CONVENTION ON INTERNATIONAL TRADE IN ENDANGERED SPECIES
OF WILD FAUNA AND FLORA

Seventeenth meeting of the Conference of the Parties
Johannesburg (South Africa), 24 September – 5 October 2016

CONSIDERATION OF PROPOSALS FOR AMENDMENT OF APPENDICES I AND II

A. Proposal

Inclusion of the genus ***Polymita*** in Appendix I, in accordance with Article II, Paragraph 1, of the Text of the Convention, as it meets Annex 1, criteria B and C of Resolution Conf. 9.24 (Rev. CoP16) for: *Polymita picta*, *P. muscarum*, *P. venusta*, *P. sulphurosa*, *P. brocheri*, and *P. versicolor.*

B. Proponent

Cuba*.

C. Supporting statement

1. Taxonomy

1.1 Class: Gastropoda

1.2 Order: Stylomatophora

1.3 Family: Cepolidae

The family Cepolidae (Ihering, 1909) is distributed in the Greater Antilles, some of the Lesser Antilles, the Cayman Islands, Florida, and the Florida Keys. Currently, the most accepted taxonomy is that proposed by Bouchet and Rocroi (2005) based on the anatomical criteria for the reproductive system, as revised by Nordsieck (2006) and Hausdorf (1998). Recent phylogenetic studies recognize the family (Wade *et al*., 2006; Wade *et al*., 2007; Razkin *et al*., 2015) based on molecular characteristics.

1.4 Genus: *Polymita* Beck, 1837

Subgenus *Polymita* Beck, 1837
P. picta (Born, 1780)
P. venusta (Gmelin, 1792)
P. muscarum (Lea, 1834)
P. sulphurosa (Morelet, 1849)

Subgenus *Oligomita*
P. versicolor (Born, 1780)
P. brocheri (Gutiérrez en Pfeiffer, 1864)

1.5 Scientific synonyms: *P. picta* (Born, 1780), Synonym: *Helix picta* Born, 1780
P. venusta (Gmelin, 1792), Synonym: *Helix venusta* Gmelin, 1792

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* *The geographical designations employed in this document do not imply the expression of any opinion whatsoever on the part of the CITES Secretariat (or the United Nations Environment Programme) concerning the legal status of any country, territory, or area, or concerning the delimitation of its frontiers or boundaries. The responsibility for the contents of the document rests exclusively with its author.*

P. muscarum (Lea, 1834), Synonym: *Helix muscarum* Lea, 1834
P. versicolor (Born, 1780),Synonym: *Helix versicolor* Born, 1780
P. brocheri (Gutiérrez en Pfeiffer, 1864) Synonym: *Helix brocheri* Gutiérrez en Pfeiffer, 1864

1.6 Common names: Polimita

1.7 Code numbers: N/A

2. Overview

Polymita, an endemic genus limited to the eastern region of Cuba, includes seven species (*P. picta, P muscarum, P. venusta, P. sulphurosa, P. brocheri,* and *P. versicolor*); between 1780 and 1950, 12 subspecies were described. They are considered jewels of nature because of their high polymorphism, brilliant colours, and variety of striped shells, which are considered the most beautifully coloured shells in the world (Fernández y Martínez, 1987). These same characteristics make them "prime targets" for collectors, who use them for different purposes, including international trade, which is currently one of the main causes of their threatened extinction. Further factors that have led to a drastic decrease in the geographic distribution and size of Cuban land snail populations are the destruction, alteration, and fragmentation of their habitats (Alfonso and Berovides, 1993; Fernández *et al*., 1995, 2001a; Maceira *et al*., 2005; González-Guillén, 2008, 2014; Espinosa and Ortea, 2009; Espinosa, 2013).

None of the Cuban species of terrestrial molluscs has been assessed by the International Union for Conservation of Nature (IUCN). However, recent assessments made by scientists from national institutions for the Red List of Cuban Invertebrates (currently being edited), classify the species of *Polymita* as Critically Endangered (CR), according to IUCN criteria.

Polymite snails have been found in international trade since the beginning of last century, and are exported in barrel loads to the United States of America, and Canada (Jaume, 1943; Fernández and Martínez, 1987). International trade decreased significantly during the latter half of the 20th century. However, there has been a resurgence of illegal trade, intended for the international market, at a time when the ecological status of the species is most vulnerable, and unless such trade is halted, the species could become extinct.

The species of the genus *Polymita* meet the biological and trade criteria for inclusion in Appendix I of CITES, in accordance with Paragraph 1 of the Text of the Convention, and criteria B i, ii, and iv, and C ii of Annex 1 of Resolution Conf. 9.24 (Rev. CoP16), given that the species are endemic to the eastern region of Cuba, and their distribution is limited (*Polymita sulfurosa* 6.7 km^2*; P. brocheri* 52 km^2, *P. versicolor* 98.5 km^2; *P. muscarum* 3577 km^2; *P. picta* 2622 km^2; and *P. venusta* 7755 km^2). The range of the genus has decreased by over 56%, its habitat is fragmented, and population size has diminished, with a loss of some populations.

The range of all species of the genus has decreased, more notably in some cases than in others. The situation is particularly alarming in the case of *Polymita sulfurosa*, whose range has decreased by 97 %, bringing it to the verge of extinction, and also *P. venusta* and *P. muscarum,* whose ranges have decreased by 63 % and 56 % respectively. The species' habitats are fragmented and degraded, which, added to illegal harvesting for trade, has led to the extirpation of several populations.

3. Species characteristics

3.1 Distribution

The genus *Polymita* is limited to areas in the eastern zone of the Cuban archipelago, ranging from the province of Camagüey to Guantánamo province.

Historic distribution of the species of the genus *Polymita* has been mapped, based on more than 2000 records from the collections at the Felipe Poey Museum, the Institute of Ecology and Systematics, the Harvard Museum of Comparative Zoology, the Cuban National Natural History Museum, scientific literature, and geo-referenced imaging from recent field expeditions. These maps show the geographic distribution by location area.

