Table 1. Compilation of studies dealing with seagrass-sea cucumber associations in the seagrass ecosystem. The seagrass distributions are based on global biographic bioregions developed by Short et al. 2007. LS, Laboratory Study; FS, Field Study; *Ac, Actinopyga*; *Ap, Apostichopus*; *B, Bohadschia; Ch, Chirodota; Cy, Cymodocea; E, Enhalus, Ha, Halophila; Ho, Holothuria; Pe, Pearsonothuria; Po, Posidonia; St, Stichopus; Sy, Syringodium; T, thalassia; Z, Zostera.*

| **Location** | **Bioregion** | **Study type** | **Seagrass****Species** | **Explanatory****Variables** | **Sea cucumber****Species** | **Response****variables** | **Conclusion(s)** | **Source** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Southeast Queensland, Australia | Tropical Indo-Pacific | FS | Cy. serrulata | Sea cucumber density | Ho. scabra | Seagrass growth rates and biomass | Biomass and growth rate lower when sea cucumbers were excluded | Wolken-hauer et al. 2010 |
| Cocos Island, Australia | Tropical Indo-Pacific | FS | Not specified | Seagrass coverage | Ac. mauritiana;Ac. miliaris;B. argus;Ch. rigida;Ho. atra;Ho. coluber;Ho. edulis;Ho. fuscogilva;Pe. graeffei;St. chloronotus;St. herrmanni;Thelenota ananas;Synapta maculata; | Sea cucumber abundance | No discernible relationship between the seagrass coverage and sea cucumber abundance | Bell-chambers et al. 2011 |
| Solomon Islands | Tropical Indo-Pacific | LS | T. hemprichii; E. acoroides | Seagrass composition | Ho. scabra | Settlement and metamorphosis rates | Seagrasses as suitable substrate for settlement of larvae; Seagrass extracts promoted metamorphosis of larvae | Mercier et al. 2000 |
| Torres Strait | Tropical Indo-Pacific | FS | Not specified | Seagrass coverage | Ho. scabra (main species); 33 other species | Abundance and distribution pattern | Distribution and abundance of *Ho. scabra* correlated to seagrass coverage | Long et al. 1996 |
| New Caledonia | Tropical Indo-Pacific | FS | Cy. serrulata;Cy. rotundata; Ha. ovalis;Sy. isoetifolium | Segrass coverage | Ho. scabra | Survival rate, Growth rates,Burying rates | Survival was highest at 42% seagrass cover; Growth rate was highest at 34% seagrass cover; Burial rate was highest at intermediate C content | Ceccarelli et al. 2018 |
| New Caledonia | Tropical Indo-Pacific | FS | Cy. serrulata;Cy. rotundata;Sy. isoitifolium;Ha. ovalis | Seagrass coverage | Ho. scabra | Survival and growth rates | Survival rate was variable and depended on sites; Growth rate was dependent on the stocking density | Purcell and Simutoga 2008 |
| New Ireland,Papua New Guinea | Tropical Indo-Pacific | FS | Cy. rotundataE. acoroidesT. hemprichii | Seagrass coverage & composition; Canopy height | JuvenileHo. scabra | Survival rates;Growth rates | Seagrass coverage, Chlorophyll-a content and epiphytes were required to the survival and growth of sea cucumbers | Hair et al. 2016 |
| New Ireland,Papua New Guinea | Tropical Indo-Pacific | FS | Cy. rotundataE. acoroidesT. hemprichii | Seagrass coverage, presence/absence | JuvenileHo. scabra | Burying behavior | Reduced burying of cultured individuals may increase the potential for predation | Hair et al. 2020 |
| North Lombok, Indonesia | Tropical Indo-Pacific | LS | E. acoroides | Stable Isotope values of food sources  | Ho. scabra | Assimilation rates | Low assimilation rates of seagrass | Indriana et al. 2018 |
| Northwest Philippines | Tropical Indo-Pacific | FS | T. hemprichii | Seagrass density | Juvenile St. cf. horrens | Sea cucumber density | Abundance was associated with the seagrass density and with the sediment organic matter from plant detritus | Palomar-Abesamis et al. 2017 |
| Trang Province, Andaman Sea | Tropical Indo-Pacific | FS | E. acoroides;T. hemprichii;Ha. ovalis | Stable Isotope values of food sources | Ho. scabra;Ho. atra-H. leucospilota complex | Fractional contribution to sea cucumber diets | Up to 61-70% of the sea cucumber diets were derived from the seagrasses | Floren et al. 2021 |
| Northwest Sri Lanka | Tropical Indo-Pacific | FS | Not specified | Seagrass coverage | Ho. atra;Ho. edulis | Sea cucumber abundance | Seagrass as preferred habitat by both sea cucumber species | Dissana-yake and Stefansson 2012 |
| Western Grand Bahamas | Tropical Atlantic | FS | T. testudinum | Distribution patterns; Habitat refuge | Ho. arenicola | Sea cucumber density | Highest densities of sea cucumbers are found in seagrass beds | Mosher 1980 |
