CURIO TRADE: SOUTHWEST MADAGASCAR

DECEMBER 2011

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REEF DOCTOR
RESEARCH EDUCATION CONSERVATION

ACKNOWLEDGEMENTS

ReefDoctor would like to express thanks to Hery Zo Mamonjisoa Andrianantenaina, François Ernestin Randriamihaja, Marie Alphonsine Haingoniony and Maminiaina Jonah Albert Rakotonirinastudents of the *Institut Halieutique et des Sciences Marines* (university of marine research) Toliara, Southwest Madagascar. ReefDoctor would also like to acknowledge the Marine Conservation Society (MSC) for their financial support. Finally, we would like to thank ReefDoctor volunteers May Bokobza and Elias Bader and research assistants Lauren Wiesebron and Nina Hughes for their important contributory support during the curio trade investigation.

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I. INTRODUCTION

Madagascar spans almost 14° of latitude (11°47’ - 25°35’ S) with an extensive coastline encompassing of 3,450 linear km of diverse reef systems (Cooke 2002). The west coast of Madagascar has some of the largest tidal ranges of the Western Indian Ocean region due to the narrowing of the Mozambique Channel with a mean spring tide of 3.8 in the north and 2.6 in the south (McClanahan 2009). Indigenous communities inhabiting this coastline are dependent on the near-shore marine environment for survival. During the low tide period, women and children from these communities access the reef flats and seagrass meadows where the fishing activity of gleaning provides a significant amount of molluscs for the curio trade.

II. METHODOLOGY

Study Area

This study evaluates the curio trade in three coastal communities situated on the southwest coast of Madagascar, Toliara, Ifaty and Mangily. The principle town of Toliara has a population of 101,661 (2001 census) and is a major touristic destination, this area contains two established markets where independent vendors trade in curio products. Ifaty and Mangily are both situated in the lagoon system of the Bay of Ranobe, 27 Km North of Toliara. Ifaty is a small artisanal fishing village with a population of over 6500 (pers. comm. President of the village of

Figure 1. Satellite image of survey areas Toliara, Ifaty, and Mangily

Ifaty, 2011); this coastline has a sporadic distribution of hotels that have minimal interaction with the indigenous community. Curio products are collected locally with the number of vendors selling curio products varying in accordance with the tourist season (pers. obs.). The village of Mangily, has a population of over 10,500 (pers. comm. President of the village of Mangily 2011), developed around numerous small hotels (*ca.* 20) catering to the tourist trade. This community has a small curio market of independent vendors however women and children often trade curio products on the beaches and around the hotels.

Assessment of curio products in the three survey areas took place over an eleven-day period from November 29th to December 9th, 2011, (low tourist season). The survey team consisted of five Malagasy and four European participants. Information was gathered through structured interviews together with physical data on the curio products. Thirty-seven vendors participated in the survey: Toliara; 28, Ifaty; 2 and Mangily; 7. Each vendor who participated was presented with small gift of 500 MGA during the interview session as a token of goodwill. Initial identification of curio products was conducted in the field with specimens checked for accuracy and maximum adult size of species through reputable online collections, such as the Natural History Museum Rotterdam[1] and the Indo-Pacific Molluscan Species Database[2].

Analysis

This study used excel analysis software for data evaluation (function = 'barplot' n=139), datasets were subdivided by location and parameters (product size, stock quantity, vendor profit,). Due to the large number of species recorded, n=139, the dataset was further divided into two sections (a, b) to increase the legibility and interpretability of the graphs.

III. RESULTS

During the course of the market surveys, n=139 marine species were identified for sale in the curio trade throughout the 3 coastal communities. Amongst the marine species identified, n=122 were categorised as mollusc species (table 1) and n=17 were classified as non-mollusc marine products (table 2). Species of special interest that are trade-protected under the international CITES legislation (ratified by Madagascar in 1975), such as scleractinian corals and marine turtles, were also recorded during the evaluation by the survey team.

1. Mollusca.htm Westzeedijk 345 (Museumpark)| The Netherlands|010 4364222|ingo@nmr.nl
2. Indo-Pacific Molluscan Species Database at The Academy of Natural Sciences www.clade.ansp.org

TABLE 1. Mollusc species identified n=122 during market surveys in Toliara, Ifaty and Mangily

SCIENTIFIC NAME	ENGLISH COMMON NAME
Anodontia.edentula	Toothless platter shell
Arestorides.argus	Eyed cowry
Argopecten.purpuratus	Peruvian calico scallop
Atrina.vexillum	Penn shell
Bufonaria.crumena	Frog shell
Bulla.stiata	
Cassis.cornuta	Helmet shells
Cerithium.nodulosum	Giant Knobbed Cerith
Charonia.tritonis	Triton's trumpet
Chelycypraea.testudinaria	Tortoise cowry
Chicoreus.groschi	Murex snails, rock snails
Chicoreus.ramosus	Ramose murex, branched murex
Cinguloterebra.anilis	
Clanculus.puniceus	Strawberry top shell
Cnidarialiophila.violacea	Violet coral shell
Codakia.punctata	
Colubraria.muricata	Maculated Dwarf Triton, Giant False Triton, Spotted Colubraria
Conomurex.decorus	Mauritian Conch
Conus.aulicus.(f).gracianus	Princely cone
Conus.betulinus	Beech cone
Conus.ebraeus	Black-and-white cone
Conus.figulinus	Fig cone

Conus.flavidus	Yellow Pacific Cone
Conus.generalis	General cone
Conus.geographus	Geography cone
Conus.leopardus	Leopard cone
Conus.litteratus.	Lettered cone
Conus.lividus	Livid cone
Conus.marmoreus	Marbled cone
Conus.miles	Soldier cone
Conus.nussatella	Nussatella cone
Conus.omaria	
Conus.pennaceus	Feathered cone
Conus.striatellus	Striatellus Cone
Conus.striatus	Striated cone
Conus.tessulatus	Tessellate cone
Conus.textile	Cloth of gold cone
Conus.tulipa	Tulip Cone
Conus.virgo	Virgin Cone
Cymatium.(Septa).pileare	Hairy triton
Cypraea.tigris	Tiger cowry
Cypraecassis.rufa	Bullmouth, red helmet shell
Distorsio.anus	Common distorsio
Erosaria.citrina	Orange cowry
Erosaria.labrolineata	Lined-Lip cowry, Lined Margin Cowry
Erronea.caurica	Thick-edged cowry
Erronea.errones	

Euprotomus.aurisdianae	Diana conch
Euprotomus.aurora	Diana conch
Fasciolaria.filamentosa	Filamentous Horse Conch
Ficus.ventricosus	Swollen Fig Shell
Fusinus.australis	Australia Spindle
Fusinus.colus	Distaff spindle
Gelagna.succincta	Lesser girdled triton,
Gibberulus.gibberulus	Humpbacked conch
Haliotis.pustulata	Abalone
Harpa.davidis	Madras harp
Harpa.harpa	True harp
Harpa.major	Large harp, major harp
Harpago.arthritica	Arthritic Spider conch
Haustellum.longicaudum	
Hyotissa.hyotis	Giant coxcomb oyster, honeycomb oyster
Lambis.crocata	Orange Spider conch
Lambis.digitata	True conch
Lambis.indomaris	Spider conch
Lambis.lambis	Spider conch
Lambis.scorpius	Scorpion conch, scorpion Spider conch
Lambis.truncata	Giant Spider conch
Lentigo.lentiginosus	Silver conch
Lophiotoma	
Lophiotoma.acuta	Marbled turrid
Luria.isabella	Isabel's Cowry, Fawn-coloured Cowry

Lyncina.aurantium	golden cowry
Lyncina.camelopardalis	Camel cowry
Lyncina.carneola	Carnelian cowry
Lyncina.lynx	Lynx Cowry, Eyed cowry
Lyncina.vitellus	Calf Cowry, Pacific Deer Cowry
Malea.pomum	Tunn shell
Mauritia.arabica	Arabian cowry
Mauritia.eglantina	Dog-Rose Cowry, Eglantine Cowry
Mauritia.histrio	Harlequin Cowry, Stage Cowry
Mauritia.maculifera	Mauritius Cowrie
Mauritia.mauritiana	Humpback Cowry, Chocolate Cowry, Mourning Cowry, Mauritius Cowry,
Mitra.cardinalis	The pontifical mitre
Mitra.mitra	Episcopal miter
Mitra.papalis	Papal Miter
Monetaria.annulus	Ring cowry, gold ringer
Monetaria.caputserpentis	Serpent's-head cowry
Monetaria.moneta	Money cowry
Murex.brevispina	Short-spined murex
Murex.pecten	Venus comb
Nassa.serta	Sertum rock shell
Natica.onca	Chestnut Sand Snail
Nerita.textilis	Textile nerite
Oliva.elegans	
Oliva.miniacea	Pacific common olive
Oliva.tigridella	Tiger olive

Ovula.ovum	Common egg cowry
Oxymeris.areolata	Dark-spotted Auger
Oxymeris.dimidiata	Orange Auger
Oxymeris.maculata	Crenulate Auger
Palmadusta.androyensis	Cowry
Phalium.glaucum	Grey bonnet
Pinctada.margaritifera	Black-lip pearl shell
Pleuroploca.trapezium	Trapezium horse conch
Polinices.flemingianus	Moon snail
Polinices.mammilla	Oval Moon Snail
Ranularia.cynocephalum	Dog-head triton
Rapa.rapa.	
Rhinoclavis.sinensis	Obelise Creeper
Saccostrea.cucullata	Hooded oyster
Talostolida.teres	
Talparia.talpa	Mole Cowry, Chocolate Banded Cowry
Tonna.allium	Costate tun
Tridacna.maxima	Small giant clam
Turbo.argyrostomus	Silver-mouthed turban
Turbo.coronatus	Coronate Moon Turban, Crowned Turban Shell
Turbo.marmoratus	Marbled turban, great green turban
Tutufa.bubo	Giant frog snail, giant Frog shell
Vasum.turbinellus	Common Pacific Vase, Horned Heavy Whelk
Vexillum.intermedium	Intermediate mitre
Volema.pyrum	Chank shell, sacred chank, chank

TABLE 2. Non-mollusc marine species, n=17, identified during market surveys in Toliara, Ifaty and Mangily

SCIENTIFIC NAME	ENGLISH COMMON NAME
Acroporidae	Hard coral
Asterodiscides	Cushion Starfish
Carcharhinidae	Requiem shark
Chelonia.mydas	Green turtle
Diodontidae	Porcupine fishes
Echinodiscus.auritus	Shield urchin
Ellisellidae.	Black coral
Eretmochelys.imbricata	Hawksbill turtle
Fungiidae	Mushroom coral
Heterocentrotus.mammillatus	Pencil urchin
Hippocampus	Seahorse
Malvafundus.normalis	Worm cast
Petrosiidae	Barrel sponge
Protoreaster.lincki	Starfish
Sepiidae	Cuttlebone
Stellaster.equestris	Starfish
Subergorgia.	Sea fan

Sourcing and distribution of curio products

The capacity of vendors to acquire rare and valuable curio specimens appears to vary by location (figure 2) and be dependent upon market forces. Toliara has the greatest access to curio products (table 3) being one of the largest towns in the southwest and boasting the largest curio market of all three survey areas. Data

collected during the course of this study indicate that high-value products are imported into the Toliara region by transient dealers attracted to the resources and trade centres. Observations of the rare and valuable mollusc species, the golden cowry (*Lyncina.aurantium*) and non-mollusc species such as preserved marine turtles (*Chelonia mydas*), were only documented during the survey of Toliara. Evaluation of the Ifaty data indicated that only locally-sourced curio products are sold by the vendors, with curio products from Ifaty being purchased by vendors in Toliara (table 3). Vendors from Mangily purchase a few specimens from adjacent communities although the majority of curio products are sourced locally (table 3).

