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Inventory of Locally Traded Stony Corals (Phylum Cnidaria, Order Scleractinia) in the Cartimar Shopping Center, Pasay City

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The Philippines is known for its high marine BIODIVERSITY and for the high risk to that diversity. Of the human activities implicated in the degradation of coral reefs, collection of organisms for the aquarium trade is probably the most controversial. As a first step in determining the local impact of this trade and how, if possible, it can be managed, this paper presents an inventory of the corals being sold in Cartimar Shopping Center, the center of the pet trade in Metro Manila. A total of 29 species in nine families were found, with pocilloporids and *Acropora* being the best-selling. Euphyliids and gonioporids were also common in the shops, probably because these corals survive well in tanks. Ten of the species identified were categorized as near threatened, and another six were categorized as vulnerable in the IUCN Red List of Threatened Species. Therefore, corals in both categories should not be in the trade. Suggestions on how the aquarium trade could be made self-regulating are presented in this work.

Keywords: Scleractinia, coral species, aquarium trade

INTRODUCTION

The Philippines is part of the "Coral Triangle", a region with high coral species richness, and among the marine biodiversity hotspots of the world (Roberts et al., 2000; Sanciangco, Carpenter, Etnoyer, & Moretzsohn, 2013; Huang et al., 2014). This high diversity is reflected in the local trade of marine species. For example, 350 species of the over 500 fish species in Bolinao, northern Philippines are sold in the local markets for food (McManus, Nañola, Reyes, & Kesner, 1992). Unfortunately, more than 98% of the country's reefs are at risk of loss in the next 20 years (Burke, Reytar, Spalding, & Perry, 2012) and one third of coral species are at higher risk of extinction due to climate change and anthropogenic impacts (Carpenter et al., 2008). Exploitation of reef fishes for the aquarium trade has been blamed for the reduced species richness in central Philippines (Nañola, Aliño, & Carpenter, 2011).

Of the human activities implicated in the degradation of coral reefs, collection of organisms for the aquarium and curio trade is probably the most controversial. The trade is currently the

subject of draft regulation and legal action in the U.S. (Tlusty, 2002; Rhyne, Rotjan, Bruckner, & Tlusty, 2009; Kessler, 2013). The Philippine government is also finalizing regulations to legalize and manage the export of farmed corals (personal communications to the second author). The Philippines was the main exporter of stony corals in the world, sending out as much as 2,000 tons in 1976 (Wells, 1982). Indonesian exports supplied the market demand after the ban on exportation of hard corals from the Philippines in 1977. Indonesia remains as the world's largest exporter of live corals while the Philippines remains as the top supplier of marine tropical fish (Tissot et al. 2010).

Corals are still being collected and sold locally despite their listing in Appendix II of CITES (Convention on International Trade in Endangered Species) and the ban on their gathering and export from the Philippines (Bureau of Fisheries and Aquatic Resources, 2000). Cartimar Shopping Center in Pasay City is a major trading area for aquarium organisms, including stony corals. An inventory of the corals being sold in Cartimar is the first step in determining the impact of the aquarium trade and is how science can provide the basis for the possible management of this trade. This paper presents the results of such an inventory. Suggestions on how coral mortalities may be reduced by self-regulation in the industry and among hobbyists are also presented.

MATERIALS AND METHODS

Specimens were bought from Cartimar Shopping Center from September 2006 to March 2007. This extended buying period was meant to maximize the number of species obtained. The initial plan was to photograph the corals as they are inside the traders' tanks. However, due to inadequate lighting and the poor water clarity, specimens had to be purchased. These corals were then transferred to an aquarium at the U.P. Marine Science Institute (MSI) where the second author was affiliated at that time of the study.

Once acclimated in the aquarium and polyps were extended, photographs of the specimens were taken using underwater cameras (an Olympus Stylus 720SW and a Canon Powershot A610 with an underwater casing). Specimens from monospecific genera and those that were readily recognizable from other species were left alive. For specimens whose general morphology and polyp appearance were inadequate to further distinguish up to the species level, skeletal features of bleached samples were examined using an Olympus SZX-TR30 stereomicroscope. The field guide of Veron (2000) and the accompanying Coral ID software of Veron (2002) and Wallace (1999) were used for the identifications. Specimens were deposited at the Coral Museum of MSI.

