**Stichopodidae (Holothuroidea: Echinodermata)** from Nyamuk Island, Karimunjawa National Park, Central of Java, Indonesia

R Hartati*, A Ambariyanto¹, W Widianingsih¹, R T Mahendrajaya¹, M Mustagfirin² and P Prihatinningsih³

¹Department of Marine Science, Faculty of Fisheries and Marine Science, Diponegoro University, Jl. Prof. Soedharto, SH. Kampus Tembalang, Semarang, Indonesia
²PT. Kilang Pertamina International Refinery Unit VII Kasim, Sorong, Papua Barat
³Karimunjawa National Park Office

*Corresponding author email: retnohartati.undip@yahoo.com

**Abstract.** Sea cucumbers have been the subject of increased worldwide interest for scientific knowledge, sustainable use and conservation purposes. One family found in Karimunjawa National Park Area, Jepara was Stichopodidae. The present work was aimed to identify the species of Stichopodidae caught from the waters around Nyamuk Island, Karimunjawa National Park prior to sea ranching for their conservation. The samples were taken during 2018-2019 directly from fisher, processor, traders and wholesaler. By fisher, collections relied on free diving (in depth of 5-10 meters); diving with compressor (in depth of 10-25 meters) and all sea cucumbers were capture by hand. In the processors, the species were samples taken before being processed. They usually were gutted/un-gutted, boiled, smoked or brined. The identification was done through their morphological characters. There were eleven species found belonged to two genera (Stichopus and Thelenota), i.e. *Stichopus horrens*, *S. pseudohorrens*, *S. naso*, *S. vastus*, *S. chloronatus*, *S. herrmanni*, *S. monotuberculatus*, *S. ocellatus*, *S. quadrifasciatus*, *Thelenota anax* and *T. ananas*. All Stichopodid sea cucumber called as gamet or gamat by all stake holders of sea cucumber fisheries. With the increasing demand and good price of these species, the conservation effort, especially through sea ranching was urged to be done.

1. **Introduction**

The Karimunjawa islands is located in the Java Sea (110°07.2’ - 110°37.2’ BT and 5°43.2’ - 5°54.6’ LS), east of Seribu Islands and west of Madura-Bali waters. The islands of Karimunjawa are a small district belongs to Jepara Regency, Central of Java Province of Indonesia. The coastal community are only inhabited at six islands (out of 27 islands) i.e. Parang, Nyamuk, Kemujan, Karimunjawa, Sambangan and Genting Island, distributed in four villages, namely Nyamuk, Parang, Karimunjawa and Kemujan Villages. Most of area of Karimunjawa archipelago is under authority of Karimunjawa National Park. In this area, the west (December–March) and east (July-September) monsoonal seasons are the dominant climatic forces influencing both human activity and also likely to affect the marine resources by physical forces (e.g. wave action, currents, turbidity) and recruitment and migration of species (e.g. currents). Karimunjawa waters experience two calm seasons (April-June and October-November) [1]. The Karimunjawa archipelago is known for its unique environment and diverse habitats;
these fishing grounds are important for the growth and reproduction of many marine taxa, including corals, fish, crabs, mollusks, seaweeds, and echinoderms, particularly sea cucumbers. Sea cucumber have been longtime fished and processed in Karimunjawa and Kemujan Islands [2]. There were a total of 15 species of sea cucumbers found according to study done by Balai Taman Nasional Karimunjawa, in 2008 carried out at Karimunjawa archipelago, i.e. Geleang, Ujung Gelam, Karang Wangkang, Alang-alang and Menjangan Besar Island. More recent studies, stated that 18 out of 26 sea cucumber species processed as teripang in Indonesia were found from Karimunjawa archipelago [3], which belong to the family of Holothuridae and Stichopodidae. The family Stichopodidae (Echinodermata: Holothuroidea) consists of diverse and commercially important species [4], especially those in the Indo-Pacific region [5].

