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**STUDY OF AN ORIGINAL LOBSTER FISHERY IN NEW CALEDONIA
(CRUSTACEA: PALINURIDAE & SCYLLARIDAE)**

BY

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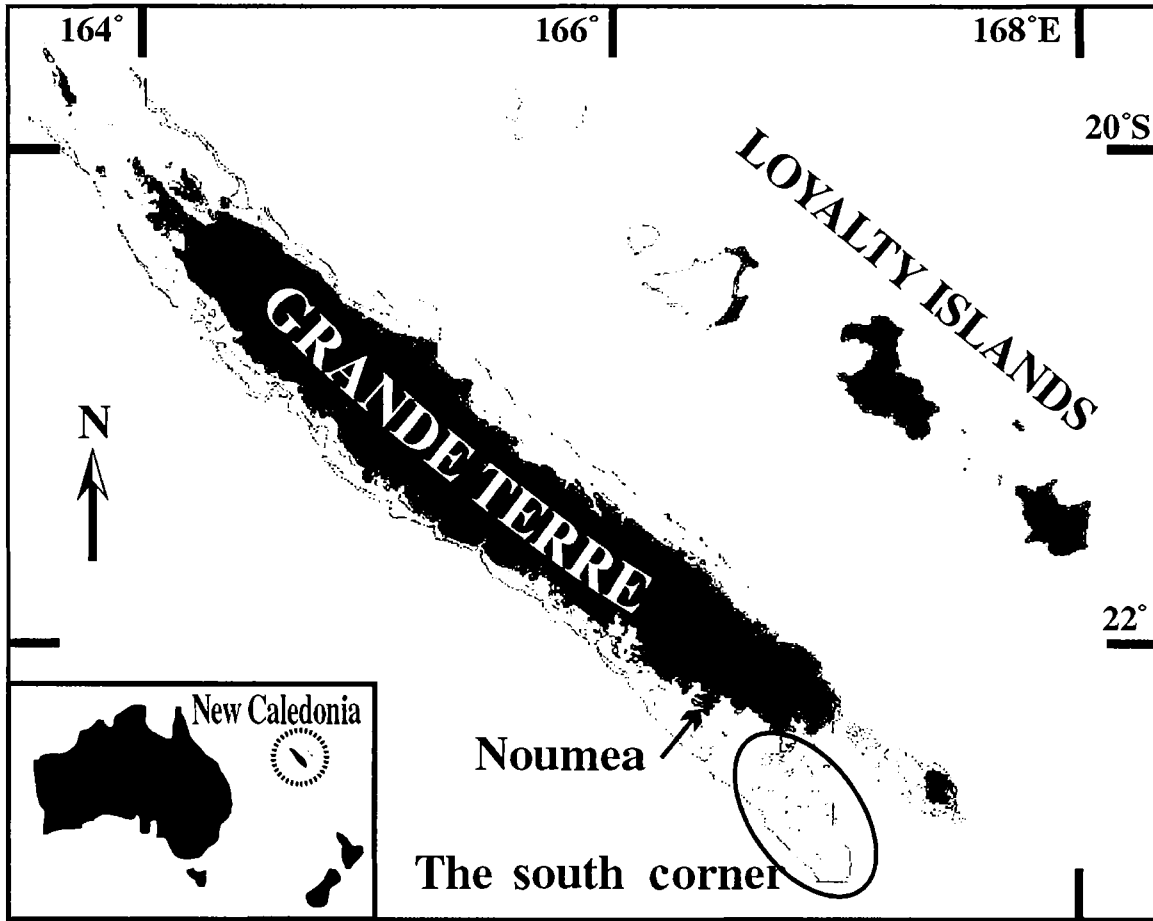


Figure 1. Location of New Caledonia and sampling area.