Based on the map of plant formations drawn up by Estrada *et al*. (2013), plant formations in which the species is no longer found, i.e., mangrove swamps, pine forests, and the mountain rainforests of Sierra Maestra, were eliminated from the original maps. Final map boundaries were based on geological, geomorphological, landscape, and biogeographic criteria, using ArcGis 9.3 software to make a GIS analysis. Current distribution was mapped by eliminating all areas from the map of historic distribution where it has been verified that natural or semi-natural vegetation no longer exists (semi-natural vegetation includes secondary and/or degraded forests and scrubland), according to Estrada *et al*. (2013), as well as all areas with natural or semi-natural vegetation in which, according to the literature and expert reports, the populations have disappeared. The maps of current distribution and the distribution tables derived therefrom showed a potential current distribution that was larger than actual distribution. These maps of historic and current distribution were subsequently revised and improved at three expert workshops on the genus.

Taking into consideration the sources used (mainly *Landsat* 7 ETM and *Landsat* 8 OLI images), and the aforementioned map drawn up by Estrada *et al*. (2013), which shows minimum areas of 1.5 ha and is considered appropriate for working at a scale of 1: 100 000, the maps obtained are equivalent to that scale, i.e., 1: 100 000; the resolution of some maps has been reduced to allow their inclusion in this proposal. The maps were created with WGS 84 and were reprojected with NAD 27 Cuba Sur for area calculation.

Distribution maps of the genus Polymita

Polymita picta: The geographic range of this species is limited to the territories in the present-day municipalities of Baracoa and Maisí in Guantánamo, and to some of the adjacent areas in the neighbouring province of Holguín (Torre, 1950; Fernández and Martínez, 1987). The historic range of *P. picta* was estimated at approximately 2365 km^2. The current range of the species is estimated at 2215 km^2, which represents a decrease of 6.35 % of its original range (Figure 1).

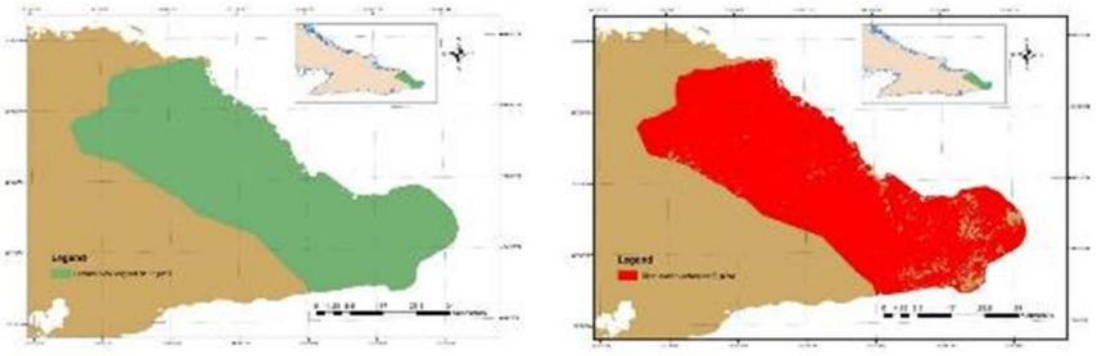


Figure 1. Historic and current range of *Polymita picta*

Polymita muscarum: This species is endemic to the northeast coast of Cuba, with several disperse populations that extend from the Guayaba Key - Nuevitas (Camagüey) to Frank País in Holguín, including other keys (Torre, 1950; Fernández and Martínez, 1987; Fernández *et al*., 2000a, 2000b). The historic range of *P. muscarum* was estimated at approximately 8152 km^2, and its current range at 3577 km^2, which means that its historic range has decreased by 56.2 % (Figure 2).

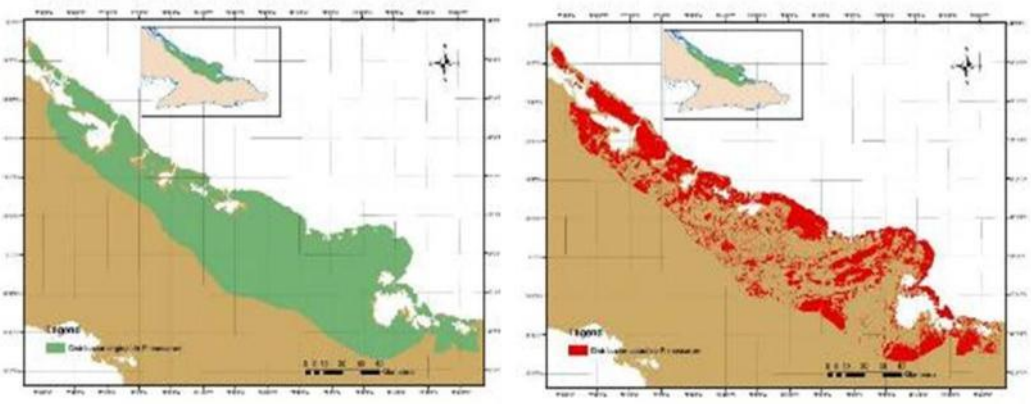


Figure 2. Historic and current distribution of *Polymita muscarum*

Polymita venusta: This is the most widely distributed species of the genus although its range is very much fragmented, encompassing the five eastern provinces of Cuba (Torre, 1950; Fernández y Martínez, 1987; Espinosa, 1989; Fernández *et al*., 2001b). Some populations have been verified as extinct, especially in Santiago de Cuba. The historic range of *P. venusta* was estimated to be approximately 21 087 km^2; estimated current range is 7755 km^2, which represents a decrease of 63.23 % of its historic range (Figure 3).

