

Review

Not peer-reviewed version

Ecology and Biodiversity of Sea Cucumbers (Holothuroidea de Blainville, 1834) in India and Its Checklist

[Karthika Padmini](#) , [Ameen Ummath](#) , [Atikulla Shaikh](#) , [Balu Alagar Venmathi Maran](#) *

Posted Date: 20 October 2025

doi: 10.20944/preprints202510.1223.v1

Keywords: India; Andaman; sea cucumber; Holothuroidea; East Coast; West Coast; checklist; Lakshadweep



Preprints.org is a free multidisciplinary platform providing preprint service that is dedicated to making early versions of research outputs permanently available and citable. Preprints posted at Preprints.org appear in Web of Science, Crossref, Google Scholar, Scilit, Europe PMC.

Copyright: This open access article is published under a Creative Commons CC BY 4.0 license, which permit the free download, distribution, and reuse, provided that the author and preprint are cited in any reuse.

Disclaimer/Publisher's Note: The statements, opinions, and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions, or products referred to in the content.

Article

Ecology and Biodiversity of Sea Cucumbers (Holothuroidea de Blainville, 1834) in India and Its Checklist

Karthika Padmini ^{1,2}, Ameen Ummath ², Atikulla Shaikh ^{2,3} and Balu Alagar Venmathi Maran ^{1,*}

¹ Graduate School of Integrated Science and Technology, Nagasaki University, 1-14 Bunkyo-machi, Nagasaki 852-8521, Japan

² Department of Ocean Studies and Marine Biology, Pondicherry University, Port Blair, Off campus, Andaman and Nicobar Islands, India, 744112

³ CSIR National Institute of Oceanography, Regional centre- Mumbai, Maharashtra, India 400053

* Correspondence: bavmaran@nagasaki-u.ac.jp

Abstract

Holothuroids play a vital role in nutrient cycling and bioturbation to enhance the marine ecosystem. They enhance the biodiversity for various symbiotic marine organisms by providing essential shelter and spawning grounds. This review focuses on the Class Holothuroidea de Blainville, 1834 (Phylum Echinodermata) in Indian waters, encompassing a total of 187 species organized into 7 orders and 21 families. Notably, the order Holothuriida Miller, Kerr, Paulay, Reich, Wilson, Carvajal & Rouse, 2017, represents the largest proportion of species, accounting for 26.73%. These species are well-distributed across India, with the Andaman and Nicobar Islands exhibiting the highest level of species richness (109 species), followed by the East Coast (102 species), Lakshadweep (39 species), and the West Coast (34 species). Species diversity was assessed using the Shannon-Weiner diversity index. Results indicate that the Andaman and Nicobar Islands ($H' = 2.23$) and the West Coast ($H' = 2.14$) demonstrate the highest levels of diversity. This review provides a comprehensive and precise inventory of all Holothuroidea species reported in Indian waters. A checklist is provided to facilitate understanding of the reported species, their systematics, and distribution.

Keywords: India; Andaman; sea cucumber; Holothuroidea; East Coast; West Coast; checklist; Lakshadweep

1. Introduction

Sea cucumbers (Echinodermata, Holothuroidea), comprising approximately 1,800 species, inhabit oceans worldwide, thriving in environments ranging from shallow intertidal zones to the ocean's depths [1,2,3]. A large-scale investigation into echinoderm taxonomy began in the 19th century, utilizing samples collected from expeditions such as Valdivia, Siboga, Challenger, and Albatross, among others [4]. Koehler & Vaney made notable collections of Holothuroidea de Blainville, 1834 in the years 1905 and 1908 [4]. Several noteworthy contributions to the current understanding of Indian holothurian biodiversity have been made by [5], [6,7], [8], and [9]. These contributions include the documentation of distribution patterns, the identification of taxonomic errors, and the description of new species.

On the other hand, holothurians are extensively used in the food industry, particularly in Asian countries, where they are traditionally processed into beche-de-mer or trepang [10]. Moreover, their bodies are rich in various bioactive compounds such as phenols, collagen, amino acids, saponins, and chondroitin sulfate, making them valuable in both the cosmetic and pharmaceutical sectors [11,12]. Due to their commercial significance, sea cucumbers have faced excessive exploitation over the years,

leading to declines in their populations as a result of overharvesting, illegal trade, and poaching [13]. Consequently, the Government of India has listed all holothurians under Schedule 1 of the Indian Wildlife Protection Act of 1972 to safeguard their populations [13].

This review aims to identify any previously undocumented species in Indian reports, thereby enriching our understanding of regional biodiversity. The review also addresses nomenclatural criteria, evaluates the extent of taxonomic inflation, and updates the checklist of Holothuroidea from India. It encompasses information on the ecology, biodiversity, in particular distribution, and abundance, making it a valuable resource for researchers and conservationists engaged in marine biodiversity studies.

2. Materials and Methods

Records detailing the distribution and abundance of holothurians in India were collected from a variety of sources, including websites, checklists, testimonials, articles, and other available resources. For each reported species, scientific names were verified using the WoRMS database. All corrected names were subsequently updated, resulting in the creation of a new checklist. Statistical analyses were conducted using Primer software and Excel spreadsheets. The author meticulously reviewed scientific publications from 1887 to 2024 to ensure the accuracy and currency of the checklist. The checklist reflects significant updates on nomen dubium, unaccepted names, synonyms, and other critical taxonomic terms following [3]. To interpret the diversity, dominance, and similarity, the authors organized the data by different regions, including the West Coast, East Coast, Andaman and Nicobar Islands, and Lakshadweep (Figure1).

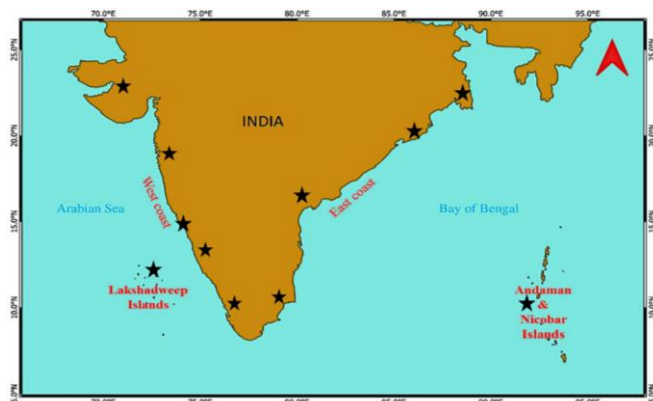


Figure 1. Map showing the Location of the West Coast, the East Coast, the Andaman and Nicobar Islands, and the Lakshadweep.

3. Results

3.1. Diversity

The prevalence of sea cucumbers along the coastlines of the Indian Exclusive Economic Zone (EEZ) is noteworthy, attributed to the diverse habitats that support their thriving populations. An updated checklist reveals that a total of 187 species have been identified in Indian waters through previous research, encompassing 7 orders and 21 families.

The Andaman and Nicobar Islands exhibit the highest number of species, totaling 109, attributed to their remarkable biodiversity (Table 1). Figure 2 and Figure 3 display images of the cucumber photographed from the South Coast of Andaman.

Table 1. Updated checklist of the Class Holothuroidea de Blainville, 1834 from the Andaman & Nicobar Islands.

Sl. No	Species	Order: Family	Distribution	Reference
1	<i>Polycheira rufescens</i> (Brandt, 1835)	Apodida Brandt, 1835: Chiridotidae Östergren, 1898	Andaman & Nicobar	[6,7,8,14]

2	<i>Psammothuria ganapati</i> (Rao, 1968)		Andaman & Nicobar	[14]
3	<i>Taeniogyrus havelockensis</i> (Rao, 1975)		Andaman & Nicobar	[14,15]
4	<i>Leptosynapta</i> sp.		Andaman & Nicobar	[14]
5	<i>Labidoplax</i> sp		Andaman & Nicobar	[16]
6	<i>Opheodesoma grisea</i> (Semper, 1867)		Andaman & Nicobar	[6,7, 8,14,17,18]
7	<i>Patinapta ooplax</i> (von Marenzeller, 1882)		Andaman & Nicobar	[6, 14,19]
8	<i>Protankyra errata</i> (Koehler &Vaney, 1905)		Andaman & Nicobar	[8,14]
9	<i>Protankyra pseudodigitata</i> (Semper, 1867)		Andaman & Nicobar	[14,20]
10	<i>Rynkatorpa timida</i> (Koehler &Vaney, 1905)		Andaman & Nicobar	[14]
11	<i>Synapta maculata</i> (Chamisso and Eysenhardt, 1821)		Andaman & Nicobar	[6,8,14,17,21]
12	<i>Synaptula recta</i> (Semper, 1867)		Andaman & Nicobar	[8]
13	<i>Actinocucumis typica</i> (Ludwig, 1875)	Dendrochirotida Grube, 1840: Cucumariidae Ludwig, 1894	Andaman & Nicobar	[22]
14	<i>Aslia forbesi</i> (Bell, 1886)		Andaman & Nicobar	[14]
15	<i>Leptopentacta bacilliformis</i> (Koehler &Vaney, 1908)		Andaman & Nicobar	[8,14]
16	<i>Pseudocnus alcocki</i> (Koehler &Vaney, 1908)		Andaman & Nicobar	[8]
17	<i>Pseudocolochirus violaceus</i> (Theel, 1886)		Andaman & Nicobar	[23]
18	<i>Psolidium rugosum</i> (Koehler &Vaney, 1905)	Dendrochirotida Grube, 1840: Psolidae Burmeister, 1837	Andaman & Nicobar	[16]
19	<i>Psolus mannarensis</i> James, 1984		Andaman & Nicobar	[16]
20	<i>Phyrella fragilis</i> (Mitsukuri & Ohshima in Ohshima, 1912)		Andaman & Nicobar	[14,16,24,25]
21	<i>Phyllophorus</i> (<i>Phyllothuria</i>) <i>celer</i> (koehler&Vaney, 1908)		Andaman & Nicobar	[14,16]

22	<i>Phyllophorella spiculata</i> (Chang, 1935)		Andaman & Nicobar	[14,21]
23	<i>Thyone dura</i> (Koehler and Vaney, 1908)		Andaman & Nicobar	[14,16]
24	<i>Afrocucumis africana</i> (Semper, 1867)	Dendrochirotida Grube, 1840: Sclerodactylidae Panning, 1949	Andaman & Nicobar	[14,16,24]
25	<i>Cladolabes aciculus</i> (Semper, 1867)		Andaman & Nicobar	[8,14,16]
26	<i>Ohshimella ehrenbergii</i> (Selenka, 1868)		Andaman & Nicobar	[14,22]
27	<i>Ypsilothuria bitentaculata</i> (Ludwing, 1893)	Dendrochirotida Grube, 1840: Yasilothuriidae Heding, 1942	Andaman & Nicobar	[8,14]
28	<i>Apodogaster alcocki</i> (Walsh, 1891)	ElasipodidaThéel, 1882: Laetmogonidae Ekman, 1926	Andaman & Nicobar	[8,14]
29	<i>Enypniastes eximia</i> (Théel, 1882)	ElasipodidaThéel, 1882: Pelagothuriidae Ludwig, 1893	Andaman & Nicobar	[8,14]
30	<i>Benthodytes sanguinolenta</i> (Théel, 1882)	ElasipodidaThéel, 1882: Psychropotidae Théel, 1882	Andaman & Nicobar	[8]
31	<i>Enypniastes eximia</i> (Théel, 1882)	Elasipodida Théel, 1882: Pelagothuriidae Ludwig, 1893	Andaman & Nicobar	[8,14]
32	<i>Benthodytes sanguinolenta</i> (Théel, 1882)		Andaman & Nicobar	[8]
33	<i>Benthodytes typica</i> (Théel, 1882)	Elasipodida Théel, 1882: Psychropotidae Théel, 1882	Andaman & Nicobar	[8,14]
34	<i>Actinopyga echinities</i> (Jaeger, 1833)	Holothuriida Miller, Kerr, Paulay, Reich, Wilson, Carvajal & Rouse, 2017 :Holothuriidae Burmeister, 1837	Andaman & Nicobar	[5,8,,14,21,27]
35	<i>Actinopyga lecanora</i> (Jaeger, 1833)		Andaman & Nicobar	[8,14,21]
36	<i>Actinopyga mauritiana</i> (Quoy&Gaimard, 1834)		Andaman & Nicobar	[5,8,14,21,27]
37	<i>Actinopyga miliaris</i> (Quoy&Gaimard, 1834)		Andaman & Nicobar	[8,14,21,23,27]
38	<i>Actinopygas erratidens</i> (Pearson, 1903)		Andaman & Nicobar	[7]

