

Diversity Study on Echinoderms in Mu Ko Man, Rayong Province, Eastern Coast of Thailand

Arom Mucharin^{*1}, Samroeng Yaikla², Wanchai Sukkasem¹ and Bang-on Changlom¹

*1 Natural History Museum, National Science Museum, Thailand,
Technopolis, Khlong 5, Khlong Luang, Pathum Thani 12120 Thailand*

2 Eastern Marine and Coastal Resources Research Center, Kram, Klaeng, Rayong 21190 Thailand

ABSTRACT: The echinoderms of Mu Ko Man, Rayong Province, located in the Eastern Coast of Thailand were intensively studied from specimens collected from sandy beaches, rocky beaches and coral reefs at 13 sites, namely: Ko Mannai (3 sites), Ko Manklang (3 sites), Ko Mannok (4 sites), Hin Toihoui (1 site) and Hin Farang (2 sites) from December 2006 to June 2008. The echinoderms found were classified into 5 classes, 12 orders, 19 families, 24 genera and 36 species. The most abundant Echinoderms in this area are: *Lamprometra palmate*, *Diadema setosum*, *Brissus latercarinatus*, *Holothuria (Metensiothuria) leucospilota*, and *Holothuria (Stauropora) fuscocinerea*. Only one species, namely *Holothuria (Metriatyla) scabra*, is important to Thais commercially.

KEY WORDS: Echinoderm, Mu Ko Man, Rayong Province, Eastern Coast of Thailand.

INTRODUCTION

The Phylum Echinodermata is widely distributed. They are common intertidally and also abundant at great depths. Almost all forms are benthic as adults (Morrissey & Sumich, 2008). Echinoderms include animals commonly known as feather stars and sealilies (Crinoidea); starfish or sea stars (Asteroidea); brittle and basket stars (Ophiuroidea); sea urchins, sand dollars and heart urchins (Echinoidea); and sea cucumbers (Holothuroidea). Their phylum contains about 7,000 living species and approximately 13,000 species are known from a rich fossil records dating back to the early Cambrian era (Brusca & Brusca, 2003). Mu Ko Man is a group of 3 offshore islets in Rayong Province, namely: Ko Man Nai, Ko Man Klang and Ko Man Nok, including Hin Farang and Hin Toi Houi. At present, Ko Man Nai is under the responsibility of the Eastern Marine and

Coastal Resources Research Centre (EMCOR), the Department of Marine and Coastal Resources for use as a sea turtle breeding and research station (Mucharin & Sukkasem, 2008).

Former literature reporting on the Echinoderms in the Eastern Coast of Thailand was first conducted in the reign of King Rama V by the Dane, Dr. Th. Mortensen. He surveyed and collected sea animals in the Gulf of Thailand and reported four new sea urchins in the Gulf of Siam, namely: *Chaetodiadema granulatum*, *Pleurechinus dodderleini*, *Pleurechinus siamensis* and *Gymnechinus pulchellus* (Mortensen, 1904). Waiyanida (1984) took note of twelve species of starfish from Ao Pattaya and Mu Ko Phai, Chon Buri Province. Rodma (1996) reported fifty-nine echinoderms from Chon Buri and Rayong Provinces. Putchakarn (1998) provided information on fifty-six echinoderms from the eastern

*Corresponding author:
E-mail: arom@nsm.or.th

coast of Thailand. Mucharin (1998) wrote of seventeen species of sea cucumbers from Mu Ko Lan and Mu Ko Phai, Chon Buri Province. Putchakarn *et al.* (2000) provided details of thirteen species of sea cucumbers (Aspidochoirida) from Mu Ko Lan and Mu Ko Phai, Chon Buri Province. Mucharin and Putchakarn (2005) added to the known species with a new record of holothurian in Thailand i.e. *Holothuria (Stauropora) discrepans* Semper, 1868. Mucharin, *et al.* (2005) gave an account of thirty-four species of sea cucumbers from the eastern coast of Thailand. Mucharin (2008) added to the known species with the first record of *Cladolabes hamatus* (Sluiter, 1914) from the South China Sea. Mucharin and Sukkasem (2008) added the occurrence of *Holothuria (Metriatyla) scabra* Jaeger, 1833 at Mu Ko Man, Rayong Province, Eastern Coast of Thailand. Lastly, the Eastern Marine and Coastal Resources Research Centre (2008)

reported twenty nine echinoderms from the Mu Ko Man, Rayong Province.