Figure 2. Map of Madagascar depicting the source of curio products in proximity to Toliara (Toliary) region (red) encompassing Mangily and Ifaty

TABLE 3. Distances between collection points and points of sale

	POINTS OF SALE		
COLLECTION POINT	TOLIARA (KM)	IFATY (KM)	MANGILY (KM)
ANAKAO	56	Sourced locally only	86
ANDAVADOAKY	338		308
ANDROKA	296		-
ANKILYBEARY	296		-
BEHELOKA	145		-
FORT DAUPHIN	624		-
IFATY	27		-
ITAMPOLO	240		-
MANOMBO	50		-
MOROMBE	290		262
SALARY	70		-
SARODRANO	25		49
SOALARA NORTH	70		-
SOALARA SOUTH	43		-
IMPORTED FROM ABROAD	Origin unknown		-

Profit

Assessment of profit, (defined as the net income from the sale of a curio product after the deduction of the acquisition price) of all three survey areas highlights the fact that only a few specific rare curio products yield a significant profit (fig 3a, 3b,). Overall, the majority of the species yield less than 1000 MGA (*ca.* 0.25 GBP) profit per item (fig 4a, 4b,). Further examination of the surveys indicate that these high valued species *Lyncina aurantium* and *Chelonia mydas* with a profit of 240,000 MGA (*ca.* 69.46 GBP) to 50,500 MGA (*ca.* 14.62 GBP) respectively (fig 5a, 5b) are only documented in the Toliara curio market. Average profit

per curio specimen in Toliara is 3000 MGA (*ca*.0.75 GBP), with minimum profit averaging at 30 MGA (*ca* < 0.01 GBP) for species such as *Mitra cardinalis* and *Rhinoclavis sinensis* (fig 6a, 6b).

Ifaty demonstrated the lowest benefit from the curio trade of all survey areas with a maximum profit of 1500 MGA (*ca* 0.44 GBP) per specimen for *Conus virgo* and *Conus leopardus*. Average profit per curio specimen was 406 MGA (*ca* 0.12 GBP), with a minimum profit averaging at 10 MGA (*ca* < 0.01 GBP) for species such as *Monetaria annulus* and *Monetaria moneta* (fig 7). Survey results from Mangily exhibited a larger benefit from the curio trade compared with Ifaty, with a maximum profit per specimen of 10000 MGA (*ca* 2.91 GBP) for *Lambis truncate*. Average profit per curio specimen was 579 MGA (*ca* 0.17 GBP) with a minimum profit of 43 MGA (*ca* < 0.01 GBP) for *Lyncina lynx* (fig 8a, 8b,).

Comparison of the profit of mollusc and non-mollusc species suggests that profit for mollusc species average at 2774 MGA (*ca* 0.81 GBP) per species and profit for non-mollusc products averages at 4600 MGA (*ca* 1.34 GBP). Disparity in the price of the same species of mollusc and/or curio product during the survey may be explained by price variation depending on the survey area and/or by the quality and size of curio products available for trade. Results indicate that few curio product of high value are stocked and/or accessible (fig, 9a, 9b,) and species of minimal profit are stocked in high quantity.

Species diversity and stock

During the course of the present curio market survey, 139 marine species were identified in the markets of Toliara (fig 9a, 9b), Ifaty (fig, 10) and Mangily (fig, 11). Toliara exhibited the highest diversity with 124 species recorded, whereas Ifaty and Mangily showed a significantly lower species diversity, 50 and 65 species respectively. Results from the surveys demonstrated that the majority of curio products in Toliara, Ifaty and Mangily are stocked at an average quantity of less than 20 specimens per species (fig 9a, 9b, 10, 11). Curio products stocked with an average quantity of more than 20 specimens per species varied significantly by survey area.

Assessment of the three survey areas showed that 18 species out of the 124 species identified for Toliara were recorded with a quantity of more than 20 specimens; molluscs represented a large proportion of these species (table 5). Ifaty survey identified 3 mollusc species out of the 50 species identified for this study area with stocks above 20 specimens per species. Mangily survey identified 6 mollusc species out of the 65 species identified for this study area with stocks above 20 specimens per species (table 5). Comparisons between survey areas show that those species stocked in substantial quantities in Toliara (*i.e. Conus textile, Mauritia arabica* and *Mitra mitra*), are similarly found in large quantities in Mangily (table 5).

Size classification

Evaluation of the measured size of curio specimens recorded during the survey compared with the maximum size these species can attain, illustrates that the majority of species are collected before reaching maximum adult size (fig 12a, 12b,). Species of ecological importance, such as *Charonia tritonis*, are recorded at an average of 270 mm below the maximum adult size (fig 13a, 13b,). Socioeconomic important species such as *Chicoreus ramosus* and *Atrina vexillum* that constitutes an important food source for the indigenous coastal people of Ifaty and Mangily averaged at 194 and 175 mm below MSL respectively (fig 13a, 13b,)

Relative importance of curio products

During the survey, vendors were asked to rank their curio products in terms of consumer preference. From the consensus opinion of vendors from Toliara, preference ranks for the curio-trade species, from greatest to least importance, are: 1) *Lambis scorpius*, 2) *Turbo marmoratus*, *Cypraecassis rufa*, *Mauritia mauritiana*, *Charonia tritonis* and *Cassis cornuta* 3*) Harpa major* 4) *Cypraea tigris*, 5) *Acroporidae*, 6) *Gibberulus gibberulus*, 7) *Mauritia histrio*. 9) *Chelonia mydas*, *Lambis digitata, Harpago arthritica*, 10) *Tutufa bubo, Harpa harpa, Murex pectin*, *Arestorides argus*, *Conus betulinus* and *Oliva miniacea*. Based on the consensus opinion of vendors from Ifaty and Mangily species were ranked in order of relative importance from

greatest to least, as follows: 1) *Harpa.major* 2) *Cypraea tigris*, 3) *Harpa.davidis*, 4) *Harpa.harpa*, 5) *Mauritia.arabica*, 6) *Lambis.lambis*, 7) *Mauritia.histrio* 8) *Cypraecassis.rufa*, *Lambis.truncata*, *Lophiotoma.acuta*, 9) *Turbo.marmoratus*, 10) *Harpago.arthritica*,

IV. CONCLUSION

Evaluation of the curio trade in Toliara, Ifaty and Mangily has highlighted the large demand for curio products by tourists visiting Madagascar. This trade has even extended to include endangered and vulnerable species protected under national and international law. It is therefore paramount, that steps are taken to improve awareness and outreach programs so vendors and clients can make informed decisions about the purchase of curio products.

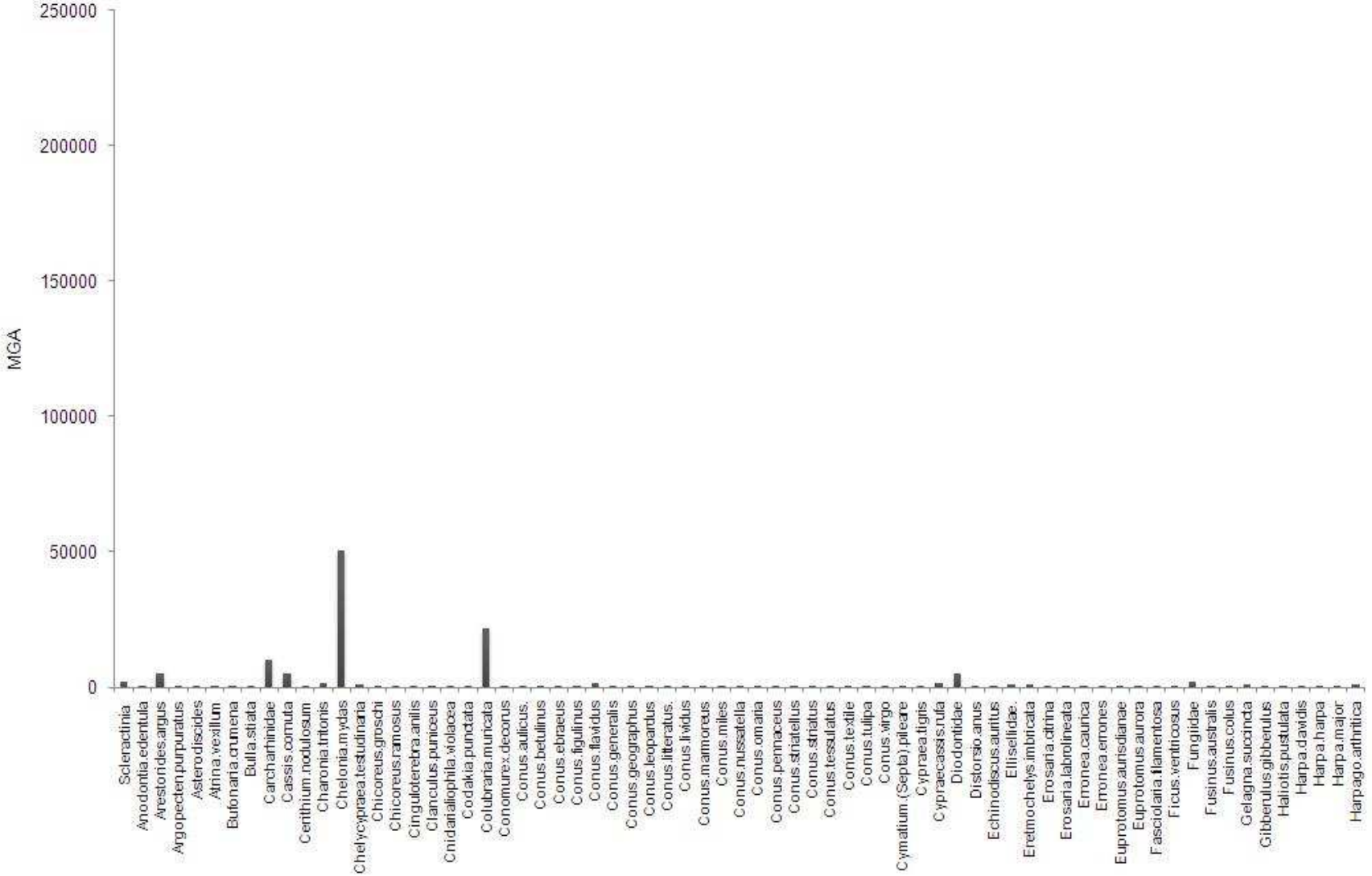


Figure 3a. Profit in Malagasy Ariary (MGA) on the sale of curio products for Toliara, Ifaty and Mangily.

