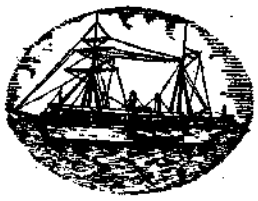
SYMPOSIUM ON CRUSTACEA

PART V



MARINE BIOLOGICAL ASSOCIATION OF INDIA

MARINE FISHERIES P.O., MANDAPAM CAMP

INDIA

PROCEEDINGS

OF THE

SYMPOSIUM ON CRUSTACEA

HELD AT

ERNAKULAM

FROM JANUARY 12 TO 15, 1965

PART V

SYMPOSIUM SERIES 2

MARINE BIOLOGICAL ASSOCIATION OF INDIA

MARINE FISHERIES P.O., MANDAPAM CAMP

INDIA

AN ANNOTATED BIBLIOGRAPHY OF THE BIOLOGY AND FISHERY OF THE EDIBLE CRABS OF INDIA*

P. C. GEORGE** AND P. VEDAVYASA RAO***

Central Marine Fisheries Research Institute, Mandapam Camp, India

ABSTRACT

All available information on the edible crabs of India are brought under this bibliography. The number of species that come under this group is limited. The term "edible" crab includes only those species that are accepted as common food crabs and such that support a fishery of some magnitude at least in some areas of the country. Since great importance is attached at present to the increased exploitation of the Indian crustacean fisheries, a compilation that would give a complete and connected account of the relevant sources of information is considered quite desirable, although the accounts relating to the biology and bionomics are scattered and diffused.

The species dealt with are *Portunus pelagicus* (Linnaeus), *P. sanguinolentus* (Herbst), *Scylla serrata* (Forskal) and the different species of the genera *Charybdis* and *Paratelphusa*.

THE edible crab resources of the Indian region, exploited at present to a limited extent, give scope for further development. Of late, attempt has been made to study the biology and fishery of some of the important species. With the increased research activities envisaged in the overall development of the crustacean fishery of the country, crab fisheries would naturally receive great attention. It is hoped that the compilation of a bibliography mainly on the fishery and biology of the edible crabs of India would be of practical use to workers in this field.

Only those species that support a fishery of some magnitude and are accepted as common food crabs are dealt with in this bibliography. The main species that come under this group are *Portunus pelagicus*, *P. sanguinolentus*, *Charybdis* spp., *Scylla serrata* and *Paratelphusa* spp.

1. ALCOCK, A., 1896–1901. Materials for a carcinological fauna of India. (Nos. 1–6. The Brachyura, Oxyrhyncha, Oxystoma, Cyclometopa, Primigenia or Dromiacea and Catometopa or Grapsoidea). *J. Asiat. Soc. Bengal*, **64**: 157–291; **65**: 134–296; **67**: 67–233; **68**: 1–104; 123–169; **69**: 279–486.
   Detailed description and notes on distribution of crabs given along with exhaustive keys to Indian genera and species.

2. ALI, J. A. 1955. Hunting the land crab *Paratelphusa guerini* (M. Edw.). *J. Bombay Nat. Hist. Soc.*, **52**: 941–945.
   Discusses the harm done to the cultivator and control of the crab.

3. ANONYMOUS 1951. Agricultural marketing in India. Preliminary guide to Indian Fish, Fisheries, methods of fishing and curing. *Marketing Series* No. 66: 1–138.
   Scylla serrata, *Neptunus pelagicus* and *Paratelphusa spinigera* are described. Special notes on fishing methods for crustaceans given.

4. ——— 1950. *The Wealth of India. A Dictionary of Indian Raw Materials and Industrial Products*. Vol. 2. Council of Scientific and Industrial Research, Delhi.

5. ——— 1962. *Ibid.*, Vol. 4. *Fish and Fisheries*. Council of Scientific and Industrial Research, Delhi.
   Important species listed; seasons of fishing in Bombay, Madras, West Bengal and South-west coast of India given.

