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# Identification and distribution of sea cucumber exploited in Lampung, Indonesia

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**Abstract.** *Setyastuti A, Wirawati I, Iswari MY. 2018. Identification and distribution of sea cucumber exploited in Lampung, Indonesia. Biodiversitas 19: 726-732.* Recently approx. 54 species of sea cucumbers were successfully listed that still being exploited from Indonesian waters. However, out of those only 33 species were taxonomically confirmed because the identification of remaining 21 species need to be verified. Inventory on commercial sea cucumber in Bakaheuni water, Lampung was conducted to bridge the gap in fisheries data by addressing the understanding of the diversity of species exploited for trade. Eight commercially important species of sea cucumber were discovered *viz*. *Actinopyga echinites*, *A. mauritiana*, *Holothuria* (*Halodeima*) *atra*, *Holothuria (Thymiosycia) impatiens*, *Holothuria (Acanthotrapeza) coluber*, *Pearsonothuria graeffei*, *Stichopus ocellatus* and *Stichopus vastus* during the present study. Two most interesting species namely *Actinopyga mauritiana* was one of the species that fortuitously confirmed its utilization status as commercial species through this study, and *Stichopus ocellatus* is newly reported species in Indonesia, not only from fisheries point of view but also taxonomical studies. Hence, the findings of the present study will prove best for the updating of the list of sea cucumber species fished in Indonesia for trade purpose. Till date, we can paraphrase that the number of sea cucumber being involved in a trade is 55 species. It was also concluded that almost 90% of over 650 individuals of sea cucumber found in Bakaheuni waters was observed in the intertidal area, out of which *Holothuria atra* is the most abundant one. Data presented also revealed that local fishermen are not interested to exploit the low-value species of sea cucumber.

**Keywords**: Sea cucumber, *Actinopyga mauritiana, Stichopus ocellatus*, Indonesia, trade

## INTRODUCTION

Setyastuti and Purwati (2015) successfully listed up 54 species of sea cucumbers that were or still being exploited in Indonesian waters. Their data were based on field inventory at four locations and compilation of many sources on sea cucumber industries (Purwati 2005; Choo 2008; Manez and Ferse 2010; Purwati et al. 2010; Purcell 2013). However, out of all only 33 species have been taxonomically confirmed and the remaining 21 species are yet to be verified not only for their accurate identification but also for their species name validation.

Sea cucumbers are harvested in artisanal fisheries that are scattered throughout the many islands of Indonesia, since Indonesia known as an archipelago country that possessed more than 17.000 islands. Thus, number of species involved in trade will change along with more sample from more localities (Setyastuti and Purwati 2015). In general, fishermen experienced that sea cucumber is harder to collect, they have to dive deeper than the past couple of decades. Furthermore, the size of individuals found is mostly smaller compared to the past time. Global perspective indicated that sea cucumber fisheries status in Indonesia is overexploited (Toral-Granda et al. 2008; Purcell et al. 2013). However, those opinion is mostly inferred from the Indonesian export data. In fact, Indonesian natural stock of sea cucumber is not quantified properly yet due to lack of data. Indeed, it is also admitted that the natural population data of sea cucumber species exploited for trade are sparse because the area is too large to cover with limited access, whereas the expert who focused on this alarming issue is only a few.

Inventory on commercial sea cucumber in Bakaheuni water, Lampung was conducted to bridge the gap in fisheries data by addressing the diversity of species exploited for trade. However, even though Lampung was known as one of the sea cucumber fishing site in Indonesia (Tuwo and Conand 1992; Aziz and Al-Hakim 2007; Choo 2008), detailed information on its local distribution have never been described. The method used during the survey was rendered us to explore a wider area covering both intertidal and subtidal.

## MATERIALS AND METHODS

### Study locations

The present study was conducted in Bakaheuni waters, Lampung, West Indonesia (Figure 1). The presence of commercially exploited varieties of sea cucumber species was surveyed across the seven islands during April 2016. The seven islands, viz. Harimau Balak Island, Kandang Balak Island, Tumpul Lunik Island, Bawangan Beach, Sindu Island, Dua Balak Island, Penjurit Island and Kandang Lunik Island. Survey basically based on the information getting from local fisheries authorities, from local people guidance and also according to the accessibility of the sites. The survey of both the areas, i.e.,

intertidal and sub-tidal was conducted during the study. The low-tide observation was used during the survey of the intertidal area, whereas scuba diving method was applied in the subtidal area.