Nyamuk Island is located in the west part of Karimunjawa National Park. This area is surrounding by a very good coral and sea grass ecosystem as habitats of sea cucumber. There are several processors, two traders and sea cucumber whole seller in Nyamuk Island, but there is more than fifteen fisher who joined in sea cucumber fisher community group “Maju Lancar”. During their preliminary survey in several island around Nyamuk Island, [6] found Thelenota anax, H. edulis, H. coluber, Personothuria graeffei, Stichopus vastus, and S. horrens were processed as teripang. As demand of these products is increased yearly, the catch was more profound for Stichopodid family sea cucumber. The product has higher price than holothurid family. Therefore it is urgent need to do their conservation. One good effort of sea cucumber conservation is sea ranching, in which cultured or wild juveniles/youth are released into an area of natural habitat and harvested when they reach a commercially optimal size [7][8]. Lower inputs throughout their growth process in sea ranching will give advantage for coastal community since it is still able to produce marketable size of sea cucumber [9]. Stichopodidae sea cucumber in Nyamuk Island was called as gamat or gamet. They create high intensity bioactive compounds for marine pharmaceuticals and provide good protein sources for human diet, particularly for coastal communities [10]. Another advantage of this family is that they are able to do asexual reproduction (include in fissiparous holothurian) [11]. After doing asexual reproduction (fission), anterior part of body (with its mouth, tentacles and some internal organs) will regrown as well as its posterior part (with anus, intestinal and respiratory tree) become two new individual [12]. Therefore the present work was aimed to identify the species of Stichopodidae caught from the waters around Nyamuk Island, Karimunjawa National Park prior to their community based sea ranching for their conservation.

2. Materials and Methods

The samples were taken during 2018-2020 directly from sea cucumber fisher, processor, traders and wholesaler in Nyamuk Island of Karimunjawa National Park. By fisher, collections were relied on their free diving (in depth of 5-10 meters) (locations of D, E, F) or compressor diving (in depth of 10-25 meters) (locations of A, B, C, G, and H) around Nyamuk, Krakal Besar and Krakal Kecil Island. The map where the sea cucumber fisher fished the sea cucumber is presented in Figure 1. All sea cucumbers were capture by hand. In the processors, the species were samples taken before being processed, i.e. gutted/un-gutted, boiled, smoked or brined. The identification were done through their fresh morphological characters, afterwards, the specimens were labeled, and fixed in 95% ethanol overnight. The following day, the previous ethanol was removed and the specimen was preserved in 70% ethanol for longer preservation [13]. The referred guides to species identification were used guidance book by [14–16]. The outer morphology observed is the shape of body cross section, maximum body length, the arrangement of the papillae and tube feet, whether or not protrusion of the papillae, position of the mouth and rectum, there the absence of anal modification, and the number of tentacles [17].
3. Results and Discussion

Sea cucumbers are now considered as important invertebrate marine resources, not only to be significant to marine ecosystem, but also to global trade and livelihoods [18]. As a result, there has been a surge in international interest in them for scientific research, long-term usage, and conservation [19]. One of this sea cucumber is family Stichopodidae, belonged to Ordo Aspidochirotida Class Holothuroidea (Echinodermata), in which consisted mostly the commercially trade sea cucumber in Indonesia and high economic value since it is edible and have medicinal materials [20]. The species member of Stichopodidae family is in most cases nocturnal; during the day, it hides in sea grass, rock or in reef crevices. Therefore fisher of Nyamuk Island, both free and compressor diving, go for sea cucumber fishing during the night.

Stichopodidae from Nyamuk Island could be distinguished from Holothuroidea, that their overall body shape were trapezium in transverse section and similar diameter along the length of the body and their body shape have rough dorsal surface due the presence of enlarged papillae or tubicular structures. There were eleven species of Family Stichopodidae found consisted of two genera (Stichopus and Thelenota), i.e. Stichopus horrens, S. pseudohorrens, S. naso, S. vastus, S. chloronatus, S. herrmanni, S. monotuberculatus, S. ocellatus, S. quadrifasciatus, Thelenota anax and T. ananas.