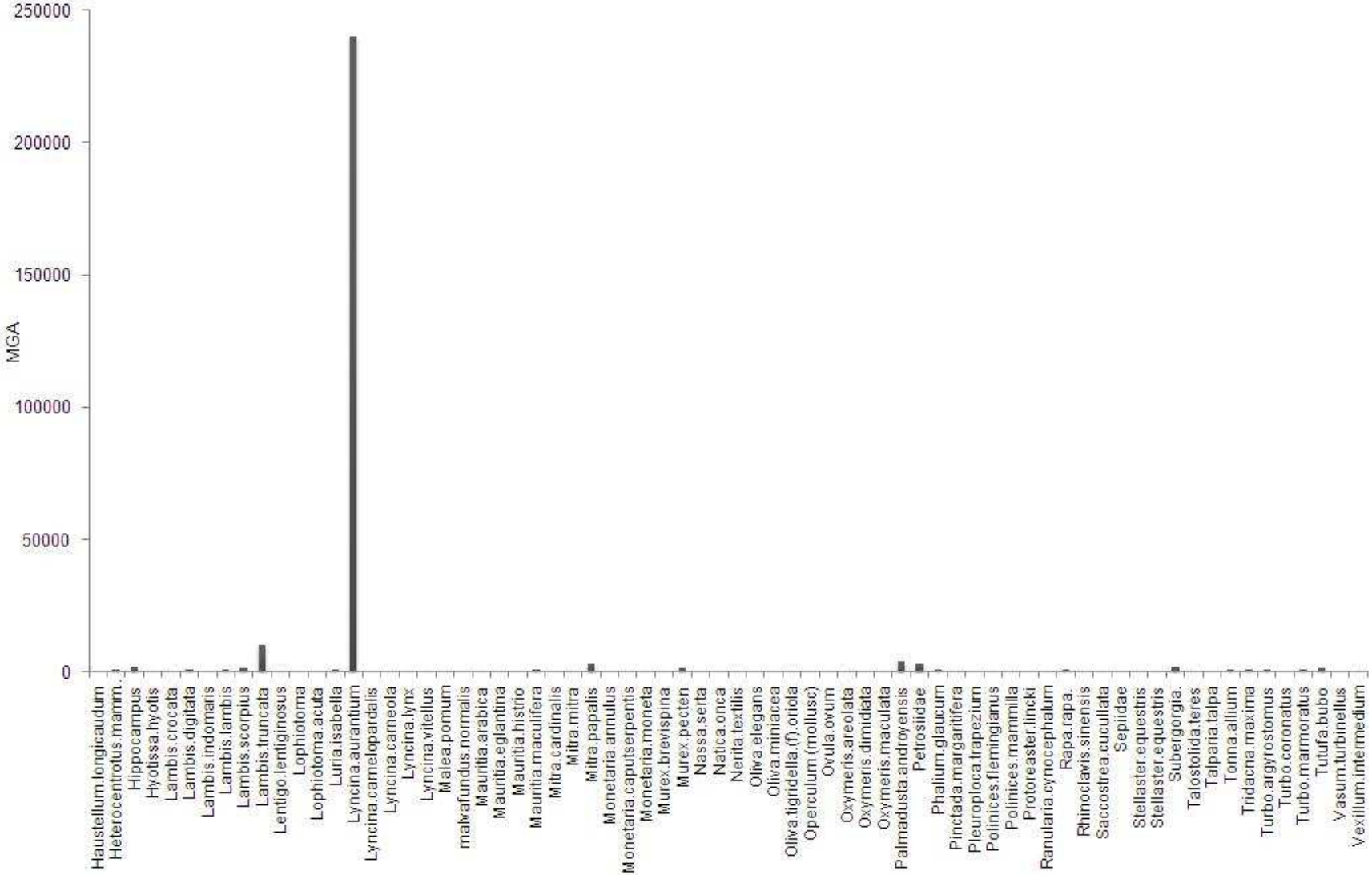


Figure 3b. Profit in Malagasy Ariary (MGA) on the sale of all curio products for Toliara, Ifaty and Mangily

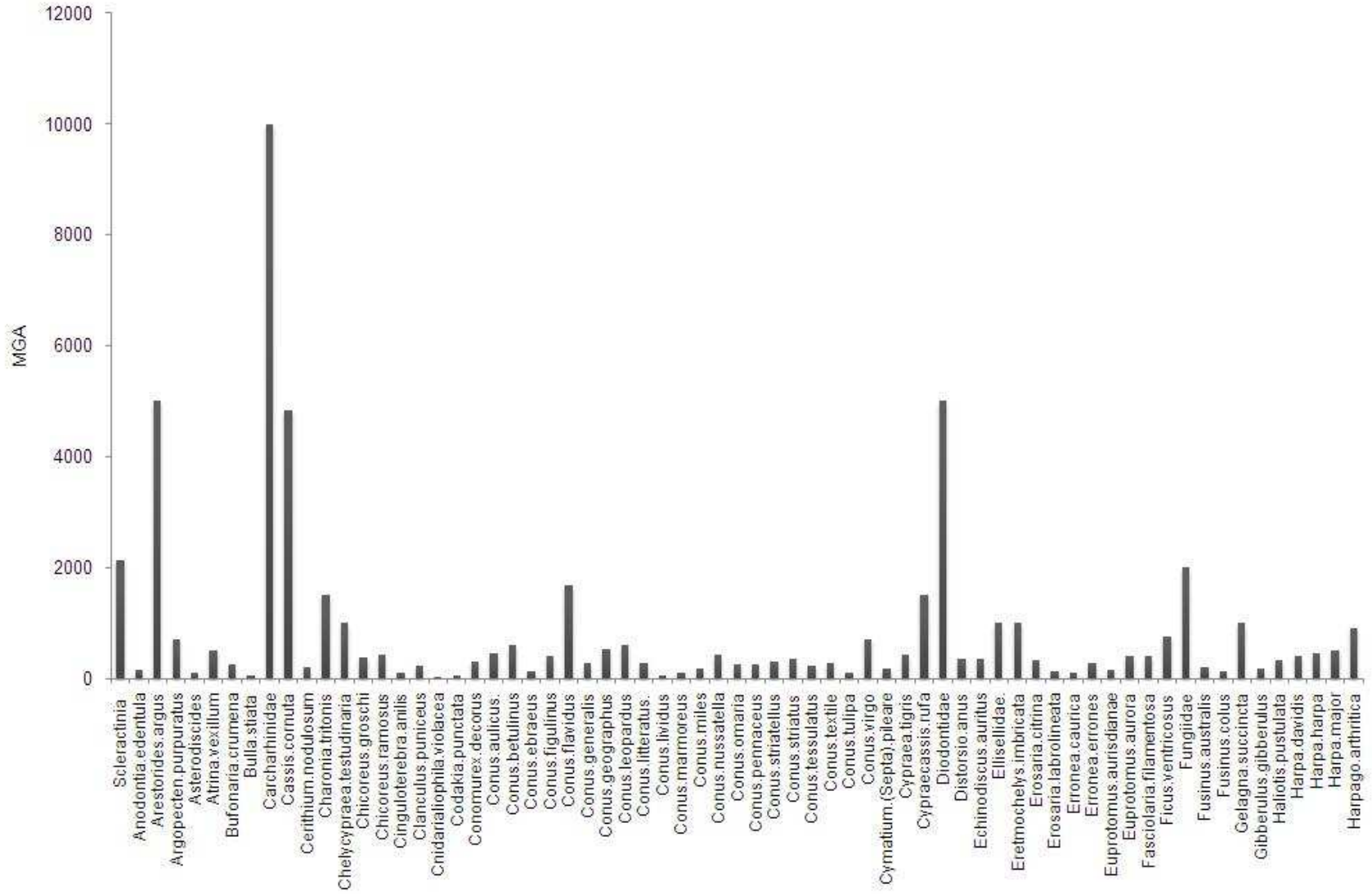


Figure 4a. Profit in Malagasy Ariary (MGA) on the sale of all curio products for Toliara, Ifaty and Mangily; *Lyncina aurantium* and *Colubraria muricatare* (maculated Dwarf Triton, Giant False Triton) removed to assess curio products

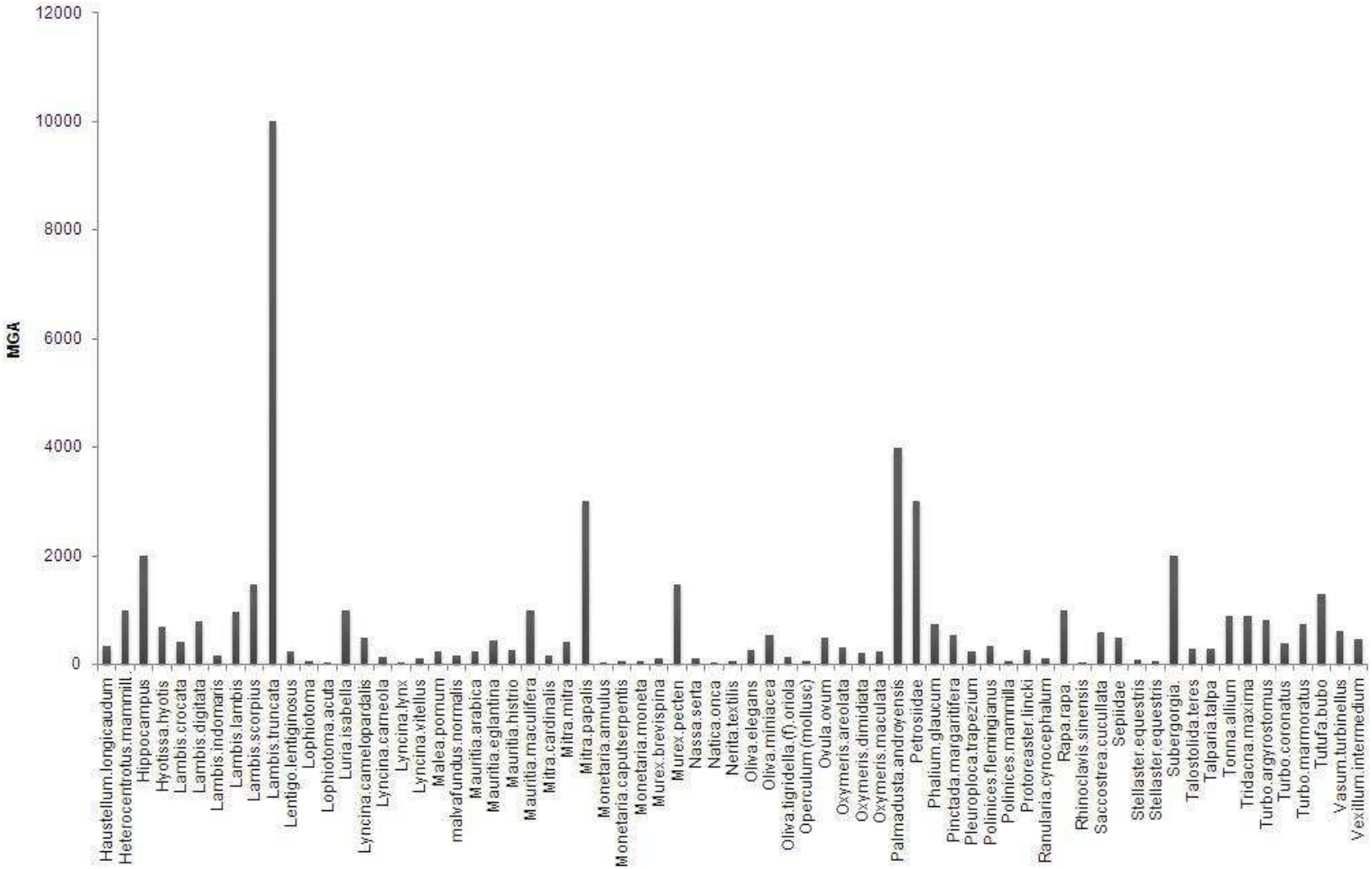


Figure 4b. Profit in Malagasy Ariary (MGA) on the sale of all curio products for Toliara, Ifaty and Mangily; *Chelonia mydas* (green turtle) removed to assess curio products under 12,000 MGA

Figure 5a. Profit in Malagasy Ariary (MGA) on the sale of all curio products Toliara