39	<i>Bohadschia atra</i> (Massin, Rasolofonirina, Conand & Samyn, 1999)		Andaman & Nicobar	[28]
40	<i>Bohadschia argus</i> (Jaeger, 1833)		Andaman & Nicobar	[14,26]
41	<i>Bohadschia marmorata</i> (Jaeger, 1833)		Andaman & Nicobar	[5,8,21]
42	<i>Bohadschia vitiensis</i> (Semper, 1868)		Andaman & Nicobar	[5,14]
43	<i>Holothuria (Acanthotrabeza) coluber</i> (Semper, 1868)		Andaman & Nicobar	[14,21]
44	<i>Holothuria (Acanthotrabeza) pyxis</i> (Selenka, 1867)		Andaman & Nicobar	[8,14,17,21,29]
45	<i>Holothuria (Cystipus) inhamilis</i> (Selenka, 1867)		Andaman & Nicobar	[8,14,17]
46	<i>Holothuria (Cystipus) rigida</i> (Selenka, 1867)		Andaman & Nicobar	[8,14,16,29]
47	<i>Holothuria (Halodeima) atra</i> (Jaeger, 1833)		Andaman & Nicobar	[8,21,23,30]
48	<i>Holothuria (Halodeima) edulis</i> (Lesson, 1830)		Andaman & Nicobar	[8,21,23,28]
49	<i>Holothuria (Lessonothuria) pardalis</i> (Selenka, 1867)		Andaman & Nicobar	[8,17]
50	<i>Holothuria (Mertensiothuria) hilla</i> (Lesson, 1830)		Andaman & Nicobar	[8,17,21,28]
51	<i>Holothuria (Mertensiothuria) leucospilota</i> (Brandt, 1835)		Andaman & Nicobar	[8,17,20,21,23]
52	<i>Holothuria (Metriatyla) albiventer</i> (Semper, 1868)		Andaman & Nicobar	[14,16]
53	<i>Holothuria (Metriatyla) scabra</i> (Jaeger, 1833)		Andaman & Nicobar	[21]
54	<i>Holothuria (Microthele) nobilis</i> (Selenka, 1867)		Andaman & Nicobar	[14,29]
55	<i>Holothuria (Platyperona) difficilis</i> (Semper, 1868)		Andaman & Nicobar	[8,9,14]
56	<i>Holothuria (Selenkothuria) erinacea</i> (Semper, 1868)		Andaman & Nicobar	[8,14,16,28]
57	<i>Holothuria (Selenkothuria) glaberrima</i> (Selenka, 1867)		Andaman & Nicobar	[8]

58	<i>Holothuria</i> (<i>Selenkothuria</i>) <i>lubrica</i> (Selenka, 1867)		Andaman & Nicobar	[20,28]
59	<i>Holothuria</i> (<i>Selenkothuria</i>) <i>moebii</i> (Brandt, 1883)		Andaman & Nicobar	[14]
60	<i>Holothuria</i> (<i>Semperothuria</i>) <i>cinerascens</i> (Brandt, 1835)		Andaman & Nicobar	[5,8]
61	<i>Holothuria</i> (<i>Stauropora</i>) <i>fuscocinerea</i> (Jaeger, 1833)		Andaman & Nicobar	[14,21,28]
62	<i>Holothuria</i> (<i>Stauropora</i>) <i>modesta</i> (Ludwig, 1875)		Andaman & Nicobar	[8,14,16]
63	<i>Holothuria</i> (<i>Stauropora</i>) <i>pervicax</i> (Selenka, 1867)		andaman & Nicobar	[14,28]
64	<i>Holothuria</i> (<i>Theelothuria</i>) <i>cadelli</i> (Bell, 1887)		Andaman & Nicobar	[31]
65	<i>Holothuria</i> (<i>Theelothuria</i>) <i>spinifera</i> (Théel, 1886)		Andaman & Nicobar	[32]
66	<i>Holothuria</i> (<i>Thymiosycia</i>) <i>arenicola</i> (Semper, 1868)		Andaman & Nicobar	[8,17]
67	<i>Holothuria</i> (<i>Thymiosycia</i>) <i>gracilis</i> (Semper 1868)		Andaman & Nicobar	[14,16,33]
68	<i>Holothuria</i> (<i>Thymiosycia</i>) <i>impatiens</i> (Forskål, 1775)		Andaman & Nicobar	[8,9,17,21,28]
69	<i>Holothuria</i> (<i>Thymiosycia</i>) <i>remollescens</i> (Lampert, 1885)		Andaman & Nicobar	[8,14,16,34]
70	<i>Labidodemas rugosum</i> (Ludwig, 1875)		Andaman & Nicobar	[5,7,8,9,14,16,35]
71	<i>Labidodemas semperianum</i> (Selenka, 1867)		Andaman & Nicobar	[8,14,16]
72	<i>Pearsonothuria graeffei</i> (Semper, 1868)		Andaman & Nicobar	[14,21,36]
73	<i>Acaudina molpadioides</i> (Semper, 1867)	Molpadida Haeckel, 1896 :Caudindae Heding, 1931	Andaman & Nicobar	[8,37]
74	<i>Paracaudina australis</i> (Semper, 1868)		Andaman & Nicobar	[8,14]
75	<i>Eupyrgus scaber</i> (Lütken, 1857)	Molpadida Haeckel, 1896 :Eupyrgidae Semper, 1867	Andaman & Nicobar	[14]
76	<i>Molpadia andamanensis</i> (Walsh, 1891)	Molpadida Haeckel, 1896 : Molpadiidae Müller, 1850	Andaman & Nicobar	[8,14]
77	<i>Molpadia brevicaudata</i> (Koehler & Vaney, 1905)		Andaman & Nicobar	[8,14]

78	<i>Molpadia elongata</i> (Koehler & Vaney, 1905)		Andaman & Nicobar	[8,14]
79	<i>Molpadia musculus</i> (Risso, 1826)		Andaman & Nicobar	[8]
80	<i>Molpadia undulata</i> (Koehler & Vaney, 1905)		Andaman & Nicobar	[8]
81	<i>Apostichopus japonicus</i> (Selenka, 1867)	Synallactida Miller, Kerr, Paulay, Reich, Wilson, Carvajal & Rouse, 2017: Stichopodidae Haeckel, 1896	Andaman & Nicobar	[14,16]
82	<i>Stichopus chloronatus</i> (Brandt, 1835)		Andaman & Nicobar	[8,30]
83	<i>Stichopus hermanni</i> (Semper, 1868)		Andaman & Nicobar	[30]
84	<i>Stichopus horrens</i> (Selenka, 1867)		Andaman & Nicobar	[8,20,21]
85	<i>Stichopus vastus</i> (Sluiter, 1887)		Andaman & Nicobar	[14,16,21]
86	<i>Thelenota ananas</i> (Jaeger, 1833)		Andaman & Nicobar	[1621,30]
87	<i>Deima validumvalidum</i> (Théel, 1879)	Synallactida Miller, Kerr, Paulay, Reich, Wilson, Carvajal & Rouse, 2017 :DeimatidaeThéel , 1882	Andaman & Nicobar	[8,14]
88	<i>Orphnurgus glaber</i> (Walsh, 1891)		Andaman & Nicobar	[8,14]
89	<i>Allopatides dendroides</i> (Koehler & Vaney, 1905)	Synallactida Miller, Kerr, Paulay, Reich, Wilson, Carvajal & Rouse, 2017: Synallactidae Ludwig, 1894	Andaman & Nicobar	[8,14,16,34]
90	<i>Amphigymnas woodmasoni</i> (Walsh, 1891)		Andaman & Nicobar	[8,14,16]
91	<i>Bathyplorescinctus</i> (Koehler & Vaney, 1910)		Andaman & Nicobar	[8,14,16]
92	<i>Bathyplores crenulatus</i> (Koehler & Vaney, 1905)		Andaman & Nicobar	[8,14,16]
93	<i>Bathyplores natans</i> (M. Sars, 1868)		Andaman & Nicobar	[16]
94	<i>Bathyplores variabilis</i> (Koehler & Vaney, 1905)		Andaman & Nicobar	[16]

95	<i>Paelopatides dissidens</i> (Koehler & Vaney, 1910)		Andaman & Nicobar	[8,14,16,34]
96	<i>Paelopatides gelatinosus</i> (Walsh, 1891)		Andaman & Nicobar	[8,14,16]
97	<i>Paelopatides incerta</i> (Koehler & Vaney, 1905)		Andaman & Nicobar	[16]
98	<i>Paelopatides insignis</i> (Koehler & Vaney, 1905)		Andaman & Nicobar	[16]
99	<i>Paelopatides modestus</i> (Koehler & Vaney, 1905)		Andaman & Nicobar	[8,14,16,34]
100	<i>Paelopatides mollis</i> (Koehler & Vaney, 1905)		Andaman & Nicobar	[8,14,16]
101	<i>Paelopatides ovalis</i> (Walsh, 1891)		Andaman & Nicobar	[8,14,16]
102	<i>Paelopatides verrucosus</i> (Koehler & Vaney, 1905)		Andaman & Nicobar	[14,16]
103	<i>Synallactes horridus</i> (Koehler & Vaney, 1905)		Andaman & Nicobar	[14,16]
104	<i>Synallactes profundus</i> (Koehler & Vaney, 1905)		Andaman & Nicobar	[8,14,16]
105	<i>Synallactes rigidus</i> (Koehler & Vaney, 1905)		Andaman & Nicobar	[14,16]
106	<i>Pseudostichopus elegans</i> (Koehler & Vaney, 1905)	Persiculida Miller, Kerr, Paulay, Reich, Wilson, Carvajal & Rouse, 2017: Pseudostichopodidae Miller, Kerr, Paulay, Reich, Wilson, Carvajal & Rouse, 2017	Andaman & Nicobar	[8,14]
107	<i>Pseudostichopus occultatus</i> Marenzeller Von, 1893		Andaman & Nicobar	[8,14]
108	<i>Benthothuria cristata</i> (Koehler & Vaney, 1905)		Andaman & Nicobar	[8,14,16]
109	<i>Benthothuria distorta</i> (Koehler & Vaney, 1905)		Andaman & Nicobar	[16]



Figure 2. Sea Cucumber along the south coast of the Andaman (a) *Holothuria (Halodeima) atra* Jaeger,1833, (b) *Stichopus chloronotus* Brandt,1835, (c) *Actinopyga mauritiana* Quoy & Gaimard, 1834, (d) *Holothuria (Mertensiothuria) hilla* Lesson, 1830, (e) *Holothuria (Halodeima) edulis* Lesson,1830, (f) *Labiodemas semperianum* Selenka, 1867, (g) *Holothuria (Mertensiothuria) leucospilota* Brandt, 1835, (h) *Holothuria (Lessonothuria) pardalis* Selenka,1867,(i) *Holothuria (Thymiosycia) impatiens* Forsskal,1775.