**Species identification**

Specimen of sea cucumber was labeled then relaxed in 5% magnesium chloride (MgCl) until photography session. Afterward, it was fixed in 96% ethanol overnight to ensure the whole specimen body was completely preserved. The overnight sample was exposed to 70% ethanol for longer preservation. Specimens were identified by observing the morphological characteristics and also by examining the ossicles of their body. To prepare the ossicles, small cuts of the dorsal and ventral body wall, tentacles, papillae and tube feet were dipped in NaClO (domestic bleach) for several minutes. The precipitated ossicles were rinsed with aquadest several times followed by 70% ethanol before being observed under compound microscope. This technique has been adopted by various researchers (Wirawati et al. 2007; Purwati and Wirawati 2009; Setyastuti 2015, 2009). The reference guides to species identification included Quoy and Gaimard (1833); Cherbonnier (1988); Massin (1996, 1999); Samyn et al. (2006).


**Figure 1.** Sampling sites at Lampung waters, Indonesia

**Distribution map**

To get the local distribution, Global Positioning System (GPS) was used to track and plotting the waypoint of all sea cucumber both in intertidal or subtidal sites. Later on, to draw the distribution map, all the GPS waypoints were transferred to the computer for the analysis by using ArcGIS software. This observation method was modification of Visual Encounter Surveys methods by Heyer et al. (2015) and had been adopted in several previous works (Purwati 2006; Purwati et al. 2008; Purwati and Syahailatua 2008; Setyastuti 2015).

## RESULTS AND DISCUSSION

**Synopsis of sea cucumber species exploited in Lampung**

Phylum: Echinodermata
Class: Holothuroidea
Order: Aspidochirotida
Family: Holothuriidae
Genus: *Actinopyga*

*Actinopyga echinites* (Jaeger, 1833) (Figure 2.A, C), local name is "Suwala sepatu"

This species was found in the subtidal area. Body color is uniformly chocolate brown on the dorsal and light brown on the ventral. Dorsal papillae color is chocolate brown and arranged densely on the dorsal surface. Tube feet color is light brown and arranged within the ambulacral.

*Actinopyga mauritiana* (Quoy & Gaimard, 1833) (Figure 2.B, D), local name is "Suwala batu"

This species was found in the subtidal area. Body color is uniformly brown on the dorsal surface with white spots that fused to a form of line pattern along the lateral surface. Ventral surface is white uniformly. Papillae are densely scattered on the dorsal surface. Tube feet color is light brown and scattered over the ventral surface.

Remarks – The color pattern is slightly different with specimen collected from Ambon, Indonesia (Massin 1996). Massin described the body color was chocolate brown with white spots in the dorsal and anal, but present specimen has brown body color with white spots that fused to a form of line pattern along the lateral surface.

Genus: *Holothuria*

*Holothuria* (*Acanthotrapeza*) *coluber* Semper, 1868 (Figure 2.E), local name is not available

This species was found under the rocks in the intertidal area. Body shape is cylindrical, narrow anteriorly than posterior part. Body color is uniformly brown on the dorsal and light brown on the ventral surface. Dorsal papillae and ventral tube feet uniformly yellow in color and scattered over the body surface. Tentacle shape is peltate and uniformly yellow.

Remarks – The color of this specimen is slightly different with other specimens collected from Spermonde and West Lombok, Indonesia (Massin 1999; Purwati and Wirawati 2009), which the coloration of the body is uniformly black instead of brown.

*Holothuria* (*Halodeima*) *atra* Jaeger, 1833 (Figure 2.F), local name is "Suwala hitam"

This species was abundant in the intertidal area out of all studied sites. Body color is uniformly black. Dorsal papillae color is black and arranged densely on dorsal surface. Tube feet are similar to dorsal papillae.

*Holothuria* (*Thymiosycia*) *impatiens* (Forskal, 1775) (Figure 2.G), local name is "Suwala hitam"

This species was found under the rocks in the intertidal area. Body color is light brown with dark brown band horizontally. Dorsal papillae and ventral tube feet are spread over the surface of the body.

Remarks – the color pattern in this species varies from the dark brown band to dark brown spots on each side of the dorsal surface.

