	–	–	–	+	–	–	–	+	–
Medaeus granulosus (Haswell)	+	–	+	–	+	–	+	–	+	+
Etisus laevimanus Randall	–	+	+	+	+	+	–	+	+	+
Galene bispinosa (Herbst) ...	–	–	–	–	+	–	–	–	–	+
Actaea savignyi (Milne-Edwards)	+	+	+	+	+	–	+	–	+	+
Myomenippe hardwickii (Gray)	–	+	–	–	+	–	+	–	–	–
Ozius rugulosus Stimpson ...	–	–	+	–	+	–	–	–	–	+
Epixanthus frontalis (Milne-Edwards)	–	+	+	–	+	–	+	+	+	+
Pilumnus vespertilio (Fabricius)	–	+	+	–	+	–	–	–	–	–
Pilumnus longicornis Hilgendorf	–	+	–	–	–	–	+	–	–	+
Heteropanope laevis (Dana)	–	–	–	–	–	–	–	–	–	–
Eurycarcinus orientalis (Milne-Edwards) ...	–	–	–	–	+	–	+	–	–	–

TABLE I—(*Contd.*)

Forms from the coast of Bombay State described in the present paper	South Africa	East coast of Africa, Madagascar, Mauritius, Seychelles I.	Red Sea, Persian Gulf	Laccadives and Maldives	Burma, Tavoy and Mergui, Andaman and Nicobar Is., Indonesia, Singapore	Cocos-Keeling and Christmas Is.	Thailand, South China Sea	Philippines	Australia	Japan, China
Eriphia laevimana smithii Macleay	−	+	+	−	+	−	+	−	+	+
Eucrate crenata dentata (Stimpson)	−	−	+	−	−	−	+	−	−	−
Litocheira angustifrons Alcock	−	−	−	+	+	−	−	−	−	−
Litocheira setosa (Milne-Edwards)	−	−	−	−	+	−	+	−	−	−
Pinnotheres placunae Hornell and Southwell ...	−	−	−	−	−	−	−	−	−	−
Ocypoda ceratophthalma (Pallas)	+	+	+	−	+	+	+	+	+	+
Ocypoda cordimana Desmarest	+	+	+	+	+	+	−	+	+	+
Ocypoda rotundata Miers ...	−	−	−	−	−	−	−	−	−	−

Gelasimus annulipes Latreille	+	+	+	–	+	–	+	+	+	+
Gelasimus marionis (Desmarest)	+	+	+	–	+	–	+	+	+	+
Gelasimus marionis nitidus Dana	+	+	+	–	+	–	+	+	+	+
Gelasimus dussumieri Milne-Edwards	–	–	–	–	+	–	+	+	+	–
Dotilla myctiroides (Milne-Edwards)	–	–	–	–	+	–	–	–	–	–
Macrophthalmus pectinipes Guerin	–	–	–	–	+	–	–	–	–	–
Macrophthalmus sulcatus Milne-Edwards ...	+	+	–	–	+	–	–	–	+ ?	–
Macrophthalmus latreillei Desmarest	–	+	–	–	+	–	+	+	+	+
Macrophthalmus depressus Ruppe	–	–	+	–	–	–	–	–	+ ?	–
Macrophthalmus crinitus Rathbun	–	–	–	–	+	–	+	–	–	–
Macrophthalmus pacificus Dana	–	–	–	–	+	–	–	–	+	–
Grapsus strigosus (Herbst) ...	+	+	+	–	+	+	+	+	+	+
Metopograpsus messor (Forskal)	+	+	+	–	+	–	+	+	+	+

TABLE I—(*Contd.*)

Forms from the coast of Bombay State described in the present paper	South Africa	East coast of Africa, Madagascar, Mauritius, Seychelles I.	Red Sea, Persian Gulf	Laccadives and Maldives	Burma, Tavoy and Mergui, Andaman and Nicobar Is., Indonesia, Singapore	Cocos-Keeling and Christmas Is.	Thailand, South China Sea	Philippines	Australia	Japan, China
Metopograpsus maculatus Milne-Edwards ...	−	−	−	−	+	−	−	+	−	−
Varuna litterata (Fabricius)	+	+	−	−	+	−	+	+	+	+
Sesarma (Sesarma) quadrata (Fabricius)	−	+	−	−	+	−	−	+	−	+
Sesarma (Sesarma) oceanica de Man	−	−	−	−	+	−	−	−	−	−
Sesarma (Sesarma) taeniolata White	−	−	−	−	+	−	+	+	−	−
Sesarma (Sesarma) minuta de Man	−	−	−	−	+	−	−	−	−	−
Meiaplax indica Milne-Edwards	−	−	−	−	−	−	−	−	−	−
Metaplax distincta Milne-Edwards	−	−	−	−	+	−	−	−	−	−
Plagusia depressa tuberculata (Lamarck)	+	+	+	+	+	+	+	+	+	+

may be carried along with ocean currents and the forms that cling to them are also taken along with them. Thus weed-clinging littoral forms may be carried away and dispersed widely.' Chilton (1910) has also called attention to the role of the movements of ships in the dispersal of larger Crustacea like crabs and Amphipoda, and remarks: 'Naturally, the Crustaceans that are suitable for dispersal by ships can also be dispersed by floating logs; in that case, however, they would follow the tracks of the prevailing currents.' The accidental transport of these foreign species taken from harbours where foreign ships dock for several weeks cannot have any geographic significance of scientific value.

