Introduction

Sea cucumbers are among the commonly harvested marine invertebrates in coastal areas of Palawan, Philippines. Its fishery is generally small scale but is a valuable source of livelihood among coastal dwellers (Schoppe 2000). Sea cucumbers are locally called balat or balatan and are primarily traded as trepang, beche-de-mer or hai-shen - terms for dried sea cucumbers (Akamine 2005). Trepang is mainly consumed as food and as ingredient of various health and wellness products (Bordbar et al. 2011).

Over the years, the demand for sea cucumbers in the world market has been increasing and such fueled the massive exploitation of this resource across the globe including the Philippines (Uthicke 2004; Conand 2006; Purcell 2010; Pakoa and Bertram 2013; Conand et al. 2014). Despite being artisanal in nature, trepang is the ninth major fishery export of the Philippines and about 20% of landings come from Palawan (DA-BFAR 2014; Brown et al. 2010). However, the natural population of sea cucumbers in Palawan is threatened by overharvesting due to lack of regulations. Assessments in commonly gleaned areas revealed low population estimates of sea cucumbers. Gatherers also perceived that their catch at present is only a small portion of what they used to collect in the past. Statistics likewise showed that the country’s trepang production is a “boom and bust” type (Choo 2008). After its peak in 1985 with exports reaching 3,500 MT, the country’s production showed a declining trend (Akamine 2005).

Given the importance of sea cucumber fishery in supporting the livelihood of coastal communities, it is imperative to manage and make this fishery sustainable. This paper presents the nature of sea cucumber fishery in Palawan, Philippines with information on gathering practices, commonly traded species and secondary accounts on wild populations. Current issues on sea cucumber fishery are also presented here along with recommended double management measures.

Nature of Sea cucumber fishery

The sea cucumber fishery in Palawan is mainly artisanal and catch are processed into trepang for commercial export. Sea cucumbers are seldom consumed by local residents and are not considered as staple food, although a few other local consumers eat the products raw or pickled.

Gathering of sea cucumbers is commonly performed in shallow seagrass beds, reef flats and coral reefs through handpicking and skin diving. Handpicking is done mainly by women and children in shallow seagrass beds and reef flats, while skin diving is employed solely by men in coral reefs. Gathering is a year-round activity but its peak is between March and June. During these months, spring tide occurs in the afternoon and fishers go in fleet to gather sea cucumbers. They have observed that sea cucumbers particularly the Stichopus species crawl out of reef crevices at night, thus they prefer to gather when low tide occurs at night. Late March until early June is also the school break of children, allowing them to help their mothers handpick sea cucumbers and other marine resources.

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Most of the gatherers sell their catch to processors who are also middlemen. Upon delivery, the processor grades the catch according to species, size and freshness. Stichopus species are processed first as they tend to melt when exposed on air, while other species are soaked in water and processed later. Processing is traditional and involves several steps from grading and sorting, gutting, cooking or boiling, smoking and sun drying (Figure 1). Cooking time varies according to species. Stichopus species are boiled under medium fire for

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about 2 hours with frequent stirring, for too much heat may cause their body to burst. Other species like *Actinopyga, Bohadschia, Holothuria* and *Pearsonothuria* are cooked altogether for a relatively longer time, sometimes up to 4 hours. After cooking, sea cucumbers are placed in an improvised smoking chamber for 2 to 3 days until the body is almost dry. And to achieve the "stone-dry" quality, sea cucumbers are further dried under the sun for 3 to 5 days until the desired quality is achieved.

At least 36 species under Family Holothuriidae, Stichopodidae and Phyllophoridae are regularly harvested and processed into trepang in Palawan (Table 1). The prices vary largely among species, size and quality of the dried products. Among the high-valued species are *Holothuria fuscogilva, H. scabra, Stichopus species* and *Thelenota species*, which are sold up to about US$ 106 kl⁻¹. The buying price of all species had tremendously increased by almost 400% compared to the price reported by Schoppe (2000) and Akamine (2005). For example a kilo of *H. scabra*, which was sold at US$ 25 in 2000, increased to US$ 40 in 2005 and is now being sold at US$ 112. Additional species such as the *Neocucumis proteus or bola-bola* and another species identified only by its local name ‘yellow beauty’ were added to the list of exploited sea cucumbers for trepang production in Palawan.

Figure 2 shows the province’s sea cucumber production compared with the country’s total production. Overall, the country’s production showed a downward trend from 1,300

Fig. 1. Steps in processing the sea cucumbers into trepang.

Fig. 2. Production volume (MT) of dried sea cucumbers in the Philippines (blue bars) and in Palawan Province (red bars) (Sources: PSA website www.psa.gov.ph, data from Bureau of Fisheries and Aquatic Resources-Palawan Provincial Office (BFAR-PFO unpub., and Caabay 2018).
### Table 1. Buying price for trepang by traders in Puerto Princesa City, Palawan, Philippines.

