



## Executive Summary

Source: A Rapid Marine Biodiversity Assessment of the Coral Reefs of the Northwest Lagoon, between Koumac and Yandé, Province Nord, New Caledonia: 10

Published By: Conservation International

URL: <https://doi.org/10.1896/054.053.0104>

---

BioOne Complete ([complete.BioOne.org](https://complete.BioOne.org)) is a full-text database of 200 subscribed and open-access titles in the biological, ecological, and environmental sciences published by nonprofit societies, associations, museums, institutions, and presses.

Your use of this PDF, the BioOne Complete website, and all posted and associated content indicates your acceptance of BioOne's Terms of Use, available at [www.bioone.org/terms-of-use](http://www.bioone.org/terms-of-use).

Usage of BioOne Complete content is strictly limited to personal, educational, and non - commercial use. Commercial inquiries or rights and permissions requests should be directed to the individual publisher as copyright holder.

---

BioOne sees sustainable scholarly publishing as an inherently collaborative enterprise connecting authors, nonprofit publishers, academic institutions, research libraries, and research funders in the common goal of maximizing access to critical research.

## Chapter 3

### Assessment of targeted marine invertebrate species of the northwestern lagoon of Grande-Terre (Poum to Koumac), New Caledonia

Caroline Vieux

---

#### SUMMARY

- A total of 28 sites were assessed for targeted marine invertebrate species of sea cucumbers and molluscs (*Trochus niloticus* and giant clams) to a maximal depth of 12 meters. The assessment included sites in the southern portion of the survey area (Poum and Koumac) and did not include the northern portion between Yandé and Poum.
- Thirteen species of sea cucumbers were recorded and the highest diversity was observed in intermediate type reefs with 11 species. Densities of the most harvested species, *Holothuria scabra* and *Holothuria nobilis* were extremely low to nil.
- *Trochus niloticus* were most frequently observed on barrier reefs and in higher numbers than observed during the 2004 Mont Panié RAP survey. Densities were similar between intermediate and fringing reefs. Data from Province Nord shows significant levels of harvesting for this species and a stock assessment would precise the sustainability of *T. niloticus* extraction rate.
- Only three species of giant clams were recorded along the transects and one *Tridacna dervasa* was observed outside the transect. Only empty *Hippopus hippopus* shells were observed. As expected no *T. gigas* were observed. The most recorded species was *T. crocea*.
- A comprehensive stock assessment is urgently needed for bêche-de-mer. This assessment would include sites deeper than 12 meters. Similar assessments are needed for giant clams and Trochus as well as regular monitoring of the stocks and the pursuit of regular monitoring of catches for these three invertebrates.

---

#### INTRODUCTION

Targeted marine invertebrate species of sea cucumbers and molluscs (trochus and giant clams) were previously assessed for reef sites off the northeast coast or Mount Panié region (Pouébo and Hieghène) of Province Nord (Lindsay and McKenna 2006). Here, we report the findings from an assessment of the same species for reef sites off the northwest coast (Poum and Koumac) of Province Nord using the belt transect method. These invertebrate species are collected for commercial and subsistence purposes. This chapter focuses on sea cucumbers, trochus and giant clams species within the context of the 28 sites assessed in the southern portion of the survey area (Koumac). For more detailed background on these select invertebrates, the reader is referred to the previous RAP survey report (McKenna et al. 2006). To be consistent with terminology for the sea cucumber fishery, bêche-de-mer will be used when referring to the dead animal prepared for commercial purposes. Holothurians or sea cucumbers will be the terms used for the live animal. The World Fish Center's terms to describe genus and species of sea cucumbers are used.

