

## **Socioeconomic Study of Ponérihouen, Poindimié and Touho Communes Regarding Issues Associated with the Lagoon and Reef Environments**

Author: Wickel, Antoine

Source: A Rapid Marine Biodiversity Assessment of the Northeastern Lagoon from Touho to Ponérihouen, Province Nord, New Caledonia: 234

Published By: Conservation International

URL: <https://doi.org/10.1896/054.062.0108>

---

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](https://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 7

### Socioeconomic study of Ponérihouen, Poindimié and Touho communes regarding issues associated with the lagoon and reef environments

*Antoine WICKEL*

#### SUMMARY

---

- The socioeconomic study involved a field survey where 88 interviews (individual or collective) were conducted. A questionnaire on seafood consumption was given to primary schools. The approach of the target groups was adapted to the local social structure.
- The study area has about 10,000 inhabitants, of whom 80% are of Melanesian origin and of customary law status. The population is very young, and for the most part lives on the coast. The unemployment rate is high but informal subsistence activities are widespread.
- The marine environment supports many uses, primarily various types of fishing, which are characterized but remain difficult to quantify. Dependency on fisheries resource for food is very strong.
- The main anthropogenic pressures are terrigenous runoffs related to land erosion and domestic pollution.
- The public expresses strong support for environmental management but the organization of a participatory management project requires taking into account local socio-cultural realities.

#### INTRODUCTION

---

The study area spans across three communes, consisting of 44 “official” tribes. The maritime area is composed of a large lagoon, where the population carries out many activities, mainly fishing. The employment sectors are quite restricted and therefore the subsistence activities (farming and fishing) represent important issues for the local population, from which it derives much of its food. Other users also use the lagoon, including the communes’ population, which engages in recreational fishing. The overall fishing pressure remains relatively low, as well as other environmental threats associated with human activities. However, in view of demographic trends and issues related to the marine environment for the population, the conservation of the lagoon and reef environment appears as a necessity.

Any management project (implementation of managed areas or regulations) requires the support of local people to guarantee acceptance and success. Currently, the lagoon adjoining the study area is part of the zones recently listed as a World Heritage Site by the UNESCO.

This step provides a real opportunity to launch a management process, as preferred, on participatory bases. This process has begun already with the establishment of a management committee for the areas of Poindimié and Touho. This approach seems well adapted to the local context but requires taking into account territorial issues (e.g. socioeconomic, cultural etc). In the local context, this means taking into account the social and contemporary customary realities and adapting them to the participatory management methods to optimize the acceptance of projects and the involvement of the population.

This study aims to provide a general description of the socio-economic, customary and territory structure of the Ponérihouen, Poindimié, and Touho area in relation to management

issues of the lagoon and reef environment, with the scope of providing support for informed decision making in the context of future marine management projects.

METHODOLOGY

Identification of key stakeholders

Contacts with customary law status people were made by following the administrative “customary path” (Figure 7.1). When the district councils or the Big Chiefs could not be contacted (difficulty in organizing an appointment or absence of the customary authority) contacts were directly made with Small Chiefs or with the presidents of the clan councils from each tribe (dotted arrow). This approach allows for undertaking fieldwork with permission from the local customary authorities that is often necessary. However, field work may be delayed if the organization of a meeting is difficult. Contacts with common law status people were taken over the course of meetings and by appointment with resourceful people previously identified.

Field data collection phase

Most of the study consisted of a qualitative field investigation during which 88 interviews were conducted with individuals that were identified to use the marine resources, broken down by the type of stakeholder (Figure 7.2). These individuals or “resource persons” were selected among different users of the marine environment (i.e. defined from an estimated proportion of each category in relation to the overall number of users). These included people with a social and/or professional activity in relation to environmental management (institutional and customary), as well as some representatives of the population having no use nor activity in connection with the marine environment (category “inhabitants”).

Semi-structured interviews were conducted individually or collectively according to interviewees’ availability. In total, about 130 people were interviewed; the majority residing by the coast. The study area covered the three communes including the 25 tribes located on the seaside or at river mouths. The study involved 54 days of field operation, divided into several phases between March 13th and July 2nd, 2010.

The interview schedule for fishermen was developed based on previous RAPs (Rapid Assessment Program) and

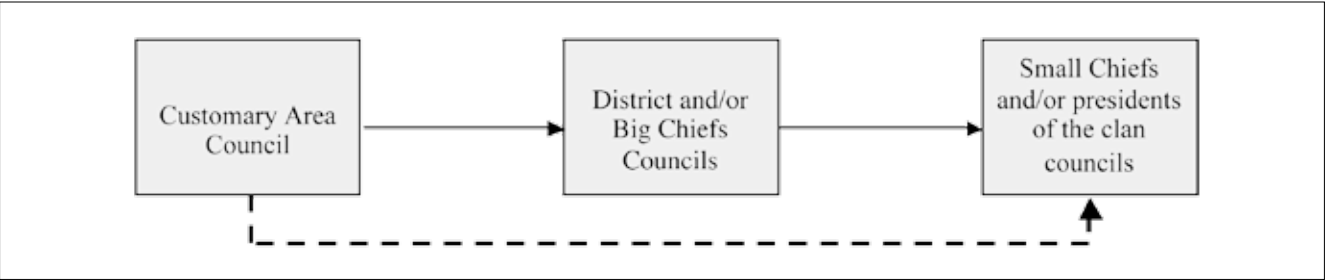


Figure 7.1. Consulting of customary authorities to conduct the field study.