Genus: *Pearsonothuria*

*Pearsonothuria graeffei* (Semper 1868) (Figure 2.H), local name is "Suwala duri"

This species was found in the subtidal area. Body color is uniformly light brown with small spot of black or darker brown. Dorsal papillae base is dark brown in color, and the tip is white. Tube feet is with white and brown stripes.

Family: Stichopodidae
Genus: *Stichopus*

*Stichopus ocellatus* Massin, Zulfigar, Hwai & Boss, 2002 (Figure 2.I), local name is "Suwala kasur kuning"

This species was found in the subtidal area. 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.

*Stichopus vastus* Sluiter, 1887 (Figure 2.J), local name is "Suwala kasur"

This species was found in the subtidal area. 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.

**Species identification**

Eight species discovered during the present study provides additional data on Indonesian sea cucumber fisheries (Figure 2). Based on the listed species of sea cucumber in trade by Setyastuti and Purwati (2015) several species were confirmed. One of it is *Actinopyga mauritiana*. Since it is taxonomically verified that *A. mauritiana* is involved in trade, total species of sea cucumber mentioned in Setyastuti and Purwati (2015) that need to be confirmed is getting reduced.

Another attracting species that was found is *Stichopus ocellatus* which is the first time reported from Indonesia during the study. Hence, this finding will automatically add the list of sea cucumber species exploited for trade in Indonesia by Setyastuti and Purwati (2015). Therefore, we can state that 55 species of sea cucumber are exploited for trade.

Seven species of sea cucumber was found during research conducted in 1995 out of which six of them *viz., Holothuria atra*, *H. coluber*, *H. hilla*, *H. impatiens*, *H. pervicax* and *Stichopus horrens* are commercially important species of Bakaheuni water (Aziz and Al Hakim 2007). The last mentioned species, *i.e., Stichopus horrens* holds the first rank regarding price. Only two individuals belonging to two species *H. atra* and *S. vastus* were found since last two decades (Fahmi et al. 2015). Their report ended up with a conclusion that the sea cucumber in Bakaheuni water have been over-exploited and it was also supported by local information that it was easier to catch the sea cucumber a decade ago than in 2015. Another report from Lampung Bay, noted down the six species of commercially important sea cucumber, *i.e., Holothuria edulis*, *H. impatiens, H. atra*, *H. pervicax*, *Bohadchia marmorata*, *Stichopus variegatus* (Darsono and Aziz 2002).