The homogeneity of the Indo-Pacific Brachyuran fauna has been stressed by Laurie (1915), who states: 'The homogeneity of the Indo-Pacific region is illustrated by the fact that in places so far apart as Seychelles and Hawaii the percentage of crabs common to the Red Sea is very similar, approximately 33% in each case, that this percentage occurs at Ceylon and a fairly similar one at the Maldives and Laccadives. India is below, and Torres Straits distinctly above, this average figure.* His conclusion is that 'the Indo-Pacific figures suggest that one may prophesy with a probable error of $\pm$ 5 or 6 that 35 is the most likely percentage of species common to the Red Sea which will be found in a collection of . . . . . crabs from hitherto unexplored, or insufficiently explored, portion of the Indo-Pacific region.'

The Bombay State crab fauna gives a percentage of 43, which is somewhat high.

It will be noted from the table that the different families of crabs vary considerably in the 'percentage of homogeneity'; this may be noted also in Laurie's table. The Xanthidae, as might be expected, are above the average, and the Portunidae come next. It may be remarked, too, that it is the extremely widespread species which bring the percentage of homogeneity up.

Table II deals with the percentage of homogeneity of the different families of Brachyura as occurring in Bombay State and in India.

Observations on Ecological Adaptations

Observations on the natural habitats of crabs indicate that they are found in a variety of ecological conditions and manifest interesting morphological and physiological adaptations to suit their varying environments. The different tribes and families can be grouped according to the environmental conditions in which they live and to which they respond.

The majority of crabs are marine, but many can tolerate brackish water; others live in entirely fresh water, while a considerable number are amphibious, living partly on land and partly in water. Most of the marine crabs inhabit littoral and shallow water, but many others live at great depths.

The shore crabs display the widest range of variation in their adaptations. Some of the extreme adaptations are almost inexplicable, but most of them are elucidated below in relation to their ecological significance, and the part they play in preserving and perpetuating the species.

* In estimating the significance of these percentages, it should be remembered that some areas having been fairly explored are a good standard; on the other hand, other populations may have been sampled under different conditions.

TABLE II

Tribe/Family	Red Sea species (based on Laurie)	Total Indian species (based on Alcock)	Number common to Red Sea	Percentage common to Red Sea	Total Bombay species (based on the present paper)	Number common to Red Sea	Percentage common to Red Sea
Oxystomata	30	113	17	15	9	5	55
Calappidae	5	15	5	33	3	2	67
Leucosiidae	23	82	10	12	5	3	60
Dorippidae	1	11	1	9	1	0	0
Raninidae	1	5	1	20	...	...	...
Dromiacea	8	29	6	20	2	1	50
Dromiidea	8	21	6	28	2	1	50
Homolodromiidae ...	...	1	0	0	...	...	...
Dromiidae	8	18	6	33	2	1	50
Dynomenidae	...	2	0	0	...	...	...
Homolidea	...	8	0	0	...	...	...
Homolidae	...	6	0	0	...	...	...
Latreillidae	...	2	0	0	...	...	...
Brachygnatha	222	459	117	25	70	28	28
Oxyrhyncha	34	112	18	16	8	2	25
Hymenosomidae ...	1	5	0	0	1	0	0

Maiidae	22	76	13	17	5	2	40
Parthenopidae	11	31	5	16	2	0	0
Brachyrhyncha ...	188	347	99	28	63	26	41
Corystidae	...	1	0	0	...	...	...
Portunidae	35	63	22	34	11	6	54
Potamonidae	...	...	...	...	4	...	...
Atelecyclidae	...	4	0	0	...	...	...
Trichiidae	...	...	...	...	...	...	...
Cancridae	...	...	...	...	...	...	...
Xanthidae	107	147	56	38	19	11	58
Goneplacidae	5	29	3	10	3	1	33
Pinnotheridae	12	11	1	9	1	...	...
Ptenoplacidae	...	1	0	0	...	...	...
Palicidae	2	5	2	40	...	...	...
Grapsidae	11	48	6	12	11	3	30
Gecarcinidae	...	5	0	0	...	...	...
Ocypodidae	15	33	9	27	14	5	36
Hapalocarcinidae ...	1	...	...	...	...	...	...
Total species ...	260	601	140	23	81	35	43

The spider-crabs (Oxyrhyncha) comprise a group by themselves, a majority of them being adapted specially for life amongst weeds, mostly in the inter-tidal zone. They are sluggish and inoffensive and depend for their survival on camouflage. They are curiously coloured and sculptured so as to resemble the patterns of broken shells and eroded rocks among which they live. Their bodies are specially adapted for gathering weeds and small organisms, being provided with knob-like processes, hooks, and spines, on which algae, sponges, worms, etc. can get a hold. Alcock (1901) states: 'Some species purposely attach pieces of seaweed and fragments of shell on their bodies so as to escape notice.' They have long, tapering legs by which they can walk through entangled shore algae or cling tightly to the rocks or algae in which they dwell. They have no other defence and, when removed from their surroundings, quiver their legs helplessly. A typical example is *Paramithrax* (*Chlorinoides*) *aculeatus*.