S. horrens Selenka, 1867 is commercially called dragon fish and locally named as Gamet kacang goreng or Gamet rengget. The mouth located ventrally equipped with 20 tentacles. The body is solid, thick, folded and soft flesh. The body color is yellowish green with a small patch with blackish brown stripes. Papillae are white, long and small with a large protrusion at the base. The protrusions are greenish-white and somewhat transparent, scattered on the dorsal surface. On the ventral surface, the tube feet are organized in three longitudinal rows. It has a wide range of coloration, ranging from grey to beige to dark red, dark brown, or black with various colored spots on the dorsal surface [21]. Long and conical, or wart-like, papillae are generally in two rows along the upper dorsal surface, with a row of bigger papillae along the lateral borders of the flattened ventral surface. On the ventral surface, there are many huge podia. It's easy to confuse, because S. naso has similar look with S. quadrifasciatus, S. monotuberculatus. As a result, the spicules must be used to further identify [22]. S. horrens from Nyamuk Island is relatively small. Average fresh weight were 100-250 g with average fresh length 12-22 cm. Gamet rengget is caught by free diving fisher in rocky bottoms with sandy patches in the depth of 2-10 meter and the compressor diving caught them from rocky shore, reef flats and upper slopes in depth of more than 10 meter.
S. pseudohorrens Cherbonnier, 1967 is a large species and locally named as Gamet duri. It has ventral mouth surrounded by large papillae and has 20 long dark brown tentacles. The anus is terminal. It has solid, thick and hard flesh. Body color was reddish brown with yellowish spots. Papillae are very large and tightly packed covering the dorsal surface. Tube feet are arranged in three long bars lengthwise. S. pseudohorrens generally brownish-yellow to rosy red with darker motting colour [16]. The body is squarish to trapezoidal in cross-section, with a high arched dorsal arch and a flattened ventral arch. It features very long, thin, conical papillae on the dorsal aspect of the body, particularly on the top side; the dorsal papillae are typically darker in color than the body wall[5]. Long papillae can also be found on the ventral surface's lateral borders. Gamet duri from Nyamuk Island is quite big size with average body length more than 20 cm and more than 700 grams in weight. This species mostly caught by compressor diver from coral sand area up to 20 m depth.

S. naso Semper, 1868 found from Nyamuk Island are usually relatively small, trapezoidal to rectangular in cross-section. With 18–20 tentacles, the mouth is ventral. The terminal of Anus is unproctected by papillae. It has a yellowish-tan dorsal coloring that is speckled with brown, or a uniform light brown colour [23]. Laterally, it's a little lighter. A brown center longitudinal stripe runs between the rows of podia on the ventral side. The tips of the podia and the dorsal papillae are a dark brown color. Small specimens are virtually uniformly grey, with a pair of reddish dorsolateral papillae occasionally present. It is lightly arched, dorsal surface with squat, and conical dorsolateral papillae. On the ventral surface, there are many huge podia organized in longitudinal rows [24]. The sample of this Teri pang gamet fresh length from Nyamuk Island was from 10 to 20 cm and approximately 100 g to 200 g fresh weight. In international market, the intestine and gonads were consumed as traditional diets. S. naso is often misidentified as S. horrens, S. monotuberculatus or S. quadrifasciatus. This gamet species from Nyamuk Island has fresh length from 10 to 25 cm, with average weight of 250 g.

In Nyamuk Island, Gamet kacang goreng or gamet pace is also found in the sub tidal area. S. vastus Sluiter, 1887, commercially named as Curry fish. Ventrally located mouth has 18–20 tentacles, surrounded by a collar of papillae. The anus is terminal, with no-teeth. This species has a squarish cross-section with a strongly arched dorsally and flattened ventrally body. Body wall folded. Body color is grey-green with numerous dark brown stripes on the dorsal surface and lighter color on the ventral surface. Dorsal papillae are enlarged at the base with dark brown stripes, and tube feet are arranged in the ambulacral area.

S. vastus has a variety of colour, i.e. brownish-yellow, goldish-yellow, reddish, olive green or greyish-green [25]. The base of large papillae is surrounded by fine, dark, discontinuous lines on the dorsal surface. On the top dorsal surface and along the lateral borders of the ventral surface, there are 5–6 rows of huge, wart-like papillae. All across the dorsal surface are tiny wart-like papillae. Dorsally, deep transverse creases are possible. The interambulacral regions are yellow-orange and the ventral surface is brown. There are several large podia along the ventral surface's ambulacra.

Gamet kacang goreng or gamet pace is fished by free diver fisher on sand of inshore reefs edges, coral rubble or muddy sand in shallow waters and at the base of semi-sheltered reefs, generally to about 8 m depth. It also could be found on sandy or coral rubble substrates. This is big size species, with fresh weight of 100-1500 g with average length of 30 cm. When it is handled and held out of water for a long time, its body wall will be broken apart.

Gamet jepon is a very distinct sea cucumber species from Nyamuk Island as their entire body colour is green or blue-black with orange papillae. S. chloronatus Brandt, 1835 is commercially named as Greenfish/squarefish. In cross-section, the body is fairly solid and squarish. It has ventral mouth with 19 or 20 white to greyish robust tentacles. The terminal anus has five big papillae. This species has a solid, thick and hard flesh body. The papilla is small and short with a large, long bulge in the conscious. The ridges are arranged along both sides of the dorsal part of the body in longitudinal rows. It has got four rows long green ventral podia. The three longitudinal tube feet rows were arranged on the ventral surface. According to [25], the body color of S. chloronatus is dark green to near black on the dorsal side and dark green on the ventral side. On both sides of the dorsal surface and along both lower lateral
borders of the body have rows of long, conical papillae. The tops of the papillae are generally orange to yellow.