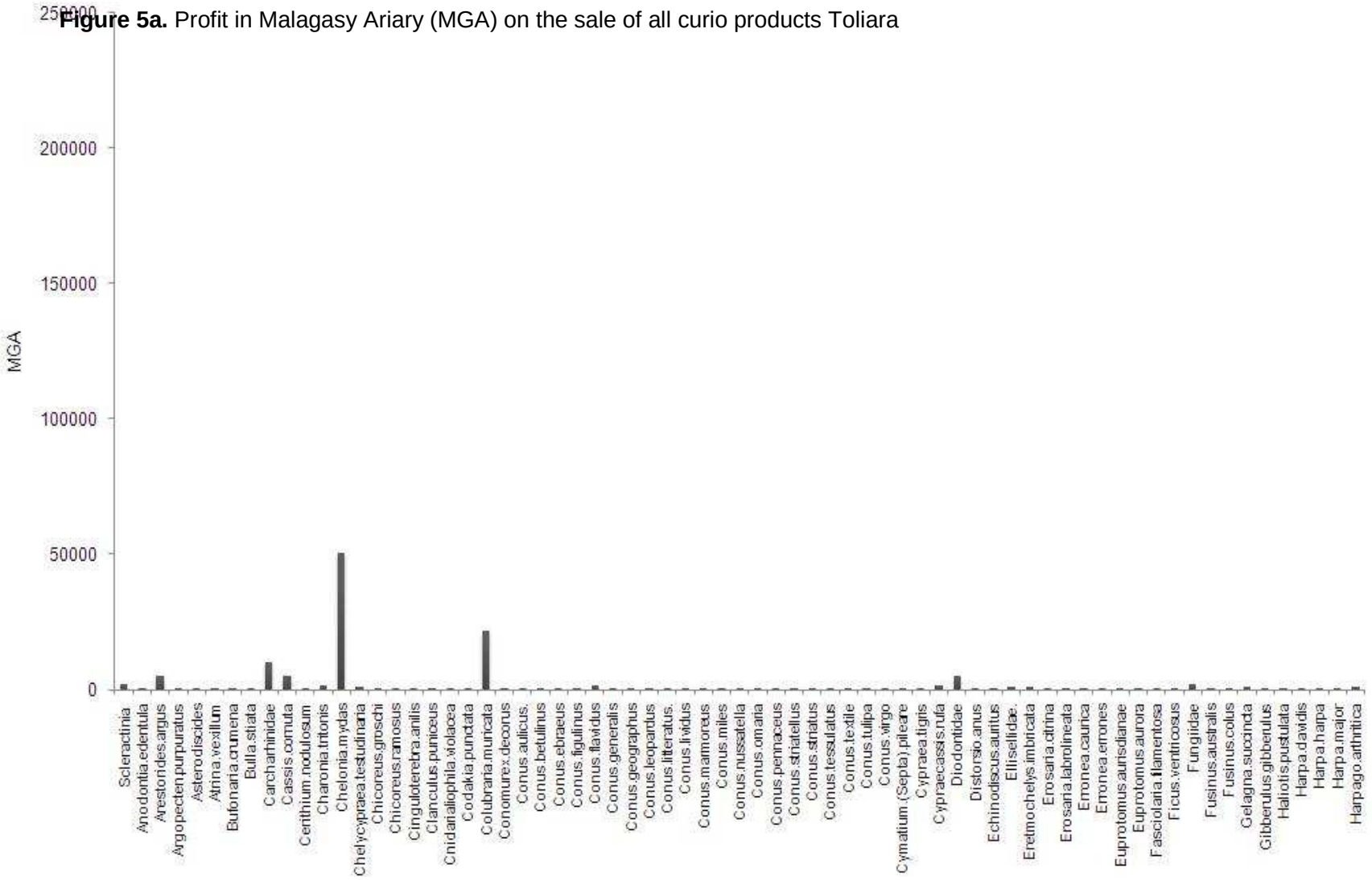


Figure 5a: Profit (MGA) on the sale of all curio products Toliara

Figure 5a: Profit (MGA) on the sale of all curio products Toliara, scale reduced

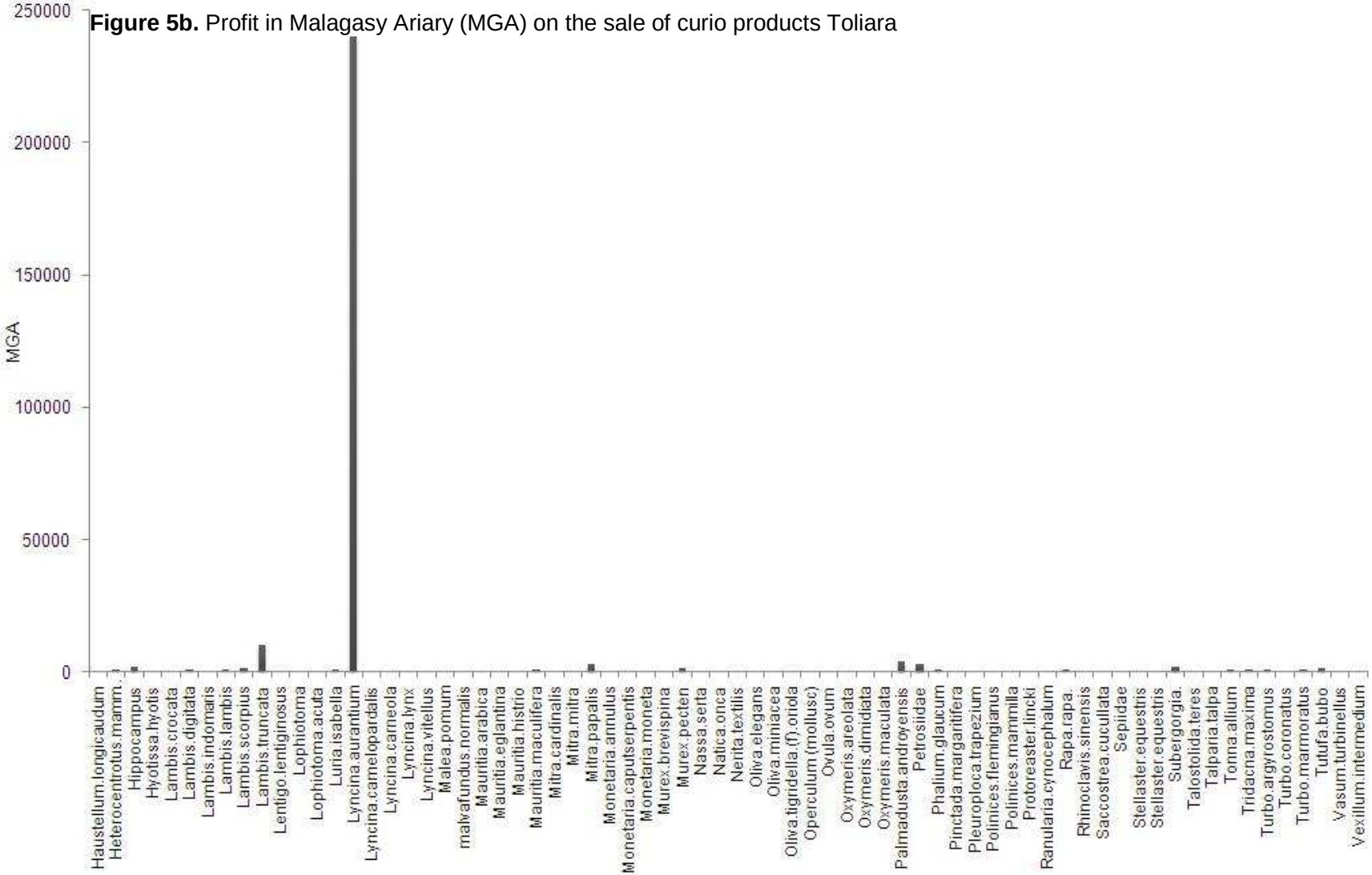


Figure 5b. Profit in Malagasy Ariary (MGA) on the sale of curio products Toliara

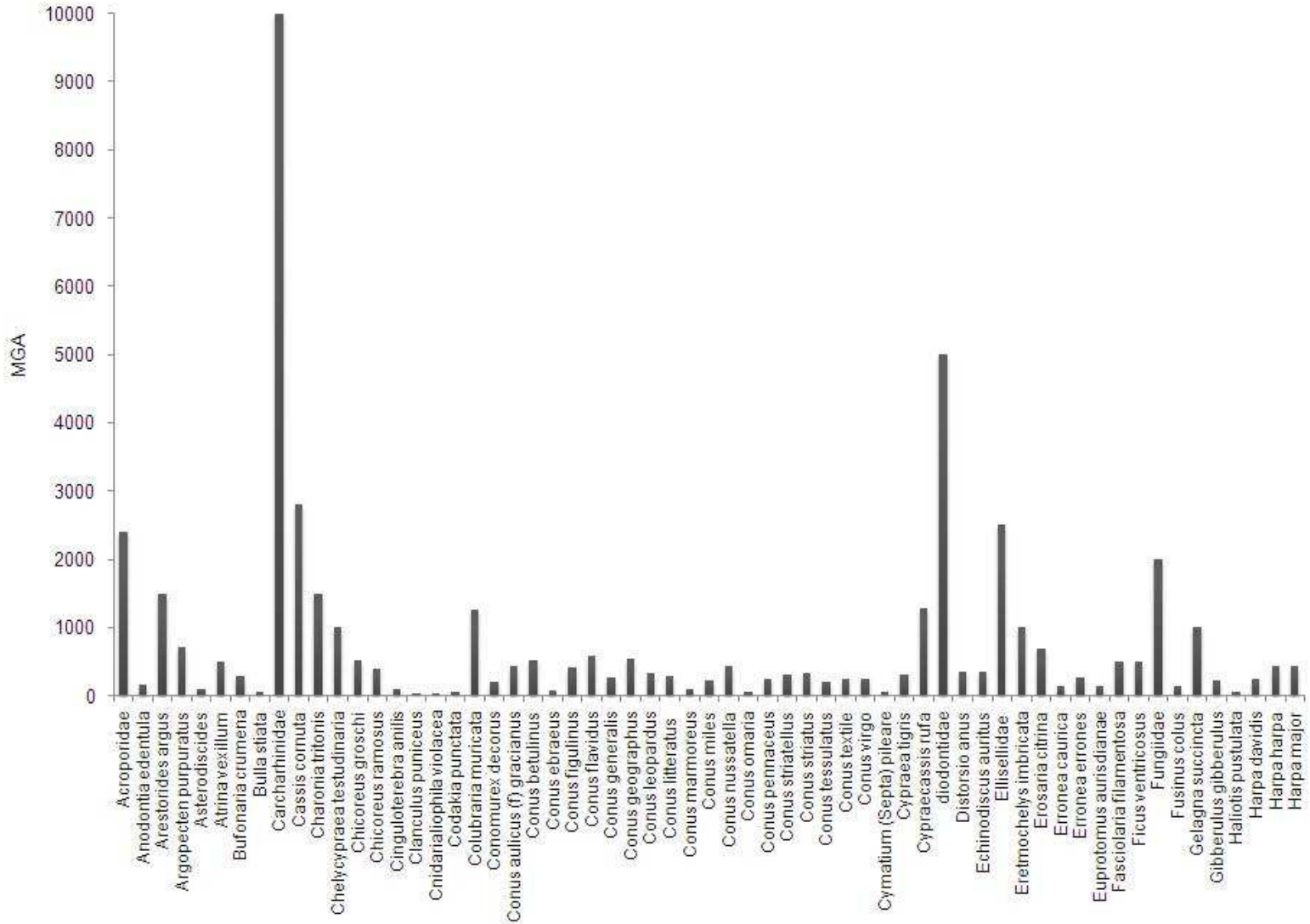


Figure 6a. Profit in Malagasy Ariary (MGA) on the sale of curio products Toliara; *Lyncina aurantium* removed to assess curio products under 10,000 MGA