Most of the Oxystomata are burrowing crabs. They live in sand or mud, some remaining buried till only their eyestalks show above the surface. Their carapace is coloured to blend with the sandy background. The Calappidae have peculiarly modified chelae. When held close to the body, the flattened claws together form a sort of buckler protecting the body (e.g. *Calappa lophos*). The Matutinae have all their legs modified to form paddles by means of which they swim with ease and speed (e.g. *Matuta lunaris*). The Leucosiidae are so coloured and shaped as to resemble pellets of mud so as to escape detection (e.g. *Leucosia pubescens*). Many of the Dorippidae carry about a house of their own by roofing themselves over with a shell, held by the last two pairs of legs (e.g. *Dorippe astuta*).

This peculiar habit is also common to the Dromiacea, or sponge-crabs, in which too the last two pairs of legs are usually adapted for holding a piece of sponge or shell over the body (e.g. *Dromia dormia*). They are primitive crabs, connecting the higher Brachyura with the Macrura.

The Portunidae, or swimming crabs, are pelagic forms, living either in open seas or in creeks or estuaries. They have the last pair of legs modified to form paddles, and they are active creatures. When swimming, they often hold one chela extended, and the other folded in, so that one might mistake them for a fish. They rely for defence on speed, but are also able to use their claws to great effect, and the larger forms are greatly feared by fishermen. They are also coloured slaty blue or grey, which is the general colour of sea-water below the surface [e.g. *Neptunus* (*Neptunus*) *pelagicus*].

The Xanthidae are mostly rock-dwellers, or live in mud under stones. Their carapace, which may be so convex as to be almost subglobular, or flat, is very strongly calcified. They are sluggish forms and, when disturbed, do not scuttle away. Although having powerful chelae, it is surprising that they do not use them. On being handled, they fold up their legs and chelae against the body, a position peculiar to the Xanthidae (e.g. *Ozius rugulosus*).

The Pinnotheridae are a peculiar group of crabs, living as commensals in the body-cavities of bivalves and Holothurians, undergoing degeneration. They are feeble crabs, with soft bodies and tiny eyes. The males may live freely or as commensals (e.g. *Pinnotheres placunae*).

The Ocypodinae are amphibious. They are gregarious and live close to the seashore in burrows, and can breathe air so long as their gill-chambers are moist, but die when forcibly submerged in water for a long

time. They are some of the most intelligent of all the crabs. They are extremely fast and active on land, their speed equalling, if not exceeding, a running man's (e.g. *Ocypoda ceratophthalma*).

The Scopimerinae are soft, feeble crabs, living in colonies, burrowing in mud. They are also called 'soldier-crabs', from their habit of 'marching in formation' (e. g. *Dotilla myctiroides*).

The Macrophthalminae are pelagic or mud-dwellers.

The Grapsidae are rock-dwellers, mostly living on stone embankments. They are vigilant and intelligent creatures and trust to their speed and craft to escape their enemies, it being very difficult to pursue them (e.g. *Grapsus strigosus*). A member of their family, *Eriocheir sinensis*, is important in that its natural distribution is China, but it has colonized in Germany.

The Varuninae make their home on drift timber or drift seaweed, and are well adapted for swimming, this accounting for their wide distribution (e.g. *Varuna litterata*).

The size of the body in crabs is also extremely variable, exhibiting a wide range. In large specimens of *Scylla serrata*, the carapace attains a breadth of 211 mm. (or 8 inches), and the span of the chelipeds measures 810 mm., whereas the other extreme in size is met with in *Sesarma* (*Sesarma*) *minuta*, which has the tiniest carapace, the breadth of which, in the adult, is 3.2 mm.

In some crabs there are sufficiently well-marked 'secondary' sexual characters, e.g. differences in the size and sculpture of the chelipeds of adult males and adult females or immature males (e.g. *Gelasimus annulipes*). Several genera (e.g. *Matuta*, *Ocypoda*, *Metaplax* male) possess organs of stridulation for attracting the opposite sex.

Crabs play an important role in nature's economy in two ways:

(1) They are one of the principal sources of food for numerous fishes (especially sting rays), frogs, crocodiles, swimming and wading birds, jackals, and other carnivorous animals, and last but not least, man.

(2) They are important as scavengers of the seashore, making up in numbers what they lack in size.

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