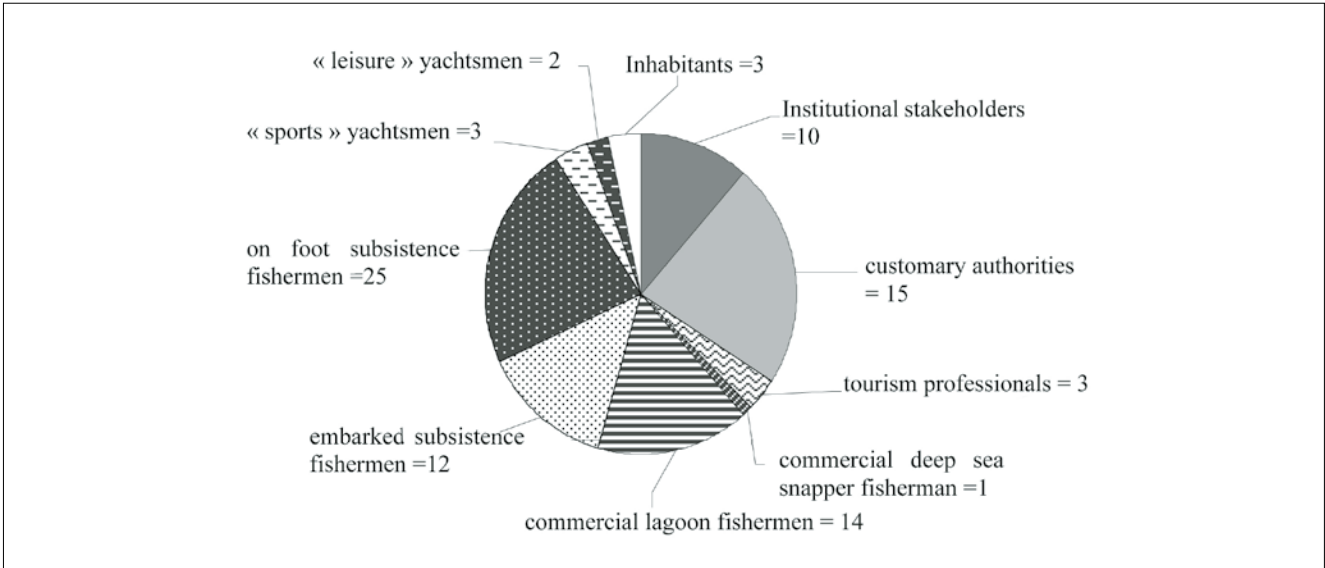


Figure 7.2. Number of interviews (n=88) by stakeholder type.

**Table 7.1.** Demographic characteristics of the townships. (source : ISEE 2004, 2009\*)

Commune	Population (inhabitants) *	Density (hab./ km <sup>2</sup> )	Number of tribes	Population in tribes (%)	Individuals per household	Average age	Customary lands (%)
Ponérihouen	2726	3.85	13	85.2	4.3	28	22.5
Poindimié	4824	7.17	20	76.8	4	28	32
Touho	2274	8.04	11	74.5	4.2	29	31

\* The 2009 census figures are shown, but other figures in the table are those of 2004 (the calculations are not yet available for the census figures of 2009).

enriched according to the existing literature during the preparation phase. It covers the following topics: social and customary context of the area, marine environment uses, representations and perceptions of the marine environment and its health status, and expectations and ideas in terms of environmental management. Maps and photos of local fish were used when discussing different topics. In addition to the qualitative interviews, a survey on the consumption of seafood was conducted among primary schools in the three communes: 90 questionnaires were distributed to four elementary schools. This phase allowed prompt collection of a relatively large data set on consumed species that included the frequency of consumption and the means of resource procurement (fishing, buying, and donation).

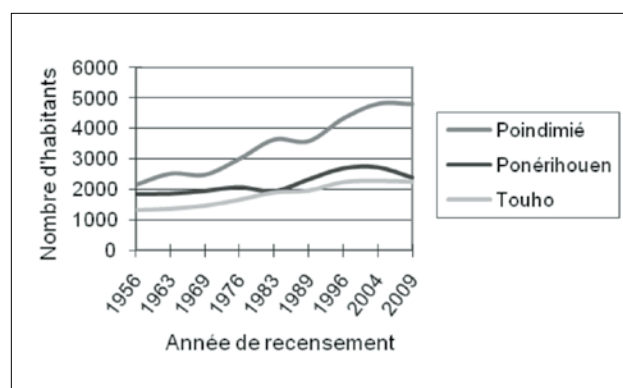
## SOCIO-ECONOMIC CONTEXT OF THE STUDY AREA