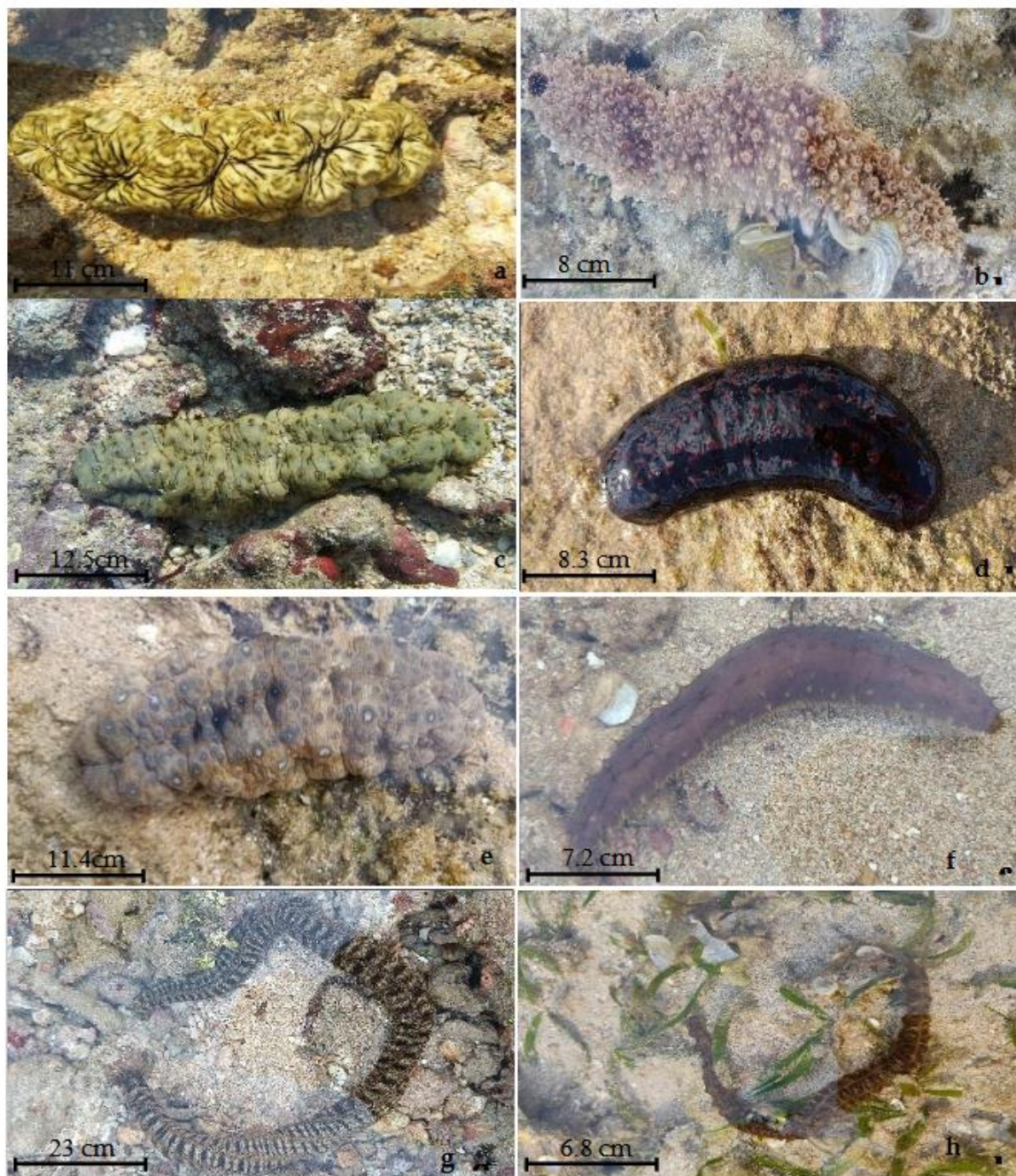


Figure 3. (a) *Stichopus vastus* Sluiter, 1887, (b) *Holothuria (Stauropora) pervicax* Selenka, 1867, (c) *Stichopus herrmani* semper, 1868, (d) *Bohadschia atra* Massin, Rasolofonirina, Conand & Samyn, 1999, (e) *Stichopus horrens* Selenka, 1867, (f) *Holothuria (Semperothuria) flavomaculata* Semper, 1868, (g) *Synapta maculata* Chamisso & Eysenhardt, (h) *Opheodesoma grisea* Semper, 1867.

The East Coast ranks as the second richest marine biodiversity region, harboring approximately 102 species (Table 2). A significant concentration of these species has been recorded in the Gulf of Mannar area.

Table 2. Updated checklist of the Class Holothuroidea de Blainville, 1834 from the East Coast.

Sl. No	Species	Order:Family	Distribution	Reference
--------	---------	--------------	--------------	-----------

1	<i>Polycheira rufescens</i> (Brandt, 1835)	Apodida Brandt, 1835: Chiridotidae Östergren, 1898	Gulf of Mannar	[5,37,38,39]
2	<i>Psammothuria ganapati</i> (Rao, 1968)		Andra Pradesh	[22]
3	<i>Anapta gracilis</i> (Semper, 1867)	Apodida Brandt, 1835: Synaptidae Burmeister, 1837	Andra Pradesh	[6,7,22]
4	<i>Labidoplax</i> sp.		Bay of Bengal	[6]
5	<i>Opheodesoma grisea</i> (Semper, 1867)		Gulf of Mannar	[38,39]
6	<i>Protankyra assymetrica</i> (Ludwig, 1875)		Gulf of Mannar	[37]
7	<i>Protankyra conferta</i> Koehler & Vaney, 1905		Andra Pradesh	[22]
8	<i>Protankyra denticulata</i> (Koehler & Vaney, 1905)		Andra Pradesh	[22]
9	<i>Protankyra inflexa</i> (Koehler & Vaney, 1905)		Andra Pradesh	[22]
			Bay of Bengal	[22]
10	<i>Protankyra pseudodigitata</i> (Semper, 1867)		Gulf of Mannar	[32,39]
11	<i>Protankyra similis</i> (Semper, 1867)		West Bengal	[6]
			Andra Pradesh	[22]
12	<i>Protankyra tristis</i> (Koehler & Vaney, 1905)		Andra Pradesh	[22]
13	<i>Protankyra tuticorenensis</i> (James, 1832)		Gulf of Mannar	[6,7]
14	<i>Synapta maculata</i> (Chamisso and Eysenhardt, 1821)		Gulf of Mannar	[20,37,38,39]
15	<i>Synaptula media</i> (Cherbonnier and Feral, 1985)		Gulf of Mannar	[23]
16	<i>Synaptula recta</i> (Semper, 1867)		Gulf of Mannar	[5,6,7,9,37,38,39]
			Bay of Bengal	[8]
17	<i>Synaptula varians</i> (Nair, 1946)		Gulf of Mannar	[6,20]
18	<i>Actinocucumis typica</i> (Ludwig, 1875)	Dendrochirotida Grube, 1840 :Cucumariida e Ludwig, 1894	Gulf of Mannar	[24,17,20,32,39]
			Andra Pradesh	[22]
19	<i>Aslia forbesi</i> (Bell, 1886)		Gulf of Mannar	[38]
20	<i>Colochirus cylindricus</i> (Semper, 1867)		Gulf of Mannar	[39]

21	<i>Colochirus quadrangularis</i> (Troschel, 1846)		Gulf of Mannar	[5,20,24,37]
22	<i>Leptopentacta imbricata</i> (Semper, 1867)		Gulf of Mannar	[20,38,39]
			Orissa	[20,22]
			Andra Pradesh	[22]
23	<i>Plesiocolochirus armatus</i> (Marenzeller von, 1881)		Gulf of Mannar	[38,39]
24	<i>Pseudocnus echinatus</i> (von Marenzeller, 1881)		Andra Pradesh	[22]
			Orissa	[22]
25	<i>Pseudocolochirus violaceus</i> (Theel, 1886)		Gulf of Mannar	[5, 24, 32, 20, 39, 37, 23]
			Orissa	[20, 22]
			Andra Pradesh	[22]
			Bay of Bengal	[24]
26	<i>Staurothyone rosacea</i> (Semper, 1869)		Gulf of Mannar	[39]
27	<i>Roweia frauenfeldi</i> (Ludwig, 1882)		Gulf of Mannar	[20]
28	<i>Psolidium complanatum</i> (Semper, 1867)	Dendrochirotida Grube, 1840: Psolidae Burmeister, 1837	Gulf of Mannar	[20, 39]
29	<i>Psolus mannarensis</i> (James, 1984)		Gulf of Mannar	[16, 37]
30	<i>Hemithyone semperi</i> (Bell, 1884)	Dendrochirotida Grube, 1840: Phyllophoridae Östergren, 1907	Bay of Bengal	[24]
			Gulf of Mannar	[5, 24,32,20]
31	<i>Phyllophorus brocki</i> (Ludwig, 1888)		Gulf of Mannar	[39, 37]
32	<i>Phyllophorus dubia</i> (Bedford, 1899)		Andra Pradesh	[16]
33	<i>Phyllophorus(Phyllothuria) cebuensis</i> (Semper, 1867)		Gulf of Mannar	[16, 39]
34	<i>Phyllophorella perforata</i> (Clark, 1932)		Gulf of Mannar	[20]
35	<i>Phyllophorella spiculata</i> (Chang, 1935)		Gulf of Mannar	[5, 24, 39, 37]
36	<i>Stolus buccalis</i> (Stimpson, 1855)		Gulf of Mannar	[38, 5, 24,32, 20, 41 39, 37]
			Andra Pradesh	[22]
37	<i>Stolus conjungens</i> (Semper, 1867)		Gulf of Mannar	[39, 37]
38	<i>Pseudostolus rapax</i> (Koehler & Vaney, 1908)		West Bengal	[16]
39	<i>Thorsonia investigatoris</i> (Koehler & Vaney, 1908)		West Bengal	[16]
40	<i>Thyone fusca</i> (Pearson, 1903)		Gulf of Mannar	[39]