The objectives of this study are to investigate the diversity and distribution pattern of Echinoderms on sandy beaches, rocky beaches and the coral reefs of Mu Ko Man, Rayong Province, the Eastern Coast of Thailand to serve as a baseline and update data for the diversity and distribution of marine fauna in the Gulf of Thailand.

MATERIALS AND METHODS

Survey and collection sites

The echinoderm specimens collected from December 2006 to June 2008 on sandy beaches, rocky beaches and coral reefs, covering 13 sites are shown in Table 1 and Figure 1.

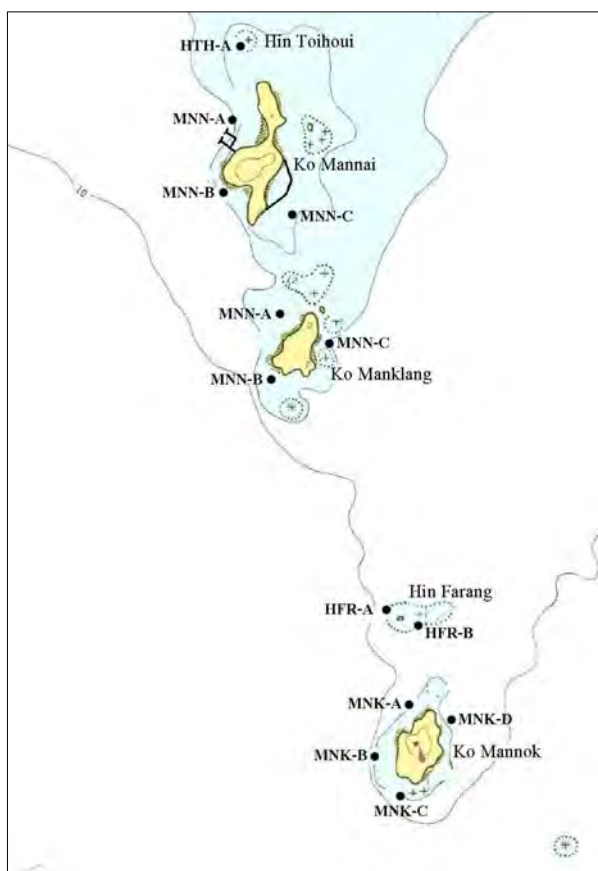


Figure 1. Specimen collection sites along Mu Ko Man, Rayong Province.

Collection, fixing and preserving

The field surveys were conducted at 13 sites in Mu Ko Man (as shown in Figure 1). The echinoderm specimens were collected by scuba diving during the daytime and random sampling throughout the coral reefs. Specimens were photographed *in situ* and kept in zipped plastic bags with some sea water. Field notes were recorded on some characteristics, host species (brittle stars) and essential ecological aspects such as colours, depth, and substrates, then specimens were sedated before preservation in 70% alcohol. The specimens obtained were deposited in the collection of the Natural History Museum, National Science Museum, Thailand, Khlong Luang, Pathum Thani, Thailand.

Laboratory Work

The feather stars, sea stars, brittle stars and sea urchins were specifically identified, mainly on their morphological characteristics using a light microscope. The sea cucumbers, they were identified mainly on the basis of internal spicules, morphological characters and classified by

their form and number of tentacles, distribution of tube feet and papillae, colour, shape, length of body, calcareous ring and presence or absence of Cuvierian tubules. For spicule examination, thin sections of the dorsal and ventral body walls, tentacle and tube feet were saturated in chlorine, dissolving the tissues and leaving the calcareous spicules intact. These were then washed three times with distilled water, dried on a hotplate, and finally mounted in permount, and examined under 100-400x magnification. The samples were then examined under the microscope and photographs were taken.