### Demography

The study area has about 10,000 inhabitants, with an age average of 28 years old. The population is divided among customary law status people (about 80% of the population) who mainly live in the tribes within the communes, common law status people, and Europeans whom predominantly live mostly in the communes, but do not live in the tribes. Although population density is very low (3-8 people/km<sup>2</sup>), housing is concentrated along the coastline, mainly in the tribes, and thus land pressure is relatively high in this area (Table 7.1). In addition, the population is increasing, mainly in the commune of Poindimié, which now has twice the population of the two other townships (Figure 7.3). This is due both to a natural increase in the tribes and an increase in the rate of migration (mainly French metropolitans) to the communes. Although the population density remains low in the tribes, communes are subject to significant real-estate pressure leading to the expansion of settlement on the lands of neighboring tribes. Although supplementary customary lands were allocated to these tribes in the 1980s to compensate for this situation, it was not enough to regulate real-estate pressure in these areas. Also increasing today is the immigration of people from other remote tribes who come to settle to work in the nearby communes (Figure 7.4).

### Field of employment and economic structure

Large disparities exist in terms of employment and income between the population of the communes, that is those who live in tribes and those who do not live in tribes. The main employment opportunities are located in the villages, but the development of the Koniambo mining project in the VKP area (Voh-Koné-Pouembout communes) offers new recruitment opportunities on the west coast. In recent years, economic changes have been taking place and the population from the tribes, (although only still partially concerned by paid employment), is fitting more and more into the economic cycle. However, unemployment remains high and the majority of the population in the tribes practice subsistence agriculture and fishing. Thus, only a few dozen commercial fishers (fishers holding a fishing authorization issued by Province Nord that allows them to sell their production) are listed in the three communes, but the majority of the population residing on the coast declares to fish regularly. In addition, many non-professional fishers and farmers sell a small portion of their harvest from time to time in cases of financial necessity. Farmers can sell their products through the GAPCE (Agricultural Producers Group of the East Coast), however fishers must market their sale on the roadside due to the lack of distribution and marketing channels. Nevertheless, these fishers do not have selling authorization. As a result, it is thus difficult to measure their production output.



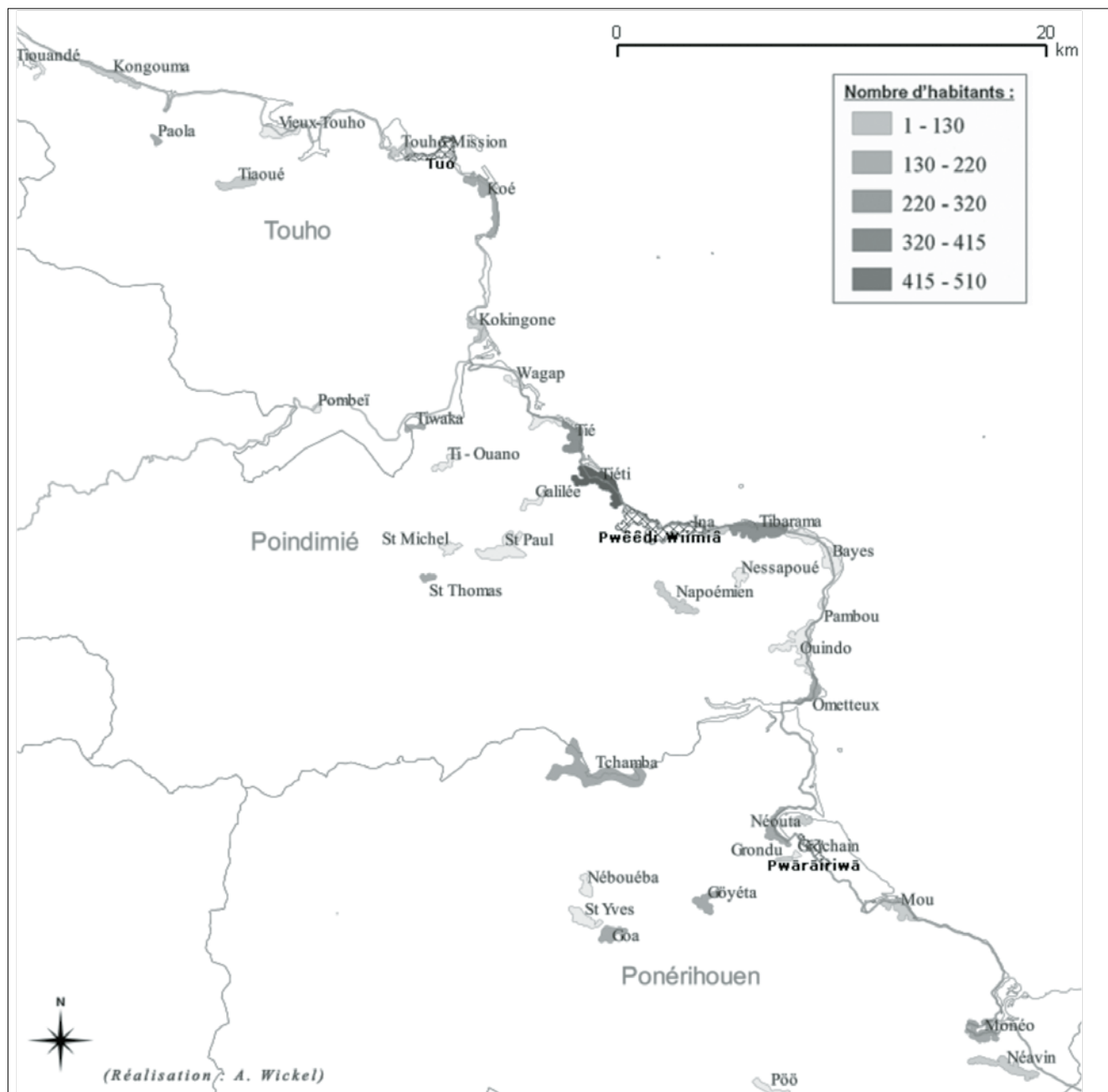
**Figure 7.3.** Demographic evolution (1956-2009) in each township. Legend: Nombre d'habitants: Number of inhabitants ; Année de recensement : Census year. (source : ISEE, 2009)