41	<i>Thyone papuensis</i> (Theel, 1886)		Gulf of Mannar	[20, 39]
42	<i>Afrocucumis africana</i> (Semper, 1867)	Dendrochirotida Grube, 1840: Sclerodactylidae Panning, 1949	Gulf of Mannar	[38, 5, 37]
43	<i>Havelockia ardens</i> (Koehler & Vaney, 1908)		Orissa	[16, 22]
44	<i>Havelockia versicolor</i> (Semper, 1867)		Gulf of Mannar	[20,24,32, 39, 37,40,42]
45	<i>Ohshimella ehrenbergii</i> (Selenka, 1868)		Andra Pradesh	[22]
			Gulf of Mannar	[39]
46	<i>Mitsukuriella inflexa</i> (Koehler & Vaney, 1908)	Dendrochirotida Grube, 1840: Vaneyellidae Pawson & Fell, 1965	Orissa	[22]
47	<i>Actinopyga echinites</i> (Jaeger, 1833)			[26,38, 39]
48	<i>Actinopyga varians</i> (Selenka, 1867)	Holothuriida Miller, Kerr, Paulay, Reich, Wilson, Carvajal & Rouse, 2017 :Holothuriida e Burmeister, 1837	Gulf of Mannar	[38]
49	<i>Actinopyga echinites</i> (Jaeger, 1833)		Gulf of Mannar	[38, 26, 39]
50	<i>Actinopyga lecanora</i> (Jaeger, 1833)		Gulf of Mannar	[38, 39]
51	<i>Actinopyga mauritiana</i> (Quoy&Gaimard, 1834)		Gulf of Mannar	[38, 26, 39, 42]
52	<i>Actinopyga miliaris</i> (Quoy&Gaimard, 1834)		Gulf of Mannar	[38, 26, 39, 37, 23]
53	<i>Actinopyga serratidens</i> (Pearson, 1903)		Gulf of Mannar	[39]
54	<i>Bohadschia argus</i> (Jaeger, 1833)		Gulf of Mannar	[38, 5, 26, 39]
55	<i>Bohadschia marmorata</i> (Jaeger, 1833)		Gulf of Mannar	[38, 8, 20, 39]
			Bay of Bengal	[8]
56	<i>Bohadschia ocellata</i> (Jaeger, 1833)		Gulf of Mannar	[20, 39]
57	<i>Bohadschia vitiensis</i> (Semper, 1868)		Gulf of Mannar	[20, 39]
58	<i>Holothuria (Acanthotrabeza) pyxis</i> (Selenka, 1867)		Gulf of Mannar	[38]
			Bay of Bengal	[8, 16]

59	<i>Holothuria (Cystipus) rigida</i> (Selenka, 1867)		Gulf of Mannar	[20, 16]
60	<i>Holothuria (Halodeima) atra</i> (Jaeger, 1833)		Gulf of Mannar	[38, 5, 32, 8, 20, 39, 30, 37, 23]
61	<i>Holothuria (Halodeima) edulis</i> (Lesson, 1830)		Gulf of Mannar	[38, 5, 32, 20, 28, 39, 37, 23]
62	<i>Holothuria (Lessonothuria) pardalis</i> (Selenka, 1867)		Gulf of Mannar	[38, 5, 32, 20, 39, 37]
63	<i>Holothuria (Lessonothuria) verrucosa</i> (Selenka, 1867)		Gulf of Mannar	[38]
64	<i>Holothuria (Mertensiothuria) hilla</i> (Lesson, 1830)		Gulf of Mannar	[5, 20, 32, 28, 39, 37]
65	<i>Holothuria (Mertensiothuria) leucospilota</i> (Brandt, 1835)		Gulf of Mannar	[38, 5, 20, 32, 39, 37, 23]
66	<i>Holothuria (Metriatyla) scabra</i> (Jaeger, 1833)		Gulf of Mannar	[5, 32, 8, 20, 39, 37]
67	<i>Holothuria (Microthele) fuscogilva</i> (Cherbonnier, 1980)		Gulf of Mannar	[16]
68	<i>Holothuria (Microthele) nobilis</i> (Selenka, 1867)		Gulf of Mannar	[26]
69	<i>Holothuria (Platyperona) difficilis</i> (Semper, 1868)		Gulf of Mannar	[39]
70	<i>Holothuria (Selenkothuria) erinacea</i> (Semper, 1868)		Gulf of Mannar	[39]
71	<i>Holothuria (Selenkothuria) lubrica</i> (Selenka, 1867)		Gulf of Mannar	[20, 28]
72	<i>Holothuria (Selenkothuria) moebii</i> (Brandt, 1883)		Gulf of Mannar	[5, 20, 32, 28, 39, 37]
73	<i>Holothuria (Semperothuria) cinerascens</i> (Brandt, 1835)		Gulf of Mannar	[5, 8, 20, 28, 39, 37, 42]
74	<i>Holothuria (Semperothuria) imitans</i> (Ludwig, 1875)		Gulf of Mannar	[38]
75	<i>Holothuria (Stauropora) fuscocinerea</i> (Jaeger, 1833)		Gulf of Mannar	[38, 39]
76	<i>Holothuria (Stauropora) pervicax</i> (Selenka, 1867)		Gulf of Mannar	[39]
77	<i>Holothuria (Theelothuria) kurti</i> (Ludwig, 1891)		Gulf of Mannar	[43, 20, 16]
78	<i>Holothuria (Theelothuria) spinifera</i> (Théel, 1886)		Andra Pradesh	[5]
			Gulf of Mannar	[38, 20, 32, 29, 39, 37, 42, 44]
79	<i>Holothuria (Thymiosycia) arenicola</i> (Semper, 1868)		Gulf of Mannar	[39, 37, 42]
80	<i>Holothuria (Thymiosycia) impatiens</i> (Forskål, 1775)		Gulf of Mannar	[38, 39, 37]
81	<i>Labidodemas rugosum</i> (Ludwig, 1875)		Bay of Bengal	[9]
82	<i>Mesothuria squamosa</i> (Koehler & Vaney, 1905)		Tamil Nadu	[16]
83	<i>Acaudina leucoprocta</i> (H.L. Clark, 1938) <i>es</i> (Semper, 1867)	Molpadida Haeckel,	Tamil Nadu	[20]

		1896 :Caudindae Heding, 1931		
84	<i>Acaudina molpadioides</i> (Semper, 1867)		Gulf of Mannar	[38, 32]
			West Bengal	[22]
			Andra Pradesh	[22]
			Orissa	[22]
85	<i>Hedingia albicans</i> (Théel, 1886)		Andra Pradesh	[22]
86	<i>Paracaudina australis</i> (Semper, 1868)		Gulf of Mannar	[5, 20]
			Bay of Bengal	[20]
87	<i>Molpadia concolor</i> (Koehler & Vaney, 1905)	Molpadida Haeckel, 1896 : Molpadiidae Müller, 1850	Andra Pradesh	[22]
88	<i>Molpadia contorta</i> (Koehler & Vaney, 1905)		Andra Pradesh	[22]
89	<i>Molpadia ealcareia</i> (Koehler & Vaney, 1905)		Tamil Nadu	[16]
90	<i>Molpadia musculus</i> (Risso, 1826)		Andra Pradesh	[14, 22]
91	<i>Molpadia paupera</i> (Koehler & Vaney, 1905)		Tamil Nadu	[16]
92	<i>Molpadia polymorpha</i> (Koehler & Vaney, 1905)		Andra Pradesh	[22]
93	<i>Apostichopus japonicus</i> (Selenka, 1867)	Synallactida Miller, Kerr, Paulay, Reich, Wilson, Carvajal & Rouse, 2017: Stichopodidae Haeckel, 1896	Gulf of Mannar	[5]
94	<i>Stichopus chloronatus</i> (Brandt, 1835)		Gulf of Mannar	[38, 5, 32, 20, 39, 37, 30]
95	<i>Stichopus hermanni</i> (Semper, 1868)		Gulf of Mannar	[39, 37, 30, 42]
96	<i>Stichopus horrens</i> (Selenka, 1867)		Gulf of Mannar	[38, 5, 20, 39, 37, 23]
97	<i>Stichopus monotuberculatus</i> (Quoy & Gaimard, 1834)		Gulf of Mannar	[5]
98	<i>Stichopus naso</i> (Semper, 1868)		Gulf of Mannar	[39]
99	<i>Parastichopus tremulus</i> (Gunnerus, 1767)		Gulf of Mannar	[28]
100	<i>Thelenota ananas</i> (Jaeger, 1833)		Gulf of Mannar	[5]

10 1	<i>Bathyploetes pellucidus</i> (Koehler & Vaney, 1905)	Synallactida Miller, Kerr, Paulay, Reich, Wilson, Carvajal & Rouse, 2017: Synallactidae Ludwig, 1894	Andra Pradesh	[16,22]
10 2	<i>Paelopatides insignis</i> (Koehler & Vaney, 1905)		Andra Pradesh	[22]

Subsequent to this, Lakshadweep (Table 3) has been documented to host a total of 39 recorded species.

Table 3. Updated checklist of the Class Holothuroidea de Blainville, 1834 from the Lakshadweep.

Sl. No	Species	Order: Family	Distribution	Reference
1	<i>Euapta godeffroyi</i> (Semper, 1868)	Apodida Brandt, 1835: Synaptidae Burmeister, 1837	Lakshadweep	[5, 6,7, 9,18, 45]
2	<i>Leptosynapta</i> sp.		Lakshadweep	[45]
3	<i>Opheodesoma grisea</i> (Semper, 1867)		Lakshadweep	[18]
4	<i>Synapta maculata</i> (Chamisso and Eysenhardt, 1821)		Lakshadweep	[5, 6, 18, 8]
5	<i>Neothyonidium intermedium</i> (Koehler & Vaney, 1908)	Dendrochirotida Grube, 1840: Phyllophoridae Östergren, 1907	Lakshadweep	[9,16]
6	<i>Phyrella fragilis</i> (Mitsukuri & Ohshima in Ohshima, 1912)		Lakshadweep	[18, 16]
7	<i>Afrocucumis africana</i> (Semper, 1867)	Dendrochirotida Grube, 1840: Sclerodactylidae Panning, 1949	Lakshadweep	[24, 18,16]
8	<i>Havelockia ariana</i> (Koehler & Vaney, 1908)		Lakshadweep	[9]
9	<i>Psychropotes minuta</i> (Koehler & Vaney, 1905)	Elasipodida Théel, 1882: Psychropotidae Théel, 1882	Lakshadweep	[16]
10	<i>Actinopyga echinites</i> (Jaeger, 1833)	Holothuriida Miller, Kerr, Paulay, Reich, Wilson, Carvajal & Rouse, 2017 :Holothuriidae Burmeister, 1837	Lakshadweep	[18, 26]
11	<i>Actinopyga mauritiana</i> (Quoy & Gaimard, 1834)		Lakshadweep	[5, 8, 18, 45]