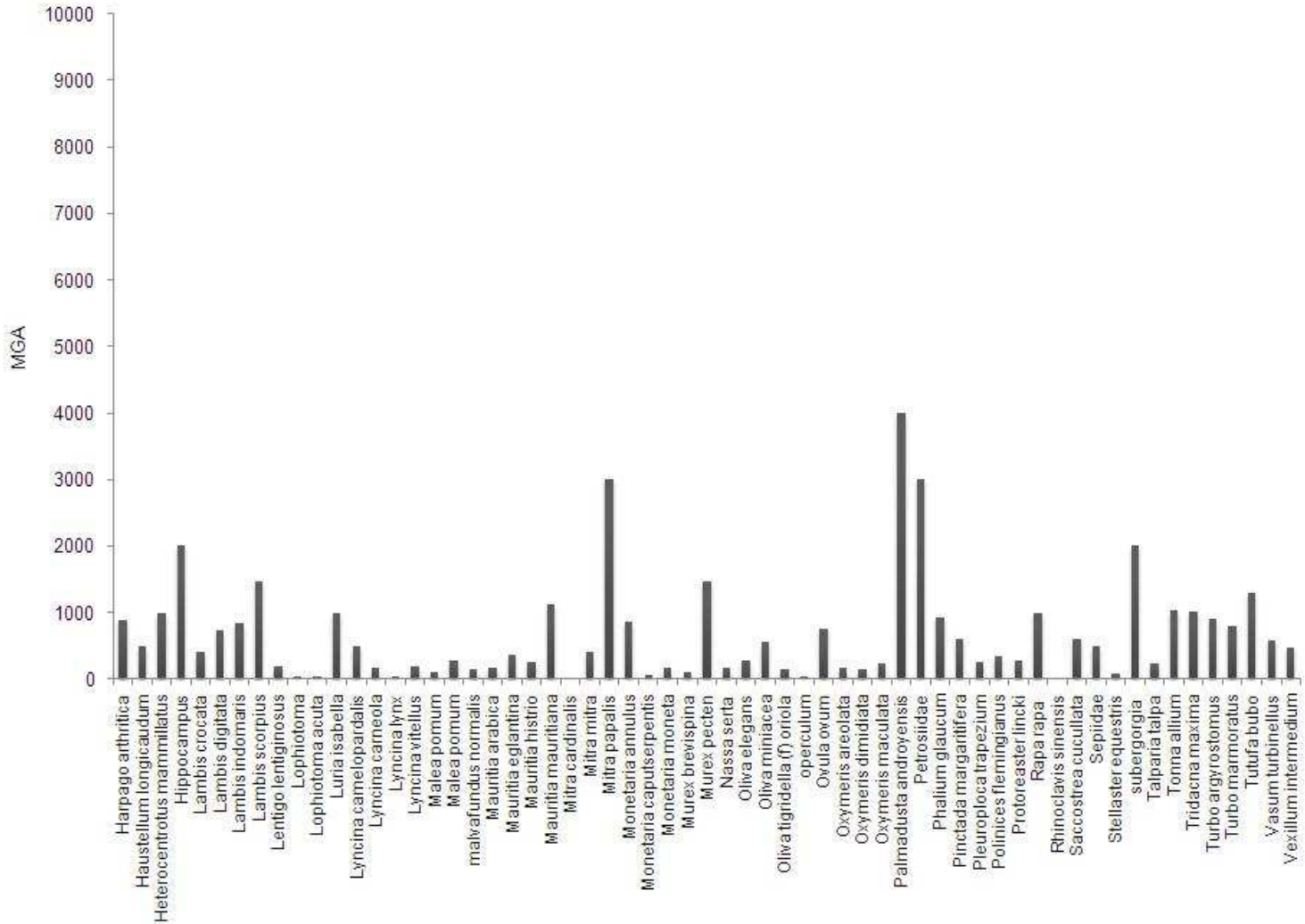


Figure 6b. Profit in (MGA) on the sale of curio products Toliara; *Chelonia mydas* (green turtle) removed to assess curio products under 10,000 MGA

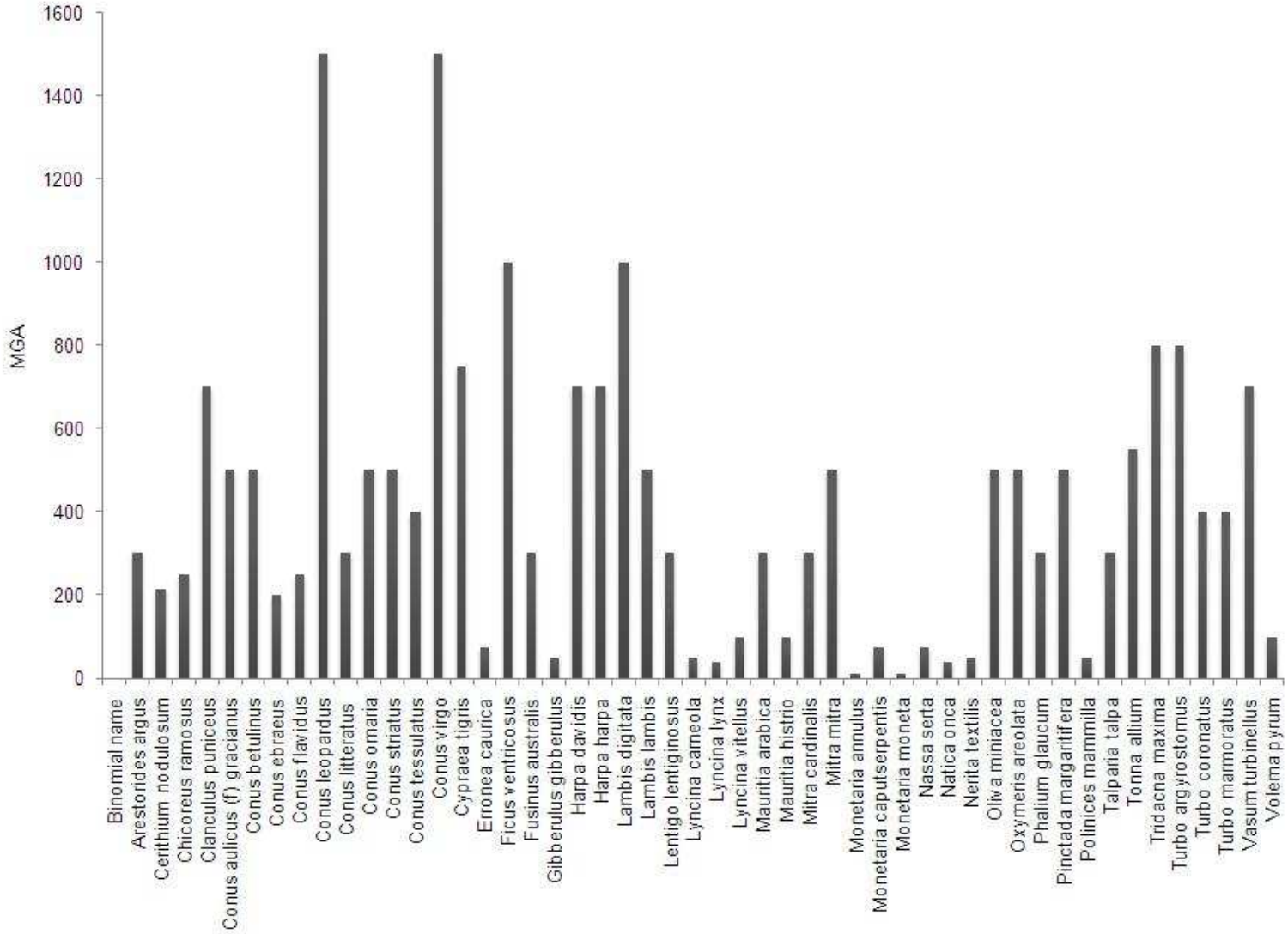


Figure 7. Profit in Malagasy Ariary (MGA) on the sale of all curio products for Ifaty

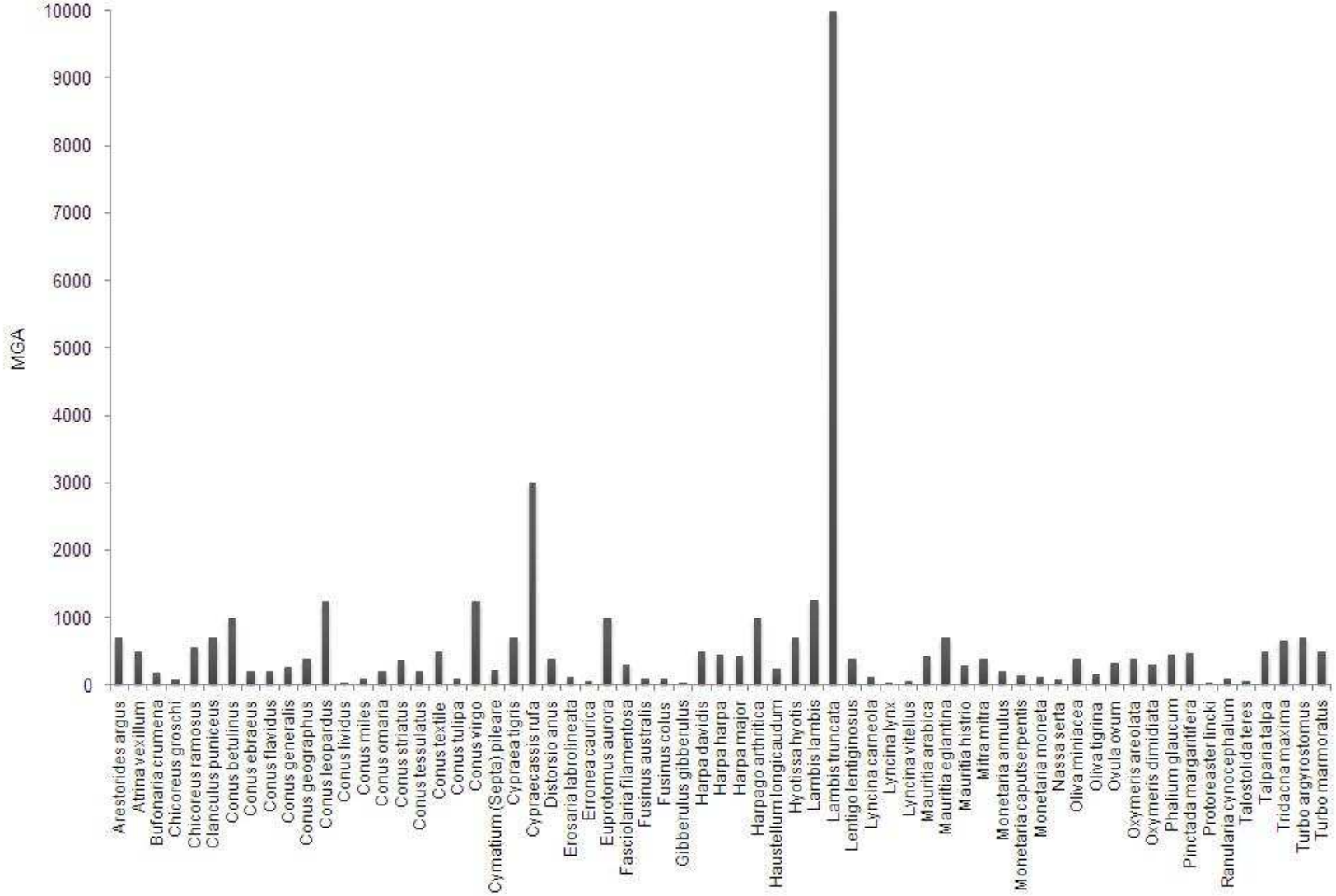


Figure 8a. Profit in Malagasy Ariary (MGA) on the sale of all curio products for Mangily