---

* Published with the permission of the Director, Central Marine Fisheries Research Institute, Mandapam Camp.

** Present Address: C.I.F.E., Kakori Camp. Bombay-58.

*** Present Address; Central Marine Fisheries Research Sub-station, Ernakulam-6, Kerala.

6. ANNANDALE, N. 1907. The fauna of brackish ponds at Port Canning, lower Bengal. Part I. Introductions and preliminary account of the fauna. *Rec. Indian Mus.*, **1**: 35–43.

Varuna is recorded in the neighbourhood of the estuary.

7. BALSS, H. 1935. On three South Indian crabs (Decapoda Brachyura) of the Madras Museum. *Ibid.*, **37**: 45–48.

8. BHATIA, D. R. AND V. NATH 1931. Studies on the origin of yolk. VI. The crustacean oogenesis. *Quart. J. Micr. Sci.*, **74**: 669–699.

The behaviour of golgi elements studied in *Paratelphusa spinigera* and *Palaemon lamarrei* and the results obtained compared.

9. BHATTACHARYA, D. R. 1931. On cytoplasmic inclusions in the oogenesis of *Scylla serrata*. *All. Univ. Studies*, **8** (2): 63–103.

Detailed account of the structure and function of the various cytoplasmic inclusions given and their relation in regard to vitellogenesis discussed.

10. BORRADAILE, L. A. 1902. The faunà and geography of the Maldive and Laccadive Archipelagoes, being the account of the work carried on and of the collections made by an expedition during the years 1899 and 1900 by J. Stanely Gardiner. Marine Crustaceans I. On varieties II. *Portunidae*, Part I, ii : 191–208.

Systematic list of the species of Portunidae, nature of varieties, the relation between varieties and species given.

11. CHACKO, P. I. AND S. THYAGARAJAN 1952. On the development and parental care in the potaminid crab, *Paratelphusa* (*Barytelphusa*) *jacquemontii* (Rathbun). *J. Bombay Nat. Hist. Soc.*, **51** (1): 289–291.

Breeding season, fecundity, structure of the egg, early development and parental care described.

12. —— AND E. PALANI 1955. An unusual crab fishery in the sea off Ennur, near Madras. *Ibid.*, **52** (4): 946–947.

Unusual crab fishery during August 1954 and the gear employed described.

13. CHHAPGAR, B. F., 1957. On the marine crabs (Decapoda Brachyura) of Bombay State. I-II. *Ibid.*, **54**: 399–439; 503–549.

78 species of crabs from the Bombay coast described. A key for their identification provided. Geographical distribution, ecological adaptation and the importance of crabs in the natures economy discussed.

14. CHIDAMBARAM, K. AND R. S. V. RAMAN 1944. Prawn and crab fishery in Madras. *Indian Farming*, **5**: 454–455.

Statistics and nutritive values are given.

15. CHOPRA, B. N. 1931. The history and progress of the Zoological Survey of India. Crustacea Section III. *J. Bombay Nat. Hist. Soc.*, **34** (2): 502–506.

History and progress of the crustacea section of the Zoological Survey of India given.

16. CHOPRA, B. N., 1935. Further notes on Decapoda Crustacea in the Indian Museum. On the Decapoda Crustacea collected by the Bengal Pilot Service off the mouth of the river Hooghly. Brachygnatha (Oxyrhyncha and Brachyrhyncha). *Rec. Indian Mus.*, **37**: 463–514.

17. ——— 1936. The cape crawfish industry of South Africa with some observations on the prawn and crab fisheries of India. *Curr. Sci.*, **4** (7): 529–533.

Cape crawfish industry reviewed. A short account of fisheries in different parts of India given. A few suggestions for further development offered.

18. ——— 1939. Some food prawns and crabs of India and their fisheries. *J. Bombay Nat. Hist. Soc.*, **41** (2): 221–234.