12	<i>Actinopyga miliaris</i> (Quoy&Gaimard, 1834)		Lakshadweep	[5, 18, 26, 45,23]
13	<i>Actinopyga serratidens</i> (Pearson, 1903)		Lakshadweep	[36]
14	<i>Bohadschia atra</i> (Massin, Rasolofonirina, Conand& Samyn, 1999)		Lakshadweep	[46]
15	<i>Bohadschia argus</i> (Jaeger, 1833)		Lakshadweep	[18, 16]
16	<i>Bohadschia marmorata</i> (Jaeger, 1833)		Lakshadweep	[5, 8, 18, 45,37,42]
17	<i>Bohadschia vitiensis</i> (Semper, 1868)		Lakshadweep	[36]
18	<i>Holothuria (Cystipus) rigida</i> (Selenka, 1867)		Lakshadweep	[18, 29]
19	<i>Holothuria (Halodeima) atra</i> (Jaeger, 1833)		Lakshadweep	[8, 45, 23, 30]
20	<i>Holothuria (Lessonothuria) pardalis</i> (Selenka, 1867)		Lakshadweep	[8, 45, 47]
21	<i>Holothuria (Lessonothuria) verrucosa</i> (Selenka, 1867)		Lakshadweep	[5]
22	<i>Holothuria (Mertensiothuria)hilla</i> (Lesson, 1830)		Lakshadweep	[5, 18, 28, 45]
23	<i>Holothuria (Mertensiothuria) leucospilota</i> (Brandt, 1835)		Lakshadweep	[5, 18, 20, 23]
24	<i>Holothuria (Microthele) nobilis</i> (Selenka, 1867)		Lakshadweep	[5, 9, 18, 29, 45]
25	<i>Holothuria (Platyperona) difficilis</i> (Semper, 1868)		Lakshadweep	[5, 9, 18, 28, 45]
26	<i>Holothuria (Semperothuria) cinerascens</i> (Brandt, 1835)		Lakshadweep	[5, 18]
27	<i>Holothuria (Stauropora) fuscocinerea</i> (Jaeger, 1833)		Lakshadweep	[9]
28	<i>Holothuria (Stauropora) pervicax</i> (Selenka, 1867)		Lakshadweep	[5, 18, 28]
29	<i>Holothuria (Thymiosycia) arenicola</i> (Semper, 1868)		Lakshadweep	[18, 28]
30	<i>Holothuria (Thymiosycia) impatiens</i> (Forskål, 1775)		Lakshadweep	[5, 8, 9, 18, 28, 45]
31	<i>Holothuria (Vaneyothuria) integra</i>		Lakshadweep	[42,9]
32	<i>Pearsonothuria graeffei</i> (Semper, 1868)		Lakshadweep	[36, 16]

33	<i>Stichopus chloronatus</i> (Brandt, 1835)	Synallactida Miller, Kerr, Paulay, Reich, Wilson, Carvajal & Rouse, 2017: Stichopodidae Haeckel, 1896	Lakshadweep	[8, 18, 21, 30]
34	<i>Stichopus hermanni</i> (Semper, 1868)		Lakshadweep	[30]
35	<i>Stichopus horrens</i> (Selenka, 1867)		Lakshadweep	[20, 18, 45]
36	<i>Parastichopus tremulus</i> (Gunnerus, 1767)		Lakshadweep	[28]
37	<i>Thelenota ananas</i> (Jaeger, 1833)		Lakshadweep	[9, 18, 45, 30]
38	<i>Oneirophanta conservata</i> (Koehler & Vaney, 1905)	Synallactida Miller, Kerr, Paulay, Reich, Wilson, Carvajal & Rouse, 2017 : Deimatidae Théel, 1882	Lakshadweep	[16]
39	<i>Dendrothuria similis</i> (Koehler & Vaney, 1905)	Synallactida Miller, Kerr, Paulay, Reich, Wilson, Carvajal & Rouse, 2017: Synallactidae Ludwig, 1894	Lakshadweep	[16]

The coast with the least biodiversity was the west coast, which recorded a total of 34 species. Among these, the highest number was found along the coast of Kerala. The checklist for the West Coast is provided in Table 4. Additionally, there are 11 species from India for which the exact locations remain unknown (Table 5).

Table 4. Updated checklist of the Class Holothuroidea de Blainville, 1834 from the West Coast.

Sl. No	Species	Order: Family	Distribution	Reference
1	<i>Protankyra bidentata</i> (Woodward & Barrett, 1858)	Apodida Brandt, 1835: Synaptidae Burmeister, 1837	Goa	[48]
2	<i>Actinocucumis typica</i> (Ludwig, 1875)	Dendrochirotida Grube, 1840: Cucumariidae Ludwig, 1894	Maharashtra	[20]
			Gulf of Kutch	[24]
3	<i>Aslia forbesi</i> (Bell, 1886)		Kerala	[49]
4	<i>Staurothyone rosacea</i> (Semper, 1869)		Kerala	[49]
5	<i>Trachasina crucifera</i> (Semper, 1869)		Kerala	[50]
6	<i>Psolus levis</i> (Koehler & Vaney, 1906)	Dendrochirotida Grube, 1840: Psolidae Burmeister, 1837	Kerala	[16]

7	<i>Psolus membranaceus</i> (Koehler & Vaney, 1905)		Kerala	[16]
8	<i>Neothyonidium intermedium</i> (Koehler & Vaney, 1908)	Dendrochirotida Grube, 1840: Phyllophoridae Östergren, 1907	Kerala	[16]
9	<i>Phyllophorus (Phyllothuria)</i> <i>cebuensis</i> (Semper, 1867)		Kerala	[50]
10	<i>Phyllophorus (Phyllothuria)</i> <i>celer</i> (Koehler & Vaney, 1908)		Maharashtra	[16]
11	<i>Stolus buccalis</i> (Stimpson, 1855)		Gulf of Kutch	[20]
12	<i>Athyonesp.</i>	Dendrochirotida Grube, 1840: Sclerodactylidae Panning, 1949	Maharashtra	[16]
13	<i>Havelockia ariana</i> (Koehler & Vaney, 1908)		Kerala	[16]
14	<i>Ohshimella ehrenbergii</i> (Selenka, 1868)		Gulf of Kutch	[16]
15	<i>Benthogone fragilis</i> (Koehler & Vaney, 1905)	Elasipodida Théel, 1882: Laetmogonidae Ekman, 1926	Goa	[16]
16	<i>Laetmogone violacea</i> (Théel, 1879)		Kerala	[16]
17	<i>Holothuria (Halodeima) atra</i> (Jaeger, 1833)		Karnataka	[30]
			Kerala	[30]
18	<i>Holothuria (Lessonothuria)</i> <i>pardalis</i> (Selenka, 1867)		Gulf of Kutch	[8, 20]
			Maharashtra	[20]
19	<i>Holothuria (Lessonothuria)</i> <i>verrucosa</i> (Selenka, 1867)		Gulf of Kutch	[5]
20	<i>Holothuria</i> (<i>Mertensiothuria</i>) <i>leucospilota</i> (Brandt, 1835)		Kerala	[5, 8, 20]
			Karnataka	[8]
21	<i>Holothuria (Metriatyla)</i> <i>scabra</i> (Jaeger, 1833)		Gulf of Kutch	[5, 8, 20]
22	<i>Holothuria (Microthele)</i> <i>fuscogilva</i> (Cherbonnier, 1980)		Gujarat	[51]
23	<i>Holothuria (Selenkothuria)</i> <i>moebii</i> (Brandt, 1883)		Kerala	[5, 20, 28]
24	<i>Holothuria (Semperothuria)</i> <i>cinerascens</i> (Brandt, 1835)		Kerala	[5, 8, 28, 49]
25	<i>Holothuria (Semperothuria)</i> <i>imitans</i> (Ludwig, 1875)		Kerala	[50, 39]

26	<i>Holothuria (Vaneyothuria) integra</i>		Kerala	[9]
27	<i>Mesothuria abbreviata</i> (Koehler and Vaney, 1905)	Holothuriida Miller, Kerr, Paulay, Reich, Wilson, Carvajal & Rouse, 2017: Mesothuriide Smirnov, 2012	Kerala	[16]
28	<i>Mesothuria incerta</i> (Koehler and Vaney, 1905)		Kerala	[16]
29	<i>Mesothuria multipes</i> (Ludwig, 1894)		Kerala	[16]
30	<i>Acaudina molpadioides</i> (Semper, 1867)	Molpadida Haeckel, 1896 :Caudindae Heding, 1931	Gujarat	[22]
31	<i>Eupyrgus scaber</i> (Lütken, 1857)	Molpadida Haeckel, 1896 :Eupyrgidae Semper, 1867	Kerala	[16]
32	<i>Stichopus hermanni</i> (Semper, 1868)	Synallactida Miller, Kerr, Paulay, Reich, Wilson, Carvajal & Rouse, 2017: Stichopodidae Haeckel, 1896	Kerala	[50]
33	<i>Paelopatides magna</i> (Koehler & Vaney, 1905)	Synallactida Miller, Kerr, Paulay, Reich, Wilson, Carvajal & Rouse, 2017: Synallactidae Ludwig, 1894	Goa	[16]
34	<i>Pseudothuria duplex</i> (Koehler & Vaney, 1905)		Karnataka	[16]

Table 5. Updated checklist of the Class Holothuroidea de Blainville, 1834 from the unknown location.

Sl. No	Species	Order: Family	Distribution	Reference
1	<i>Dactylapta dubiosa</i> (Koehler & Vaney, 1905)	Apodida Brandt, 1835: Synaptidae Burmeister, 1837	India: Exact location is unknown	4
2	<i>Opheodesoma radiosa</i> (Lesson, 1830)		India: Exact location is unknown	4
3	<i>Rynkatorpa pawsoni</i> (Martin, 1969)		India: Exact location is unknown	4
4	<i>Psychroplanes rigida</i> (Théel, 1882)	Elasipodida Théel, 1882: Elpidiidae Théel, 1882	India: Exact location is unknown	4

5	<i>Psychropotes verrucosa</i> (Ludwig, 1893)	Elasipodida Théel, 1882: Psychropotidae Théel, 1882	India: Exact location is unknown	4
6	<i>Molpadia acuta</i> (Koehler & Vaney, 1905)	Molpadida Haeckel, 1896 : Molpadiidae Müller, 1850	India: Exact location is unknown	4
7	<i>Molpadia granulata</i> (Ludwig, 1893)		India: Exact location is unknown	4
8	<i>Paelopatides mammillatus</i> (Koehler & Vaney, 1905)		India: Exact location is unknown	4
9	<i>Scotothuria herringi</i> (Hansen, 1978)		India: Exact location is unknown	4
10	<i>Synallactes dubius</i> (Koehler & Vaney, 1905)		India: Exact location is unknown	4
11	<i>Pseudostichopus peripatus</i> (Sluiter, 1901)		India: Exact location is unknown	4

Among these recorded sea cucumbers, the order Holothuriida represents the highest proportion, comprising 26.73% of the species, followed by Dendrochirotida at 22.99%. The least reported species belong to the order Persiculida, which constitutes only 2.67% of the total (Figure 4). Notably, five species—*Holothuria* (*Halodeima*) *atra*, *Holothuria* (*Lessonothuria*) *pardalis*, *Holothuria* (*Mertensiothuria*) *leucospilota*, *Holothuria* (*Semperothuria*) *cinerascens*, and *Stichopus hermanni*—were observed across all selected coastal zones in this review.

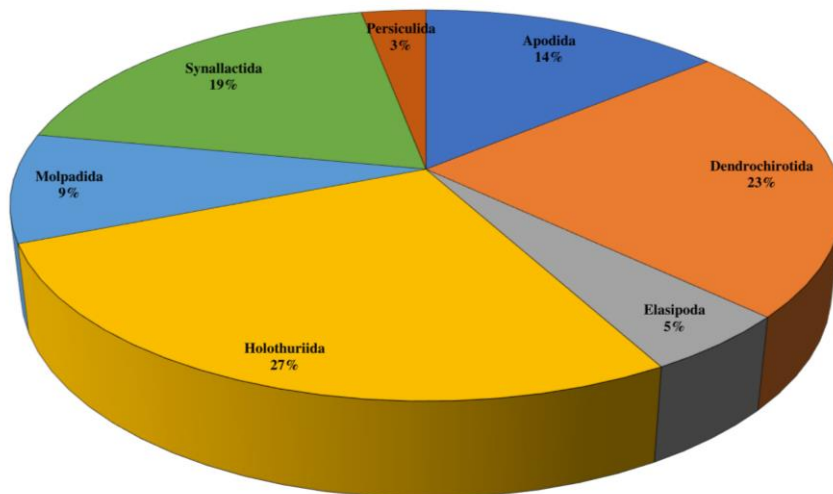


Figure 4.