Gamet jepun was caught by free diver fisher of Nyamuk Island from coral reefs, in shallow area of waters from the intertidal area to 10 m deep. It also inhabitants on reef-flats and upper reef slopes. The maximum size of *S. chloronatus* from Nyamuk Island was 38 cm. Before being processed, this species has to be handled with care, since if the animal is held out of the water for a long time, this body-wall may disintegrate

*S. ocellatus* is called as Gamet mas or gamet kasur by Nyamuk Island community [26]. This Curry fish species was found in the sub tidal area. Mouth is in ventral position and anus is in the terminal body with no teeth. Ventral side is flattened and has whitish yellow colour, while dorsal surface was rounded. Body color is yellow with small orange spots on the dorsal surface and darker yellow on the ventral surface. Dorsal papillae color is white on the base and dark green-grey color on the tip. Tube feet are dark green-grey and arrange in the ambulacral area.

The dorsal surface of identified *S. ocellatus* is yellow or yellowish-orange, with conspicuous, big, round, greenish-grey, wart-like papillae that are white at the base [5,27]. There are four rows of zigzag pattern large papillae. Only located on the ambulacral regions, greenish-brown podia are abundant on the ventral surface, with enormous suckers in the end (up to 1.5 mm diameter) [22]. *Gamet mas* is caught by sea cucumber fisher of Nyamuk island from sea grass beds on near shore reef flats with average size length of 34 cm. It is often found associated with *S. herrmanni* which have similar habitat preferences [26].

*S. quadrifasciatus* Massin, 1999 was found in Nyamuk Island and named as Gamat. It has got solid body with soft thick flesh. Light brown in color with four dark brown areas running across the dorsal part of the body. It has papillae with large protrusions at the base that are tightly packed together on the dorsal surface. It has a papilla on the lateral side with a very large protrusion at the base and shaped like a wing [14]. There are three longitudinal rows tube feet arranged in on the ventral surface of its body. This species was caught by fisher from rocky and sea grass bed shore.

*S. herrmanni* Semper 1868 or Curryfish is named as Gamat emas in Nyamuk Island. In cross-section, the body is reasonably solid, somewhat elongate, and squarish. With 8–16 strong green tentacles, the mouth is ventral. Anus is a terminal with no teeth or papillae around it. The body was solid, thick flesh, hard, and folded like a mattress. The colour of whole body is greenish or bright yellow. There are black or dark brown small papillae with big protrusions at the base scattered on the lateral and dorsal surfaces. It has three longitudinal rows tube feet arranged on the ventral surface. Body colour of *S. herrmanni* varies from light mustard-yellow to orangey-brown or brown or olive green [5]. It has lighter colour on the ventral side. It has dark brown to black patches strewn throughout the body; two double-rows of bigger wart-like papillae, and surrounded by fine dark rings. Podia are showed numerous in the ventral side. This species is previously known as *S. variegatus* [25] and sometimes mistaken as *S. monotuberculatus*. From Nyamuk Island, *S. herrmanni* have size of 25-45 cm and sea cucumber fisher found them in rubble and sandy-muddy bottoms or sea grass beds between 3 and 25 m. Sometimes they found smaller size from shallower waters. As other Stichopodid species, its body wall disintegrates easily when it is exposed to the air.

*S. monotuberculatus* Quoy & Gaimard, 1834 found from Nyamuk Island is called Gamat pace. The mouth of this species is ventral with 20 tentacles. It has a solid, thick flesh and soft body and a trapezoidal to rectangular in cross-section. It body’s color yellowish green with black dotted lines. It has long papilla with white tip and red base. The base of the papilla is a very large protrusion covering the dorsal surface. The bulge is darker in color than the body color and there is a circular dotted line. The three longitudinal rows tube feet are arranged on the ventral surface. It could be found easily in the Indo-Pacific Ocean as well as in Indonesia and had synonym name of *Holothuria monotuberculata* Quoy and Gaimard, 1833[15].