Important food crabs listed; brief information on bionomics, food habits, life-history, fishing methods, medicinal values given; suggestions for future development offered.

19. —— AND K. N. DAS 1937. Further notes on Crustacea Decapoda in the Indian Museum. On three collections of crabs from Tavoy and Mergui Archipelago. *Rec. Indian Mus.*, **39**: 377–434.

Records 57 species with taxonomic notes.

20. —— AND K. K. TIWARI 1947. Decapoda Crustacea of Patna State, Orissa. *Ibid.*, **45**: 213–224.

Paratelphusa (*Barytelphusa*) *jacquemontii* and *P.* (*oziotelphusa*) *hydrodromus* recorded.

21. DAS GUPTA HEM CH. 1924. On the occurrence of *Scylla serrata* Forskal in the upper Tertiary bed of Hathab Bhavanagar (Kathiawar). *J. Asiat. Soc. Bengal, n.s.*, **10**: 239–241.

Fossil remains of *Scylla serrata* and *Neptunus* sp. described.

22. De Man, J. G., 1887. Report on the Podophthalmus Crustacea of Mergui Archipelago collected for the Trustees of the Indian Museum, Calcutta, by Dr. John Anderson, F.R.S., Superintendent of the Museum. *J. Linn. Soc. London (Zool)*, **22** (1-5): 1-212.

Descriptions and figures of many old and new species of Brachyura and a list of Podophthalmus species.

23. ——— 1908-1909. The fauna of brackish ponds at Port Canning, Lower Bengal. Part X. Decapoda Crustacea with an account of small collection from brackish water near Calcutta and in the Dacca District, Eastern Bengal. *Rec. Indian Mus.*, **11**: 211-231.

Taxonomic notes of the crabs collected, and a list of species given.

24. Deshmukh Rekha and P. V. Rangnekar 1965. Some observations on the neurosecretory system of the marine crab, *Scylla serrata* (Forskal). *J. Biol. Sci.*, **8** (1).

25. George, M. J. 1949. Early stages in the development of *Sacculina* sp., parasitic on *Neptunus sanguinolentus* from Madras. *Proc. Indian Acad. Sci.*, **30 B**: 207-214.

Nauplius and cypris larva of the parasite described.

26. ——— 1958. Observations on the plankton of Cochin backwaters. *Indian J. Fish.*, **5** (2): 375-401.

Occurrence of zoea larvae of Brachyura and seasons of occurrence.

27. ——— 1961. On the internal skeleton and musculature of the crab *Neptunus sanguinolentus* (Herbst). *J. Madras Univ.*, **31 B** (3): 217-240.

The endophragmal skeletal system and musculature of the crab described; comparison is made with that of *Cancer pagurus*.

28. ——— 1961. The anatomy of the crab *Neptunus sanguinolentus* (Herbst). Part II. Nervous system and sense organs. *Ibid.*, **31 B** (3): 241-256.

The nervous system and sense organs described.

29. ——— 1961. The anatomy of the crab *Neptunus sanguinolentus* (Herbst). Part III. Respiratory, Excretory and blood vascular system. *Ibid.*, **31 B** (3): 257-273.

Respiratory, excretory and blood vascular system described in detail; comparison made with that of *Cancer pagurus*.

30. George, P. C. and K. Ramesh Nayak 1961. Observations on the crab fishery of Mangalore coast. *Indian J. Fish.*, **8** (1): 44-53.

Important crabs of the region, crab resources, fishery season, fishing methods, breeding, maturity, feeding habits, size composition, fluctuations of crab zoea described.

31. George, A. I., 1943. Preliminary observation of the occurrence of a new species of rhizocephalan on *Neptunus pelagicus* from Madras coast. *Proc. Indian Sci. Congr.*, *30th Sess.*, 58.

32. ——— 1959. *Heterosaccus ruginosus* (Boschma) a rhizocephalan parasite on the crab *Neptunus sanguinolentus* (Herbst). *J. zool. Soc. India*, **11** (2): 171-204.