Order-wise percentage contribution of Class Holothuroidea de Blainville, 1834

The dominance of 176 species, excluding the 11 species with uncertain locations, is illustrated in Figure 5, which encompasses the West Coast, East Coast, Andaman & Nicobar Islands, and Lakshadweep. The station with lower abundance and higher diversity is represented by the lower line. In the k- k-Dominance curve analysis, the Andaman and Nicobar Islands represented a high degree of species dominance, followed closely by the East Coast of India. At the same time, the West Coast exhibited the lowest levels of species dominance.

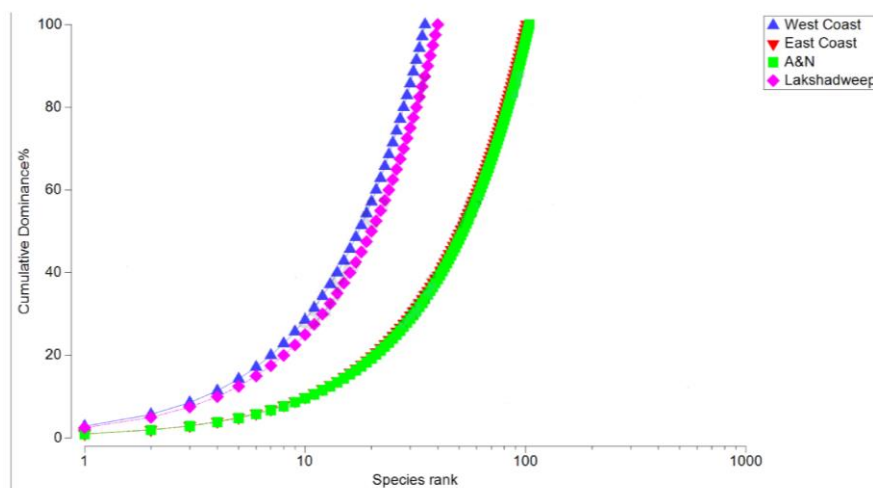


Figure 5. Species-wise k-Dominance curve using data of the published studies from the West Coast, East Coast, the Andaman & Nicobar Islands, and Lakshadweep.

The Shannon-Weiner diversity index (H') provides a comprehensive measure of biodiversity by considering both the number of species present and their relative abundance, allowing for a more accurate assessment of overall diversity across research sites. The highest diversity is observed in the Andaman and Nicobar Islands ($H' = 2.23$) and the West Coast ($H' = 2.14$). The East Coast shows modest variety ($H' = 2.06$). In contrast, Lakshadweep Island has relatively low diversity ($H' = 1.39$). The Andaman and Nicobar Islands and the West Coast, with their rich biodiversity and favorable environmental conditions, offer conducive habitats for a wide range of species, resulting in higher diversity indices (Table 6).

Table 6. Diversity indices of class Holothuroidea based on the published articles from India.

Region	S	N	d	J'	H'	(1-λ)
West Coast	12	36	3.07	0.86	2.149	0.86
East Coast	13	101	2.6	0.8	2.065	0.82
Andaman & Nicobar	18	107	3.638	0.77	2.237	0.83
Lakshadweep	8	39	1.911	0.67	1.39	0.63

Note: S (Species richness), N (No of individuals), d (Margalef diversity), J' (Pielou's evenness), H' (Diversity index), 1-λ (Gini-Simpson index).

The highest species richness ($S = 18$) was found in the Andaman and Nicobar Islands, followed by the East Coast ($S = 13$), West Coast ($S = 12$), and Lakshadweep ($S = 8$). The Andaman and Nicobar Islands also have the greatest Margalef diversity (d) at 3.638, followed by the West Coast at 3.07, the East Coast at 2.6, and Lakshadweep at 1.91. Pielou's evenness (J') evaluates both species richness and diversity. Pielou's evenness was highest on the West Coast (0.86) and lowest in Lakshadweep (0.67). These findings show that the Andaman and Nicobar Islands have both the highest species richness and Margalef diversity, indicating a greater variety of species in this region compared to the others studied. Additionally, the West Coast exhibits high Pielou's evenness, reflecting a more balanced distribution of species compared to the other three locations. By using the Bray-Curtis similarity measure, the degree of resemblance between data from existing documents can be quantified. The similarity indices of the four main stations are given in Figure 6. The results showed that the Andaman and Nicobar Islands and the East Coast had a higher level of resemblance (70%), while the West Coast and Lakshadweep exhibited a slightly lower similarity (50%). There is an overall 10% similarity shared by each location.

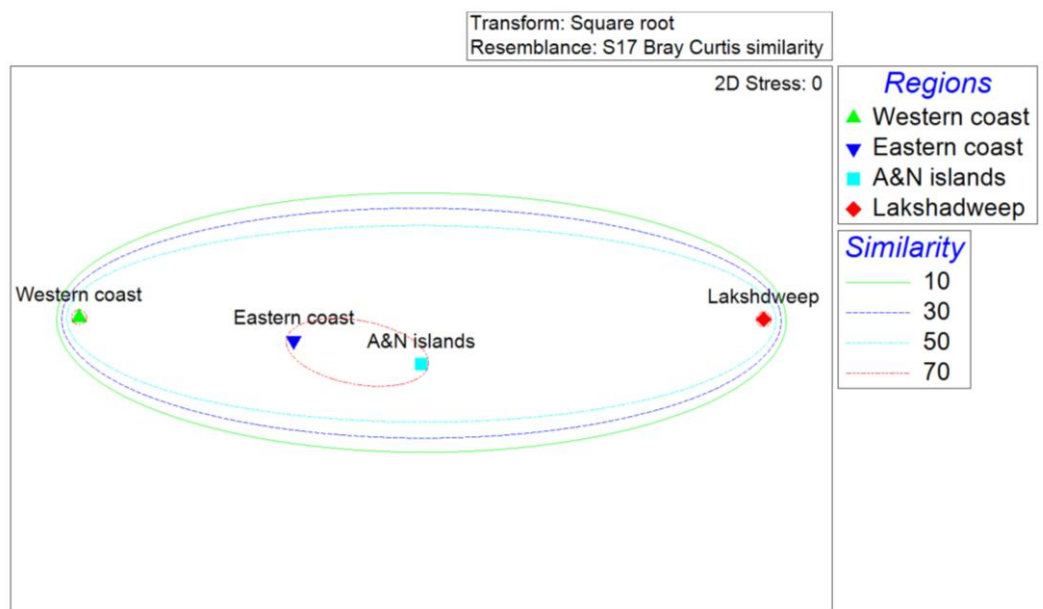


Figure 6. Bray-Curtis similarity index using data from the published studies from the West Coast, the East Coast, the Andaman and Nicobar Islands, and the Lakshadweep.

3.2. Ecology

Sea cucumbers represent one of the largest and most diverse groups of benthic invertebrates found in both intertidal and subtidal zones, contributing significantly to the overall biomass in slope and deep-sea (abyssal) benthic environments [52]. While the majority of species are sedentary or

exhibit slow movement across the seafloor, some possess the ability to swim periodically, and a few are primarily bathypelagic, spending much of their lives as free-swimming organisms in the depths of the ocean [53]. The external body of the sea cucumber is elongated both lengthwise and vertically. Its pentamerous symmetry is often recognized by the presence of five meridian-bearing ambulacra [54]. Depending on the species, the tentacles may be uniform in size or vary. Their shape is a key characteristic for identification; some can be dendritic, growing quite large in the order Dendrochirotida Grube, 1840, whereas the peltate tentacles of the Aspidochirotida Grube, 1840, have a central stalk with a small, branched disc. Molpadida Haeckel, 1896, species display digitate tentacles, and pinnate tentacles are found in the Apodida Brandt, 1835 [55]. Additionally, conical or fleshy papillae are present on the body's thick, slimy surface. Podia aid in movement, and microscopic ossicles or spicules are spread throughout the body [54,56]

3.2.1. Bioturbation & Nutritional Cycle

Sea cucumbers are often referred to as the "earthworms of the ocean" due to their crucial role in bioturbation [57]. Most aspidochirotidids are deposit feeders, making them essential bioremediators in coastal mariculture. They help decrease organic load and redistribute surface sediments. Their excreta contain inorganic nitrogen and phosphorus, which boost the productivity of benthic organisms and support ecosystem growth in nutrient-poor environments, such as coral reefs [58]. Their feeding and excretion activities also raise seawater alkalinity. Sea cucumbers play a significant role in the ecosystem by not only redistributing organic debris but also altering it through their stomachs, which act as miniature bioreactors that rapidly absorb nutrients. This makes them some of the most influential bottom bioturbators, as they continuously stir and mix sediment [59].

There is growing interest in utilizing these animals as bioremediators within Integrated Multi-Trophic Aquaculture (IMTA) and polyculture systems, as they thrive in areas impacted by mariculture where protein-rich waste accumulates [60]. Holothuroids play a significant role in influencing primary production within reef and aquaculture ecosystems. Their waste products release essential nutrients such as ammonium and phosphate, which enhance the growth of microalgae and seagrasses, even as they consume these resources through deposit feeding [61]. Research on specific species, such as *Apostichopus japonicus* Selenka, 1867, and *Australostichopus mollis* Hutton, 1872, indicates that the benefits of nutrient recycling can sometimes be outweighed by their grazing activities [62]. The exclusion of *Holothuria scabra* has been shown to reduce seagrass growth, highlighting its contribution to nutrient cycling [63]. Additionally, certain species like *Holothuria tubulosa* Gmelin, 1791 assist in the decomposition of detritus [64]. While suspension feeders like *Cucumaria frondosa* are likely to recycle nutrients as well, there is still limited knowledge regarding their specific roles in these processes [61].

3.2.2. Symbiotic Relationship of Holothuroids

Holothurians have strong links to coral reefs, seagrass beds, and seaweeds because their sediment bioturbation promotes healthy growth. They enhance primary production, infauna biodiversity, and infauna biomass [65]. Moreover, over 200 species of parasitic and commensal symbionts from nine different phyla, including gastropods, arthropods, flatworms, and polychaetes, have been found in sea cucumbers [66]. Most studies have concentrated on aspidochirotid species. Symbiotic organisms benefit from these hosts through shelter, transportation, or nutrition, while the hosts generally remain unaffected. However, certain species, such as the shrimp *Periclimenes imperator* [68] and the Harlequin crab *Lissocarcinus orbicularis* [66], exhibit host specificity and even territorial behaviors. Additionally, hosts protect chemical defenses, such as saponins, and also provide spawning sites. Recent research has revealed new associations, including those with diatoms and opisthobranchs, highlighting the ecological significance of holothuroids as hosts for symbiotic relationships [68].

4. Discussion

The present review has compiled checklist information on 187 species of holothuroids from the Indian seas, encompassing 7 orders and 21 families. The distribution of species within the class

Holothuroidea in Indian waters is uneven, with the order Holothuriida (26.73%) having the highest percentage of species. This implies that specific ecological factors or environmental conditions may favour the abundance and diversity of holothuroids in this order.