The echinoderm taxonomic scheme used in this paper follows that of Clark and Rowe (1971).

RESULTS

There were 527 specimens collected. They comprised 36 species of Echinoderms from five classes, 12 orders, 19 families and 24 genera. Their respective distribution among the collection sites is shown in Table 2.

TAXONOMIC ACCOUNT

Phylum Echinodermata Jacob Klein, 1734

Class Crinoidea Miller, 1821

Order Comatulida A.H. Clark, 1908

Family Mariametridae A.H. Clark, 1909

1. *Lamprometra palmata* J.Müller, 1841

Class Asteroidea de Blainville, 1830

Order Paxillosida Perrier, 1884

Family Luidiidae Verrill, 1899

2. *Luidia maculata* Müller & Troschel, 1842

Family Astropectinidae Gray, 1840

3. *Astropecten ployacanthus* Müller & Troschel, 1842

Order Valvatida Perrier, 1884

Family Oreasteridae Fisher, 1911

4. *Culcita novaeguineae* Müller & Troschel, 1842

Class Ophiuroidea Gray, 1840

Order Ophiurida Müller & Troschel, 1840

Family Amphiuridae Ljungman, 1867

5. *Amphilycus scripta* (Koehler, 1904)

Family Ophiactidae Matsumoto, 1915

6. *Ophiactis savignyi* (Müller & Troschel, 1842)

Family Ophiotrichidae Ljungman, 1866

7. *Macrophiothrix aspidota* (Müller & Troschel, 1842)8. *Macrophiothrix callizona* H.L. Clark, 19389. *Macrophiothrix longipeda* (Lamarck, 1816)10. *Macrophiothrix lorioli* A.M. Clark, 196811. *Macrophiothrix variabilis* (Duncan, 1887)12. *Ophiothela danae* Verrill, 186913. *Ophiothrix (Ophiothrix) exigua* Lyman, 1874

Family Ophionereididae Ljungman, 1867

14. *Ophionereis dubia* (Müller & Troschel, 1842)

Family Ophiidermatidae Ljungman, 1867

15. *Ophiarachnella gorgonia* (Müller & Troschel, 1842)16. *Ophiarachnella infernalis* (Müller & Troschel, 1842)

Class Echinoidea Leske, 1778

Order Diadematoidea Duncan, 1889

Family Diademataidae Gray, 1855

17. *Diadema setosum* (Leske, 1778)18. *Echinothrix calamaris* (Pallas, 1774)

Order Temnopleuroidea Mortensen, 1942

Family Temnopleuridae A. Agassiz, 1872

19. *Salmaciella dussumieri* (L. Agassiz, 1846)20. *Salmacis sphaeroides* (Linnaeus, 1758)

Order Echinoida Claus, 1876

Family Toxopneustidae Troschel, 1872

21. *Toxopneustes pileolus* (Lamarck, 1816)

Order Clypeasteroidea A. Agassiz, 1872

Family Astrictypeidae Stefanin, 1911

22. *Echinodiscus auritus* Leske, 1778

Order Spatangoida Claus, 1876

Family Loveniidae Lambert, 1905

23. *Lovenia elongata* (Gray, 1845)

Family Brissidae Gray, 1855

24. *Brissus latecarinatus* (Leske, 1778)25. *Metalia sternalis* Lamarck, 1816

Class Holothuroidea de Blainville, 1834

Order Aspidochirotida Grube, 1840

Family Holothuriidae Ludwig, 1884

26. *Holothuria (Halodeima) atra* Jaeger, 183327. *Holothuria (Lessonothuria) verrucosa* Selenka, 186728. *Holothuria (Metensiothuria) leucospilota* Brandt, 183529. *Holothuria (Metriatyla) scabra* Jaeger, 183330. *Holothuria (Semperothuria) flavomaculata* Semper, 1868