<table>
<thead>
<tr>
<th>Scientific Name</th>
<th>Local name</th>
<th>Price per kl (USD)</th>
<th>All Sizes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Order Aspidochirotida</strong></td>
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<tr>
<td><strong>Family Holothuriidae</strong></td>
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<tr>
<td>1. <em>Actinopyga echinites</em></td>
<td>Khaki/Hudhod</td>
<td>0.93</td>
<td></td>
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<tr>
<td>2. <em>Actinopyga lecanora</em></td>
<td>Boli/Munang/Monang</td>
<td>7.46</td>
<td></td>
</tr>
<tr>
<td>3. <em>Actinopyga mauritiana</em></td>
<td>Bacungan</td>
<td>18.65</td>
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<tr>
<td>4. <em>Actinopyga sp.</em></td>
<td>Choco brown</td>
<td>0.75</td>
<td></td>
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<tr>
<td>5. <em>Bohadschia argus</em></td>
<td>Matang-tilik</td>
<td>0.93</td>
<td></td>
</tr>
<tr>
<td>6. <em>Bohadschia marmorata</em></td>
<td>Lawayan/Tadek/Tagukan/hangad-langit</td>
<td>0.93</td>
<td></td>
</tr>
<tr>
<td>7. <em>Bohadschia ocellata</em></td>
<td>Leopard</td>
<td>18.65</td>
<td></td>
</tr>
<tr>
<td>8. <em>Bohadschia vitiensis</em></td>
<td>Lawayan-taba</td>
<td>18.65</td>
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<tr>
<td>9. <em>Holothuria atr</em></td>
<td>Balat-uwak,Blackbeauty</td>
<td>0.56</td>
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<tr>
<td>10. <em>Holothuria cavans</em></td>
<td></td>
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<tr>
<td>11. <em>Holothuria coluber</em></td>
<td>Black powder</td>
<td></td>
<td></td>
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<tr>
<td>12. <em>Holothuria edulis</em></td>
<td>Hotdog, lipstikan</td>
<td>0.93</td>
<td></td>
</tr>
<tr>
<td>13. <em>Holothuria flavomaculata</em></td>
<td></td>
<td>0.56</td>
<td></td>
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<tr>
<td>14. <em>Holothuria fuscocinerea</em></td>
<td>Labuyo</td>
<td>0.56</td>
<td></td>
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<tr>
<td>15. <em>Holothuria fuscogilva</em></td>
<td>Susuan</td>
<td>37.29</td>
<td></td>
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<tr>
<td>16. <em>Holothuria fuscopunctata</em></td>
<td>Sapatos</td>
<td>37.29</td>
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<tr>
<td>17. <em>Holothuria hill</em></td>
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<tr>
<td>18. <em>Holothuria leucospilota</em></td>
<td>Patola</td>
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<td>19. <em>Holothuria notabilis</em></td>
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<td>20. <em>Holothuria pervicax</em></td>
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<tr>
<td>21. <em>Holothuria scabra</em></td>
<td>Kurtido/kiskisan/putian</td>
<td>18.65</td>
<td></td>
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<tr>
<td>22. <em>Holothuria whitmaei</em></td>
<td>Susuan</td>
<td>18.65</td>
<td></td>
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<tr>
<td>23. <em>Pearsonothuria graeffei</em></td>
<td>Flower/mani-man</td>
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<tr>
<td><strong>Family Stichopodidae</strong></td>
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<tr>
<td>24. <em>Stichopus sp.</em> (black)*</td>
<td>Hanginan</td>
<td></td>
<td></td>
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<tr>
<td>25. <em>Stichopus chloronotus</em></td>
<td>Tres cantos</td>
<td></td>
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<tr>
<td>26. <em>Stichopus herrmanni</em></td>
<td>Hanginan</td>
<td></td>
<td></td>
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<tr>
<td>27. <em>Stichopus horrens</em></td>
<td>Hanginan</td>
<td>22.37</td>
<td></td>
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<tr>
<td>28. <em>Stichopus monotuberculatus</em></td>
<td>Hanginan</td>
<td>22.37</td>
<td></td>
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<tr>
<td>29. <em>Stichopus noctivagus</em></td>
<td>Hanginan</td>
<td>22.37</td>
<td></td>
</tr>
<tr>
<td>30. <em>Stichopus quadrifasciatus</em></td>
<td>Hanginan</td>
<td>22.37</td>
<td></td>
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<tr>
<td>31. <em>Stichopus rubermaculosus</em></td>
<td>Hanginan</td>
<td>22.37</td>
<td></td>
</tr>
<tr>
<td>32. <em>Stichopus vastus</em></td>
<td>Hanginan</td>
<td></td>
<td></td>
</tr>
<tr>
<td>33. <em>Thelenota ananas</em></td>
<td>Talipan</td>
<td>4.66</td>
<td></td>
</tr>
<tr>
<td>34. <em>Thelenota anax</em></td>
<td>Legs</td>
<td>7.46</td>
<td></td>
</tr>
<tr>
<td>35. <em>Thelenota rubralineata</em></td>
<td>Hanginan/Pinya-pinya</td>
<td>18.65</td>
<td></td>
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<tr>
<td><strong>Order Dendrochirotida</strong></td>
<td></td>
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<td></td>
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<tr>
<td><strong>Family Phyllophoridae</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>36. <em>Neocucumis proteus</em></td>
<td>Bola-bola</td>
<td>65.26</td>
<td></td>
</tr>
<tr>
<td>37. <em>Unidentified sp.</em></td>
<td>Yellowbeauty</td>
<td>24.24</td>
<td></td>
</tr>
</tbody>
</table>