The Andaman and Nicobar Islands showed a significant dominance of certain species and a higher diversity of holothuroids compared to other coastal regions included in this study. [69] made a similar observation in earlier studies. Holothurian habitats display a wide range of diversity, covering environments such as coral reefs, seagrass meadows, rocky shores, sandy beaches, muddy shores, and mangrove beds. The Andaman Islands are especially notable for hosting all these diverse habitats [70]. This variety of habitats may explain the greater abundance of holothurians in this region compared to other parts of India. The east coast and the Andaman Islands share a high similarity (70%) in species distribution, whereas the west coast and Lakshadweep Island show a 50% similarity. Notably, 102 species are found on the East Coast, while 75 species are present in the Gulf of Mannar. The Gulf of Mannar has an extensive range of echinoderms, thanks to its abundance of favorable habitats such as sandy bottoms, seagrass beds, and reefs [42]. The coral reefs and other macrofauna, particularly those found in the Gulf of Mannar and the islands of Andaman and Nicobar, are key reasons for the striking resemblance between these two locations [21]. The Andaman and Nicobar Islands and the West Coast, with their rich biodiversity and favorable environmental conditions, provide suitable habitats for many species, leading to higher diversity indices. [71] found that the Andaman and Nicobar Islands have high diversity, followed by the East Coast, West Coast, and Lakshadweep Islands. However, in this study, the West Coast shows a higher level of diversity compared to its eastern counterpart. This variation in diversity can be linked to the unique geographical features and ecosystems present in each area. In 2017, [4] published a checklist of echinoderms in India, identifying a total of 179 holothuroids. However, subsequent reclassifications have emerged, including the grouping of the families Synallactidae and Stichopodidae into the distinct order Synallactida, as well as the renaming of the order Aspidochorida to Holothuriida. These reclassifications have resulted in changes in the classification of specific species. For instance, *Stolus rapax* has been reclassified as *Pseudostolus rapax*, while other species, such as *Orphnurgus glaber* and *Oneirophanta conservata*, have been reassigned to the order Synallactida.

In addition to the recent checklist, it is worth noting that [46] reported the first sighting of *Bohadschia atra* in Indian waters, with specimens collected from Kadmat and Agatti Islands in Lakshadweep. More recently, this same species has also been documented in the Andaman and Nicobar Islands [27]. *Bohadschia atra* is characterized by its brownish-black coloration accentuated with red spots and numerous brown podia on its ventral side. [51] noted the initial presence of *Holothuria (Microthele) fuscogilva* along the Gujarat Coast. This species displays a beige or white color with yellowish undertones on its ventral side, while its dorsal surface is marked by black or dark brown mottling. These findings highlight the expanding distribution ranges of these species.

5. Conclusions

The rising demand for holothurians in the food industry has become a significant concern, contributing to a decline in their populations. Although these sea cucumbers are classified as scheduled and protected, they continue to be subject to relentless exploitation driven by high demand, particularly in neighboring countries like India. Illegal poaching remains a persistent issue, posing a serious threat to the sustainability of their populations and the fragile marine ecosystems they inhabit. The lack of up-to-date species checklists complicates the accurate assessment of biodiversity within the Indian marine ecosystem. Insufficient information presents a considerable barrier to developing effective conservation strategies and managing natural resources responsibly. Moreover, it hampers the identification of species at risk of extinction that require urgent attention. Therefore, it is essential to allocate resources and expertise to update these checklists to enhance conservation efforts in India regularly. This study offers the most recent checklist of the class Holothuroidea within Indian waters.

Supplementary Materials: The following supporting information can be downloaded at: <https://www.mdpi.com/article/doi/s1>, Figure S1: title; Table S1: title; Video S1: title.

Author Contributions: KP initiated the review and prepared the manuscript. AS formatted the figures, table, manuscript editing. AU and BAVM contributed by reviewing and editing the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Conflicts of Interest: “The authors declare no conflicts of interest.”.

References

1. Gallo, N.D.; Cameron, J.; Hardy, K.; Fryer, P.; Bartlett, D.H.; Levin, L.A. Submersible- and lander-observed community patterns in the Mariana and New Britain trenches: Influence of productivity and depth on epibenthic and scavenging communities. *Deep Sea Research. Part I* 2015, 99, 119–133. <https://doi.org/10.1016/j.dsr.2014.12.012>
2. Harini, R.; Natarajan, V.; Sunil, C.K. Sea cucumber significance: Drying techniques and India's comprehensive status. *J. Food Sci.* 2024, 89(7), 3995–4018. <https://doi.org/10.1111/1750-3841.17153>
3. World Register of Marine Species (WoRMS). Flanders Marine Institute (VLIZ). Available online: <https://www.marinespecies.org>
4. Samuel, V.K.D.; Krishnan, P.; Sreeraj, C.R.; Chamundeeswari, K.; Parthiban, C.; Sekar, V.; Ramesh, R. An updated checklist of Echinoderms from Indian waters. *Zootaxa* 2017, 4354(1), 1–68. <https://doi.org/10.11646/zootaxa.4354.1.1>
5. James, P.S.; Thomas, B.R.; Pillai, Achari, G.P. Catalogue of types and of sponges, corals, polychaetes, crabs and echinoderms in the reference collections of the Central Marine Fisheries Research Institute. *CMFRI Bull.* 1969, 7, 1–66.
6. James, D.B. Studies on Indian echinoderms on *Protankyra tuticorensis* sp. nov. and other apodous holothurians from the Indian seas. *J. Mar. Biol. Assoc. India* 1982, 24(1&2), 92–105.
7. James, D.B. Research on Indian echinoderms - a review. *J. Mar. Biol. Assoc. India* 1983, 25(1&2), 91–108.
8. Soota, T.D.; Mukhopadhyay, S.K.; Samanta, T.K. On some holothurians from the Andaman and Nicobar Islands. *Rec. Zool. Surv. India* 1983, 80(4), 507–524.
9. Mukhopadhyay, S.K.; Samanta, T.K. On a collection of shallow-water Holothurians from the Lakshadweep. *Rec. Zool. Surv. India* 1983, 81, 299–314.
10. Purcell, S.W.; Conand, C.; Uthicke, S.; Byrne, M. Ecological roles of exploited sea cucumbers. In *Oceanography and Marine Biology*; CRC Press, 2016, pp. 375–394.
11. Siahaan, E.A.; Pangestuti, R.; Munandar, H.; Kim, S.K. Cosmeceutical properties of sea cucumbers: Prospects and trends. *Cosmetics* 2017, 4(3), 26.
12. Rasyid, A.; Yasman, Y.; Putra, M.Y.Y. Current prospects of nutraceutical and pharmaceutical use of sea cucumbers. *Pharmacia* 2021, 68, 561–572. <https://doi.org/10.3897/pharmacia.68.e69140>
13. Conand, C.; Claereboudt, M.; Dissayanake, C.; Ebrahim, A.; Fernando, S.; Godvinden, R.; Friedman, K. Review of fisheries and management of sea cucumbers in the Indian Ocean. *West. Indian Ocean J. Mar. Sci.* 2022, 21(1), 125–148. <https://doi.org/10.4314/wiojms.v21i1.10>
14. Chandra, K.; Raghunathan, C. *Faunal Diversity of Biogeographic Zones: Islands of India*; Director, Zoological Survey of India: Kolkata, India, 2018; pp. 1–523.
15. Rao, G.C. On a new interstitial species of *Trochodota* (Apodida, Holothurioidea) from Andamans, India. *Curr. Sci.* 1975, 44(14), 508–509.
16. Sastry, D.R.K. *Echinodermata of India: An Annotated List*; Records of the Zoological Survey of India: Kolkata, India, 2007; Vol. 271, pp. 1–387.
17. James, P.S.; Thomas, B.R.; Pillai, G.P.; Achari, G.P. *Catalogue of Types and of Sponges, Corals, Polychaetes, Crabs and Echinoderms in the Reference Collections of the Central Marine Fisheries Research Institute*. *CMFRI Bull.* 1969, 7, 1–66.
18. James, D.B. Echinoderms of Lakshadweep and their zoogeography. *CMFRI Bull.* 1989, 43, 97–144. *Marine Living Resources of the Union Territory of Lakshadweep: An Indicative Survey with Suggestions for Development*.

19. Rao, G.C. Occurrence of some juvenile stages referable to the apodous holothurian *Patinapta ooplax* (Marenzeller) in the intertidal sands of Andaman Islands. *Proc. Indian Acad. Sci. B* **1973**, *77*(6), 225–233. <https://doi.org/10.1007/BF03045594>
20. Mukhopadhyay, S.K. On some holothurians from the Gulf of Mannar, India. *Rec. Zool. Surv. India* **1988**, *85*(1), 1–17.
21. Sadhukhan, K.; Raghunathan, C. A general account on community structure of echinoderms in North Andaman. *Int. J. Biol. Pharm. Allied Sci.* **2012**, *1*, 44–56.
22. Sastry, D.R.K.; Rao, Y.K.V.; Ganesh, T.; Rao, M.S.; Sateesh, N.; Bharati, A.; Raman, A.V. On some collections of Echinodermata from Andhra Pradesh and Orissa coasts of India. *Rec. Zool. Surv. India* **2012**, *112*(3), 61–87. <https://doi.org/10.26515/rzsi/v112i3.169084>
23. Kumar, J.S.Y.; Geetha, S. Distribution and new additions to the Class: Holothuroidea in the Gulf of Mannar Islands, India. *Int. J. Adv. Biol. Res.* **2013**, *3*(1), 116–122.
24. James, D.B. Studies on Indian echinoderms - 15. On *Psolus mannarensis* sp. nov. and other Dendrochirotidids from the Indian Seas. *J. Mar. Biol. Assoc. India* **1984**, *26*(1&2), 109–122.
25. James, D.B. Studies on Indian Echinoderms-13 *Phyrella fragilis* (Ohshima) (Echinodermata: Phyllophoridae), a new record from the Indian Ocean with notes on its habits. *J. Andaman Sci. Assoc.* **1986**, *2*(1), 37–38.
26. James, D.B. *Sea Cucumbers. Mar. Fish. Res. Manag.* 2000, pp. 124–153.
27. Padmini, K.; Ummath, A. First report of the sea cucumber, *Bohadschia atra* Massin, Rasolofonirina, Conand and Samyn, 1999 (Echinodermata, Holothuroidea), from the Andaman Islands (Indian Ocean). *Nat. Acad. Sci. Lett.* **2024**, 1–5. <https://doi.org/10.1007/s40009-024-01576-0>
28. James, D.B. Taxonomic studies of the species of *Holothuria* (Linnaeus, 1767) from the seas around India Part I. *J. Bombay Nat. Hist. Soc.* **1995a**, *92*(1), 43–62.
29. James, D.B. Taxonomic studies of the species of *Holothuria* (Linnaeus, 1767) from the seas around India Part II. *J. Bombay Nat. Hist. Soc.* **1995b**, *92*(2), 190–204.
30. **Sastry, D.R.K.; Marimuthu, N.; Rajan, R.** Echinodermata of Lakshadweep, Arabian Sea with the description of a new genus and a species. *Rec. Zool. Surv. India* 2019, *119*(4), 348–372. <https://doi.org/10.26515/rzsi/v119/i4/2019/144963>
31. Bell, F.J. Report on a collection of Echinodermata from the Andaman Islands. *Proc. Zool. Soc. Lond.* **1887**, 139–145. <https://doi.org/10.1111/j.1096-3642.1887.tb02953.x>
32. James, D.B. Echinoderm fauna of the proposed National Marine Park in the Gulf of Mannar. In *Proc. Symp. Endangered Marine Animals and Marine Parks; Marine Biological Association of India*: 1988; pp. 403–406.
33. Clark, A.H. *Monograph of Shallow-Water Indo-West Pacific Echinoderms*; British Museum (Natural History): London, UK, 1971; pp. 690–234.
34. Sastry, D.R.K. *Echinodermata of Andaman and Nicobar Islands, Bay of Bengal: An Annotated List*. *Rec. Zool. Surv. India, Occas. Pap. No. 233*, 2005, pp. 1–207.
35. James, D.B. Studies on Indian Echinoderms – 7. On a new family *Labidodematidae* (Holothuroidea: Aspidochirotida) with a detailed description of *Labidodemas rugosum* (Ludwig) from the Andamans. *J. Mar. Biol. Assoc. India* **1981**, *23*(1&2), 82–85.
36. James, D.B.; Gandhi, A.D.; Palaniswamy, N.; Rodrigo, J.X. Hatchery techniques and culture of the sea-cucumber *Holothuria scabra*. *CMFRI Spec. Publ.* **1994**, *57*, 1–40.
37. Venkatraman, C.; Padmanaban, P. On a collection of shallow-water echinoderms of the Gulf of Mannar Biosphere Reserve, southern India. *Rec. Zool. Surv. India* **2013**, *113*(1), 95–114
38. **Bell, P.J.** Report on a Collection of Echinoderms made at Tuticorin, Madras, by Mr. Edgar Thurston, CMZS, Superintendent, Government Central Museum, Madras. *Proc. Zool. Soc. Lond.* 1888, *56*(1), 383–389. <https://doi.org/10.1111/j.1469-7998.1888.tb06719.x>
39. **Gopalakrishnan, A.; Divya, P.R.; Basheer, V.S.; Swaminathan, R.; Pandian, K.A.; Bineesh, K.K.; Jena, J.K.** *Macro Flora & Fauna of the Gulf of Mannar: A Checklist*; National Bureau of Fish Genetic Resources: India, 2012; ISBN: 978-81-905540-8-4.