According to Province Nord Fisheries, the harvesting of sea cucumbers began at the end of the 19<sup>th</sup> century in the Poum-Koumac area but no data are available on their stocks. The main species harvested are *Holothuria scabra* and *Holothuria nobilis* counting respectively for 20 and

16% of the bêche-de-mer sold on the market. Incentive for commercial fishermen to harvest sea cucumbers is the attractive prices (going up to 4,500 XPF/kg) for *Holothuria fuscogilva*. Other high value species include *Actinopyga leucanora* (3,553 XPF/kg), *Stichopus chloronotus* (3,500/kg) and *Holothuria nobilis* (3,176 XPF/kg). Trochus is also taken as well as giant clams, but to a lesser extent. In comparison with bêche-de-mer prices, clam flesh is sold at 750 XPF/kg, trochus flesh at 800 XPF/kg and trochus shell at 321 XPF/kg. It is important to note that sea cucumbers need to go through various processing stages such as boiling, cleaning and drying (which lessens their weight) in order to be sold as bêche-de-mer. Fishermen sell their harvest to dealers at any stage of the process and the dealers complete the processing if necessary and sell to exporters. There are three exporters in the area.

A new legislation on the exploitation of commercial invertebrates was published in the *Journal Officiel of New Caledonia* in September 2006. The new provisions provide that people involved in the commercial exploitation of invertebrates using a boat need to register with the Province Nord administration and get a permit that requires renewal each year. This particular provision has been effective from March 2007. Size limits have been put in place for eight holothurians species (see Appendix 3). Arrangements from the former legislations still apply that trochus collected must be a minimum diameter of 9 cm. No minimum size has been legislated for giant clams however the new legislation states that only two giant clams can be collected per recreational boat and five per professional boat with no restriction on the species collected. *Tridacna gigas* is reported to be extinct in the waters of New Caledonia known only to have occurred by presence of fossil shells (Wells 1997). The use of both, spear fishing and scuba diving gear as well as any tool that could damage the habitat is banned for the harvest of these invertebrates. Night fishing is also banned. As a consequence, fishermen can only collect individuals in their hand while free diving during the day. This should limit the depth accessible for harvesting to 12–20 meters depending on the ability of fishermen.

Data from Province Nord indicates that in 2007: 3,900 kg of bêche-de-mer, 1,796 kg of trochus shell, 51 kg of trochus flesh and 3 kg of giant clams were harvested by professional fishermen in Poum and Koumac. These data represent the effort of three commercial fishermen, however Province Nord Fisheries suspects that 40 to 50 additional sea cucumber fishermen from Poum need to be included. Therefore the fishing effort is extremely underestimated for sea cucumbers. According to Province Nord Fisheries, the harvesting of Trochus is mainly done for commercial purposes rather than for subsistence, as for giant clams their harvesting is more opportunistic than targeted, individuals collected are found by chance.

There is no information available on any traditional no-take zones for invertebrates however; the Fisheries

department suspects their existence around Poum islets and possibly the island of Yandé.

The objective of this study was to provide initial data on targeted invertebrate populations in the Poum-Koumac area. The data collected is limited on the temporal and spatial scale and is not intended to serve as a basis for a management plan. The data is intended to provide to Province Nord preliminary information on the stocks for future more comprehensive studies of species and the areas to be surveyed. No previous site-specific species survey data were found for any of the species assessed in the survey area.

## METHODOLOGY

Targeted marine invertebrate species were assessed using the belt transect method (English et al., 1997). The belt transect method was chosen over the timed swim method that was used for the invertebrate species assessment of Mont Panié (Lindsay and McKenna 2006) to allow easier replication and comparison for future assessments. In comparison to the timed-swim method, the belt transect method covers less area.

The belt transect method involved placing a transect tape 100 m in length on the reef and sampling the area lying 2.5 m to the left and right of the transect for a belt width of 5 m. Segments of each transect belt was 25 m long and 5 m wide. To allow for replication along the transect, after the first 25 m was sampled the next 10 m along the transect tape was skipped and sampling was resumed for another 25 m and repeated to obtain three belt transects. Therefore data were collected from 0–25 m, 35–60 m and 70–95 m segments 5 m in width each from the 100m transect. Transects were carried out at a depth of 2–3 m and when time permitted sampling was done on transects at deeper depths (10–12 m). The maximum depth of 12 meters reflects the main harvesting area for commercial invertebrates. The transect tape was placed parallel to the reef crest except in the enclosed lagoon habitats (sites 69 and 74).