The colour of *S. monotuberculatus* is varied, often miss-identified as *S. horrens*. It has a variety of grey to beige to yellowish background color dorsally with darker brown, grey to black spots and blotches [5]. Large pointed dorsolateral and ventro-lateral papillae are retracted during the day. Ventral
and dorsal surface have three large longitudinal podia rows [4]. In Nyamuk Island, this Gamet pace is often mistaken for S. horrens, S. naso or S. quadrifasciatus. It has average fresh weight 250 g and fresh length of 15-25 cm. Sea cucumber fisher found this species emerged from rock hole and under rubble during the night on the reef flat and slope from 3 m to 25 m depth.

S. monotuberculatus, Quoy & Gaimard, 1834 of Parang Island, which is the next of Nyamuk Island [28]. Morphologically they were grey-green colour with numerous small dark patches ventrally and grey green to orange-brown with dark green to black patches dorsally with square thick integument/body wall. Radial calcareous ring pieces had a posterior notch and four short anterior points. Their ossicles showed numerous tables-shaped ossicles in the anterior and dorsal tissue of the body wall, but no rossete-shape in dorsal body wall which is the characteristic of S. monotuberculatus. DNA sequencing of nine samples showed that all samples had got 93-99% similarity with S. monotuberculatus haplotype 4, 5, 9, and 13. This result confirmed the identification through morphology and ossicles characters. It is approved the presence of S. monotuberculatus, Quoy and Gaimard, 1833 in Parang Island, Karimunjawa Archipelago, Jepara.

There are two species of Thelenota found from Nyamuk Island of Karimunjawa National Park, i.e. T. ananas and T. anax. Thelenota ananas Jaeger 1833, commercially named as Prickly redfish/Plum flower trepang and locally named as Teripang nenas/nanas. This species can reach size of 80 cm. The body is strong and stiff, with a dorsally arched and ventrally flattened shape. The body wall is rather thick. Mouth has 20 enormous brown tentacles on the ventral side, which are encircled by conical papillae. Anus is terminal and masked by enormous papillae. Body reddish brown with very large papillae and branching like leaves on the dorsal to lateral surface of the body. The color of the papilla is relatively brighter than the color of the body. Tube feet are densely distributed on the ventral surface. This species has varied dorsal colour from reddish-orange to brown or burgundy [29]. Large papillae cover the dorsal surface, which can be long and conical or star-shaped on a short stalk or branching. On the radii, brown to pink podia are more numerous than on the ventral side, which is pale pink to red. From Nyamuk Island Teripang nenas could be as long as 80 cm and e found in reef slopes, hard bottoms with large coral rubble and coral patches in waters between 1 and 25 m deep.

Thelenota anax Clark 1921 is named as Gamet Babi/donga in Nyamuk Island or Amberfish are relatively large body size that can reach 100 cm. It has a rather quadrangular in cross-section thick body wall. On the flat ventral surface there are dense fine long podia. The ventral mouth is with 18–20 peltate tentacles, while anus is in sub dorsal terminal. It has thick hard flesh body [30]. Cream body color with bright reddish hues, sometimes there is a light brown. Along the lateral side there are very large protrusions and coalesce to form a love. Scattered on the dorsal and lateral surfaces, papillae are large, slightly protruding and yellowish-brown in color [31]. The tube feet are densely distributed on the ventral surface. T. anax’s colour varies from light brown with dark brown and/or reddish spots and blotches dorsally to creamy white beige to grey [32,33]. Many of this species have light coloured, wart-like bumps occur in rows along the dorsal surface. It also has large, white papillae along the ventro-lateral margins. In Nyamuk Island, T. anax could be found inhabits in outer lagoons on sandy bottoms or reef slopes of 10 and 30 m depth. The free diver sometimes found it on hard bottoms or on coral rubble of shallower waters to about 4–5 m depth. Generally T. anax has a sparse low density population [34].

Other research found 18 sea cucumber species which is processed as teripang in Karimunjawa archipelago, there are Actinopyga banwarthy, A. miliaris, A. lecanora, Bohadschia vitiensis, B. Subrubra, B. similis Holothuria atra, H. edulis, H. leucospilota, H. fisucocinerea, H. scabra, Pearsonothuria graeffei which is belong to Holothuriidae family and S. hermanni, S. horrens, S. vastus, S. ocellatus, S. chloronotus, and T. anax belong to the family of Stichopodidae[13]. During their preliminary survey in several island around Nyamuk Island, found Stichopus vastus, S. horrens., Personothuria graeffei, H. edulis, H. coluber, and Thelenota anax[6] and [35] did study on population growth of S. quadrifasciatus in Karimunjawa Island. Among the sea cucumber exploited in Lampung that out of eight species[27], only 2 species belong to Stichopodidae family, i.e. S. ocellatus and S. vastus
While *S. variegatus* revealed in the most previous study in same area by [36]. Other studies in Bakacheuni water found *S. horrens* and *S. vastus* which were commercially important species in those area [37].