Life-history of the parasite and the effect of the parasite on the host discussed.

33. Gideon, P. W., P. K. B. Menon, S. R. V. Rao and K. V. Jose 1957. On the marine fauna of Gulf of Kutch: A preliminary Survey. *J. Bombay Nat. Hist. Soc.*, **54** (3): 690-706.

Crabs collected in the surveyed area listed.

41. Kemp, S. 1924. Crustacea Decapoda of the Siju Cave, Garo Hills, Assam. *Rec. Indian Mus.*, **24** (1): 41-48.

Paratelphusa (*Barytelphusa*) *falcidigitis* recorded.

42. Laurie R. Douglas 1906. Report on the pearl oyster fisheries of the Gulf of Mannar. Part V. Report on the Brachyura collected by Prof. Herdman at Ceylon in 1902, 349-432 pp.

43. Mecann, C. 1937. Notes on the common land crab *Paratelphusa* (*Barytelphusa*) *guerinii* of Salsette Island. *J. Bombay Nat. Hist. Soc.*, **39**: 531.

Describes the life-history and habits of the crab.

44. Menon, M. K. 1952. A note on the bionomics and fishery of the swimming crab, *Neptunus sanguinolentus* (Herbst) on the Malabar coast. *J. Zool. Soc. India*, **4** (2): 177-184.

Fishery season, breeding season, rearing experiments, growth, food are described.

45. Miers, E. J. 1884. Report of the zoological collections made in the Indo-Pacific Ocean during the voyage of H.M.S. "Alert", 1881-82. *Crustacea* (*Brachyura*): 178-232.

121 species of Brachyura are enumerated and discussed.

46. MIERS, E. J. 1888. The Brachyura collected by H.M.S. 'Challenger'. *Challenger Rep. Zool.*, **17**: 412 pp.
Systematics, distribution, list of species given.

47. MOSES, S. T. 1924. Crab folklore. *Man in India* (3 & 4): 165–173.
Common beliefs about the crab in Indian region described.

48. MUTHUSWAMY IYER, M. S. 1933. The spermatogenesis of *Paratelphusa hydrodromus* with a note on oogenesis. *J. Mysore Univ.*, **7**: 43–50.

49. NANCY SAMUEL 1945. Some aspects of the morphology of the antennary glands of three decapod crustaceans, *J. Bombay Univ.*, **14** (3): 124–134.

50. NATH, V., 1932. Spermatid and sperm in *Paratelphusa spinigera*. *Quart. J. Micr. Sci.*, **75**: 543–556.
An account of the spermatogenesis with reference to the transformation of spermatid into sperm given.

51. ——— 1938. The decapod sperm. *Proc. Indian Sci. Congr., 25th Sess.*, **3**: 72.
Spermatogenesis of *Paratelphusa* studied.

52. ——— 1941. The decapod sperm. *Trans. Nat. Inst. Sci. India*, **2** (4): 87–119.
Spermatogenesis of 27 Brachyuran species worked out; evolution of the different groups attempted.

53. NIRMAL, H. B. 1964. Neurosecretory cells in the freshwater crab, *Paratelphusa jacquemontii* Rathbun. *J. Biol. Sci.*, **7**: 15–21.

54. PANIKKA N. K., 1937. Brackishwater fauna of Madras. *Proc. Indian Acad. S ci.*, **6 B**: 284.
The fauna of brackishwater of Madras studied; habitat, distribution, breeding, general biology of animal life described.

55. ——— 1951. Physiological aspects of adaptation to estuarine conditions. *Proc. Indo-Pacif. Fish. Counc.*, **3**: 168–175.
Crabs of the family Portunidae referred. Brief account of the adaptations of the animals to various ecological factors of the habitat discussed.