Along each belt transect, the number and size of targeted invertebrate species of holothurians and molluscs (giant clams, and trochus) was noted. Other species recorded along the belt transect included oysters, turbo, cowries, Crown-of-Thorns, lambis and urchins (see appendix 3). Sizes were recorded using a soft measuring tape. Additional data collected includes depth, coral cover, visibility and time. GPS position was recorded for sites only. Population densities per site were calculated by dividing the number of individuals observed by the area surveyed, 375 m<sup>2</sup> per site. The average density is reported for commercial and most abundant species only.

The data collection for commercial invertebrates took place the last two weeks of the survey and included only the southern portion of study area, close to Koumac (from Passe de la Gazelle to Passe de Koumac). Sampling only took place during the day and not at night time when invertebrates are

usually more active. However since collecting of targeted invertebrates is banned at night time, the day time sampling provides some indication on the population of targeted species available in the select reef habitat sites during fishers activity. The reef sites in the northern region from Yandé to Poum were not assessed for targeted invertebrates. In the southern area, transects were carried out on three main classes. These included: 1) inner lagoon or inshore reefs consisting of patch and fringing habitats, 2) intermediate lagoon reefs consisting of patch reefs and 3) the outer barrier or outer lagoon consisting of the outer slope, the back reef, passes and enclosed lagoons within the barrier reef. It is important to note that the intermediate lagoon habitats of fringing and coastal barrier found off the isles of Yandé and Neba in the north were not surveyed for targeted invertebrates.

According to this classification, nine transects were on inner lagoon or inshore reefs, eleven on intermediate lagoon reefs and eight on the outer barrier reefs (Table 3.1). The total area surveyed is 12,375 m<sup>2</sup> (Table 3.2). A total of 28 geographical sites were sampled with four sites (51, 52, 85 and 87) sampled at two depths (shallow and deep). Where two depths were sampled at one site, the transects are differentiated by site number followed by either a 's' for shallow or a 'd' for deep. For example site 52 had two transects sampled, one at a depth of 2- 3 m noted as 52s and one at 10–12 m, noted as 52d.

Although different methods have been used, the results are presented here in similar format to those reported in the Mont Panié survey report to facilitate review and comparison. It is important to keep in mind that the area surveyed in the present report is over ten times less than the one surveyed in Mont Panié, 12,375 m<sup>2</sup> against 165,400 m<sup>2</sup>.

**Table 3.2.** Area surveyed by reef class in square meters.

Type of reefs	Total area surveyed (m <sup>2</sup> )
Inner lagoon or inshore reefs	3,375
Intermediate lagoon reefs	6,000
Outer barrier reefs	3,000
<b>Total</b>	<b>12,375</b>

**Table 3.1.** Classification of sites and transects by reef category. If more than one depth was sampled, the site number is followed by s for shallow with a depth of 2-3m or d for deep with a depth of 10m.

Categories or reef classes	Site numbers and transects	Total sites	Total transects
Inner lagoon or inshore reefs	29, 30, 31, 32, 34, 35, 56, 57, 86	9	9
Intermediate lagoon reefs	33, 42, 43, 48s, 48d, 49, 51s, 51d, 52s, 52d, 63, 84, 85s, 85d, 87s, 87d	11	19
Outer barrier reefs	64, 69, 72, 73, 74, 79, 80, 83	8	8

## RESULTS AND DISCUSSION

### Sea Cucumbers

A total of 13 species of sea cucumbers were observed on the 33 sites surveyed (Table 3.3). Among those species, eight are of medium to high commercial value and included *Stichopus chloronotus*, *S. hermanni*, *Actinopyga mauritiana*, *Bohadschia argus*, *B. vitiensis*, *Holothuria fuscopunctata*, *H. nobilis*, *Thelenota ananas*. Five of these eight species are reported to be mainly targeted by professional fishermen of the area (*Stichopus chloronotus*, *S. hermanni*, *Actinopyga mauritiana*, *H. nobilis*, *Thelenota ananas*). Five species (*Holothuria atra*, *H. edulis*, *H. coluber*, *Actinopyga palauensis*, *Pearsonothuria graffeii*) have no commercial value. The highest number and diversity of sea cucumbers was observed on the intermediate lagoon reef sites with 209 individuals identified from 11 different species in 11 sites.