31. *Holothuria (Stauropora) fuscocinerea* Jaeger, 1868
 32. *Holothuria (Thymiosycia) impatiens* Forskål, 1775
 Family Stichopodidae Haeckel, 1886
 33. *Stichopus horrens* Selenka, 1867
 Order Dendrochirotida Grube, 1840
 Family Cucumariidae Ludwig, 1894
 34. *Colochirus quadrangularis* Troschel, 1846
 Order Apodida Brandt, 1835
 Family Synaptidae Burmeister, 1837
 35. *Synaptula recta* (Semper, 1868)
 36. *Synaptula* sp.

CONCLUSION

All five collecting trips were made to Mu Ko Man, Rayong Province (December 2006, February 2007, June 2007, February 2008, June 2008). From sandy beaches, rocky beaches and coral reefs at 13 sites, 527 specimens were classified into 5 classes, 12 orders, 19 families, 24 genera and 36 species. Many species are common in the Gulf of Thailand, namely: *Lamprometra palmata*, *Diadema setosum*, *Brissus latecarinatus*, *Holothuria (Metensiothuria) leucospilota*, *Holothuria (Stauropora) fuscocinerea*.

There were twenty-one species found on coral reefs in the area including *Lamprometra palmata*, *Anthenea chinensis*, *Amphilycus scripta*, *Ophiactis savignyi*, *Macrophiothrix variabilis*, *Ophiothela danae*, *Ophiothrix (Ophiothrix) exigua*, *Ophionereis dubia*, *Diadema setosum*, *Echinothrix calamaris*, *Holothuria (Halodeima) atra*, *H. (Lessonothuria) verrucosa*, *H. (Metensiothuria) leucospilota*, *H. (Metriatyla) scabra*, *H. (Semperothuria) flavomaculata*, *H. (Stauropora) fuscocinerea*, *H. (Thymiosycia) impatiens*, *Stichopus horrens*, *Colochirus quadrangularis*, *Synaptula recta* and *Synaptula* sp. Eight of these species found in coral reef area associate with the other living organism such as the Gorgonian Brittle Star *Ophiothela danae*, Sand Dollar Brittle Star *Amphilycus scripta*, Sponge brittle Star *Ophiactis savignyi*,

Macrophiothrix variabilis, *Ophiothrix (Ophiothrix) exigua*, and *Ophionereis dubia* that live inside the exhalent pores of sponges; moreover, the sea cucumbers *Synaptula recta* and *Synaptula* sp. infest the surface of sponges to feed on the sediment.

Fifteen species are found in the sandy areas including six species feeding on the sand, namely: *Luidia maculata*, *Astropecten polyacanthus*, *Salmaciella dussumieri*, *Salmacis sphaeroides*, *Toxopneustes pileolus* and *Echinodiscus auritus* and nine species were concealed under the sand, namely: *Macrophiothrix aspidota*, *Macrophiothrix callizona*, *Macrophiothrix longipeda*, *Macrophiothrix lorioli*, *Ophiarachnella gorgonia*, *Ophiarachnella infernalis*, *Lovenia elongata*, *Brissus latecarinatus* and *Metalia sternalis*.

Some echinoderms associated with other living organisms, such as the Gorgonian Brittle Star, *Ophiothela danae*, are common in of the Gulf of Thailand. The brittle stars, *Ophiactis savignyi*, *Ophiothrix (Ophiothrix) exigua* and *Ophionereis dubia* live inside the exhalent pores of sponges, while the sea cucumbers, *Synaptula recta* and *Synaptula* sp. infest the surface of sponges. These echinoderms use associated sponges for different purposes. The brittle stars use sponges as a host for shelter and feed on suspended particles in the water current made by the