56. —— AND R. G. IYER 1939. Observations on breeding in brackishwater animals of Madras. *Proc. Indian Acad. Sci.*, **B 9** (6): 343–364.
Breeding habits of the brackishwater animals and the different types of breeding discussed.

57. PADMANABHA NAIDU, B. AND R. RAMAMURTHY 1961. The influence of sex and size on the osmotic pressure, the chloride and the free aminoacids of the blood of the freshwater crab, *Paratelphusa* sp. and the freshwater mussel *Lamellidens marginalis*. *J. Exp. Biol.*, **38** (1): 35–41.
The influence of sex, body size on the osmotic pressure, chloride and free aminoacids in the blood of the species were investigated and the results obtained were discussed.

58. PARAMESHWARAN, R. 1955. Neurosecretory cells in *Paratelphusa hydrodromus* (Herbst). *Curr. Sci.*, **24**: 23.
Neurosecretory cells of the thoracic ganglion and the brain, their nature and disposition described.

59. ——— 1956. Neurosecretory cells of the central nervous system of the crab *Paratelphusa hydrodromus*. *Quart. J. Micr. Sci.*, **97**: 75–81.

60. PATWARDHAN, S. S., 1934. On the structure and mechanism of the gastric mill in Decapoda. I. The structure of the gastric mill in *Paratelphusa guerini* (M. Edw.). *Proc. Indian Acad. Sci.*, **1 B**: 183–196.
The gastric mill of the crab, anatomy of the foregut, and *modus operandi* of the gastric mill described.

61. ——— 1934. A comparative account of the gastric mill in Brachyura. *Ibid.*, **1** (7): 359–375.
12 types of decapods belonging to 11 families are studied and the structure of the gastric mill compared.

62. PATIL, A. M. 1951. Study of the marine fauna of the Karwar coast and neighbouring Islands. *J. Bombay Nat. Hist. Soc.*, **50** (1): 128–139.

63. PILLAI, N. K. 1945. The crabs of Travancore with special reference to edible varieties. *Proc. Indian Sci. Congr. Sec.* **10**: 99.
Bionomics and distribution of edible crabs and methods for developing crab fisheries described.

64. ——— 1951. Decapoda (Brachyura) from Travancore. *Bull. Cent. Res. Inst. Univ. of Travancore. Trivandrum, Ser. C*, **2** (1): 1–46.
59 species belonging to the families Maiidae, Calappidae, Leucosidae, Dorrippidae Xanthidae, Potamonidae, Portunidae, Dromiidae, Pinnotheridae, Ocypodidae Hymenosomatidae and Crapsidae are described.

65. PRASAD, R. R. 1954. Observations on the distribution and fluctuation of planktonic larvae off Mandapam. *Proc. Indo-Pacif. Fish. Counc.*, 21–34.

Refers to crab larvae and distribution in the Gulf of Mannar and Palk Bay.

66. —— AND P. R. S. TAMPI 1952. An account of the fishery and fishing methods for *Neptunus pelagicus* (Linnaeus) near Mandapam. *J. zool. Soc. India*, 3 (2): 335–339.

The gear used, description of the gear, mode of operation described.

67. ——— 1953. A contribution to the biology of the blue swimming crab, *Neptunus pelagicus* (Linnaeus) with a note on the zoea of *Thalamita crenata* Latreille. *J. Bombay Nat. Hist. Soc.*, 51: 674–689.

The habits and habitat; segregation according to sex and size; breeding season; early larval stages described. A description of the zoea of *T. crenata* is given.

68. ——— 1954. Some aspects of relative growth in the blue swimming crab, *Neptunus pelagicus* (Linnaeus)' *Proc. Nat. Inst. Sci., India*, 20 B (2): 218–234.

The paper deals with the relative growth in relation to different parts of the body. The data obtained reported and discussed.

69. RAJA BAI NAIDU, K. G. 1955. The early development of *Scylla serrata* (Forskal) and *Neptunus sanguinolentus* (Herbst.). *Indian J. fish.*, 2: 67–76.