The general abundance across all sites for species targeted by the local fishermen mentioned in the introduction (Table 3.3) is nil for *Actinopyga miliaris*, *Holothuria scabra*, *Actinopyga leucanora* and *Holothuria fuscogilva*, low for *Stichopus chloronotus* (present in 10% of the sites surveyed) and extremely low for *Thelenota ananas*, *Holothuria nobilis* and *Actinopyga mauritiana* (present in less than 2% of the sites surveyed).

These findings of low abundances for sea cucumbers, especially for the commercial species are quite similar to that of the Mont Panié RAP survey, even if the different methodologies limit comparison. Further, as there is no previous data on the populations of sea cucumbers found, no conclusion can be definitely made on their population trajectory. Interestingly, the highest abundance for a potential commercial species was *Bohadschia argus* (48 individuals found in 16% of the sites), which was not recorded on the fishermen most harvested species list. Four species reported to be collected have not been observed at all across the 28 sites surveyed. These species are *Actinopyga miliaris*, *Holothuria fuscogilva*, *Holothuria scabra* and *Actinopyga lecanora*. Considering that the use of scuba gear is banned for harvesting, this study may be considered as representative of the holothurian harvest depth range and can give a fairly accurate initial picture of the harvesting trend. However, this study cannot give a clear assessment of holothurian stocks as they may be found deeper.

Given that commercial harvesting of sea cucumbers is definitely taking place, the current monitoring of the catches does not give an accurate picture (reflecting the take of only

three fishermen when 40 to 50 more fisherman are suspected in total) and that former assessments of sea cucumber stocks are not available, the current low numbers reported here in an initial assessment indicate that there is an urgent need for comprehensive monitoring of the resource. This would include assessments of sea cucumber species populations (commercial and non-commercial species for comparison) to a maximum depth of 40 to 60 meters in order to have an idea of both harvested and non-harvested stocks. The limit between the two stocks could be precisely defined with fishermen. The fishing effort and total haul by all active fishermen should also be monitored on a regular basis and at least yearly. Eventually, these assessments would need to be repeated to obtain a clear indication of the population trajectories for select species. This information could provide data for informed and adaptive management of this resource.

**Table 3.4.** Numbers of individuals, densities (number of individuals per square meter) and sizes of *Trochus niloticus* observed in the study area. Sites are classified by reef type (Ins = inshore or inner lagoon, Int = intermediate reefs, Br = barrier or outer reefs) with n representing the number of sites surveyed per reef type. A line or dash (–) indicates information is not available.

	Ins n = 9	Int n = 11	Br n = 8	Total n = 28
Number of individual (% of the total)	–	–	–	101
Average density (ind/m <sup>2</sup> ) (standard deviation)	–	–	–	8.16E-03
Average size in cm (standard deviation)	9.2 (1.7)	5.8 (1.9)	8.9 (2.2)	

**Table 3.3.** Total number of sea cucumber species observed for all sites assessed. Sites are classified by class (Ins = inshore or inner lagoon reefs, Int = intermediate lagoon reefs, Br = barrier or outer lagoon reefs). The number of sites surveyed per reef type is reported as n. A line or dash (–) is used when information is not available.