| Belize | Tropical Atlantic | FS | Not specified, but possibly T. testudinum | Distribution patterns; Size distribution | Ho. mexicana | Sea cucumber presence/absence | Seagrass habitat near mangroves as settlement and nursery area | Rogers et al. 2018 |
| Algiers Bay | Mediter-ranean | FS | Po. oceanica;Cy. nodosa | Organic matter content in the sediment; As preferred habitat | Ho. tubulosa;Ho. poli;Ho. stellati;Ho. forskali;Ho. sanctori | Percentage of organic matter inside the gut | Variation of organic matter content inside the gut was related to the micro-distribution of sea cucumbers in the meadow | Mezali and Soualili 2013. In French |
| Northwest Algeria | Mediter-ranean | FS | Po. oceanica | Stable isotope profiles of the seagrass and sea cucumbers | Ho. poli;Ho. tubulosa;Ho. sanctori; Ho. forskali | Contribution to the sea cucumber diet; Degree of niche overlap among sea cucumbers | Low contribution to sea cucumber diets; Niche sizes differed between species | Belbachir et al. 2019 |
| Northwest Spain | Mediter-ranean | FS | Po. oceanica | Landscape configuration of seagrass meadows | Ho. poli;Ho. tubulosa-mamatta complex | Source contribution to sea cucumber diets | Diet of sea cucumbers derived mainly from seagrass detritus; Contribution did not vary with the landscape configuration. | Ricart et al. 2015 |
| Saint. Mandrier, France | Mediter-ranean | FS | Po. oceanica | Distribution pattern of sea cucumbers | Ho. tubulosa;Ho. poli | Percentage of seagrass in the gut | Seagrass dominated the ingested materials | Massin and Jangoux 1976 In French |
| Gulf of Calvi | Mediter-ranean | FS | Po. oceanica | Stable isotope values of sources | Ho. stellati;Ho. tubulosa | Stable isotope values of sea cucumbers | Seagrass dominates in the diet of sea cucumber s relative to other animal taxa | Lepoint et al. 2000 |
| Northern Sicily | Mediter-ranean | LS | Po. oceanica | Sea cucumber density | Ho. tubulosa | Ingestion rate;Trophic enrichments | Ingestion rate varied from 30 to 100% depending on density; Evidence of assimilation thru stable isotope | Costa et al. 2014 |
| Central Tyrrhenian Sea | Mediter-ranean | FS | Cy. nodosa andPo. oceanica | Stable Isotope values of food sources | *Ho. polii; Ho. tubulosa* | Fractional contribution to sea cucumber diets; Niche width | About 63-74% of the sea cucumber diets were derived from the seagrasses | Boncagni et al. 2019 |
| Ria Formosa, South Portugal | Temperate Atlantic | LS | Z. noltii and Cy. nodosa | Feeding experiments with seagrass debris | *Ho. arguinensis* | Growth rates | Highest growth rate in treatment with 40% *Z. noltii* debris*;* negative growth rate in treatment with *Cy. nodosa* debris | Domínguez-Godino et al. 2019 |
| Ria Formosa coastal lagoon, South Portugal | Temperate Atlantic | FS | Z. noltii; Z. marina; Cy. nodosa | Seagrass composition | *Ho. arguinensis* | Sea cucumber density, abundance and habitat association | Sea cucumbers were significantly more abundant and largest in sizes in the *Z. noltii* meadows | Domínguez-Godino et al.2020 |
| Shandong, North China | Temperate North Pacific | LS | Z. marina | Feeding experiments with seagrass detritus | Ap. japonicus | Growth rate | Highest growth rate in treatment at 40% seagrass detritus | Liu et al. 2013 |
| Toliara, Southwest Madagascar  | Tropical Indo-Pacific | FS | T. hemprichii; Cy. rotundata | Stocking densities of juvenile H. scabra | Ho. scabra | Seagrass leaf extension rates | Significant increase in leaf extension rate in *T. hemprichii* but not in *Cy. serrulata*  | Arnull et al. 2021 |
| Northwest Philippines | Tropical Indo-Pacific | LS | T. hemprichii | Feeding experiments with seagrass detritus | Juvenile St.cf. horrens | Sea cucumber growth; feeding and sheltering behavior, biochemical composition | Seagrass detritus did not significantly affect growth and body composition when compared to a biofilm-only control | Palomar-Abesamis et al. 2018 |
| Ishigaki Island, Japan | Tropical Indo-Pacific | FS | Not specified; but possibly T. hemprichii;Ha. ovalis | Types of bottom characteristics | Ho. atra, Ho. leucospilota; St. chloronotus | Sea cucumber densities | Among the sea three cucumber species, *H. atra* was most abundant in seagrass beds | Tanita and Yamada 2019 |
| Ishigaki Island, Japan | Tropical Indo-Pacific | FS | T. hemprichii;Cy. rotundata | Types of bottom sediment and biomes | Ho. atra; St. chloronotus | Sea cucumber distribution and abundance | H. atra was more abundant than S. chloronotus in the seagrass beds; decreased in abundance over a 17- year period | Nishihama and Tanita 2021 |