## CUSTOMARY SOCIAL ORGANIZATION AND LAND TENURE

### Characteristics of the concerned customary countries

The study area is divided into two customary countries: Paicî and Cèmuhi. These countries refer to two social groups with distinct origins in the Kanak mythology, and speak both languages of the same name. Today, the boundary between the language areas is more difficult to define and therefore identify the two social groups (Figure 7.4). The population of the customary area Paicî-Cèmuhi has the distinction of being organized into two major clans, called Dui and Bai that is further divided into sub-clans and each is divided

further into families. In practice, the term “clan” is often used for these three levels, leading to confusion. The relationship between the clans Dui and Bai is often presented as originally intermarrying, although many authors acknowledge that it does not include the entire population of the area, other clans participate in the social relations of the Paicî-Cèmuhi country. Even if today this relationship seems no longer to be always a condition when choosing a spouse for marriage, it remains important in social relationships, and is taken into consideration for the balance of customary administrative authorities. Indeed, this duality determines certain land tenure practices (the clanic lands are assigned between and Dui and Bai, a clan cannot enter a taboo area of



**Figure 7.4.** Demography of the tribes (figures : ISEE, 1996). *Legend:* Number of inhabitants

the other clan etc) but also social practices (one cannot talk openly to someone from another clan etc.). Thus, under the rules of the Paicî-Cèmuhi customary council, the distribution of customary administrative responsibilities among the different levels (area, district, and tribe) must theoretically meet a certain balance between these two clans (JONC, 2000). However, although there are two authorities for each tribe and each district, cohabitation is not always obvious: in the tribes it sometimes happens that both customary authorities are from the same clan if this one particular clan holds a large majority. At the district level, it is rare that the two customary authorities are appointed, the Big Chief position is often disputed then and representativeness of the two clans is therefore not always ensured. This lack of representativeness is often criticized by the public, although it is not the only grounds for challenging the customary authorities.

### Traditional customary organization

The traditional chiefdom, which includes several “sub-clans”, is the representation of power in one place. The chiefdom is designated by the name of the place where it exerts its influence. However, the Melanesian society is based on a multi-polar distribution of power: the land clans (native from the place) also have a great influence on the decisions that are