Species	Ins (n=9)	Int (n=11)	Br (n=8)	Total number of individuals (% of the total)
<i>Actinopyga mauritiana</i>	–	–	–	–
<i>Actinopyga palauensis</i>	0	3	3	6 (2.0)
<i>Bobadschia argus</i>	–	–	–	–
<i>Holothuria atra</i>	39	32	3	74 (24.9)
<i>Bobadschia vitiensis</i>	–	–	–	–
<i>Holothuria coluber</i>	6	6	0	12 (4)
<i>Holothuria edulis</i>	2	82	0	84 (28.3)
<i>Holothuria fuscopunctata</i>	–	–	–	–
<i>Holothuria nobilis</i>	–	–	–	–
<i>Stichopus chloronotus</i>	–	–	–	–
<i>Stichopus hermanni</i>	–	–	–	–
<i>Thelenota ananas</i>	–	–	–	–
<i>Pearsonothuria graffeii</i>	0	0	2	2 (0.7)
<b>Total individuals per reef type (% total)</b>	<b>47 (16)</b>	<b>209 (70)</b>	<b>41 (14)</b>	<b>297</b>
<b>Total number of species</b>	<b>3</b>	<b>11</b>	<b>7</b>	

**Table 3.5.** Number of giant clams recorded in the area surveyed. Sites are classified by reef type (Ins = inshore or inner lagoon reefs, Int = intermediate lagoon reefs and Br = barrier or outer reefs). The number of sites surveyed per reef type is represented as n. A line or dash (–) indicates the information is not available.

	Ins n = 9	Int n = 11	Br n = 8	Total number of individuals (% of the total)
<i>Tridacna maxima</i>	–	–	–	–
<i>Tridacna squamosa</i>	–	–	–	–
<i>Tridacna crocea</i>	435	31	1	467 (63)
<b>Total number of individuals (% of the total)</b>	<b>552 (74)</b>	<b>139 (18)</b>	<b>59 (8)</b>	<b>750</b>
<b>Number of species</b>	<b>3</b>	<b>3</b>	<b>3</b>	

### Trochus

A total of 101 *Trochus niloticus* were observed on the 28 sites surveyed. Individuals observed during the survey were located on all three reef types. The mean base width of individuals observed was similar for barrier and fringing reefs, (Table 3.4), but was approximately 3cm lower in intermediate reefs. Islets in this area are very popular during the weekends and lower shell sizes might be explained by people collecting individuals over the minimum size of 9 cm only, leaving smaller individuals.

In comparison to the Mont Panié survey, densities are higher for every reef type sampled in Poum-Koumac, however densities are still low. This may be due to the difference in methodologies, the availability of suitable habitat for the trochus and higher extraction rates in the Mt. Panié area.

The low number of trochus observed on the 28 sites surveyed suggests that populations may be depleted. Along with the current monitoring of the catches, an intensive survey and assessment is needed of adults and juveniles populations in this area to obtain more information on the state of this fishery. It also is necessary to institute on-going monitoring of the stocks and pursue the monitoring of fishing effort and catches so that legislation can be adapted accordingly for improved management.

### Giant Clams

Only three species of giant clams were recorded along the belt transects for the 28 sites assessed (Table 3.5). One *Tridacna derasa* was observed while swimming back to the boat. Only empty shells of *Hippopus hippopus* were found in the whole area. As expected no *T.gigas* was noted. The main species observed was *T. crocea* counting for 60% of the total number of individuals recorded. A high occurrence of this species was observed in fringing reefs with less than 2 meter visibility (for example at site 30, a fringing reef located in a bay 168 individuals were counted on 3 belt-transects).

Three quarters of the giant clams were found on the fringing reefs and 8% on barrier reefs (Table 3.5).

Sizes recorded for *T. maxima* and *T. crocea* are similar in all reef types, between 12 and 14 cm for both species. Bigger sizes have been measured for *T. squamosa* found on intermediate and barrier reefs compared to fringing reefs (Table 3.6).

Densities observed here were higher for all reef types in comparison to the densities observed during the Mont Panié Rap survey. Data provided by Province Nord suggests that fishermen do not collect many clams (3kg of flesh in 2007). However, the absence of 3 of the 6 species recorded for New Caledonia as well as the general low sizes of all species compared to the maximum average described by other authors (Braley, 1992) for these same species would prove that intense harvesting has taken place in the past and may still be continuing.