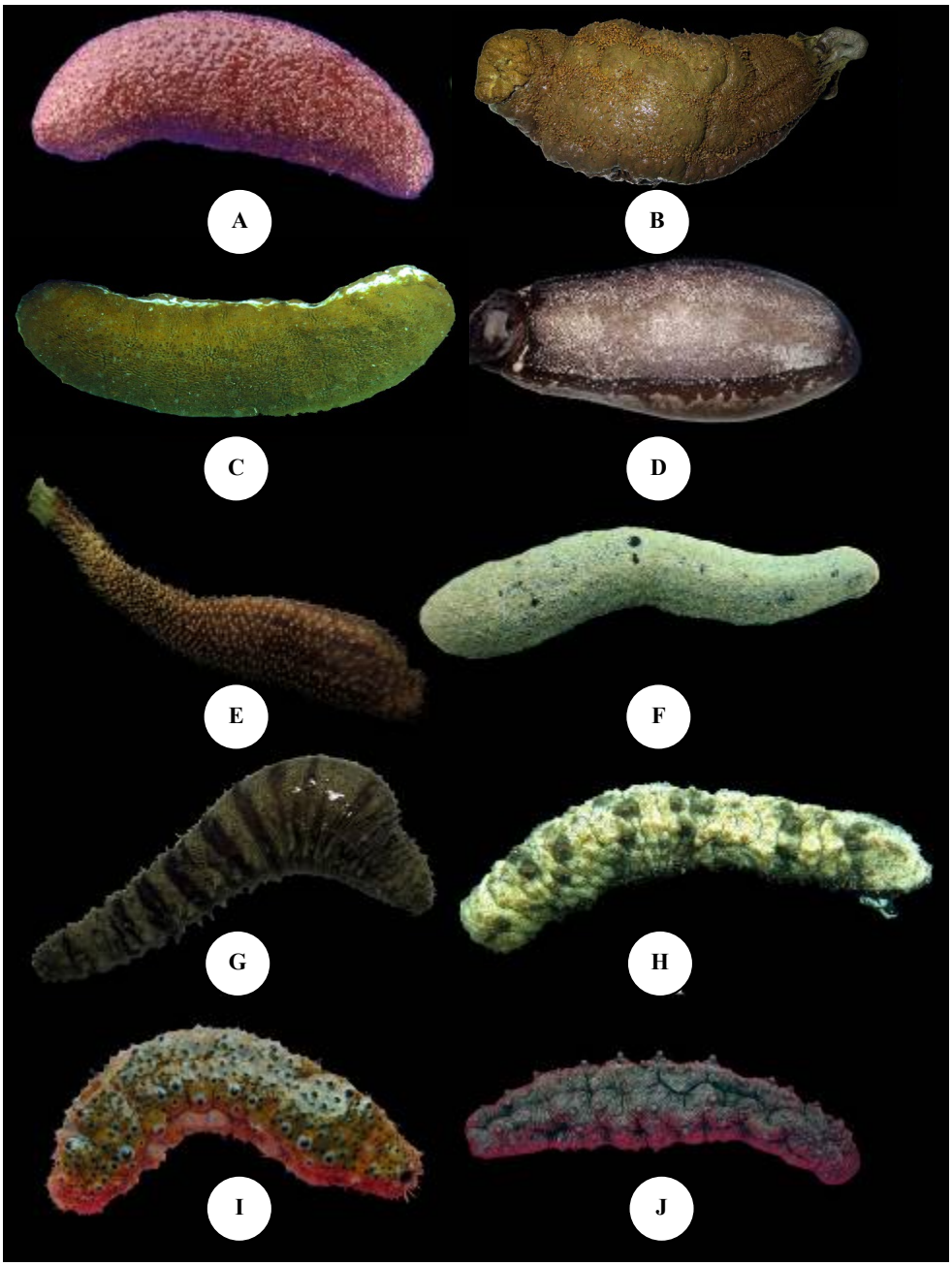


**Figure 2.** A, B. Dorsal, ventral side of *Actinopyga echinites* (Jaeger, 1833); C, D. Dorsal, ventral side of *Actinopyga mauritiana* (Quoy & Gaimard, 1833); E. *Holothuria (Acanthotrapeza) coluber* Semper, 1868; F. *Holothuria (Halodeima) atra* Jaeger, 1833; G. *Holothuria (Thymiosycia) impatiens* (Forskal, 1775); H. *Pearsonothuria graeffei* (Semper 1868); I. *Stichopus ocellatus* Massin, Zulfigar, Hwai & Boss, 2002; J. *Stichopus vastus* Sluiter, 1887.

This study showed that alteration of species exploited has occurred. Compared to 2007 and 2015 reports (Aziz and Al Hakim 2007; Fahmi et al. 2015), three species were no longer present in the harvest (*Holothuria hilla*, *H. pervicax,* and *Stichopus horrens*). Meanwhile, the present study, adding four species that are newly reported as commercially important species from the same sites namely *Actinopyga echinites*, *A. mauritiana*, *Pearsonothuria graeffei* and *Stichopus ocellatus*. So far, 11 species of sea cucumbers have been and still being exploited in Bakaheuni waters and about 13 species all around Lampung waters.