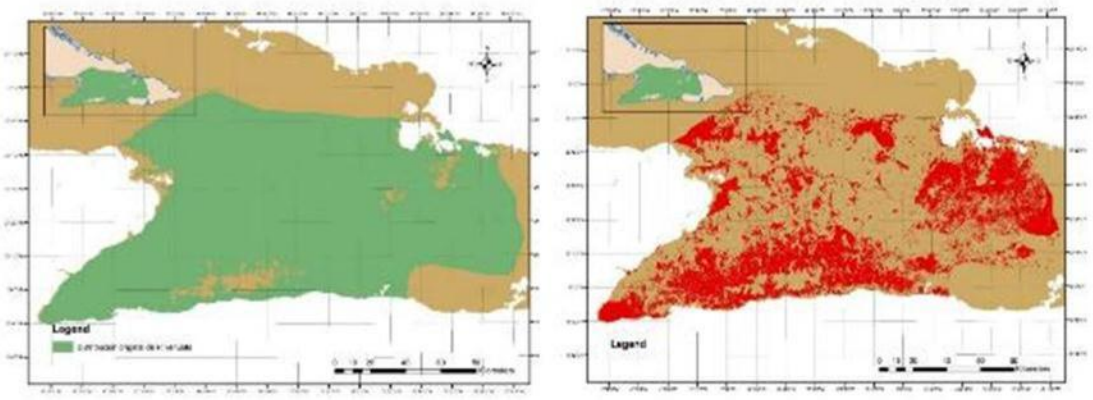


Figure 3. Historic and current distribution of *Polymita venusta*

Polymita sulphurosa: Along the eastern coast of Sagua de Tánamo, between Cayo Mambí and Cayo Guam, bordering Baracoa (Figure 4), many of the populations have been extirpated, and extant populations are very fragmented (Torre, 1950; Fernández *et al*., 1998; Reyes, 2004; Maceira *et al*., 2005). The historic range of *P. sulphurosa* was estimated at approximately 217 km^2; current range, in the best-case scenario (based on data from expeditions in the years 1996 to 2002), is estimated to comprise five possible patches covering an area of only 6.7 km^2, which represents a loss of 97.5 % of its historic range. Notably, the most recent information (from an expedition in 2015) reported only one specimen in one of these patches, which covers an area of 1.31 km^2.

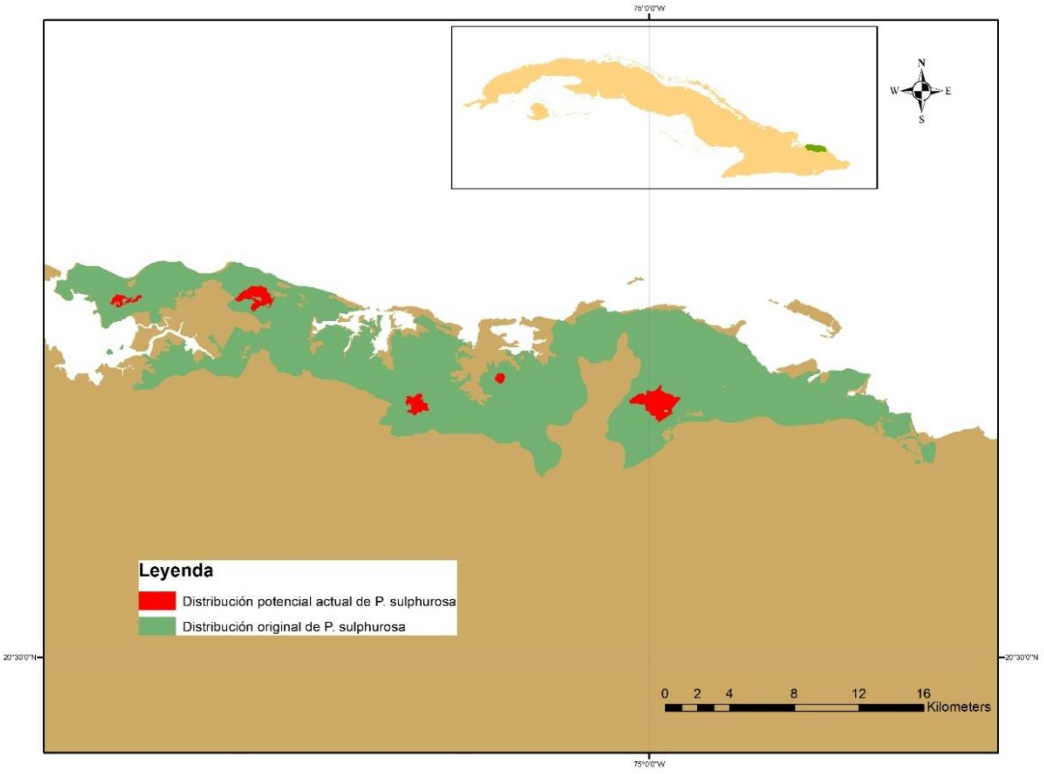


Figure 4. Historic and current range of *Polymita sulphurosa*

Polymita versicolor: This species is found in the area between Playa Siboney, Santiago de Cuba, and Playa Blanca, Maisí, Guantánamo (Torre, 1950; Fernández and Martínez, 1987). Current populations are highly fragmented. The historic range of *P. versicolor* was estimated at approximately 131 km^2. Current range is estimated at 98.5 km^2, representing a loss of 25 % of its historic range (Figure 5).

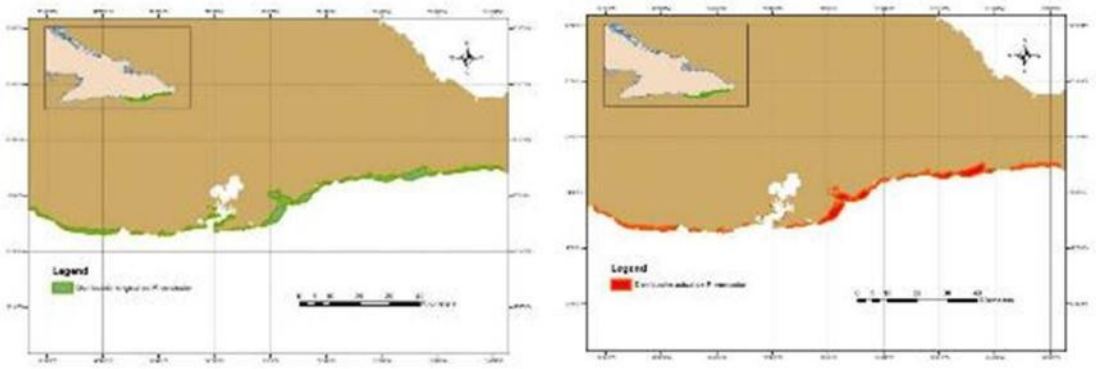


Figure 5. Historic and current range of *Polymita versicolor*.