The early first zoea and the late zoea of the two species described.

70. RAI, H. S. 1933. The shell fisheries of Bombay Presidency. Part II. *J. Bombay Nat. Hist. Soc.*, 36 (4): 884–897.

Important crabs of Bombay coast, breeding season, fishery season, gears employed and value of yield given.

71. RAMAKRISHNA, G. 1950. Notes on some Indian Potaminid crab (Crustacea Decapoda). *Rec. Indian Mus.*, 48 (2): 89–92.

4 potaminid crabs described.

72. RANGNEKAR, P. V. 1954. A comparative study of the blood volume in the crustaceans *Scylla serrata*, *Panulirus*, *polyphagus* and *Paratelphusa guerini*. *J. Animal Morphol. & Physiol.*, 1 (1): 62–64.

73. ——, P. B. SABNIS AND H. B. NIRMAL 1961. The occurrence of hypoglycernic factor in the eyestalks of freshwater crab, *Paratelphusa jacquemontii* (Rathbun). *J. Animal Morphol. & Physiol.*, 8 (2): 137–144.

The presence of hypoglycernic factor in the eyestalks is experimentally demonstrated. It is suggested that this factor is concerned with maintaining a contact level of blood sugar. Its action is compared with that of insulin on blood sugar concentration in higher vetebrates.

74. RAO, K. P., 1959. Some contributions towards an understanding of metabolism of freshwater poikilotherms. *Bull. zool. Soc. India*, 3: 6–8.

75. ——— 1963. Metabolism of tropical poikilotherms with special reference to temperature acclimatisation. Recent advances in Zoology in India. *Proc. of the first Summer School of Zoology (Simla, 1961) of Govt. of India*, 311–317.

The results of the study of some poikilotherms to understand the temperature acclimation in tropical poikilotherm given and discussed.

76. —— AND R. RAMACHANDRA 1961. Effects of acclimatisation to high temperature on the blood chloride, free aminoacids and osmotic pressure in the freshwater field crab *Paratelphusa* sp. and the freshwater mussel *Lamellidens marginalis*. *J. Exp. Biol. Cambridge*, 38 : 29–34.

Experiments conducted on acclimatisation of the freshwater crab and mussel to high temperature reported and the results discussed.

77. —— AND V. VENKATA REDDY 1961. Compensation to high temperature in the loss and active absorption of chloride in the freshwater field crab *Paratelphusa* sp. *Comp. Biochem. Physiol.*

78. —— AND G. MADANAMOHAN RAO 1963. Chloride regulation and its relation to oxygen consumption in the brackishwater crab *Sesarma plicatum* (Laterille) *Crustaceana*, 5 (3): 188–192.

Reports the changes in oxygen consumption to chloride gradient from blood to medium and the results discussed.

79. REDDY, A. R., 1935. On the *modus operandi* of certain ossicles in the gastric armature of Decapod crustacean. *Curr. Sci.*, 4: 34–37.

80. ——— 1934. The gastric armature of some South Indian Decapod Crustacea. *J. Annam. Univ.*, 4 (1).

81. REDDY, A.R., 1935. On the structure and mechanism and development of the gastric armature in Stomatopoda with a discussion as to its evolution in Decapoda. *Proc. Indian Sci. Congr.*, **1** (10): 650.

The structure of gastric armature in *Squilla nepa* given and the trend of evolution of gastric armature in decapods traced.

82. ———— 1937. The physiology of digestion and absorption in the crab *Paratelphusa* (*Oziotelphusa*) *hydrodromus* (Herbst). *Proc. Indian Acad. Sci.*, **6**: B 170–192.

General description and histology of alimentary canal, structure of gastric armature, the *modus operandus* of gastric armature, the passage of food through the digestive tract, specificity of digestive enzymes, nature of absorption and food reserves are described.