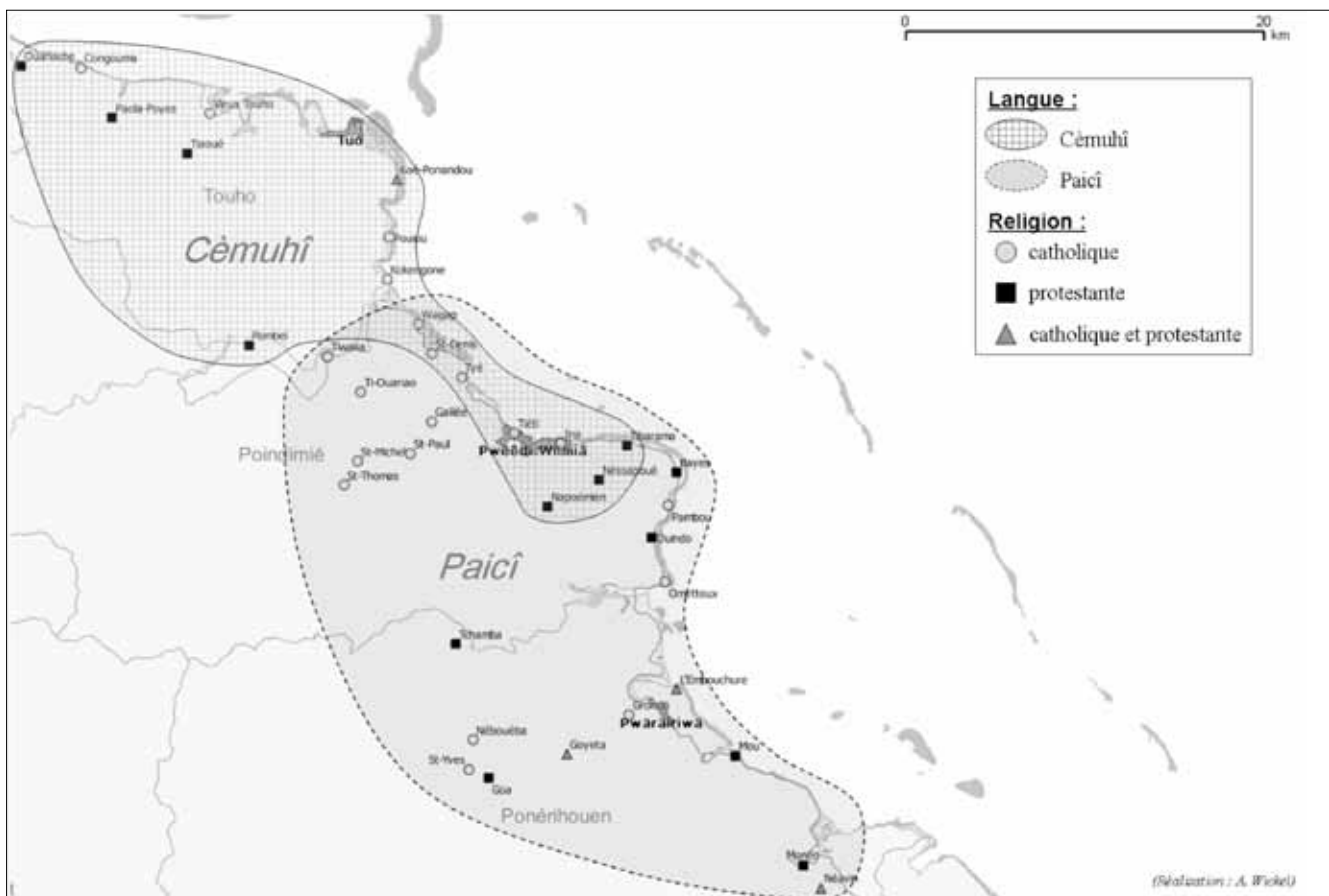
made on their place by the “representatives” of the clans (chiefs clans, warrior clans, messengers clans, etc.), even so some of the networks of “political” alliances transcend social relations throughout the territory (Guiart, 2004).

## Religion

Religious practices are very important in the area. Religious organization is shared between catholic churches, protestant churches (free and independent), and several growing minority cults. The coverage area of the different religions does not overlap directly with the language areas nor with the customary districts (see map of religions and language areas in Figure 7.5). It is possible that the installation of the missionaries might have followed some customary or “political” networks at the time, however this is not apparent today. Even if this level of social organization is less structured than the customary organization, it constitutes social networks within each community because people create social networks and engage in discussions during the meeting days that are organized by religious associations.

### New socio-territorial levels

Customary administrative authorities are the levels of power imposed by the colonial administration (see changes in the