Polymita brocheri: Maisí, Guantánamo (Fernández y Martínez, 1987). The historic range of *P. brocheri* was estimated at 71 km^2, the smallest historic range among the Cuban land snails. Its current range is 52 km^2, which represents a loss of 27% of its historic range (Figure 6).

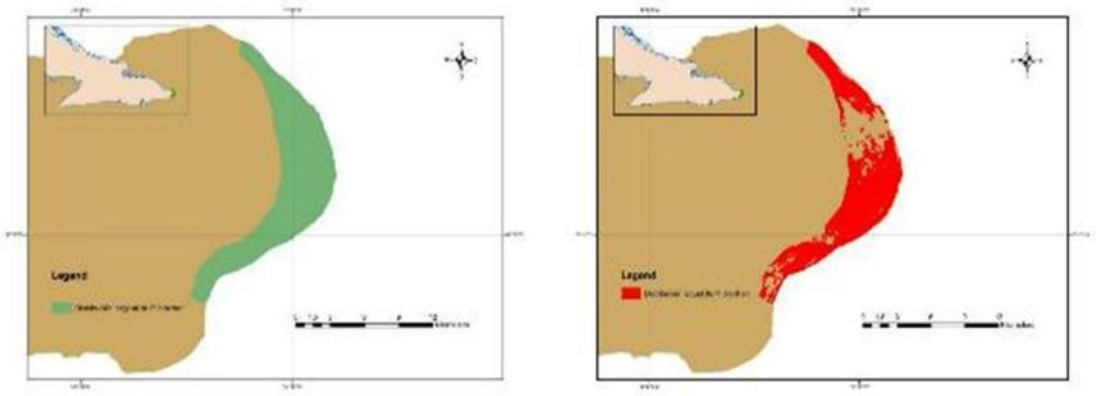


Figure 6. Historic and current range of *Polymita brocheri*

3.2 Habitat

Polymite snails are pulmonate molluscs with arboreal habits that are adapted to live on a large variety of plants, including introduced plants such as coffee bushes and coconut palms. Until now, they have been found in diverse primary plant formations: semi-deciduous forest, microphyllous evergeen forest, mesophyllous evergeen forest, the mountain ranforest of the Nipe-Sagua-Baracoa massif, coastal and subcoastal xeromorphous scrubland, although their presence has also been reported in secondary formations such as coffee plantations and grassland (Berovides, 1987; Fernández and Martínez, 1987; Maceira, 1998).

The list of plant species used by polymite snails shows a predominance of native plant species (Valdés *et al*., 1986; Fernández and Martínez, 1987; Fernández *et al*., 2000a). Recent studies report that *P. versicolor* has been found on 27 plants, *P. muscarum* on 107, *P. sulphurosa* on 13, *P. venusta* on 35, and the subspecies *P. picta nigrolimbata* and *P. picta roseolimbata* on 14 and 29 plant species, respectively. Some of the most frequent species on which they have been found are: *Lysiloma latisiliquum*, *Metopium brownei*, *Acacia macracanthoides*, *Eugenia* sp., *Lantana* sp., *Coccoloba* sp., and *Bursera* sp. (Valdés *et al*., 1986; Fernández and Martínez, 1987; Fernández, 1990; Bidart, 1997; Reyes *et al*., 2000; Fernández *et al*., 2000 a, b; Fernández *et al*., 2001a).

Overall, there is very little continuity of the habitats where the species of this genus are found. Most of the species occur basically on coastal and sub-coastal vegetation that has been or is currently being modified. This situation has led to fragmentation of these plant formations, and accordingly, of the polymite snails, which are highly vulnerable to changes due to their low mobility.

It has been shown that populations have disappeared because of habitat modification. However, in mountain areas with predominantly semi-deciduous, microphyllous evergreen, mesophyllous evergreen forests, and mountain rainforests, especially in the Baracoa region, populations are less fragmented, and there is some continuity throughout the area. In the case of polymite snails, a lack of habitat continuity affects genetic diversity, making them more vulnerable to extinction (Berovides and Alfonso, 1995).

3.3 Biological characteristics

Although these are herbivorous arboreal animals, they do not actually feed on the top plants, which are used basically as food substrates, but on the lichen, fungi, and moss that grow on the trunks, branches and leaves of the plants, which they scrape using their special, wide-cusped, gouge-like radular teeth, with the help of their curved, moderately solid, smooth jaws.

The estimated longevity of polymite snails under natural conditions is between 12 and 19 months at the most. According to Bidart *et al*. (1997), the maximum age for *P. muscarum* is 17 months. On the other hand, Reyes-Tur and Fernández (2000) report that this species survives for up to 3 years under laboratory conditions. Pérez and López (1993) report a maximum age of 15 months for *P. picta roseolimbata*.

The life cycle of polymite snails is more or less annual. These snails are hermaphrodites and breed by cross-copulation between two individuals that become fertilized simultaneously, which is an advantage in that reproductive success is double, and there is a greater likelihood of finding sexually available partners. Clutch size can vary by species, both in the number of eggs and in the number of individuals per clutch; generally speaking, clutches contain between 30 and 100 eggs – sometimes more, when eggs are collectively laid on a single patch.

Sexual maturity is reached at 9 – 10 months of age, and individuals are ready to reproduce from September onwards when rainfall frequency increases in the most easterly region of Cuba, although the peak of reproduction of some species is often around December and may even extend to the first two months of the following year (Espinosa, 2013).

In the case of *P. picta nigrolimbata,* which is one of the best-studied species, copulation takes place preferably between September and November, coinciding with the start of the rainy season. Eggs are laid on the ground, in small hollows in the soil, or among leaf litter, approximately 16 days after copulation (Bidart *et al*., 1989; Espinosa and Ortea, 2009).