RESULTS AND DISCUSSION

A total of 29 coral specimens of the same number of species were bought from Cartimar Shopping Center within the study period. Of the 29 specimens, three belong to the family Acroporidae, five belong to Euphyllidae, seven belong to Faviidae, six belong to Mussidae, two from Pocilloporidae, two from Poritidae, and one each for Dendrophyllidae, Fungiidae, Oculinidae, and Pectiniidae. Table 1 summarizes the families and species of each specimen.

At the onset of research, there were at least five shops selling corals. Two years before (2005), there were at least seven shops selling corals, but at the end of the research, only three shops remained open. The traders reported that the stores that closed were not making enough money to sustain operations and that the volumes of corals delivered have also been steadily declining. The latter may suggest depletion of nearby stocks, making it more difficult and expensive to transport corals from farther reefs.

A field study to validate this is needed but is unfortunately beyond the scope of this work, which is based on the B.S. Biology thesis of the first author.

The most popularly traded corals were pocilloporids and various *Acropora*, which were often ordered in advance, if not purchased by aquarists as soon as they arrived. The buyers were apparently well-apprised of the delivery schedules. The relative abundances of the species on display (Table 2) thus did not reflect the popularity of various species among aquarists. Criteria for describing abundance were the number of individual colonies in a store, the number of stores possessing the colonies, and their presence per visit to these stores. Species noted as "abundant" were those that were always present in every visit and either had more than five individuals per store, or there were individuals present in at least two shops per visit. "Common" species were those that were always present in every visit, or were found in more than two shops. "Uncommon" species were those that were present every few visit. Species that were only encountered once or twice during the study period were categorized as "rare".

Table 1.
List of Specimens Bought at the Cartimar Shopping Center, Pasay City.

	Family	**Species**	**Specimen number**
1	Acroporidae	*Acropora yongei*	P1L09137
2	Acroporidae	*Acropora samoensis*	P1L09136
3	Acroporidae	*Acropora inermis*	P1L09135
4	Dendrophyllidae	*Turbinaria mesenterina*	Live1
5	Euphyllidae	*Catalaphyllia jardinei*	Live2
6	Euphyllidae	*Euphyllia ancora*	Live3
7	Euphyllidae	*Euphyllia divisa*	Live4
8	Euphyllidae	*Plerogyra sinuosa*	Live5
9	Euphyllidae	*Physogyra lichtensteini*	Live6
10	Faviidae	*Favia veroni*	P1L09129
11	Faviidae	*Favia favus*	P1L09126
12	Faviidae	*Favites chinensis*	P1L09127
13	Faviidae	*Favites complanata*	P1L09131
14	Faviidae	*Favites halicora*	P1L09132
15	Faviidae	*Montastrea colemani*	P1L09130
16	Faviidae	*Platygyra pini*	P1L09122
17	Fungiidae	*Polyphyllia talpina*	Live7
18	Mussidae	*Acanthastrea echinata*	P1L09142
19	Mussidae	*Cynarina lacrymalis*	Live8
20	Mussidae	*Lobophyllia corymbosa*	P1L09139
21	Mussidae	*Lobophyllia hemprichii*	P1L09124

Table 1 continued...

22	Mussidae	*Symphyllia valenciennesi*	P1L09125
23	Mussidae	*Symphyllia radians*	P1L09123
24	Oculinidae	*Galaxea astreata*	P1L09140
25	Pectiniidae	*Pectinia lactuca*	P1L09141
26	Pocilloporidae	*Pocillopora damicornis*	P1L09134
27	Pocilloporidae	*Stylophorapistillata*	P1L09133
28	Poritidae	*Goniopora stokesi*	P1L09128
29	Poritidae	*Goniopora tenuidens*	P1L09138

Table 2.
Prices and Relative Abundance of Corals Bought at the Cartimar Shopping Center. Prices in Parentheses are More Current (August 2013 prices).