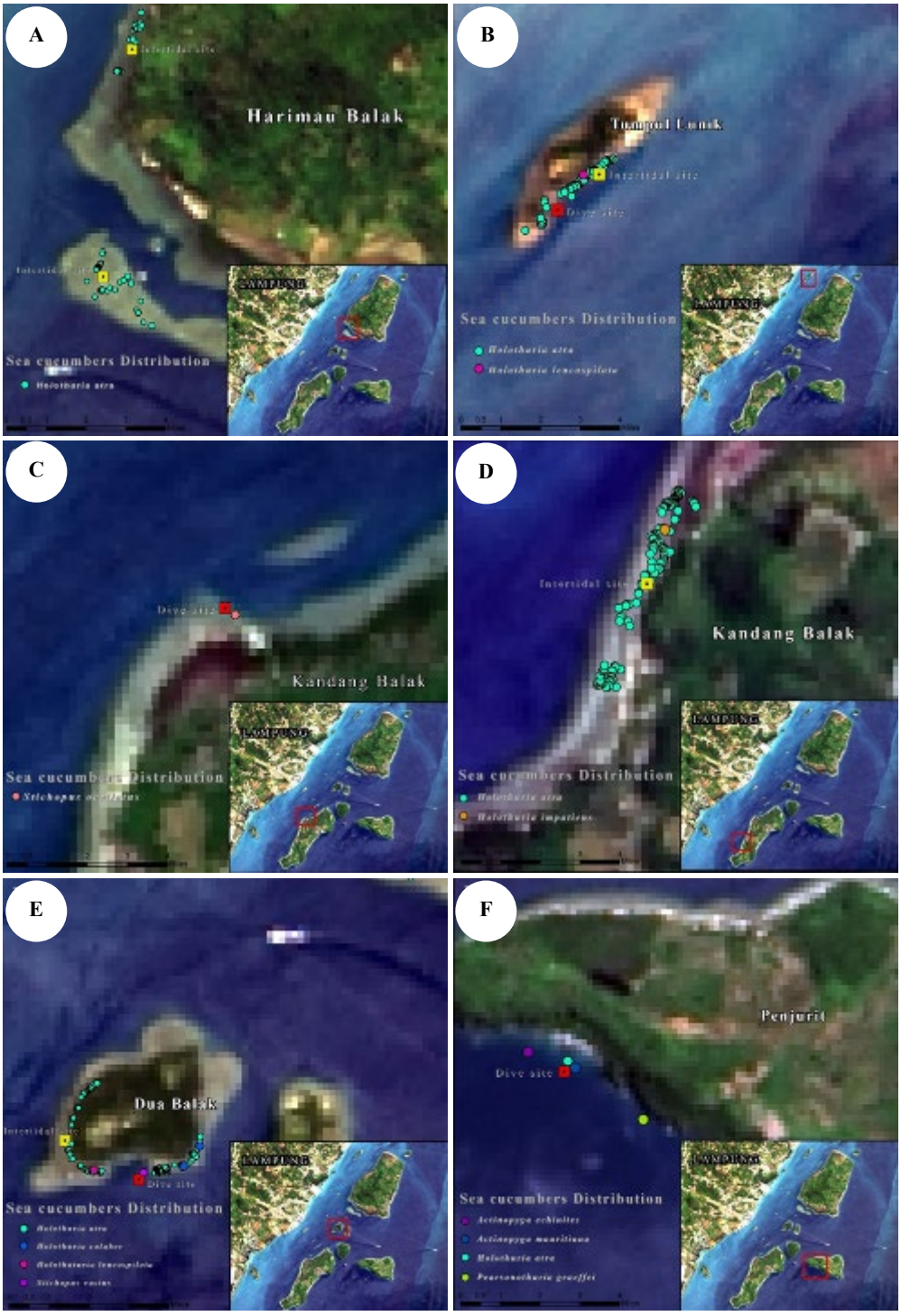


**Figure 3.** Distribution map of each species at each location in Lampung, Indonesia. A. Harimau Balak Island, B. Tumpul Lunik Island, C. Kandang Balak Island subtidal site, D. Kandang Balak Island intertidal site, E. Dua Balak Island, F. Penjurit Island

**Distribution map**

Over 600 individuals of sea cucumber which were found in Bakaheuni waters, almost 90% of them were observed in the intertidal area. *Holothuria atra* showed the highest abundance. A possible reason regarding this is might be related to the high aptitude to adapt of this species at various habitat from intertidal to subtidal area or called as a habitat generalist species (Sanvicente-Anorve et al. 2017). This observation is in line with previous publications in Indonesia about *H. atra* that have a wider distribution than any other sea cucumber species (Setyastuti 2014, 2015). Moreover, *H. atra* can adapt for high temperature up to 39.4°C by covering its body with sand, enabling the body to maintain a lower temperature than surrounding environment (Bonham and Held 1963). Additional to its broad environmental tolerance, the species can reproduce by both sexually and asexually (Sanvicente-Anorve et al. 2017). During the survey, almost half of total individual collected showing signs of having undergone fission. Similar finding also noted by Setyastuti (2015) at Pombo Island-Maluku, Central Indonesia. These two findings showed that in April many *H. atra,* both in Eastern Indonesia (Pombo Island) and West Indonesia (Lampung) underwent fission. However, it's too early to conclude about the peak of fission finding in Indonesia occurred in April due to lack of monthly data for the whole year.