40. James DB Studies on Indian Echinoderms – 6, Descriptions of two little-known holothurians with a note on an early juvenile of *Holothuria scabra* Jaeger from the Indian Seas. *Journal of the Marine Biological Association of India* 1976, 18 (1): 55–61.
41. James, D.B. Studies on Indian Echinoderms - 2. The Holothurian *Stolus buccalis* (Stimpson) with notes on its systematic position. *J. Mar. Biol. Assoc. India* 1966, 8(2), 285–289.
42. Venkatraman, C.; Venkataraman, K.; Rajkumar, R.; Shrinivaasu, S.; Padmanaban, P.; Paramasivam, K.; Sivaperuman, C. Diversity and Distribution of Echinoderms in Palk Bay and Gulf of Mannar Biosphere Reserve, Southern India. In *Ecology and Conservation of Tropical Marine Faunal Communities*; Venkataraman, K., Sivaperuman, C., Raghunathan, C., Eds.; Springer: Berlin, Germany, 2013; pp. 197–212. https://doi.org/10.1007/978-3-642-38200-0_13
43. Koehler, R.; Vaney, C.; Clark, A.H. *Echinoderma of the Indian Museum*; Order of the Trustees of the Indian Museum: Calcutta, India, 1909.
44. Asha PS, Muthiah P. Reproductive biology of the commercial sea cucumber *Holothuria spinifera* (Echinodermata: Holothuroidea) from Tuticorin, Tamil Nadu, India. *Aquaculture International* 2008 16: 231–242. <https://doi.org/10.1007/s10499-007-9140-z>
45. Nagabhushanam, A.K.; Rao, G.C. An ecological survey of the marine fauna of Minicoy Atoll (Laccadive Archipelago, Arabian Sea). *Mitt. Mus. Nat.kd. Berl., Zool. Reihe* 2008, 48(2), 265–324. <https://doi.org/10.1002/mmnz.19720480203>
46. Nithyanandan, M.; Marimuthu, N. A new record of holothuriid sea cucumber, *Bohadschia atra* Massin, Rasolofonirina, Conand and Samyn, 1999 (Echinodermata: Holothuroidea) from India. *Thalassas* 2021, 37(2), 813–816. <https://doi.org/10.1007/s41208-021-00299-z>
47. Katariya, K.; Hitesh, K.; Gadhiya, S.; Motivarsh, Y.; Kiran, G. Echinodermata diversity along Sikka coast of Gujarat. *J. Exp. Zool. India* 2021, 24, 649–656.
48. Deshmukh, A.; Ingole, B.S.; Mukharjee, I.; Sivadas, S.K. First record of the synaptid holothurian *Protankyra bidentata* (Woodward and Barrett, 1858) from the Indian Ocean. *Indian J. Fish.* 2015, 62(3), 157–160.
49. Anu, S.; Ravinesh, R.; Shijith, B.V.; Kumar, B.A. Biodiversity associated with the mussel beds of Vizhinjam coast, Kerala, India. *J. Aquat. Biol. Fish.* 2017, 5, 36–53
50. Deepa, R.P.; Kumar, A.B. New records of the sea cucumbers *Holothuria (Semperothuria) imitates* Ludwig and *Stichopus herrmanni* Semper (Echinodermata: Holothuroidea) from the southwestern coast of India. *J. Threat. Taxa* 2010, 2(2), 712–715.
51. Bhatt, S.; Mankodi, P.C.; Joshi, D. Diversity of echinoderms at the west coast of Gujarat, India. *J. Glob. Biosci.* 2022, 11(1), 9182–9188.
52. Slater, M.; Chen, J. Sea cucumber biology and ecology. In *Echinoderm Aquaculture*, 2015; pp. 47–55.
53. Miller, J.E.; Pawson, D.L. *Swimming Sea Cucumbers (Echinodermata: Holothuroidea): A Survey, with Analysis of Swimming Behavior in Four Bathyal Species*. Smithsonian Contributions to the Marine Sciences, No. 35; Smithsonian Institution Press: Washington, D.C., 1990.
54. Conand, C.; Polidoro, B.; Mercier, A.; Gamboa, R.; Hamel, J.F.; Purcell, S. The IUCN Red List assessment of aspidochirotid sea cucumbers and its implications. *SPC Beche-de-mer Inf. Bull.* 2014, 34(5), 3–7
55. Kerr, A.M.; Kim, J. Phylogeny of Holothuroidea (Echinodermata) inferred from morphology. *Zool. J. Linn. Soc.* 2001, 133(1), 63–81. <https://doi.org/10.1006/zjls.2001.0263>
56. Miller, A.K.; Kerr, A.M.; Paulay, G.; Reich, M.; Wilson, N.G.; Carvajal, J.I.; Rouse, G.W. Molecular phylogeny of extant Holothuroidea (Echinodermata). *Mol. Phylogenet. Evol.* 2017, 111, 110–131.
57. MacTavish, T.; Stenton-Dozey, J.; Vopel, K.; Savage, C. Deposit-feeding sea cucumbers enhance mineralization and nutrient cycling in organically-enriched coastal sediments. *PLoS One* 2012, 7(11), e50031.
58. Conand, C.; Muthiga, N. *Commercial Sea Cucumbers: A Review for the Western Indian Ocean*; WIOMSA Book Series No. 5; Western Indian Ocean Marine Science Association: Zanzibar, Tanzania, 2007; iii + 67 pp
59. Senff, P.; Elba, B.; Kunzmann, A.; Gillis, L.G.; Robinson, G. Carbon supplementation promotes assimilation of aquaculture waste by the sea cucumber *Holothuria scabra*: Evidence from stable isotope analysis. *Aquaculture* 2022, 547, 737295. <https://doi.org/10.1016/j.aquaculture.2021.737295>

60. Nelson, E.J.; MacDonald, B.A.; Robinson, S.M.C. The absorption efficiency of the suspension-feeding sea cucumber, *Cucumaria frondosa*, and its potential as an extractive integrated multi-trophic aquaculture (IMTA) species. *Aquaculture* 2012, 370, 19–25. <https://doi.org/10.1016/j.aquaculture.2012.09.029>
61. Purcell, S.W.; Conand, C.; Uthicke, S.; Byrne, M. Ecological roles of exploited sea cucumbers. In *Oceanography and Marine Biology: An Annual Review*; Gibson, R.N., Atkinson, R.J.A., Gordon, J.D.M., Eds.; CRC Press: Boca Raton, FL, USA, 2016; Vol. 54, pp. 375–394.
62. Yuan, X.; Shao, S.; Dupont, S.; Meng, L.; Liu, Y.; Wang, L. Impact of CO₂-driven acidification on the development of the sea cucumber *Apostichopus japonicus* (Selenka) (Echinodermata: Holothuroidea). *Mar. Pollut. Bull.* 2015, 95(1), 195–199.
63. Wolkenhauer, S.M.; Uthicke, S.; Burrige, C.; Skewes, T.; Pitcher, R. The ecological role of *Holothuria scabra* (Echinodermata: Holothuroidea) within subtropical seagrass beds. *J. Mar. Biol. Assoc. U.K.* 2010, 90(2), 215–223.
64. Costa, V.; Mazzola, A.; Vizzini, S. *Holothuria tubulosa* Gmelin 1791 (Holothuroidea, Echinodermata) enhances organic matter recycling in *Posidonia oceanica* meadows. *J. Exp. Mar. Biol. Ecol.* 2014, 461, 226–232.
65. Solan, M.; Cardinale, B.J.; Downing, A.L.; Engelhardt, K.A.; Ruesink, J.L.; Srivastava, D.S. Extinction and ecosystem function in the marine benthos. *Science* 2004, 306(5699), 1177–1180.
66. Eeckhaut, I.; Parmentier, E.; Becker, P.; Gomez da Silva, S.; Jangoux, M. Parasites and biotic diseases in field and cultivated sea cucumbers. 2004. (ISSN: 0429-9345).
67. Franssen CHJM, Hoeksema B. Going for the stars: extending the host record for the reef-dwelling Emperor shrimp, *Periclimenes imperator* (Pontoninae). *Marine Biodiversity* 2014, 44: 465–466.
68. Caulier, G.; Flammang, P.; Gerbaux, P.; Eeckhaut, I. When a repellent becomes an attractant: harmful saponins are kairomones attracting the symbiotic Harlequin crab. *Sci. Rep.* 2013, 3, 2639.
69. Asha, P.S.; Vinod, K.; Ranjith, L.; Johnson, B.; Vivekanandan, E. Conservation and sustainable use of sea cucumber resources in India: suggestions and way forward. *CMFRI Marine Fisheries Policy Series No. 7*; Central Marine Fisheries Research Institute: Kochi, India, 2017; pp. 1–77.
70. Vinithkumar, N.V.; Sathish, T.; Das, A.K.; Sivaperuman, C.; Raghunathan, C.; Dharani, G.; Kirubakaran, R.; Sujathkumar, N.V. Marine ecosystems of Andaman and Nicobar Islands—species abundance and distribution. In *Biodiversity and Climate Change Adaptation in Tropical Islands*; 2018; pp. 217–256.
71. Raghunathan, C.; Mondal, T.A.M.A.L.; Nigam, N.K. Echinoderm diversity of India. In *Current Status of Marine Faunal Diversity in India*, 2016; pp. 353–381.

Disclaimer/Publisher's Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.