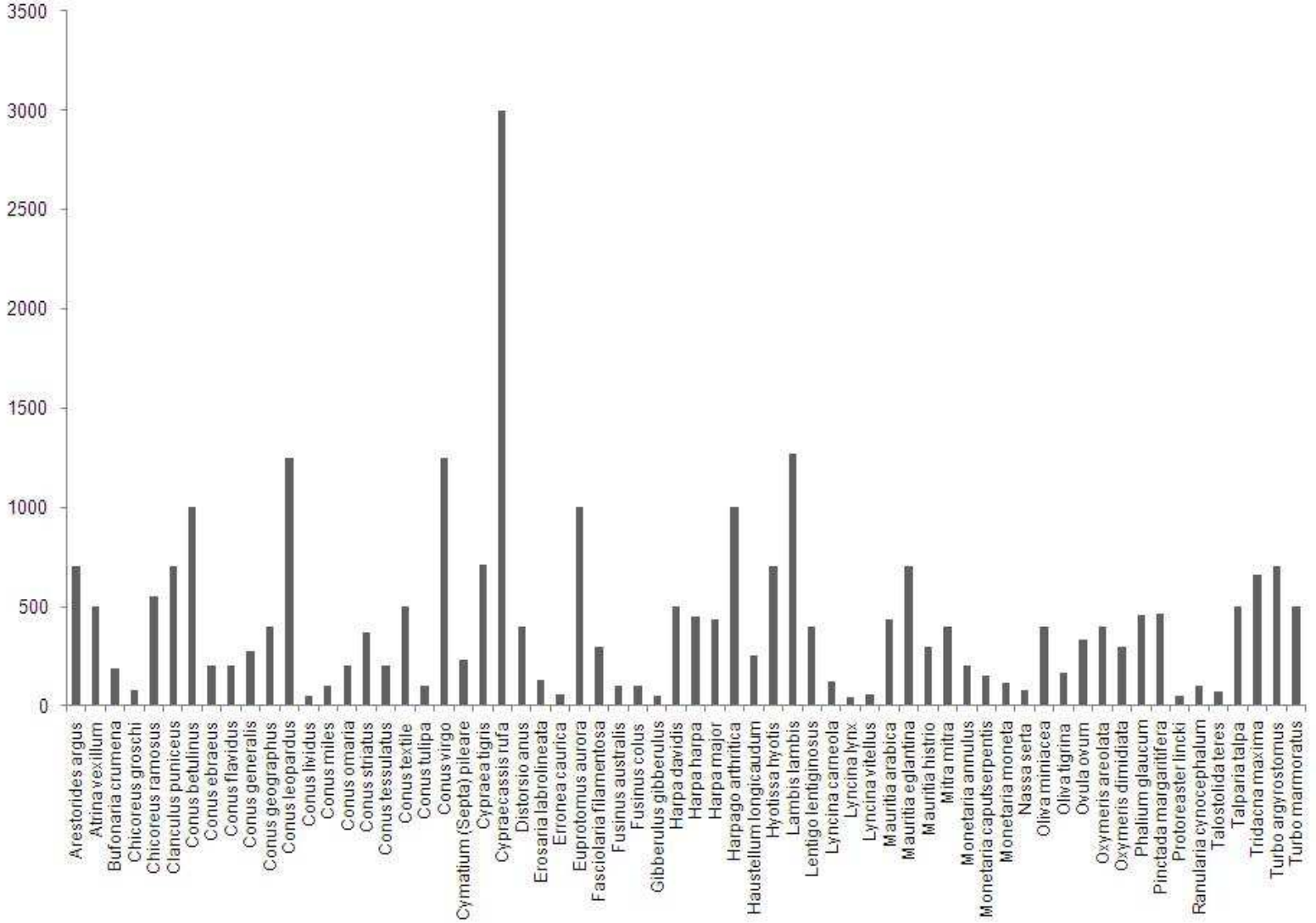
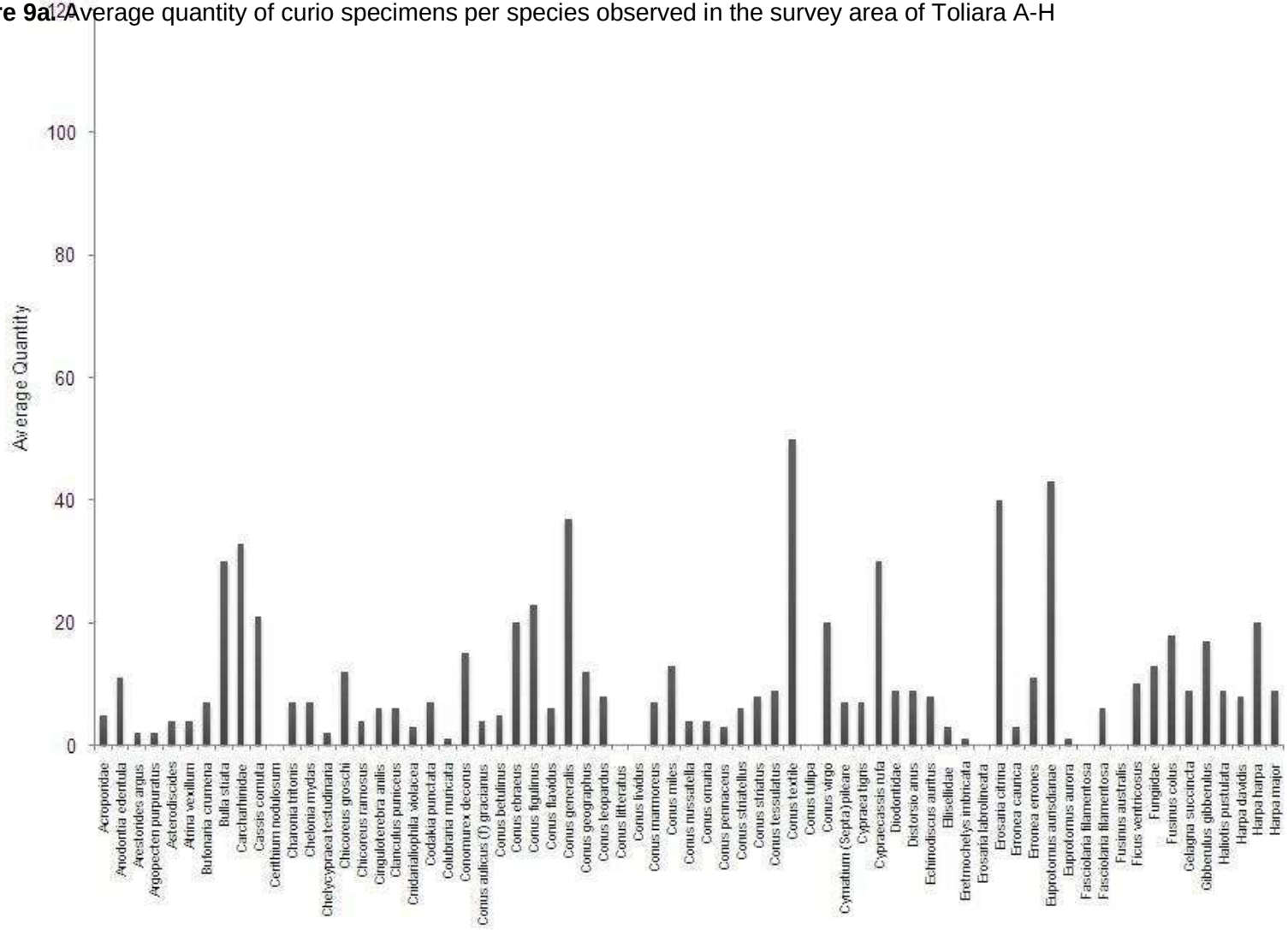


Figure 8b. Profit in Malagasy Ariary (MGA) on the sale of all curio products for Mangily

Figure 9a: Average quantity of curio specimens per species observed in the survey area of Toliara A-H



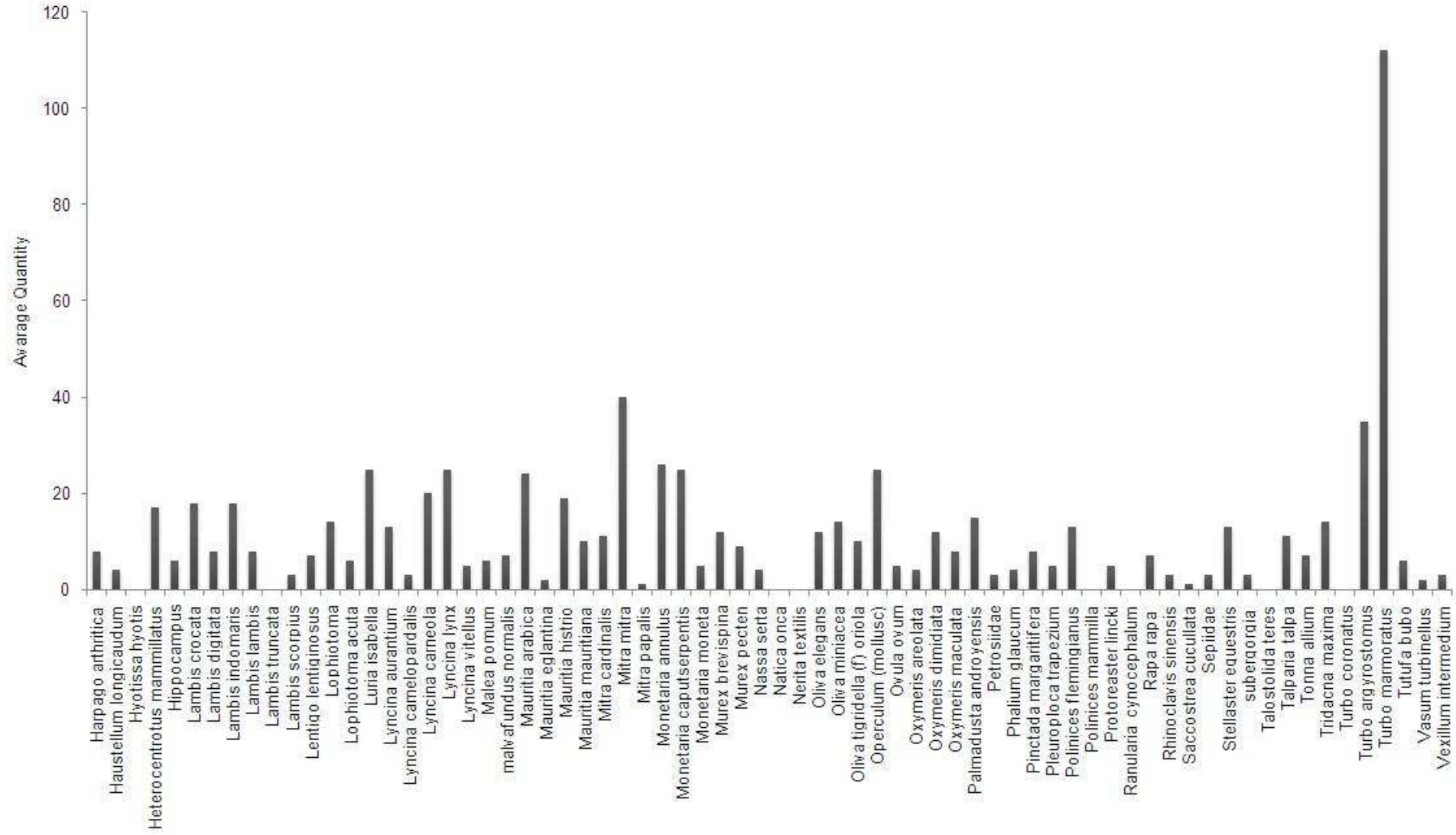


Figure 9b. Average quantity of curio specimens per species observed in the survey area of Toliara H-V