Lamprometra palmata J.Müller, 1841



Luidia maculata Müller & Troschel, 1842



Astropecten polyacanthus Müller & Troschel, 1842



Culcita novaeguineae Müller & Troschel, 1842

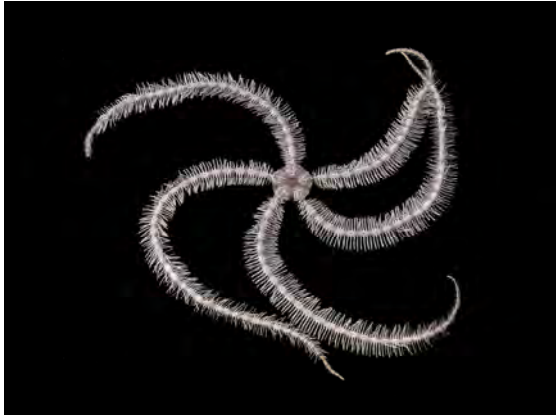


Amphilycus scripta (Koehler, 1904)



Ophiactis savignyi (Müller & Troschel, 1842)

Plate I. Echinoderms found from Mo Ko Man, Rayong Province.



Macrophiothrix aspidota (Müller & Troschel, 1842)



Macrophiothrix callizona H.L. Clark, 1938



Macrophiothrix longipeda (Lamarck, 1816)



Macrophiothrix lorioli A.M. Clark, 1968



Macrophiothrix variabilis (Duncan, 1887)



Ophiothela danae Verrill, 1869

Plate II. Echinoderms found from Mo Ko Man, Rayong Province.



Ophiothrix (Ophiothrix) exigua Lyman, 1874



Ophionereis dubia (Müller & Troschel, 1842)



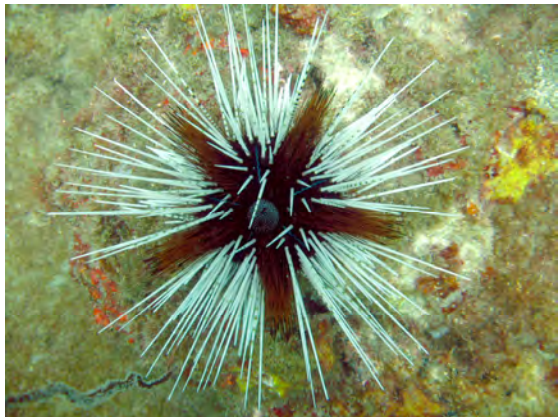
Ophiarachnella gorgonia (Müller & Troschel, 1842)



Ophiarachnella infernalis (Müller & Troschel, 1842)



Diadema setosum (Leske, 1778)



Echinothrix calamaris (Pallas, 1774)

Plate III. Echinoderms found from Mo Ko Man, Rayong Province.



Salmaciella dussumieri (L. Agassiz, 1846)



Salmacis sphaeroides (Linnaeus, 1758)



Toxopneustes pileolus (Lamarck, 1816)



Echinodiscus auritus Leske, 1778



Lovenia elongata (Gray, 1845)



Brissus latecarinatus (Leske, 1778)

Plate IV. Echinoderms found from Mo Ko Man, Rayong Province.



Metalia sternalis Lamarck, 1816



Holothuria (Halodeima) atra Jaeger, 1833



H. (Lessonothuria) verrucosa Selenka, 1867



H. (Metensiothuria) leucospilota Brandt, 1835

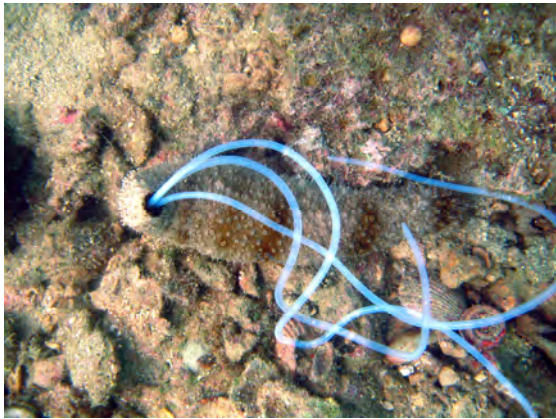


H. (Metriatyla) scabra Jaeger, 1833



H. (Semperothuria) flavomaculata Semper, 1868

Plate V. Echinoderms found from Mo Ko Man, Rayong Province.