83. SANKARANKUTTY, C. 1961. On Decapoda Brachyura from Andaman and Nicobar Islands. I. Families *Portunidae, Ocypodidae, Grapsidae* and *Mictryidae*. *J. Mar. biol. Ass., India*, **3**: 101–119.

30 species belonging to *Portunidae, Ocypodidae, Grapsidae* and *Mictrydae* are described.

84. ———— 1961. On some crabs (Decapoda Brachyura) from the Laccadive Archipelago. *J. Mar. biol. Ass. India*, **3**: 120–136.

36 species belonging to *Portunidae, Grapsidae, Ocypodidae, Xanthidae, Maiidae, Parthenopidae* and *Calappidae* are described.

85. SAROJINI, S. 1961. The androgenic organ in some Indian Crustacea. I. *J. zool. Soc. India*, **13** (2): 188–193.

The androgenic organ of 8 crabs described in relation to its shape, size and position. The gland differs in its morphology in different species.

86. VASUDEO, R. B. AND H. G. KEWALRAMANI 1960. Transport of common crab (*Scylla serrata*) in living condition. *Indian J. Fish.*, **7** (1): 169–173.

Experiments done for packing live crabs explained; the results and the observations are reported; commercial possibility recommended.

87. VELANKAR, N. K. AND K. MAHADEVA IYER 1961. On the qualitative description of aminoacids in different species of prawns. *J. Sci. & Indust. Res. India*, **20** C (2): 64–65.

The free aminoacids present in the muscle of *Neptunus pelagicus* studied and the results reported.

88. WOOD-MASON, J. 1871. Contribution to the Indian Carcinology. Part I. On Indian and Malayan *Telphusidae*. *J. Asiat. Soc. Bengal*, **11** (2): 189–207; 449–454.

Indian Telphusidae reviewed; describes 2 species of *Paratelphusa* and 7 *Thelphusa*.

SUPPLEMENT

89. AGRAWAL, V. P. AND A. P. TYAGI 1967. Respiratory behaviour of *Paratelphusa masoniana*, under different conditions. *Proceedings of the Symposium on Crustacea*, Marine Biological Association of India, 1965, Part III.

The respiratory behaviour of the crab in relation to variations in temperature, light intenstity and size of the animal studied.

90. ——, —— AND S. K. SHARMA 1967. Physiology of digestion of *Potamon martensi* Wood Mason. *Ibid.*, 1965, Part III.

The food and the physiological studies on the determination of pH and the qualitative estimation of enzymes in different parts of the gut of the crab described.

91. ——, —— AND K. A. GOEL 1967. Pharmacology of the heart of the freshwater crab *Potamon martensi* Wood Mason. *Ibid.*, 1965, Part III.

The effect of a few sedative medicines on the heart of the crab studied.

92. ALCOCK, A. AND A. R. S. ANDERSON 1894. Natural history notes from H.M. Indian Marine Survey Ship "Investigator". Ser. II, No. 17. List of shore and shallow water Brachyura collected during the season 1893–1894. *J. Asiat. Soc. Bengal*, **63** (5): 197–209.

93. GEORGE, M. J., 1963. The anatomy of the crab *Neptunus sanguinolentus* Herbst. Part IV. Reproductive system and embryological studies. *J. Madras Univ.*, **33** B (3): 289–304.

The male and female reproductive organs of the crab and the embryonic development during the three days before hatching described.

94. ———— (in Press). The anatomy of the crab *Portunus sanguinolentus* (Herbst). Part V. Digestive system. *J. Madras Univ.*

95. GEORGE, M. J. (in Press). The effect of salinity changes on weight and respiratory rate of the crab *Portunus sanguinolentus* (Herbst). *Crustaceana.*

Experiments conducted have shown that an increase of weight and oxygen consumption of the animal after it is transferred to dilute medium and the maximum is reached by the end of first hour, and then declines to almost to initial weight and respiratoty movements, within 4 to 6 hours. The initial increase in weight is due to the influx of water from the hypotonic medium. In the hypertonic medium the respiratory movements are irregular and intermittent.