Clutch size and other biological parameters are part of the adaptive strategy of the species to cope with habitat conditions (Valdés *et al*., 1986). This has been studied in several species of *Polymita* in the laboratory (Feijoó, 1984; Valdés *et al*., 1986; Iglesias, 1991, Reyes -Tur and Fernández, 1998). The most frequent clutch site is among moist leaf litter (Díaz-Piferrer, 1962), although Bidart *et al.* (1992) reported finding nests on tree stumps. Hatching takes between 11 and 15 días (Bidart *et al.,* 1989; Espinosa and Ortea, 2009).

According to Reyes-Tur *et al*. (1998), the egg-laying and hatching period of *P. venusta* starts in October in the populations of Sardinero, Santiago de Cuba, and Piedra Gorda, Holguín. However, hatching of *P. muscarum* at Playa Blanca starts in December (Reyes and Fernández, unpublished).

Polymite snails grow at a relatively fast rate during the first life stage. Depending on rainfall patterns, the recruitment period can last until March or April, although it is most intense in December. Population density and average size vary throughout the year, depending on recruitment, growth, and mortality. Three important periods have been described in the life cycle of these molluscs (Bidart *et al*., 1989):

1. Between December and February: the population is comprised of adults and juveniles. Size varies and density tends to increase with recruitment.

2. Between April and June: only juveniles. Average size is small, and population density reaches its maximum level.

3. Between June and September: only adults and sub-adults are observed. Average size of individuals reaches its maximum value, but population density is lower because of natural mortality, which reaches the highest level of the whole life cycle, and is more than 50 % of the population in any month throughout the year.

Seasonal fluctuations in population density, and hence, in population size, mean that polymite snails are particularly vulnerable at certain times of the year.

3.4 Morphological characteristics

Generally speaking, shells are sub-bulbous and elevated, brightly coloured, rather thin yet solid, and imperforate; few whorls, usually four, the last of which is deflected; large, rounded aperture; peristome simple; thickened or sharp outer lip except along the axis where it is reflected and attached to the umbilical region.

Polymita picta: characterized by its bulbous and sometimes slightly high-spired shell; strong but not very thick shell walls, few whorls – around four. Size may vary, but maximum diameter is generally between 22 and 30 mm. Shells display a wide variety of colours (Figure 7). The colouring (black, pink, iodine, ochre) of the subsutural band and the columellar spot, which may be interrupted, varies in the subspecies.

Figure 7. Chromatic variability of *Polymita picta*

P. muscarum: helical, bulbous shell, maximum diameter approximately 20 mm; relatively strong shell, the surface of which is marked by microscopic axial growth lines, sub-circular aperture. The species is characterized by the black dots covering the whole shell surface (Figure 8).

Figure 8. Chromatic variability of *Polymita muscarum*

P. venusta: maximum shell diameter between 20 and 26 mm; sub-bulbous shell formed by approximately three and a half whorls, the final whorl being very large and slightly downward-dipping. Chromatic variations have led to the description of four subspecies. It is possible to find shells that are completely sulfurish-yellow with a clear red stripe at the aperture and growth lines; all red; brilliant olive green; or yellow with thick, spiral, chestnut-coloured bands (Figure 9).

Figure 9. Chromatic variability of *Polymita venusta*.

P. sulfurosa: characterized by a medium-sized bulbous shell that may present clear flammulations over the background colour (yellow, sulfurish-yellow, green, white, and even lilac), red suture or peristome (Figure 10).

Figure 10. Chromatic variability of *Polymita sulphurosa*

P. versicolor*:* very eye-catching, white shells decorated with coloured axial and spiral lines in combinations of brown, green, and yellow; pink columella (Figure 11).

Figure 11. Chromatic variability of *Polymita versicolor*

P. brocheri: elongated bulbous shell, with a much higher spire than any other polymite snail; length approximately 20 to 22 mm, maximum diameter 14 mm; discreet colours, usually with ochre-yellow axial lines or bands on a white background; spire height varies among the subspecies (Figure 12).

Figure 12. Chromatic variability of *Polymita brocheri*

3.5 Role of the species in its ecosystem

The species of *Polymita* play an important ecological role in the ecosystems in which they occur. The symbiotic relationship between polymite snails and plants is mutually beneficial: the plants provide shelter and food for the polymite snails, while the latter keep the plants free from fumagine, a dark, fungus that leaves a thin sooty coating on leaves, preventing normal breathing and photosynthesis (Espinosa, 2013).

Like all living beings, in one way or another, *Polymita* will form part of the soil and biogeochemical cycles. Further, it has an important role in the food chain given that it forms part of the diet of several bird species, including some endangered endemic Cuban and Caribbean species such as *Rosthramus sociabilis*, *Chondroierax wilsoni*, and *Saurothera merlini*.

4. Status and trends

4.1 Habitat trends

In 1959, only 14 % of Cuba maintained its natural forest cover. In other words, in less than 500 years, Cuba lost over 80 % of its forests, and in the process, a large part of forest biodiversity, which is the habitat of abundant, highly diverse, tropical terrestrial molluscs (Espinosa, 2013).

Although forest cover has increased since 1959, the rapid populational and economic development of Cuban society has brought environmental changes.

Tourist development has had an impact on the coast, and on many of the keys around the main island, some of which remained untouched or hardly affected until the early 1990s. However, in less than 20 years, they have been completely transformed by the construction of hotels, airports, and roads, and, in some cases, are no longer geographically isolated (Espinosa, 2013). The most affected species in this sense is *Polymita muscarum*, which is typically found in the coastal habitat where one of the major tourist resorts in the eastern part of the country was developed, resulting in great fragmentation of this habitat type, and causing the disappearance of populations of the species.

Agricultural development – particularly livestock farming and sugarcane plantations, strip mining, and the construction of human settlements, dams, higihways, and roads have modified and fragmented the habitat.