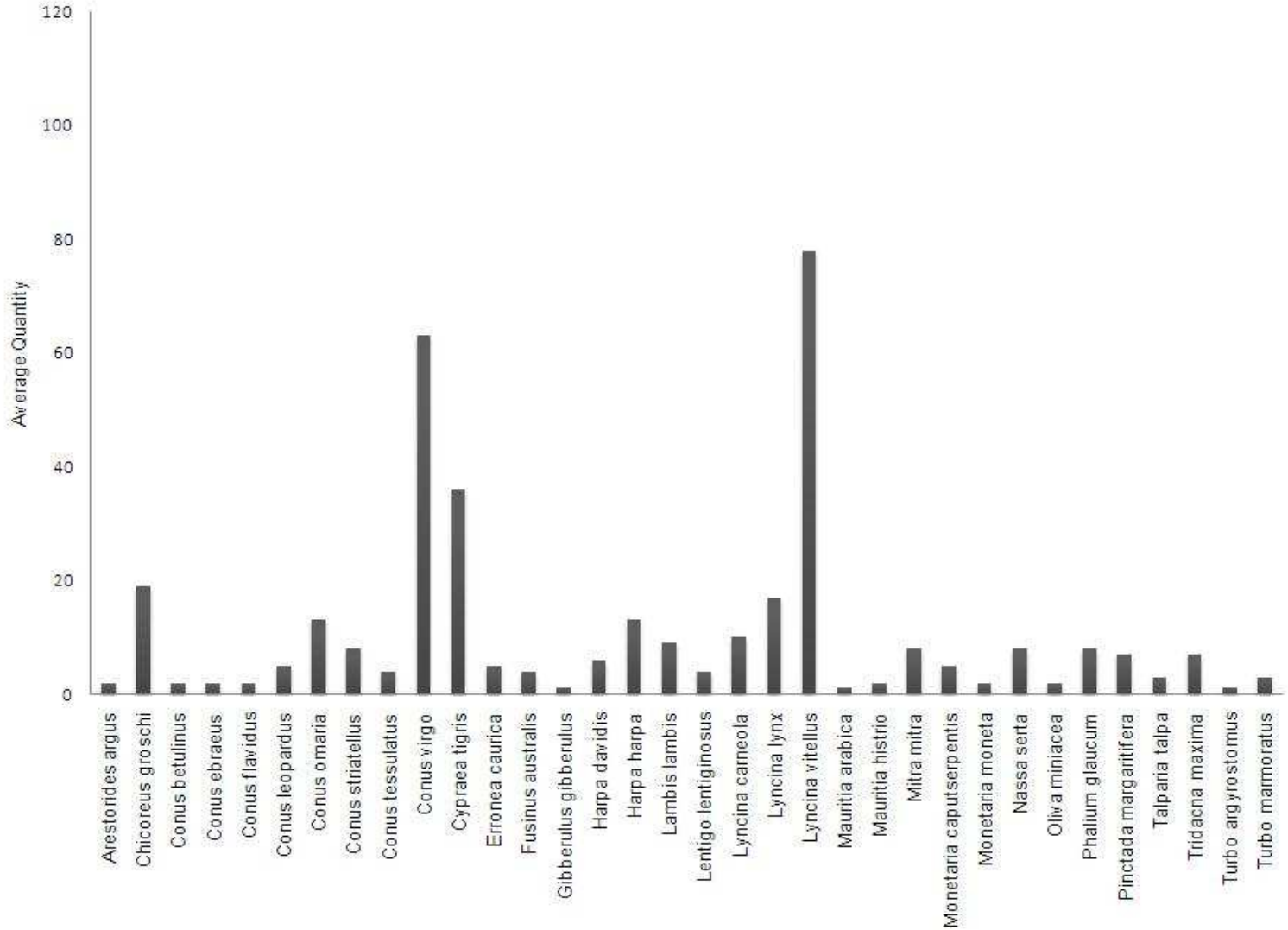


Figure 10. Average quantity of curio specimens per species observed in the survey area of Ifaty

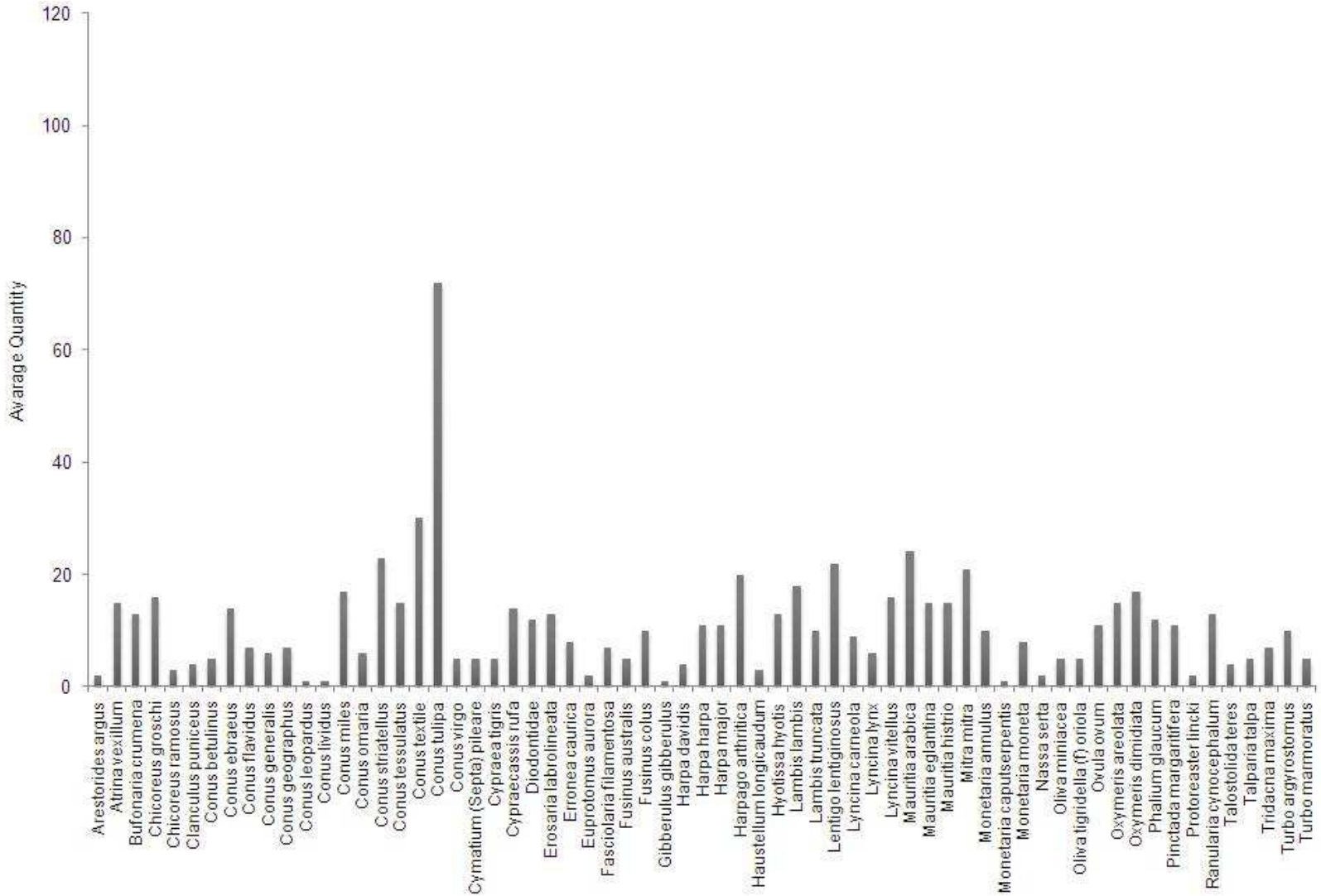


Figure 11. Average quantity of curio specimens per species observed in the survey area of Mangily

Table 4, Curio products with >20 specimens per species stocked by vendors in Toliara, Ifaty and Mangily

TOLIARA		IFATY		MANGILY	
Turbo.marmoratus	Coronate Moon Turban	Lyncina.vitellus	Pacific Deer Cowry	Conus.tulipa	Tulip Cone
Conus.textile	Cloth of gold cone	Conus.virgo	Virgin Cone	Conus.textile	Cloth of gold cone
Euprotomus.aurisdianae	Diana conch	Cypraea.tigris	Tiger cowry	Mauritia.arabica	Arabian cowry
Erosaria.citrina	Lined Margin Cowry	Nerita.textilis	Textile nerite	Conus.striatellus	Striatellus Cone
Mitra.mitra	The pontifical mitre			Lentigo.lentiginosus	Silver conch
Conus.generalis	General cone			Mitra.mitra	The pontifical mitre
Turbo.argyrostomus	Silver-mouthed turban				
Carcharhinidae	Requiem shark jaw				
Bulla.stiata	Sea slug shell				
Cypraecassis.rufa	Bullmouth, red helmet shell				
Monetaria.annulus	Ring cowry, gold ringer				
Luria.isabella	Isabel's Cowry				
Lyncina.lynx	Lynx Cowry, Eyed cowry				
Monetaria.caputserpentis	Serpent's-head cowry				
Operculum	Mollusc operculum				
Mauritia.arabica	Arabian cowry				
Conus.figulinus	Fig cone				
Cassis.cornuta	Helmet shells				

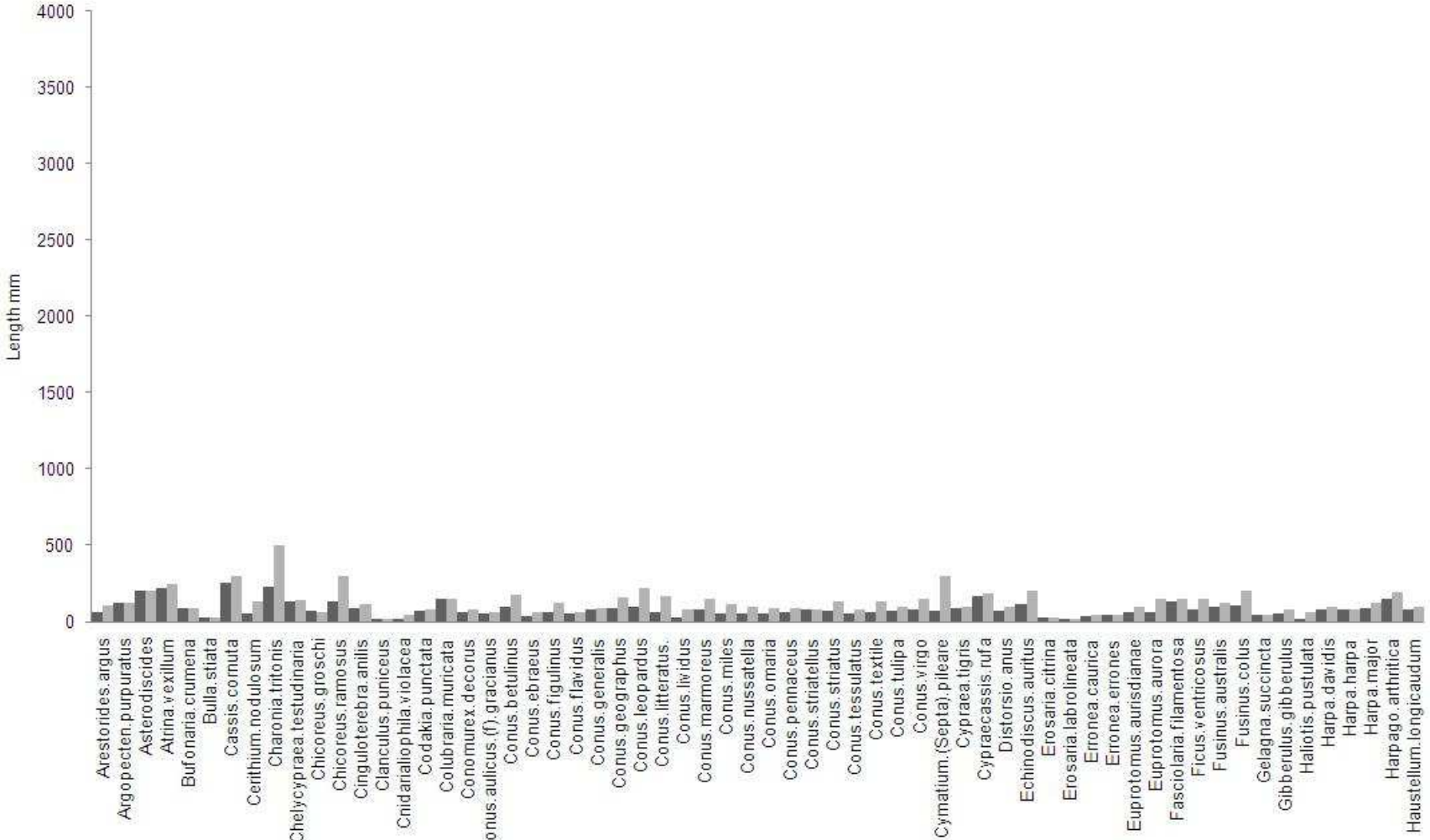


Figure 12a. Average size (mm) of measured curio products (black) and maximum size (grey) from A-H