Holothurians have been exploited for a long time, but rarely consumed raw [5], mostly were processed into a dry product called bêche-de-mer, trepang, or hai-som. This product is well known as a medicinal food and delicacy by Chinese and Asian peoples. In the tropics, it is usually collected by hand or free-diving in shallow waters at low tide. SCUBA has increasingly been used in other locations, but not in Nyamuk Island. There are 15 10-15 GT boats fishing in around Nyamuk Island, generally fitted with a 20 HP engine and have 3-4 people in one boat, 3 of them are divers. Fishers go for sea cucumber in the afternoon (around 17.00pm) and come back early in the morning. Fishermen who harvest sea cucumber are usually fished for other species such as mollusk, shark, demersal fish, and seaweed species.

In Nyamuk Island, sea cucumber are processed and become salted/non-salted smoked dried product called teripang (be-chede-mer). There are three stage of processing of sea cucumbers, i.e. viscera removal, cooking and drying. Before being processed, the sea cucumber was sorted by species and then incised on its ventral side to eviscerate the internal organ. Then it is washed with seawater, put in a boiler container and cooked for two to three hours depend on the amount of sea cucumber in the boiler. During boiling, the sea cucumbers become stiff and 50-70 % of body fluids were loosen. After allowing water to cool down, the sea cucumber placed in the bucket. Some sea cucumbers were salted for six hours according the demand of trader. The sea cucumbers are then further smoked over hot wood or oven for an additional 30 minutes and make black or dark coloration of the product. The cooked product is then sun dried up to 2 days until it properly dried. A good cooking and drying process is important otherwise it will soon start to rot and give a bad smell. Overcooking may also damage the product as it may not be a high quality product. The sea cucumber processor in Nyamuk Island process 200-300 kg of fresh holothurians per day. The sea cucumber were divided into three categories based on their price, i.e. low value (*T. anax*), medium (*S. naso, S. horrens* and *S. chloronatus*) and expensive (*S. pseudohorrens S. vastus S. ocellatus S. quadrifasciatus S. hermanni S. monotuberculatus* and *T. ananas*). In 2008, it has been estimated 4-10 tones (dry weight) of exploitable of sea cucumbers produced from Karimunjawa Archipelago [38] and sold out to Surabaya-East Java. Like in other areas of Indonesia, in Karimunjawa Islands, processed trepang has never been stored for long time and are sold as soon as possible, showed their high market demand. This phenomena make the fisher collect the sea cucumber as many as they can [3] and so they can get more extra money.

Although sea cucumber is a high quality food with high protein, low lipid concentration, and have may benefit [38], the coastal community almost never eat them. The fisher always sells the sea cucumber to sea cucumber processor. Sea cucumbers have not been classified as protected marine resources. Among Stichopodid species, *T. ananas* is classified in IUCN status as Endangered (at a high risk of extinction) and *S. hermanni* as Vulnerable and both populations are decreasing [39]. Unfortunately there has not been sea cucumber fisheries management yet in Indonesia, excessive fishing and a gradual decline of the natural resources may be happened. So several conservation efforts could be done, such as establishment of protected areas, set up a minimum catch size, and authorized fishing seasons. In addition, applied research, such as study on using asexual reproduction of economically important sea cucumbers species to produce young individual for sea ranching purposes could be conducted [12,40]. Promotion of sea cucumber conservation through community based sea cucumber ranching in Nyamuk Island is needed to be done and the result may be applied for the long term sustainability of the sea cucumber natural population.

4. Conclusions
In Nyamuk island there were eleven species Stichopodid family found belonged to two genera (Stichopus and Thelenota), i.e. *Stichopus horrens*, *S. pseudohorrens*, *S. naso*, *S. vastus*, *S. chloronatus*, *S. hermanni*, *S. monotuberculatus*, *S. ocellatus*, *S. quadrifasciatus*, *Thelenota anax* and *T. ananas*. Only two species, *T. ananas* and *S. hermanni* are classified in IUCN status as Endangered (at a high risk of extinction) and Vulnerable respectively, and both populations are decreasing. With the increasing
demand and good price of these species, the conservation effort, especially through sea ranching was urged to be done.

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