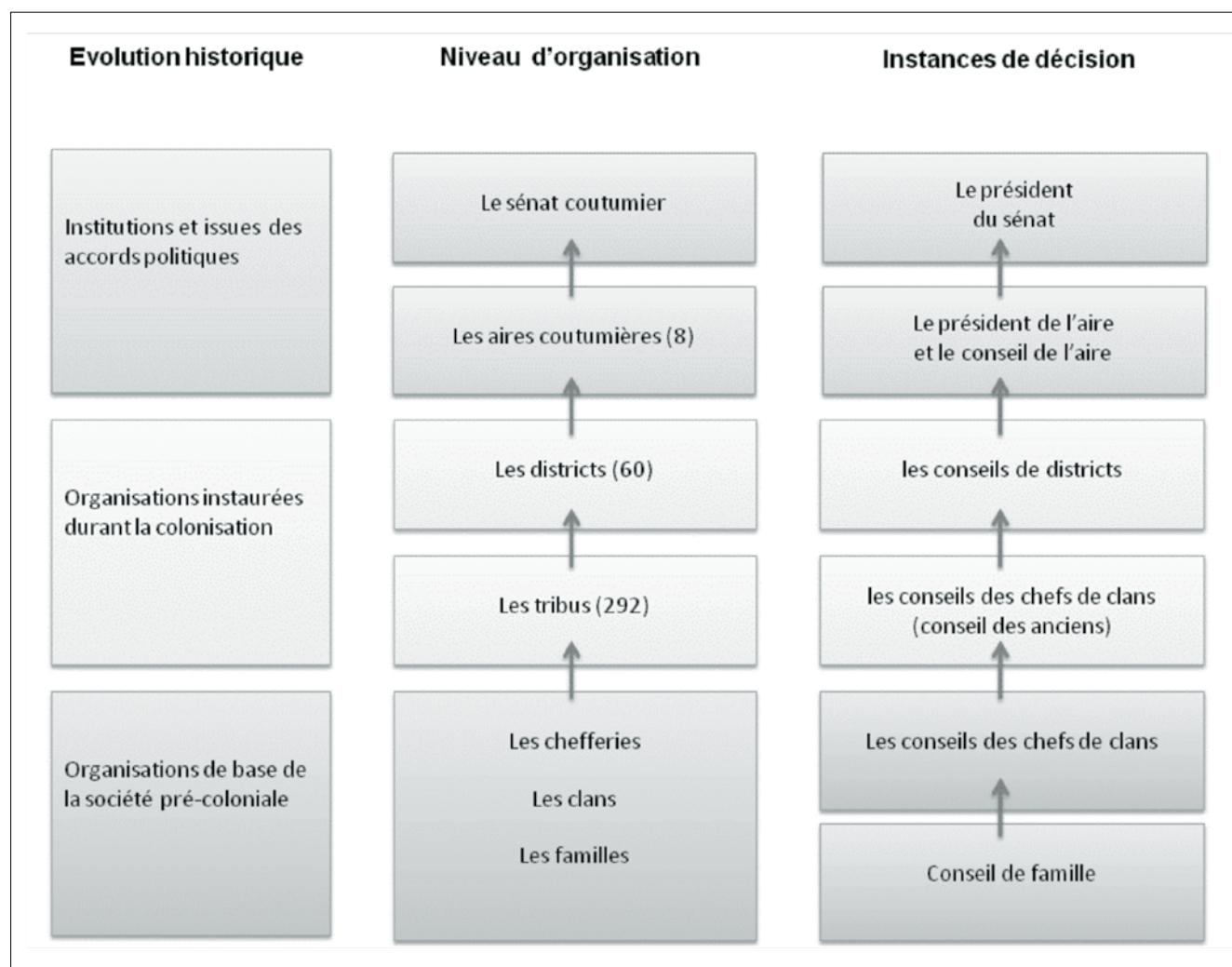
**Figure 7.5.** Map of Kanak languages spoken and religions in the area. *Legend:* Language: (Cèmuhî and Paicî) (other neighboring languages spoken at the extremities of the zone, Ajië to the south, Vamaleï and Pidjé to the North, are not reported here) Religion: Catholic, protestant, catholic and protestant



structure of the organization of the Kanak society in Figure 7.6). Indeed, the traditional structure of authority was not based on a pyramid scheme but on a multiplicity of power forms. Thus, the customary administrative authorities' power levels do not initially correspond to entities themselves, both at the social and spatial levels. Indeed, evangelism involved the displacement of populations to bring people together around missions (basis of many current tribes), thus creating clusters of families from different places. This has changed the traditional social equilibriums and created considerable changes to a customary organization based on the recognition of social identity through a precise territory. Further the land expropriation policies undertaken by the colonial government with the aim of colonization led to the creation of reserves where people were confined, thus severing the ties between clans/families from different places. Consequently

this again disrupts the organization of a society that has worked in social networks spread out spatially. Further, this results in the administration of defined districts that do not necessarily correspond to customary land entities. These changes have created forms of centralized powers over initially very heterogeneous territories. Customary administrative authorities managing these new organizational levels may therefore encounter difficulties to be legitimate in the eyes of their "citizens". In the study area such claims are particularly present at the district level. Thus, district councils rarely meet in full, and only two Big Chiefs are designated (which does not mean uncontested) across the six districts.

However, in reality, the organization imposed by the colonial administration did not replace the customary organization but has superimposed itself, although both levels are often unstructured. And if the customary administrative



**Figure 7.6.** The organizations of the Kanak society. Review of the global structure. (Source : ADRAF) Legend: Evolution historique : *Historical evolution* ; Niveau d'organisation : *level of organization* ; Instances de décision : *decision authorities* ; Institutions et issues des accords politiques : *Institutions and issued from political agreements* ; Organisations instaurées durant la colonisation : *Organizations established during the colonization* ; Organisation de base de la société pré-coloniale : *Basic societal organization prior to colonization* ; Le sénat coutumier : *the customary senate* ; Les aires coutumières : *the customary areas* ; Les districts : *the district* ; Les tribus : *the tribes* ; Les chefferies : *the chieftoms* ; Les clans : *the clans* ; Les familles : *the families* ; Le président du sénat : *the president of the senate* ; Le président de l'aire et le conseil de l'aire : *the president of the area and the council of the area* ; Les conseils de districts : *the district councils* ; Les conseils des chefs des clans (conseil des anciens) : *clan chiefs' councils (council of the elders)* ; Conseil de famille : *Family council* .

structures are easily identified, it is more difficult to understand and spatially delineate the structures of the traditional customary organization that remain today. The bibliography on the subject often only provides a very detailed analysis which is hardly synthesizable regarding the various social changes since the pre-colonial period until today. One can nevertheless find an adaptation of social competition for new spheres of power (customary administrative, religious, and today political), with an overlap of issues and legitimacy. This creates significant difficulties in communication between the different levels of organization, and validation in collective decision making.