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ABSTRACT

A lobster fishermen team using two fishing techniques was studied in New Caledonia. The day-fishing technique is used to catch pronghorn spiny lobsters (*Panulirus penicillatus*) and Caledonian mitten lobsters (*Parribacus caledonicus*) while walking on the reef flat at low tide near the breakers directly to their den. The night-fishing technique allows catching three species and one subspecies of palinurids (*Panulirus penicillatus*, *P. longipes bispinosus* and some *P. ornatus*) and two scyllarid species (*Scyllarides squammosus* and some *Parribacus caledonicus*) by diving with a water torch over the reefs. Analysis of fishermen's efficiency shows that one of them always catches more than others. Catch analysis among the lunar phase indicates that night catches are not influenced by the moonlight with the exception of *Parribacus caledonicus*.

INTRODUCTION

In New Caledonia (Fig. 1), three species and one subspecies of *Panulirus* spp. and two species of slipper lobsters are commonly found in the lagoon (Table 1), i.e., from the shoreline to the barrier reef surf line (Richer de Forges and Laboute, 1995; Coutures, 2000). Adults of these species are associated with different habitat features in the lagoon (Fig. 2). As lobster densities are greater on the barrier reef, professional fishermen mainly prospect this area. The main fishing method in New Caledonia is night diving with a waterproof torch, catching lobsters by hand while they forage on the reef flat. However, some fishermen also catch lobsters by walking on the reef flats during the day at low tide.

The present contribution compares catches qualitatively and quantitatively using both fishing methods in the southwest lagoon of New Caledonia.

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Table 1. The common species of Palinuridae (spiny lobster) and Scyllaridae (slipper lobster) in New Caledonian shallow water.

Family	Species
PALINURIDAE	<i>Panulirus penicillatus</i> (Olivier, 1791) Pronghorn spiny lobster
	<i>P. longipes bispinosus</i> Borradaile, 1899 Longlegged spiny lobster
	<i>P. ornatus</i> (Fabricius, 1798) Ornate spiny lobster
	<i>P. versicolor</i> (Lateille, 1804) Painted spiny lobster
SCYLLARIDAE	<i>Scyllarides squammosus</i> (H. Milne-Edwards, 1837) Blunt slipper lobster
	<i>Parribacus caledonicus</i> Holthuis, 1960 Caledonian mitten lobster

METHODS

New Caledonia is situated between 20°-22°30' S and 164°-167°E (Fig. 1) and is surrounded by a 23,400 km² lagoon, delimited by 1,600 km of an almost continuous barrier reef.

A professional fishermen team based in Noumea was monitored. Their favorite fishing areas are situated in the south corner of New Caledonia (Fig. 2). Each fishing trip lasts six days and a new part of the south corner barrier reef is being prospected every day. The team is composed of four or five fishermen who fish during daytime at low tide and at night by diving. At the end of the outing, each fisherman's catch was weighed according to three groups: spiny lobsters (*Panulirus* spp.), blunt slipper lobsters (*Scyllarides squammosus*) and Caledonian mitten lobsters (*Parribacus caledonicus*). These data were recorded with dates and fishing sites obtained by Global Positioning System (GPS).

In order to study fishing methods and determine catch per unit effort (cpue) index, we joined the fishermen during five campaigns in 1995. This sampling was also used to evaluate the proportion of each species of spiny lobster in catches.

A cpue was defined as the catches (in kg) of a fisherman in a day or night knowing that a day of fishing lasts two hours whereas during the night they fish on average three hours. Average cpue by day vs night was compared from data recorded by the captain between April 1994 and July 1995. As catches are nominatives, fishermen's efficiency was compared by *t*-paired tests.

Several authors (Prescott, 1980, 1988; Pitcher, 1992) indicate that most species of spiny lobster are relatively inactive during the light phase of the moon. Thus, variations of cpue among lunar cycles were analysed by Kruskal-Wallis tests and Multiple

Comparison Between Treatment (MCBT) as a posteriori test when appropriate (Dagnelie, 1980; Siegel and Castellan, 1989).