96. ——— 1967. Mark recovery experiments in Crustaceans. *Proceedings of Symposium on Crustacea,* Marine Biological Association of India, 1965, Part IV: 1284–95.

The various methods used in marking studies, and the movements elucidated so far described.

97. HASHMI, S. S. 1965. Crabs of West Pakistan. *Symposium on Crustacea. Mar. biol. Ass. India,* p. 67.

The present status of the crab fisheries in West Pakistan described. Edible crabs—*Neptunus pelagicus, N. sanguinolentus, Scylla serrata* and *Charybdis cruciata* listed.

98. KRISHNAMURTHY, K., T. N. C. RAMAPRASAD AND T. VENKATESWARLU 1967. Free aminoacids in the blood of *Ocypoda paltytarsis* and *Scylla serrata. Proceedings of the Symposium on Crustacea,* Marine Biological Association of India, 1965, Part III.

The distribution of free aminoacid in the blood of the two crabs studied, and the differences noted.

99. NOBLE, A. 1964. Abnormality in the portunid crab, *Neptunus* (*Neptunus*) *sanguinolentus* Herbst. *J. Mar. biol. Ass., India,* 6(2): 312–313.

An abnormality in the left chela in having two additional thumbs reported.

100. SANKARANKUTTY, C. 1966. On Decapoda Brachyura from the Gulf of Mannar and Palk Bay. *Proceedings of the Symposium on Crustacea,* Marine Biological Association of India, 1965, Part I: 347–362.

86 species collected from the Gulf of Mannar and Palk Bay described with a brief outline on the species of Brachyura associated with the various habitats of the area.

101. KRISHNASWAMY, S. 1967. Reproductive and nutritional cycles in a few invertebrates from the east coast of India. *International India Ocean Expedition,* Newsletter, 4(4): 18.

Based on the systematic study of the gonad and hepatic index, it has been shown that on the basis of their breeding behaviour *Portunus pelagicus* are continuous breeders.

102. PATEL, B. S., Y. M. BHATT, T. M. KRISHNAMOORTHY, G. R. DOSHI, P. M. A. BHATTATHIRI, C. K. UNNI AND R. VISWANATHAN 1966. Uptake of radionuclides by some marine shellfish of commercial importance. *Ibid.,* 4(2), 20–21.

Experiments were conducted on the uptake, accumulation and loss of radionuclides by two species of bivalves, and a crab *Scylla serrata* (Forskal). The concentration factor for cesium-137 in this crab was sex-dependant, the female crab concentrating the maximum amount. The hepatopancreas showed the maximum concentration of cesium-137. Equilibrium was reached in about 9–10 days of exposure.

103. RAJABAI, K. G., 1961. Studies on the oxygen consumption in tropical poikilotherms. VI. Effect of starvation on the oxygen consumption of the freshwater field crab, *Paratelphusa* sp. *Proc. Ind. Acad. Sci.,* 54 B(6): 276–280.

The effect of starvation on the oxygen consumption at the habitat temperature has been described in detail.

104. ——— 1963. Studies on the oxygen consumption in tropical poikilotherms. VII. Effect of starvation on the temperature response of metabolism in the freshwater crab, *Paratelphusa* sp. *Ibid.,* 58(4): 207–214.

Starvation stress is reflected in changes in thermal response but differences in oxygen consumption are not pronounced. On the first day of the experiment the Q_{10} values decrease with increasing weight but increase with increasing temperature at all temperatures studied. On the 14th and 21st day of starvation Q_{10} values increase with increasing body weight between 25 and 30° C. but between 30 and 35° C. decrease with size. The *b* values on the 14th day of starvation are intermediate between surface area dependence and weight dependence at all temperatures and surface area dependent on the 21st day at all temperatures.

SUBJECT INDEX

(The numbers refer to the serial numbers of references in the annotated bibliography.)