4.2 Population size

The population size of the various species is unknown. Most existing population estimates date back to over ten years ago (Maceira *et al*. 2005) and were obtained from specific ecological studies (ecological density) involving very little sampling of only a few populations. Further, it is difficult to make estimations because of annual population dynamics, the species' high sensitivity to climate variables such as periods of intense drought, and the different ecosystems and plant formations in which the species occur; accordingly, the density values obtained cannot be extrapolated to the whole population of a species, and are only valid for monitoring specific areas, species, or sites.

4.3 Population trends

Most authors agree that the populations of the six species are in constant decline, and this is confirmed by the disappearance of populations from sites where their presence was notable, and by the lower density found in most of the populations assessed.

Although studies remain insufficient, the best-studied species of the genus *Polymita* are *P. picta, P. muscarum, and P. venusta*; very little is known about the other species of the genus (Fernández *et al.*, 1998).

Calculation of ecological density (number of individuals/m^2) for the species of *Polymita* still requires intense monitoring. There is not sufficient data as to determine that the species occurring in xerophyllous zones, i.e., *P. muscarum*, *P. sulphurosa*, *P. brocheri*, and *P. versicolor,* are more endangered than those that are found only in evergreen, semi-deciduous, and tropical rainforests, i.e., *P. picta*, *P. muscarum* y *P. venusta*, or species such as *P. picta* that are adapted to agroecosystems.

It is significant that some populations of *P. muscarum*, which is classified as the “least endangered” by studies performed to determine the level of threat to the species of the genus, report similar minimum values of population density to that reported for the relict population of *P. sulphurosa*, considered to be the most endangered.

In studies conducted on populations of *P. sulphurosa* between 1995 and 2002, at different times of the year, the species could only be found at 25 % of the sites reported in the literature, and even when a group was located, densitiy was very low (0.08-0.40 ind/m^2; Reyes, 2004). Maceira *et al*. (2005) found similar results in these and other locations between 1995 and 2004; until then, authors had reported only five living populations of the species.

In the case of *P. muscarum*, many populations have declined as a result of habitat changes, while others have remained stable. In 22 coastal locations in the province of Camagüey, population density is very low, ranging from 0.002 to 0.31 ind/m^2 (Barrios and Ramírez, 2004). A similar trend was found in the most easterly part of the range in the province of Holguín (Fernández, 2012). The species has been particularly affected by the transformation of the coastal zone where it most commonly occurred. Maceira *et al*. (2005) studied several aspects, including population density, of the species *Polymita brocheri* in the xeromorphous coastal scrubland of Punta de Maisí in April and August 1998, July 2000, April 2002 and 2003, and November 2004. These authors observed fluctuations in population density during the study period. The most recent study on the species was conducted in April 2010, when ecological density (groups of species) was found to be 3.5 ind/m^2 (Suárez and Fernández 2012).

When the density trend of *Polymita venusta* was studied in three populations, the fluctuations observed were alarming (Maceira *et al*., 2005).

Very little is known about the ecological aspects of *Polymita versicolor*. The only available data on population density were obtained in Baitiquirí, Guantánamo, where very low values were reported for the localized groups (0.06 ind/m^2) in August 1998; however, in November 2004, density had increased to 0.22 ind/m^2 (Maceira *et al.,* 2005). In contrast, the population studied in La Yana,

Guantánamo, showed a different trend: estimated density was 0.04 ind/m^2 in April 2003, and had decreased to 0 ind/m^2 by November 2004.

Estimated densities are known for several populations of *Polymita picta,* one of the most studied species. Values between 0.1 and 1.1 ind/m^2 were reported for the sub-species *P. picta nigrolimbata* in Yara, Baracoa, Guantánamo (Bidart *et al*., 1989), and values greater than 1 ind/ m^2 for *P. picta roseolimbata* (Valdés *et al*., 1986).

4.4 Geographic trends

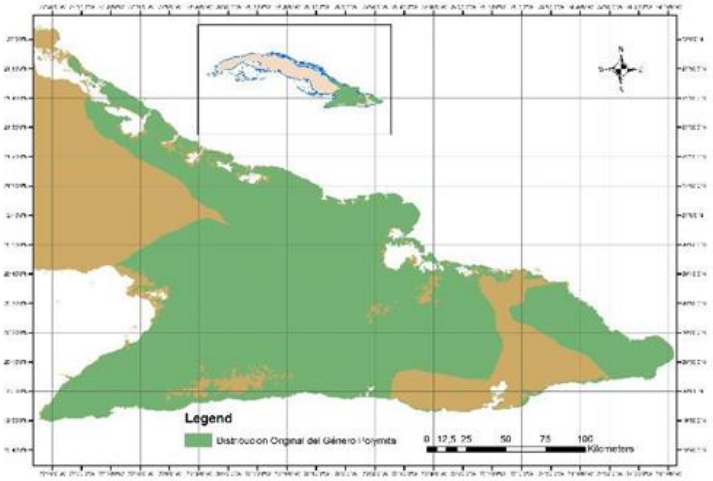
Since 1970, local extinctions of populations have been reported in the Granma, Santiago de Cuba, and Guantanamo provinces for the species *P. venusta, P. versicolor,* and *P. picta*.

In the case of *Polymita sulphurosa*, the growth of nickel strip mining and the sugar industry over a period of 60 years caused huge changes and fragmentation of the habitats along the most north-easterly coast, with a consequent loss of several of the species' populations.

With regard to the remaining coastal species, habitat modification for pasture and secondary vegetation are linked to the extirpation of populations of *P. brocheri*. Changes in land use for diverse crops, gypsum mining, grazing, and for rural housing areas have led to the disappearance of several populations of *P. versicolor*.

In the case of the two remaining species, *P. picta* and *P. venusta*, particularly the latter, the various land uses and the increase in human population are the factors that have contributed most to habitat modification and fragmentation (Maceira *et al.,* 2005)

The historic range of the genus Polymita was estimated at approximately 29 702 km^2, and its current range at 12 870 km^2, which represents a 56.67 % reduction of its historic range.