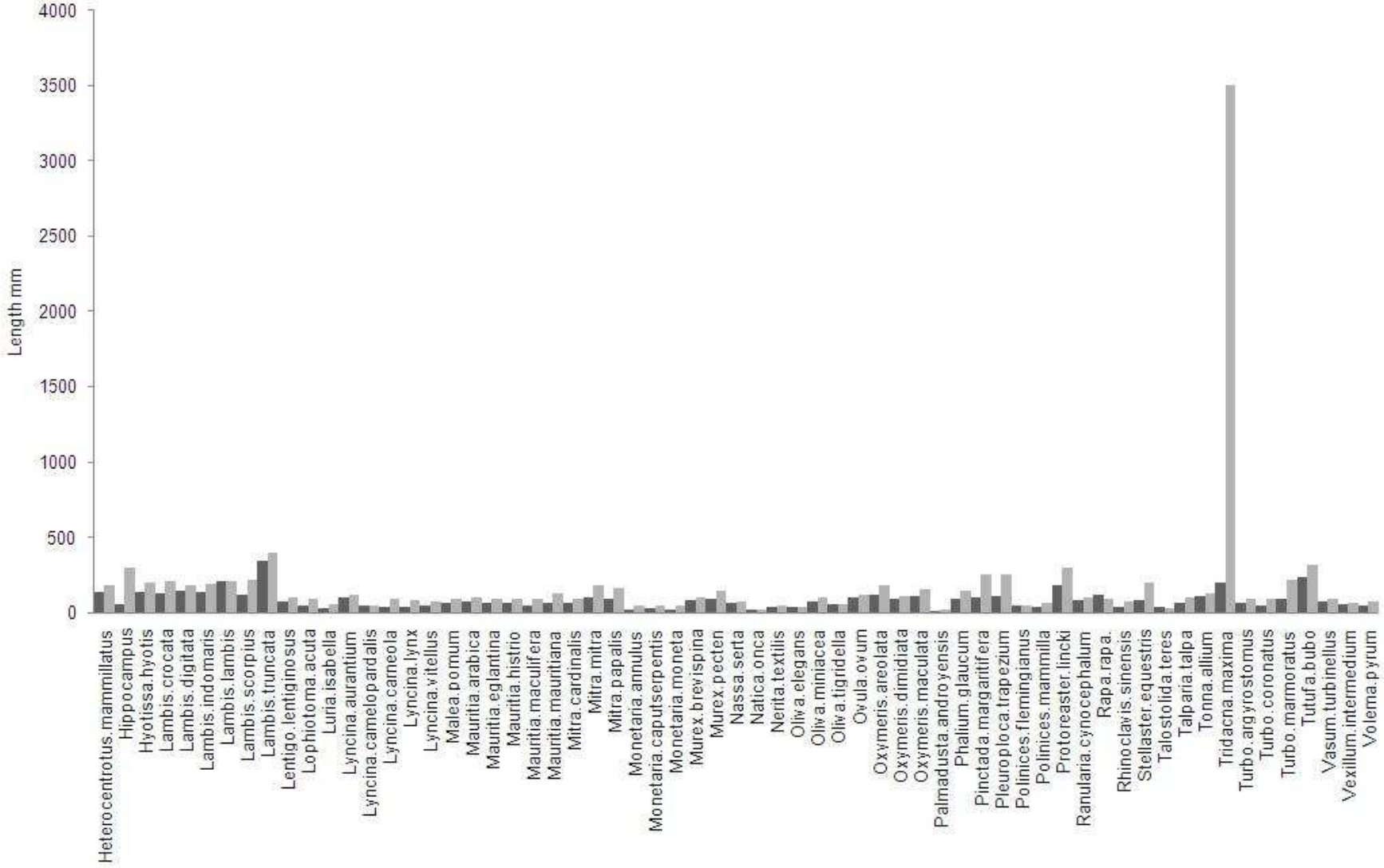


Figure 13b. Average size (mm) of measured curio products (black) and maximum size (grey) from H-V

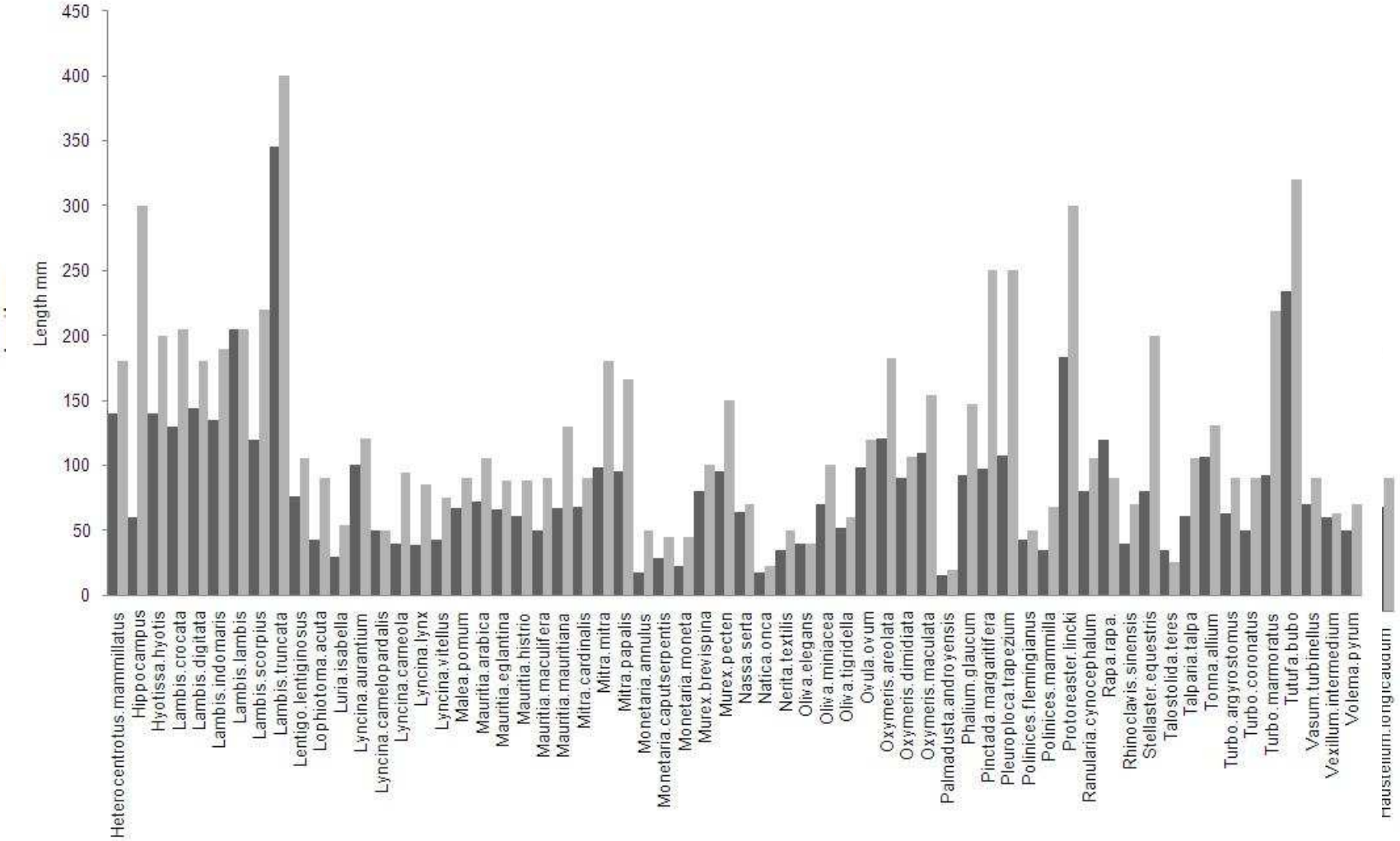


Figure 13a. Average size (mm) of measured curio products (black) and maximum size (grey) from A-H with *Tridacna.maxima* removed to assess curio products under 450mm in length

Table 5. Curio products stocked by vendors in Toliara, Ifaty and Mangily

TOLIARA		IFATY		MANGILY	
LAMBIS.LAMBIS	SPIDER CONCH	CERITHIUM.NODULOSUM	GIANT KNOBBED CERITH	MAURITIA.HISTRIO	HARLEQUIN COWRY
CYPRAEA.TIGRIS	TIGER COWRY	TURBO.MARMORATUS	GREAT GREEN TURBAN	CYPRAEA.TIGRIS	TIGER COWRY
CONUS.BETULINUS	BEECH CONE	LYNCINA.LYNX	LYNX COWRY, EYED COWRY	LYNCINA.LYNX	EYED COWRY
TURBO.MARMORATUS	GREAT GREEN TURBAN	CONUS.EBRAEUS	BLACK-AND-WHITE CONE	LAMBIS.LAMBIS	SPIDER CONCH
OLIVA.MINIACEA	PACIFIC COMMON OLIVE	TRIDACNA.MAXIMA	SILVER-MOUTHED TURBAN	HARPA.MAJOR	MAJOR HARP
CONUS.TEXTILE	CLOTH OF GOLD CONE	CHICOREUS.GROSCHI	ROCK SNAILS	LYNCINA.CARNEOLA	CARNELIAN COWRY
CONUS.GEOGRAPHUS	GEOGRAPHY CONE	TALPARIA.TALPA	CHOCOLATE BANDED COWRY	PHALIUM.GLAUCUM	GREY BONNET
CONUS.STRIATUS	STRIATED CONE	CONUS.TESSULATUS	TESSELLATE CONE	CONUS.BETULINUS	BEECH CONE
HARPA.HARPA	TRUE HARP	HARPA.DAVIDIS	MADRAS HARP	HARPA.HARPA	TRUE HARP
HARPA.MAJOR	MAJOR HARP	CONUS.LEOPARDUS	LEOPARD CONE	TRIDACNA.MAXIMA	SILVER-MOUTHED TURBAN
CONUS.TESSULATUS	TESSELLATE CONE	CYPRAEA.TIGRIS	TIGER COWRY	HARPA.DAVIDIS	MADRAS HARP
LYNCINA.CARNEOLA	CARNELIAN COWRY	TONNA.ALLIUM	COSTATE TUN	CONUS.GENERALIS	GENERAL CONE
MAURITIA.HISTRIO	HARLEQUIN COWRY,	CONUS.STRIATELLUS	STRIATELLUS CONE	ERRONEA.CAURICA	THICK-EDGED COWRY
CYPRAECASSIS.RUFA	BULLMOUTH	CONUS.FLAVIDUS	YELLOW PACIFIC CONE	LYNCINA.VITELLUS	PACIFIC DEER COWRY

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