1 Jontila et al. 2014; 2 Jontila et al. 2017, unpub; 3 Caabay 2018

1 USD = PhP 53.6314
higher estimates (about 133 and 235 ind.ha⁻¹) since collection
Island, Brooke’s Pt., Rasa Island in Narra, and El Nido had
were no records of such in the statistics.
cucumbers are not yet accounted by the government as there
reserved for said buyer. Clearly, production of fresh or live sea
sandfish that they collected from the wild are held and
managed and sustained.
Assessments of sea cucumber in the wild showed low
population estimates particularly in areas where collection is
rampant. For example, sea cucumber populations in the
municipalities of Bataraza, Quezon and Roxas were recorded
to be 25 to 40 ind.ha⁻¹ only even if these areas are the known
producers of trepang in the province. Other sites like Arrecife
Island, Brooke’s Pt., Rasa Island in Narra, and El Nido had
higher estimates (about 133 and 235 ind.ha⁻¹) since collection
in these sites are either restricted or limited (Jontila et al. 2012,
Pitong 2013, Dolorosa et al. 2017). Other sites in the country
that are open to exploitation also had low sea cucumber
populations, like Bolinao and Anda in Pangasinan with
densities between 0.3 to 9 ind.ha⁻¹ only (Olavides et al. 2010).
Most of the productive sites in the province are the island
communities and reefs away from the shore. The traditional
gleaning sites like seagrass beds in Johnson Island and Green
Island in Roxas, Palawan were almost devoid of commercially
important sea cucumbers (Jontila et al. unpub). Compared with
coral reefs and reef flats, sea cucumbers in seagrass beds are
the most prone to depletion for they are very accessible to
gatherers.

Management initiatives and challenges
To date, the only legal instrument that regulates sea
cucumber harvest and trade is the Administrative Circular
(AC) No. 248 which was issued by the Bureau of Fisheries and
Aquatic Resources (BFAR) in 2013. AC 248 imposes a
minimum size limit of 5 cm on traded dried sea cucumbers. It
also requires gatherers to secure wildlife collectors’ permit.
Traders are required to secure a transport permit. To date
however, no study reviewed the effectiveness of this regulation.
Since the sea cucumber fishery forms a vital source of
livelihood among marginal fishers, the Palawan Council for
Sustainable Development Staff (PCSDS) facilitated a review
of the current status of its fishery in the province. Based on the
results, some doable management measures were presented to
the Scientific Advisory Panel (SAP) of the Palawan Council
for Sustainable Development (PCSD) for adoption. Among
the recommendations given include adoption of size limit on
dried products, a ban on the gathering of endangered sea
cucumbers, establishment of closed season or rotational
closure and reserves, establishment of monitoring system for
production and trade, licensing and registration systems for
gatherers and traders. The conduct of information campaigns
among coastal communities particularly the gatherers on the
economic and ecological importance of sea cucumbers is also
recommended.

The establishment of a hatchery for selected species (e.g.
sandfish *Holothuria scabra*) may also be considered to
produce juveniles for grow-out culture using a low cost,
ocean-based nursery system technology. Sea ranching has
been proven successful in producing export grade *trepang* and
in enhancing the natural stocks of nearby sites as demonstrated
by the University of the Philippines - Marine Science Institute
(*UPMSI*) in Bolinao, Pangasinan. With available juveniles, re-
stocking can be done in depleted seagrass beds in order to
revive the population. However, caution must be taken so as
not to mix the stocks and conserve the genetic diversity of
local populations.

At present, gathering of sea cucumbers remains open and
unregulated. But with the institutionalization of the proposed
management measures and cooperation of Local Government
Units (LGUs), it is hope that sea cucumber fishery will be
managed and sustained.

Conclusion
This paper presents the nature and status of the sea
cucumber fishery in Palawan, Philippines. The fishery is
artisanal in nature, collection methods are labor-intensive, and
processing is traditional. Fishery records suggest that sea
cucumber production in the country has been decreasing. In
contrast, trading prices of the resource had increased several
folds which could further put pressure on the resource. It is
also apparent that existing legal and management measures to
protect and manage the sea cucumber resources in the country
need to be reviewed.

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The sea cucumber fishery in Palawan, Philippines

University and the Palawan Council for Sustainable Development Staff.

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Diliman, Quezon City, Philippines, 10 pp

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