**References**

Arnull, J., Wilson, A.M.W., Brayne, K., Dexter, K., Donah, A.G., Gough, C.L.A., Klückow, T., Ngwenya, B., and Tudhope, A. 2021. Aquac Environ Interact. 13 : 301-310. https://doi.org/10.3354/aei00409

Belbachir NE, Lepoint G, Mezali K (2019) Comparison of isotopic niches of four sea cucumbers species (Holothuroidea: Echinodermata) inhabiting two seagrass meadows in the southwestern Mediterranean Sea (Mostaganem, Algeria). Belgian J Zool 149:95–106. https://doi.org/10.26496/bjz.2019.32

Bellchambers LM, Meeuwig JJ, Evans SN, Legendre P (2011) Modelling habitat associations of 14 species of holothurians from an unfished coral atoll : implications for fisheries management. Aquat Biol 14:57–66. https://doi.org/10.3354/ab00381

Boncagni, P., Rakaj, A., and Fianchini, A., and Vizzini, S. 2019. Preferential assimilation of seagrass detritus by two coexisting Mideteranean sea cucumbers: *Holothuria polii* and *Holothuria tubulosa*.Estuar Coast Shelf Sci. doi:10.1016/j.ecss.2019.106464

Ceccarelli DM, Logan M, Purcell SW (2018) Analysis of optimal habitat for captive release of the sea cucumber *Holothuria scabra*. Mar Ecol Prog Ser 588:85–100. https://doi.org/10.3354/meps12444

Costa V, Mazzola A, Vizzini S (2014) *Holothuria tubulosa* Gmelin 1791 ( Holothuroidea , Echinodermata ) enhances organic matter recycling in *Posidonia oceanica* meadows. J Exp Mar Bio Ecol 461:226–232. https://doi.org/10.1016/j.jembe.2014.08.008

Dissanayake DCT, Stefansson G (2012) Habitat preference of sea cucumbers: *Holothuria atra* and *Holothuria edulis* in the coastal waters of Sri Lanka . J Mar Biol Assoc United Kingdom 92:581–590. https://doi.org/10.1017/s0025315411000051

Domínguez-Godino, J. A., Santos, T. F., Pereira, H., Custódio, L., and González-Wangüemert, M. 2019. Seagrass debris as potential food source to enhance Holothuria arguinensis' growth in aquaculture. Aquac Res. 1499https://doi.org/10.1111/are.14495

Domínguez-Godino, J.A., and González-Wangüemert. 2020. Habitat associations and seasonal abundance patterns of the sea cucumber *Holothuria arguinensis* at Ria Formosa coastal lagoon (South Portugal). Aquat Eco 54:337-354. https://doi.org/10.1007/s10452-020-09746-0

Floren A, Hayashizaki K, Tuntiprapas P, Prathep, A. (2021). Contributions of seagrasses and other sources to sea cucumber diets in a tropical seagrass ecosystem. Chiang Mai J. Sci. 48 (5) 1259-1270Fourqurean J, Schrlau J (2003) Changes in nutrient content and stable isotope ratios of C and N during decomposition of seagrasses and mangrove leaves along a nutrient availability gradient in Florida Bay, USA. Chem Ecol 19:373–390. https://doi.org/10.1080/02757540310001609370

Hair C, Mills DJ, McIntyre R, Southgate PC (2016) Optimising methods for community-based sea cucumber ranching: Experimental releases of cultured juvenile *Holothuria scabra* into seagrass meadows in Papua New Guinea. Aquac Reports 3:198–208. https://doi.org/10.1016/j.aqrep.2016.03.004