## IMPLICATIONS IN TERMS OF LAGOON AND REEF SPACE USE

### Maritime customary rights and spatial use

In terms of maritime territoriality, the local social context results in a superposition of legitimacies. If the legal aspect of the regulatory DPM (Public Maritime Domain) is known to all, this administrative legitimacy overlaps with customary legitimacy in regards to resource access or access to certain areas. Although this dual concept of maritime space creates many tensions in discourses, it applies concretely in areas frequented regularly by people of the tribes (mainly the fringing reef).

Traditional maritime territoriality was used to divide the fringing reef among families, while the lagoon space was allocated to chiefdoms. Today, the family division of the fringing reef is no longer very active. The limits are still relatively well known but deliberately attenuated so as not to cause conflict in a context where many families have been displaced. Currently, the fringing reef is rather divided between tribes, the limits being fixed by landmarks (creek, outcrop etc.). The population often claims a right of ownership over the resource present in this area (except for migratory species, which according to the population belong to no one since they do not stay in one place). This right is sometimes reflected in the establishment of tribal reserves, in other words, reserved fishing areas for a tribe. This claim to a place does not initially mean to deny access to people outside the tribe, but rather a demand for respect towards an essential resource for feeding the tribe.

As for the lagoon area, it no longer appears to be managed directly by the chiefdoms but rather follows a district zoning, which rather generates legitimacy in terms of who participates in decisions concerning the environment rather than strict restrictions on use. However, the area is still linked to customary ownership of the space, particularly through the toponymy and taboo areas. Although this intangible cultural heritage no longer refers directly to user rights or restrictions, it is still valid for speech in references to the history of the area. The islets are often regarded as clan property, often leading to claims.

Thus, uses follow this division: on foot subsistence fishing is mainly practiced in front of the tribe, whilst for

subsistence fishing by small boat, zones are not fixed and are spread throughout the lagoon with no apparent access restrictions. The choice of sites depends on the proximity or availability of the resource and is also dependent on the quantity of fuel on hand for travel.

### Local fisheries management systems

Many anthropological works state that in the traditional customary organization, each family (or clan, depending on the term used) was assigned a role in community organization. Management of the marine environment was therefore assigned to groups that are generally called “sea clans”. Some would be responsible to fish for feeding other families, other fished for chiefdom ceremonies, and others were the guardians of the places whom had to be consulted to ensure a good catch (Leblic, 1999). Today these roles are no longer necessarily known, and are not especially active in managing the marine environment. People who hold traditional knowledge do not appear to regulate fishing, including those fishing for ceremonies, it is the person who has a boat that is tasked to go fishing.

The bases of current traditional management systems often seem to rest on the conscience of the users in showing attitudes of general respect (i.e. not to fish in excess of requirements, have a respectful attitude towards species and highly symbolic places, etc) rather than the specific practice of restrictions (GIE Océanide, 2009). But there still exists some rules regarding the fringing reefs established at the tribe level by the clan councils. Some tribes prohibit fishing at night with spear-guns, others also prohibit spear fishing and netting during the day, whilst others establish tribal reserves subject to various restrictions (fishing reserved for ceremonies, fishing on the reef flat banned for people outside the tribe, etc). These rules have been put into place in order to adapt to the changing pressures (population growth, anthropogenic terrigenous runoffs), techniques (more impacting), and to the loss of traditional knowledge and management structures. However, responsibility for compliance with these rules rests with tribal customary authorities, who admit they are not always able to deal with infringements. As for the districts’ customary authorities, they rarely participate in decisions concerning the marine environment.

Tensions over access to fisheries resources on the fringing reef (e.g. fish, shellfish, and crustaceans) are highly dependent on resource availability, on the size of the fringing reef and its health or status, and of the population density in the tribe. Thus, tribes subject to one or more of these factors are subject to tensions regarding on foot subsistence fishing. These tensions can lead to a shift of the fishing pressure onto neighboring tribes, which then creates conflicts with these tribes, or the establishment of tribal fishing regulations by the council of the clans. But this type of management also shifts the fishing pressure to other neighboring tribes because people often have no alternatives for obtaining food resources. Additionally, the creation of a reserve can generate tensions within the tribe if the decision was not taken in a consensual manner.



## USES AND ESTIMATION OF THE COMMERCIAL AND SUBSISTENCE FISHING EFFORT APPLIED IN THE ZONE

### Main fishing uses typology

The main marine activity is fishing, which covers a variety of uses that the standard categories of fishing (recreational - subsistence - commercial) do not allow for full differentiation. These categories have been thus refined to have a more realistic view of various uses; the typology used is presented in Table 7.2. Determining factors in the choice of the categories include: the purpose of fishing, type of gear used and the targeted species. The categories were not established on the basis of the commercial aspect of the fishery because this factor covers very different realities depending on the proportion and type of sold catches.