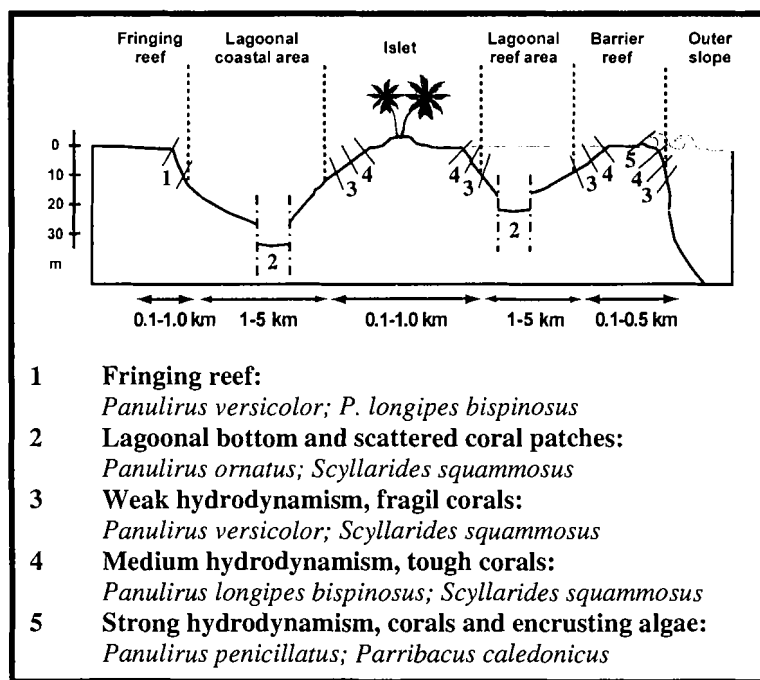


Figure 2. The habitats of common Palinuridae and Scyllaridae in the southwestern lagoon of New Caledonia. Adapted from George (1974) and Dandonneau *et al.* (1981).

RESULTS

Fishing technique

Whereas the diving fishing method by night is well known, catching lobsters by day is an original technique. Fishermen walk on the reef flat at low tide when the swell is not too strong. They crisscross the area situated near the swash zone and search animals in their holes. Two species are caught: the pronghorn spiny lobster (*Panulirus penicillatus*) and the Caledonian mitten lobster (*Parribacus caledonicus*). The first lives under the breakers in immersed cavities dug in large dead coral patches. Their capture is difficult because it is hard to recognize open corals that contain lobsters. In addition power and agility are needed to extract them from holes. The Caledonian mitten lobsters live at about 20 m from the breakers in cavities (called nests) with small openings. This species is gregarious and a nest can contain 40 individuals. These animals are generally hung upside down under the dome and are easily caught.

During the night fishermen dive near the breakers, over the inner slope of the barrier reef and sometimes also over lagoonal reefs. Thus, they can catch different species of lobsters. Figure 3 shows the proportion of each spiny lobster species caught by night.

Table 2 shows average cpue by day and by night of the three groups: spiny lobster, blunt slipper lobster (*Scyllarides squammosus*) and Caledonian mitten lobster (*Parribacus caledonicus*).

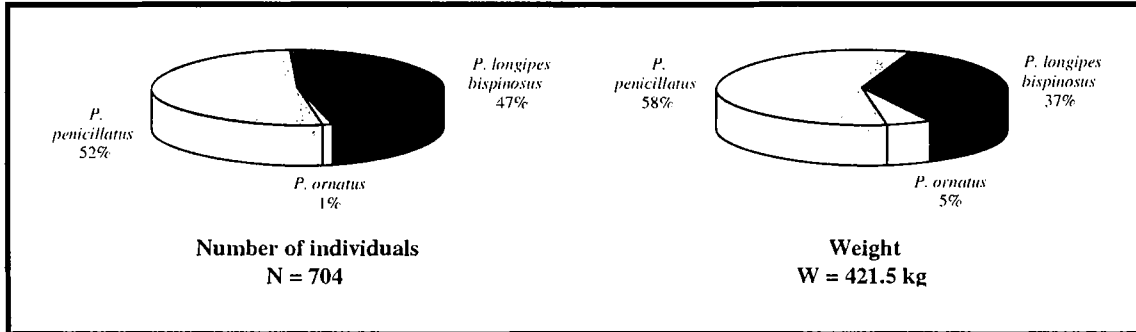


Figure 3. Ratio of different *Panulirus* species and subspecies in night catches.

Table 2. Average Catch Per Unit Effort (cpue) in kg/fisherman/day or night of Caledonian mitten lobsters (*Parribacus caledonicus*), blunt slipper lobsters (*Scyllarides squammosus*) and spiny lobsters (*Panulirus* spp.). SD = standard deviation.