### CONSERVATION RECOMMENDATIONS

There is a lack of data on both invertebrate stocks and fishing effort for subsistence or commercial purposes. The sites surveyed during this assessment have shown general low numbers of high cash value species of sea cucumbers and giant clams underpinning a possible over-harvesting trend. However, it is important to mention that not all habitats suitable for invertebrates have been sampled extensively, such as embayments or seagrass beds. Stock assessments in all types of habitats as well as monitoring of the resource needs to be undertaken and the monitoring of catches needs to be pursued. Based on the general low densities of high value sea cucumbers, a limitation of their harvesting should be put in place as a precautionary approach and more accurate quotas could be implemented after a comprehensive stock assessment. The current legislation does not mention any restriction on species of giant clams to be collected. As numbers of rare giant clam species such as *Tridacna derasa* and *Hippopus hippopus* ranged from extremely low to nil, it may be necessary to put a ban on these species and educate fishermen on their identification. Moreover, *Tridacna derasa* has been

**Table 3.6.** Densities (individuals/m<sup>2</sup>) and sizes (cm) of giant clams observed on the 28 sites assessed. Sites are classified by reef type (Ins = inshore or inner lagoon reefs, Int = intermediate reefs, Br = barrier or outer lagoon reefs) with n representing the number of sites surveyed per reef type. A line or dash (–) indicates the information is not available. Standard deviation is noted in brackets.

Species	Ins n = 9		Int n = 11		Br n = 8	
	density	size	density	size	density	size
<i>Tridacna maxima</i>	–	13.9 (3.4)	–	12.9 (4.7)	–	13.9 (5.7)
<i>Tridacna squamosa</i>	–	15.4 (5.0)	–	22.7 (6.1)	–	25.6 (16.2)
<i>Tridacna crocea</i>	1.3E–01 (1.4E–01)	11.4 (3.8)	5.2E–02 (1.2E–02)	11.6 (3.5)	3.3E–04 (9.4E–04)	13.0 <sup>a</sup>
<b>Total average density</b>	<b>1.5E–01 (1.6E–01)</b>		<b>2.9E–02 (4.1E–02)</b>		<b>2.0E–02 (2.0E–02)</b>	

a no standard deviation given as only one animal measured

evaluated on the IUCN Red List as a vulnerable species and updating of its status is needed. Similar stock assessment needs to be undertaken for trochus populations considering that numbers were low in lagoon sites and catch rate are at a high level.

## REFERENCES

---

- Aquaculture and Fisheries Department, DDEE, Database, Northern Province, 2008.
- Braley, R.D. 1992. The giant clam: hatchery and nursery culture manual. ACIAR Monograph. Number 15.
- English, S., C. Wilkinson, and V. Baker (eds.). 1997. Survey Manual of Tropical Marine Resources, 2<sup>nd</sup> Edition. Australian Institute of Marine Science. Townsville, Australia.
- Journal Officiel de la Nouvelle-Calédonie, p. 6707–6778, Septembre 26th, 2006.
- Lindsay, S. and S.A. McKenna 2006. L'évaluation d'espèces marine macro-invertébrées exploitées. *In*: McKenna S.A., N. Baillon, H. Blaffart, and G. Abrusci (eds.). Une évaluation rapide de la biodiversité marine des récifs coralliens du Mont-Panié, Province Nord, Nouvelle-Calédonie. Bulletin PER d'évaluation biologique numéro quarante-deux. Conservation International. Washington, DC. Pp. 43–52.
- McKenna, S.A., Baillon, N., Blaffart, H., Abrusci, G. (eds.) 2006. Une évaluation rapide de la biodiversité marine des récifs coralliens du Mont-Panié, Province Nord, Nouvelle-Calédonie. Bulletin PER d'évaluation biologique quarante-deux. Conservation International. Washington, DC.
- Wells, S. 1997. Giant clams: Status, Trade and Mariculture and the role of CITES in management. IUCN. Cambridge, United Kingdom.
- IUCN 2007. IUCN Red list of threatened species. Web site: [www.iucnredlist.org](http://www.iucnredlist.org).