Species	Price range	Traders' common name	Abundance
Acropora yongei	P90 – 120	Acropora	Common
Acropora samoensis	P90 – 120	Acropora	Common
Acropora inermis	P90 – 150	Acropora	Common
Turbinaria mesenterina	P40		Rare
Catalaphyllia jardinei	P70 – 80 (P350)	Elegance	Abundant
Euphyllia ancora	P65 – 75 (P250-300)	Hammer	Abundant
Euphyllia divisa	P60 – 70	Frogspawn/octopus	Common
Plerogyra sinuosa	P50 – 80 (P250-300)	Bubble coral	Common
Physogyra lichtensteini	P70	Bubble coral	Rare
Favia veroni	P50	Moon coral	Uncommon
Favia favus	P40 – 50	Moon coral	Uncommon
Favites chinensis	P30 – 50	Moon coral	Uncommon
Favites complanata	P30 – 40	Moon coral	Uncommon
Favites halicora	P45 – 65	Moon coral	Uncommon
Montastrea colemani	P30 – 50	Moon coral	Common
Platygyra pini	P30 – 50	Zipper coral	Common
Polyphyllia talpina	P75	Sandal coral	Rare
Acanthastrea echinata	P70	Pineapple	Uncommon
Cynarina lacrymalis	P60	Celerina/button	Common
Lobophyllia corymbosa	P50 – 60	Lobo	Common
Lobophyllia hemprichii	P60 – 80	Lobo/brain coral	Uncommon
Symphyllia valenciennesi	P60 – 70	Lobo/brain coral	Uncommon
Symphyllia radians	P85 (P300-350)	Brain coral	Rare

Table 2 continued...

Galaxea astreata	P100	Star coral	Rare
Pectinia lactuca	P85	Lettuce coral	Rare
Pocillopora damicornis	P75		Uncommon
Stylophora pistillata	P75 – 90		Common
Goniopora stokesi	P40 – 60 (P150)	Gonio/flower pot	Abundant
Goniopora tenuidens	P50 – 60 (P150)	Gonio/flower pot	Common

Acroporids and pocilloporids were present in every new delivery and thus were categorized as common. The high demand by aquarists for these corals meant their turnover rate was high. In fact, most corals from these families were reserved and the three specimens acquired were far apart in time. Euphylliids and gonioporids were abundant, with each store having at least five individuals. Their abundance is probably because corals from these families are hardy and survive well in aquaria.

Although some the species listed in Table 1 were commonly occurring in natural reefs (see Veron, 2000), 10 species (*Euphyllia divisa*, *Plerogyra sinuosa*, *Favia veroni*, *Favites chinensis*, *F. complanata, F. halicora*, *Montastrea colemani*, *Cynarina lacrymalis, Stylophora pistillata,* and *Goniopora stokesi*) are listed as "near threatened" (NT) in the IUCN Red List of Threatened Species (see http://www.iucnredlist.org/search). Another six species (*Turbinaria mesenterina*, *Catalaphyllia jardinei*, *E.ancora*, *Physogyra lichtensteini*, *Galaxea astreata*, and *Pectinia lactuca*) are listed as "vulnerable" (VU). NT and VU species should not be in the trade. However, given the challenges of identifying living corals to the species level, enforcement of regulations at this level will be difficult, if not impossible. Identification and the problems of distinguishing farmed corals from wild-collected corals are among the concerns that must be addressed if the trade of Philippine corals is to be made sustainable.

RECOMMENDATIONS

Given the continued operation of the shops and the draft FAO legalizing the trade of farmed corals, we propose a system of self-regulation to allow the traders and hobbyists to reduce the likely environmental impacts of the aquarium trade and still provide livelihood opportunities for coastal communities. This self-regulation could begin with the formation of hobbyist groups that can implement a rating and accreditation system among their members. For instance, new members could, at a proposed Level 1 accreditation, be restricted to the procurement and maintenance of hardy species (e.g., select species of reef fish). After a reasonable period and achievement of certain qualification standards, the club members may progress to Level 2 accreditation that allows them to buy and maintain species and larger tanks that require specialized training and experience. Level 3 accreditation is proposed for trainers and those who are allowed to install and maintain very large display aquaria. A similar accreditation and licensing system will also be needed among traders to ensure that they are qualified to maintain and sell appropriate species and that the organisms are sold only to those hobbyists with the corresponding correct accreditation. This system can only work with strong institutions and sustained enforcement.

It is suggested that the inventory study be conducted over a longer period in order to have a more complete listing of the coral species being

traded. This recommendation is made because some species like *E.divisa* were found only in a few deliveries, raising the probability that the researchers missed shipments of rare species. In addition, the high demand by aquarists for branching corals like *Seriatopora* and *Acropora* meant similar corals were hard to obtain. Field studies on the abundance of the species listed in Table 1 should be done in local reefs, especially in the collecting grounds near Metro Manila. Studies on these corals' growth and survival rates in aquaria should also be done. The provision of such knowledge can help guide traders and hobbyists in which species to avoid in order to curb mortalities.

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