	Species	Average CPUE	SD	Min.	Max.
DAY N = 278	<i>P. caledonicus</i>	5.20	4.72	0	17.00
	<i>Panulirus</i> spp.	2.81	2.78	0	11.60
NIGHT N = 154	<i>P. caledonicus</i>	0.54	0.76	0	4.33
	<i>Panulirus</i> spp.	7.24	7.42	0	58.75
	<i>S. squammosus</i>	1.32	1.95	0	10.55

Catch Analysis

From nominative records, one fisherman often appeared more efficient than the others. Catches (cpue) of this fisherman were compared to the mean cpue of other fishermen for each outing. Results indicate that this fisherman is more efficient (+ 60%, in average) in catching all species, whatever the technique (Table 3). In order not to introduce bias, catches of this fisherman were not taken in account for the following analysis.

After using a Kruskal & Wallis test, no differences were shown between cpue of *S. squammosus* and *Panulirus* spp. among lunar cycles. Catches of *P. caledonicus* are statistically different during the lunar phase, and MCBT a-posteriori test indicates that catches during the full moon are lower than those during a new moon and the first quarter (Table 4).

DISCUSSION

This study has supplied quantitative and qualitative data on lobster fishery in coral-reef environments. The original day-fishing technique allows catching plenty of Caledonian slipper lobsters. This species is easily sold in local markets and its value is equal to the prices of other lobsters (20/25 US\$ per kg). In fact, this technique is additional to night fishing because it allows diversification of catches (and potential markets), and the doubling of activity when fishermen leave for several days. However, this technique is not applicable everywhere in New Caledonia. Some reefs contain too many holes or there are not enough exposed at low tide to fish near breakers. Moreover, reefs too exposed cannot be fished or only rarely.

Table 3. *t*-paired test between cpue's of the more efficient fisherman (in bold) and the average cpue of other fishermen (in brackets). SD = standard deviation; DF = degree freedom; *t* = student value; *p* = probability value.

	Species	Average cpue	SD	Min.	Max.	DF	<i>t</i>	<i>p</i>
DAY	<i>P. caledonicus</i>	4.36 (2.76)	<i>4.59</i> (3.00)	0 (0)	26.30 (13.90)	132	5.161	<.0001
	<i>Panulirus</i> spp.	5.71 (3.75)	<i>8.85</i> (5.07)	0 (0)	68.50 (48.70)	132	3.776	0.0002
NIGHT	<i>P. caledonicus</i>	0.79 (0.46)	<i>1.13</i> (0.77)	0 (0)	5.20 (4.75)	116	3.828	0.0002
	<i>Panulirus</i> spp.	9.84 (5.71)	<i>8.83</i> (4.99)	0 (0)	40.50 (29.75)	116	7.101	<.0001
	<i>S. squammosus</i>	2.16 (1.30)	<i>3.14</i> (1.87)	0 (0)	14.40 (8.60)	116	4.006	0.0001

Table 4. Comparisons by Kruskal-Wallis (K-W) test and Multiple Comparisons Between Treatments (MCBT) between average night cpue (in bold) among the lunar phase. Standard deviation in italics.

Species	Average cpue				K-W	MCBT
	NM	FQ	FM	LQ	<i>p</i>	
<i>P. caledonicus</i>	0.63 <i>0.80</i>	1.05 <i>1.25</i>	0.28 <i>0.43</i>	0.61 <i>0.75</i>	0.002	FM<NM-FQ
<i>Panulirus</i> spp.	7.20 <i>1.20</i>	8.05 <i>8.61</i>	7.34 <i>9.28</i>	6.55 <i>5.20</i>	0.969	---
<i>S. squammosus</i>	0.96 <i>6.20</i>	1.86 <i>1.96</i>	0.84 <i>2.70</i>	0.93 <i>1.39</i>	0.367	---

Whether by day or by night, fisherman's efficiencies are not equal. This is important in terms of management when fishery analyses are carried out from landing records. These records are rarely filled out with the numbers and names of fishermen,