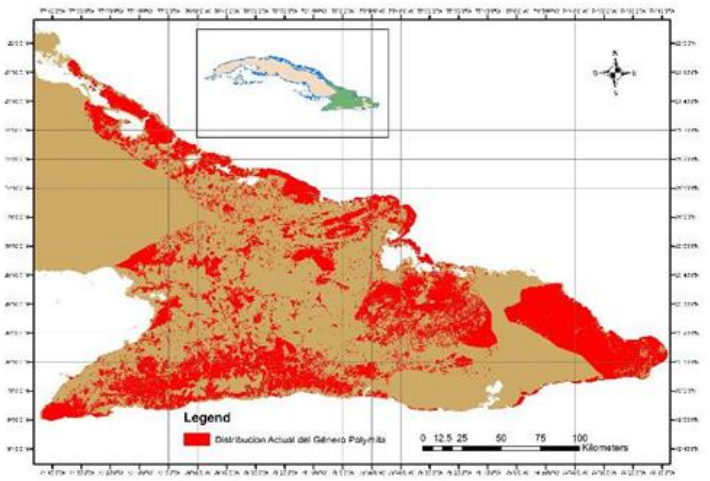


Figure 13. Historic and current range of the genus Polymita

5. Threats

Generally speaking, there is a consensus on the main factors that adversely affect the populations of polymite snails: destruction and fragmentation of their natural habitats; mass harvesting; introduction of exotic plants and animals that modify the natural habitat given that they are not plants preferred by polymite snails (Fernández *et al*., 2001a); and a greater number of potential predators.

According to reports, vertebrates are the main predators of the genus *Polymita*. Birds that predate on this genus include: *Aramus guarauna, Rosthramus sociabilis, Chondroierax wilsoni, and Saurothera merlini*. Predatory mammals include *Rattus rattus and Mus musculus* (exotic species). There are also reports of predatory reptiles such as *Anolis baracoae,* and amphibians such as *Peltophryne sp*. Reported predatory invertebrates include crustaceans such as *Coenobita clypeatus*; arachnids such as *Phormictopus sp*., and insects, *Selenopsis germinata* (Valdés *et al*., 1986; Fernández, 1990; Bidart and Espinosa, 1994; Reyes-Tur and Fernández, 1997). Terrestrial molluscs of the genus *Oleacina* might have been potential predators of nests and hatchlings of *P. venusta*, given the evidence found under both natural and laboratory conditions (Reyes-Tur, 2004). Parasitism by diptera larvae of the family Sarcophagidae is a further cause of mortality (Valdés *et al*., 1986; Fernández, 1990; Bidart and Espinosa, 1994).

Given the precarious situation of most polymite snail populations, Berovides *et al.* (1998) consider the whole genus to be critically endangered. Literature reports more than one example of a polymite snail population disappearing because of abrupt changes to its historic vegetation, infrastructure works, or mass harvesting (Fernández and Martínez 1987, Maceira *et al*., 2005), which have not only altered the substrate on which the species lives and feeds, but have also completely changed the structural and functional characteristics of the habitat in most cases.

Out of these six species of polymite snails, *P. sulphurosa* is the most threatened by habitat transformations. This species occurs in a relatively small territory in the current municipalities of Sagua de Tánamo and Moa in Holguin, which are intensely exploited for sugarcane production and livestock farming, as well as for other crops required to feed the large rural population living in these municipalities. Currently, possibly only five relict populations of this species remain.

The limited area of its natural range makes *P. brocheri* very vulnerable to modifications to its habitat. Generally speaking, although the soil in its natural range is not suitable for agriculture, extensive sheep farming throughout Maisí as an alternative food source for the population, the possibility of naturally-occurring or deliberate forest fires, an increasing trend in prolonged periods of severe drought, desertification, and potential and expected climate changes (greater aridity) are high risk factors for survival of this species (Espinosa, 2013).

The situation for *P. versicolor* is much similar, and although its range is much larger, the same risk factors apply, and further include the indiscriminate harvesting of some of its populations, particularly in the vicinity of Cajobabo, in the municipality of Imías. The disappearance of certain populations of this species for no

apparent reason, e.g., as reported in Siboney, in the eastern part of Santiago de Cuba, leads us to assume that the cause was illegal harvesting (Espinosa, 2013).

P. venusta is probably the second polymite snail species most affected by habitat transformations, after *P. sulphurosa*. Nowadays, only relict populations are found in a few places in the provinces of Santiago de Cuba, Holguín, Granma, and Las Tunas, and are mainly confined to areas with little agricultural value. Some of these populations are located in protected areas of Sierra Maestra, and are therefore afforded some level of protection; others, such as the populations reported in Aguadores, Sardinero, and Loma de la Cantera, in the province of Santiago de Cuba, are affected by intense harvesting and changes in land use, which are a threat to the species (Espinosa, 2013).

P. muscarum is another polymite snail that is very much affected by transformations of its natural habitats. The species is currently limited to a narrow strip of coastal vegetation (coastal and subcoastal xeromorphous scrubland) in the northern part of the provinces Holguín, Las Tunas, and East Camagüey. The populations that occurred in inland areas of Holguín, e.g., the degraded semi-deciduous Yayal forest to the west of the town, have practically disappeared, or are in an extremely critical state (Fernández and Martínez, 1987; Bidart, 1997; Bidart *et al*., 1995, 1996). A further threat for extant populations of *P. muscarum*, a characteristically coastal species that is often found right at the coastline, is severe weather. Global climate change is another potential threat to its survival (Espinosa, 2013).

The conservation status of *P. picta* is just as critical as the other five species of the genus. The notable loss of its natural habitats, and intense, indiscriminate harvesting (the worst among the species of the genus) for more than a century have led to a drastic decline in population densities, and in many cases to complete extirpation, which has consequently led to a loss of phenotypic diversity in some populations (Berovides, 1987).

6. Utilization and trade

6.1 National utilization

In 1943, an extract from a letter, sent on 23rd February 1942 to the Malacological Society by Dr. Juan Cros from Baracoa, was published by professor Miguel Luis Jaume in the first pages of the newly-created Journal of the Malacological Society Carlos de la Torre: "*I wish to inform the Society of the trade in Polymites that has been taking place for more than two years now. I can assure you that more than half a million are collected every year, seemingly to be used to make necklaces. Obviously, if so many are collected, I have no doubts that the species will likely disappear. Most of this trade occurs in Maisí, but it is also taking place in Montecristo…"* (Jaume, 1943).