H. (Stauropora) fuscocinerea Jaeger, 1868



H. (Thymiosycia) impatiens Forskål, 1775



Stichopus horrens Selenka, 1867



Colochirus quadrangularis Troschel, 1846



Synaptula recta (Sempler, 1868)



Synaptula sp.

Plate VI. Echinoderms found from Mo Ko Man, Rayong Province

ACKNOWLEDGEMENTS

This work was kindly supported by the National Science Museum (NSM) and Department of Marine and Coastal

Resources (DMCR). We express our gratitude to Dr. Sumaitt Putchakarn and Mr. Michael Cota for his kindness in providing useful comments on the manuscript.

REFERENCES

- Brusca R.C. and G.J. Brusca, 2003. *Invertebrates*. Sinauer Associates, Inc., Publishers, Sunderland. 936 pp.
- Clark, A.M. and F.W.E. Rowe, 1971. *Monograph of shallow-water Indo-West Pacific echinoderms*. British Museum (Natural History), London. 238 pp.
- Eastern Marine and Coastal Resources Research Center. 2008. *The Biodiversity of Mu Ko Man Handbook*. National Buddhist Officer Publishers, Bangkok. 170 pp. (in Thai).
- Mortensen, T. 1904. The Danish Expedition to Siam, 1899-1900. II. Echinoidea. *K danske Vidensk Selsk Skr.* (7)1(I), 124 pp.
- Mucharin, A. 2008. First Record of *Cladolabes hamatus* (Sluiter, 1914) (Echinodermata: Holothuroidea: Dendrochirotida) from the South China Sea. *The Thailand Natural History Museum Journal*. 3(1): 17-24.
- Mucharin, A and S. Putchakarn. 2005. New Thai Record : *Holothuria (Stauropora) discrepans* Semper, 1868. *The Thailand Natural History Museum Journal*. 1(1): 1-8.
- Mucharin, A., S. Putchakarn and P. Sonchaeng. 2005. Holothurians (Holothuroidea : Echinodermata) of the Eastern Coast of Thailand. Resources (DMCR). We express our gratitude to Dr. Sumaitt Putchakarn and Mr. Michael Cota for his kindness in providing useful comments on the manuscript.
- The Thailand Natural History Museum Journal*. 1(2): 97-136.
- Mucharin, A., and W. Sukkasem. 2008. Occurrence of *Holothuria (Metriatyla) scabra* Jaeger, 1833. *The Thailand Natural History Museum Journal*. 3(1): 65-67.
- Putchakarn, S. 1998. Taxonomic study on echinoderms from the eastern coast of Thailand. Report submitted to the National Research Council Thailand. 109 pp. (in Thai).
- Putchakarn, S., A. Mucharin and P. Sonchaeng. 2000. Coral reef aspidochirotes (Holothuroidea, Echinodermata) from Lan and Phai Islands, Chonburi Province, Gulf of Thailand. Paper for oral presentation in The 38th Kasetsart University Annual Conference. February 1-4, 2000. 8 pp. (in Thai).
- Putchakarn, S. and P. Sonchaeng. 2004. Echinoderm Fauna of Thailand: History and Inventory Reviews. *Science Asia*. 30: 417-428.
- Rodma, P. 1996. Echinoderms from Chonburi and Rayong provinces. Special problem in biological science, Faculty of Science, Burapha University. 60 pp.(in Thai).
- Waiyaniya, W. 1984. Starfishes from Ao Pattaya and Ko Chang, Chonburi Province. *Technical paper of Marine Fisheries Research Station 26/2*, Marine Fisheries Division, Department of Fisheries. 16 pp. (in Thai).