Out of all surveyed sites, *H. atra* of shallower water was found at highest range in Dua Balak Island (Figure 3). This might be supported by the topography of the area that is mostly rocky and dead coral flat with clumps of seagrass over the low-tide area. Nevertheless, Dissanayake and Stefansson (2011) argued that the habitat preference of holothurians seems to be associated with their feeding activity and shelter prospecting.

Another possible reason behind the higher number of *H. atra* might also because of low-value species is no longer interesting to look for. Based on personal communication with fishermen, since the developing of many industrial sectors around surveys area and the denseness of marine traffic, it impacted the marine habitat somehow. Several sites used to have a vast area of coral reef habitat, but at present survey, no large or healthy coral reef was observed. Most of the sites visit during survey were found to be full of dead coral and/or sandy-muddy substrate. This indicates that the habitat degradation has been or still being occurred in this area. However, it could affect the abundance and the distribution pattern of sea cucumber. The species list in table 1 and the distribution map in Figure 3 are evidence that most of the high-value species (*Actinopyga echinites*, *A. mauritiana*, *Pearsonothuria graeffei*, *Stichopus ocellatus* and *S. vastus*) were always captured at low density in deeper water of more than 20 meters. Meanwhile, the low-value species like *Holothuria atra*, *H. impatiens*, and *H. coluber* were mostly found in the shallower water with the higher density.

*Actinopyga echinites*, *A. mauritiana*, *Pearsonothuria graeffei*, *Stichopus ocellatus* and *S. vastus* were each found as a single specimen with the bigger in size than the individual in the shallower area. This results might enrich the hypothesis of ontogenetic habitat shift by explaining the reason that different life-stages may have different habitat requirements (Bos et al. 2011). Their experiment specifically conducted for sea star of *Archaster typicus*, but not impossible that habitat shifting might occur to all member of echinoderms including holothurians, even though we could only provide evidence for this hypothesis for *H. atra*. Individual of *H. atra* was bigger in the area of more than 10-meter depth than in the intertidal water. However, for all high-value species found in deeper water, the most accepted explanation for the rarity of individual number is exploitation for trade by fisher.

**Table 1.** Sea cucumber faunal composition at each study site at Lampung waters, Indonesia

| Species | Harimau Balak Is. | | Kandang Balak Is. | | Tumpul Lunik Is. | | Bawangan Beach □ | | Sindu Is. | | Dua Balak Is. | | Penjurit Is. | | Kandang Lunik Is. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | I | S | I | S | I | S | I | S | I | S | I | S | I | S | I | S |
| *Actinopyga echinites* | - | na | - | - | - | na | - | na | - | na | - | - | na | + | na | - |
| *Actinopyga mauritiana* | - | na | - | - | - | na | - | na | - | na | - | - | na | + | na | - |
| *Holothuria (Halodeima) atra* | + | na | + | - | + | na | - | na | + | na | + | - | na | + | na | - |
| *Holothuria (Thymiosycia) impatiens* | - | na | + | - | - | na | - | na | - | na | + | - | na | - | na | - |
| *Holothuria (Acanthotrapeza) coluber* | - | na | - | - | - | na | - | na | - | na | + | - | na | - | na | - |
| *Pearsonothuria graeffei* | - | na | - | - | - | na | - | na | - | na | - | - | na | + | na | - |
| *Stichopus ocellatus* | - | na | - | + | - | na | - | na | - | na | - | - | na | - | na | - |
| *Stichopus vastus* | - | na | - | + | - | na | - | na | - | na | - | + | na | - | na | - |

*Note: I=Intertidal site (reef walking and snorkeling), S=Subtidal site (diving), na= data not available/sampling not conducted

In summary, the number of sea cucumber species involved in the Indonesian trade is 55 species. This study is also confirming the involvement of *Actinopyga mauritiana* and *Stichopus ocellatus* as a commercially important species. Since last 20 years, three species of sea cucumber were disappeared. This composition shifting could be an early sign of depleted populations/species in the area. However, the dominance of one species, *H. atra*, is obvious. The most acceptable reason for this finding besides the low commercial value might be due to its nature as habitat generalist species.

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