Jaume himself also complained about the situation described by Dr. Cros, and reported that the owner of a trading house in Havana had boasted to him about the success of polymite exports – between 15 000 and 20 000 shells per month, the smaller shells being more in demand because of their low prices.

Possibly, as a result of the demands voiced by the then flourishing Malacological Society Carlos de la Torre, which was founded on 22nd January 1942, Decree Law No. 932 was issued and published in the State Gazette by the Republic of Cuba on 27th March 1943. This Decree Law fully prohibited all exports of polymite snails, unless for scientific activities or purposes; obviously, it had very little effect on the illegal trade that existed in Baracoa or elsewhere, and which was not controlled by Customs.

An inventory of a company in Baracoa, owned by a trader who had been exporting for over half a century, revealed 129 000 specimens (shells) of the 5 sub-species of *Polymita picta*, and 30 000 specimens of *Polymita versicolor* (Fernández and Martínez, 1987).

In the 1960s, although exports to the USA and Canada had stopped, shells were still being used at a local level –obviously on a smaller scale– to make handicrafts, necklaces, and other items. Nonetheless, over the past decade, the expansion of international tourism in Cuba, the country's migratory and economic tranformations, and the development of electronic trade, have fostered a lucrative, illegal trade in polymite snails, particularly international trade.

6.2 Legal trade

Only two exports have been recorded in the past 20 years: 55 dead specimens (shells) to Canada, for personal use, and 35 live specimens to an aquarium in Tokyo, Japan, for non-commercial purposes.

6.3 Parts and derivatives in trade

Shells found in trade are basically single shells, shell collections, or shell handicrafts (necklaces).

6.4 Illegal trade

In the years 2012 to 2016, following the entry into force of Resolution 160/2011 on Species of Special Significance in the Republic of Cuba, the General Customs Office of the Republic of Cuba seized 15 attempted exports of polymite snail specimens – more than 23 400 shells. All cases involved Cuban citizens residing in Cuba or in the USA attempting to export shells to the USA by air (either directly, or transiting through the Bahamas, Grand Cayman, or Mexico).

No border seizures of handicrafts have been reported, although it is known that there is an illegal trade of tourist souvenirs made with these shells, mainly in the eastern region of the country.

Polymite snails are widely traded at international level on Internet websites outside Cuba such as *ebay*, *worthPoint*, *cubacollectibles.com*, *conchology*, among others. Shells are sold individually, or in batches of 6, 9, 12, 36, and 100 specimens, at prices of up to 106 US dollars for a specimen of *P. sulfurosa*. Inclusion of the genus in CITES Appendix I will help reduce illegal trade, foster communication and information sharing among the Parties in the fight against illegal trade, and contribute to the conservation of these wondrous species that are part of the natural heritage of Cuba and the rest of the world.

6.5 Actual or potential trade impacts

There is no legally authorized domestic or international trade.

7. Legal instruments

7.1 National

Polymite snails have been protected by Cuban laws since 1943 when Decree-Law No. 932 came into force (Fernández and Martínez, 1987), and more recently, by Resolution 160 of 2011 of the Ministry of Science, Technology and Environment, which classified them as Species of Special Significance in the Republic of Cuba and afforded them the maximum level of protection (Appendix I). These two legal instruments prohibit domestic and international trade unless a permit has been issued (trade is only allowed for scientific or conservation purposes).

Decree-Law 200 on Environmental Offences establishes the applicable penalties; further laws are in place on environmental protection such as Law 81 (Environment Law), Law 85 (Forestry Law), and Decree Law 201 (on National Protected Areas).

7.2 International

There are currently no international legal instruments in force that protect these species.

8. Species management

8.1 Management measures

There are no approved harvesting or captive-breeding programmes except those described in paragraph 8.4, which never involve more than 200 specimens.

8.2 Population monitoring

N/A

8.3 Control measures

8.3.1 International

There are no international control measures in place for this genus.

8.3.2 Domestic

The capture, collection, breeding, transport, trade (including international trade), and any other form of use, management or harvesting of polymite snails, their parts, or derivatives, are subject to control and require a permit. Permits are only granted for scientific or conservation purposes. The Environmental Inspection and Control Centre (CICA) is the only competent authority to issue such permits.

Under Decree Law 200, national and provincial environmental inspectors, and also Forest Rangers (MININT) have the powers to impose sanctions for any infringements of Resolution 160; inspectors from the Directorate for Inspection and Supervision of Boards of Management are only authorized to impose sanctions in case of domestic trade by private employees (craftspeople and traders). The General Customs Office of the Republic of Cuba has the power to seize goods and apply sanctions for infringements of international trade regulations.

8.4 Captive breeding and artificial propagation

Captive breeding programmes have never been implemented for commercial purposes, although several programmes have been established for research purposes (Feijoó, 1984; Valdés *et al.*, 1986; Iglesias, 1991, Reyes-Tur and Fernández, 1998). An experimental breeding programme for *Polymita picta* is currently underway at Quinta de los Molinos Gardens in Havana for educational and conservation purposes.

8.5 Habitat conservation

According to the National Centre for Protected Areas (CNAP, 2013), the six species of polymite snails are reported to occur in 36 protected areas in the National System, 24 of which have administrations for the management of their natural resources, and 17 are legally approved.

The six species occur in protected areas in which strict management categories apply; however, *P. sulphurosa* is not found in any of the legally approved protected areas, and is therefore exposed to several types of risk that could affect its populations. The management plans for nine of the protected areas include research and/or monitoring programmes (relating to aspects such as distribution, ecology, population dynamics, threats, and conservation status) for the species *Polymita picta*, *P. muscarum*, and *P. venusta*.

9. Information on similar species

There are no similar species in trade.

Given the wide range of colours that characterize this genus, the Republic of Cuba will provide the Parties with a large collection of photographs for publication on the CITES web site to help with identification.

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