Hair, C. Militz, T., Daniels, N. and Southgate, P.C.2020. Comparison of survival, growth and burrying behavior of cultured and wild sandfish (*Holothuria scabra*) juveniles: Implications for ocean mariculture. Aquaculture 526. 10.1016/j.aquaculture.2020.735355

Indriana L, Wahyudi A, Kunzmann A (2018) Assimilation Dynamics of Different Diet Sources by the Sea Cucumber *Holothuria scabra*, with Evidence from Stable Isotope Signature. Annu Res Rev Biol 28:1–10. https://doi.org/10.9734/arrb/2018/42591

Lepoint G, Nyssen F, Gobert S, et al (2000) Relative impact of a seagrass bed and its adjacent epilithic algal community in consumer diets. Mar Biol 136:513–518. https://doi.org/10.1007/s002270050711

Liu X, Zhou Y, Yang H, Ru S (2013) Eelgrass Detritus as a Food Source for the Sea Cucumber *Apostichopus japonicus* Selenka (Echinidermata: Holothuroidea) in Coastal Waters of North China: An Experimental Study in Flow-Through Systems. PLoS One 8:2–7. https://doi.org/10.1371/journal.pone.0058293

Long BG, Long B, Skewes T, et al (1996) Distribution and abundance of beche-de-mer on Torres Strait reefs on Torres Strait reefs. Beche-de-mer Inf Bull 9

Massin C, Jangoux M (1976) Obervations Écologiues sur *Holothuria tubulosa*, *H. Poli* et *H. forskali* (Echinodermata-Holothuroidea) et comportement alimentaire de *H. tubulosa*. Cah Biol Mar 17:45–59

Mercier A, Battaglene SC, Hamel JF (2000) Settlement preferences and early migration of the tropical sea cucumber *Holothuria scabra*. J Exp Mar Bio Ecol 249:89–110. https://doi.org/10.1016/S0022-0981(00)00187-8

Mezali K, Soualili DL (2013) Capacité de sélection des particules sédimentaires et de la matière organique chez les holothuries. La Beche-de-mer, Bull la CPS No33 38–43

Mosher C (1980) Distribution of *Holothuria arenicola* Semper in the Bahamas with observations on habitat, behavior, and feeding acitvity (Echinodermata: Holothuroidea). Bull Mar Sci 30:1–12

Nishihama, S. and Tanita, I. (2021) Holothurian assemblages before the harvest-boom era in inner reefs of Ishigaki Island, focusing on population dynamics of lollyfish *Holothuria atra* Jäger, 1883. Plankton Benthos Res. 16(3): 165-178. doi: 10.3800/pbr.16.165

Palomar-Abesamis N, Abesamis RA, Juinio-Meñez MA (2017) Distribution and microhabitat associations of the juveniles of a high-value sea cucumber, *Stichopus* cf. *horrens*, in northern Philippines. Aquat Ecol 51:17–31. https://doi.org/10.1007/s10452-016-9591-2

Palomar-Abesamis, N., Juinio-Meñez, M.A. and Slater, M.J. 2018. Macrophyte detritus as nursery diets for juveniles sea cucumber *Stichopus* cf. *horrens*. Aquac Res. 1-10. https://doi.org/10.1111/are.13829

Purcell SW, Simutoga M (2008) Spatio-temporal and size-dependent variation in the success of releasing cultured sea cucumbers in the wild. Rev Fish Sci 16:204–214. https://doi.org/10.1080/10641260701686895

Ricart AM, Dalmau A, Perez M, Romero J (2015) Effects of landscape configuration on the exchange of materials in seagrass ecosystems. Mar Ecol Prog Ser 532: 89-100. https://doi.org/10.3354/meps11384

Rogers, A., Hamel, J.F., and Mercier, A. 2018. Population structure and reproductive cycle of the commercial sea cucumber *Holothuria mexicana* (Echinodermata: Holothuroidea) in Belize. Revista de Biologia Tropical 66 (4): 1624-1648. http://dx.doi.org/10.15517/rbt.v66i4.32551

Tanita, I. and Yamada, H. 2019. Distribution of sea cucumbers in relation to sediment characteristics in coral reef lagoons and adjacent waters around Ishigaki Island, southern Japan. Mar Eco. http://dx.doi.org/10.1111/maec.12564

Wolkenhauer S, Uthicke S, Burridge C, et al (2010) The ecological role of *Holothuria scabra* ( Echinodermata : Holothuroidea ) within subtropical seagrass beds. J Mar Biolog Assoc UK 90 (02): 215-223. https://doi.org/10.1017/S0025315409990518