The fisheries' characteristics (i.e. frequency of trips, target species, and amount harvested) vary greatly between seasons (more fish during the warm season results in more fishing activity during that time) and king tides (for collecting shellfish and octopus on the reef flat during the cold season). For categories A, C, D, E, catches are very diverse: mostly reef fish (e.g. snappers, surgeonfishes, groupers, and emperors, etc) but also crab, octopus, shellfish, and seasonal fish (Spanish mackerel or *Scomberomorus commerson*, sardines etc.).

Recreational (A) and sports fishing (B) (both herein also referred to as recreational and sports fishers) are mainly concentrated in Poindimié. The Poawee Association, which manages the harbor of Tibarama (main launching point in Poindimié) gathers about 90 members, most of whom practice fishing, including a dozen of these members who fish on a regular basis. Recreational fishing in other communes is difficult to measure because fishers are not grouped into an association. Many people denounce a parallel market from sports fishing fisheries products sold to commercial premises or between individuals. Of course, this aspect is very difficult to pinpoint.

Subsistence fishing (C and D) is practiced by most of the population from the tribes and is therefore the main type of fishing in terms of user numbers. But most fishermen do not have a boat, as they lack financial means, and primarily fish on the fringing reef. The few boats available are generally too small to go all the way out to the outer barrier reef and the fishermen are therefore often confined to shoals near the coast.

For this type of fishing, the catch amount is adapted to the needs: during normal times, only a few kilos will be harvested to cook a few meals for the family, but for traditional or religious ceremonies (e.g. weddings, funerals, celebrations etc.) only one person (often the one that has a boat) will be charged to catch a large amount of fish to ensure meals for several tens or even hundreds of people over a few days. No species is specifically targeted for these ceremonial fisheries.

Commercial lagoon fishing (E) differs from subsistence fishing mainly by the fact that these fishermen have a fishing license; the characteristics of the two categories in terms of fishing effort are not very different. If provincial subsidies

and local micro-credits are sometimes granted to commercial fishermen to expand their activity to allow them to have boats a little longer or to have boats with engines, fishing techniques remain similar, and the total catch per trip are substantially the same. Additionally, marketing channels are not structured, and each commercial fisherman himself must package and sell their products (except for trochus and sea cucumbers for which there are channels for export). Most lagoon commercial fishermen practice more than one activity (e.g. fishing, agriculture, construction etc) and fishing frequency is not necessarily more intense than subsistence fishing from small boats.

For commercial deep sea snapper fishing (F), performed immediately outside the barrier reef, the catch is exported to Noumea, the fishing gears are more substantial than for commercial lagoon fishing, but the pressure on the environment is reduced as only one fisherman practices this activity in the area.

### Other secondary uses

"Noteworthy" fishing is dependent on needs (e.g. celebrations etc.) and on the passages of migratory species. Spanish mackerel fishing takes place from October to December, during their passage into the lagoon for breeding. The schools move along the coast and fishing can be done from the fringing reef, making it accessible to fishermen on foot. The products of this fishery are shared between families, and then consumed throughout the the year end period. Although this fishery cannot be considered as customary, it greatly contributes to maintaining social ties. Similarly, during the Christmas celebration season, lobster fishing is highly practiced for local sale as demand is high.

One can also note some specific fisheries: fishing for the manufacture of traditional currencies (e.g. oysters, juvenile trumpet shells etc.) and harvesting of particular species for local marketing (e.g. shells, corals etc.).

In addition to fishers, other users of the marine resources remain a minority. Some tourist activities i.e. two diving clubs and a few game fishing companies) are available in Poindimié but are a small minority and therefore have little impact. Recreational and sport fishers also practice snorkeling around the islets.

### Fishing effort estimation

The characteristics of reef fisheries (i.e. the diversity of catches and techniques used, informal marketing etc.) make it difficult to quantitatively estimate the overall fishing effort (Pascal, 2010). The high variability of the different characteristics of these fisheries makes extrapolations unreliable, and realistic quantification would require field studies on the long term. Moreover, even within categories, fishing frequency and quantities taken vary widely from one fishers to another.

Available official information (New Caledonia Maritime Affaires) on the fisheries sector (e.g. statistics, records etc) do not give precise details of the actual practices of lagoon and

**Table 7.2.** Definition of the fishing effort: typology of the different fishermen categories.

Category	Type of fishing		User profiles					Organization of the sector			
	Designation	Purpose of fishing	Main community	Gender	Place of residence	Source of income	Estimated number (according to interviewed persons)	Use of fishery products	Marketing channel	Marketing authorisation	Association
A	recreational fishing	fun, discovery	temporarily French metropolitans	M	township	employment not related to the fishery	Touho : 20 Poindimié : 60 Ponérihouen : 10	consumption, gift, sale almost non existent	direct sale to individuals (rarely)	no	sometimes
B	sports fishing	fun, "sportive"	europeans settled since many years, caledonians	M	township	employment not related to the fishery	Touho : 3 Poindimié : 30 (including 10 regulars) Ponérihouen : 3	consumption, gift, potential sale but difficult to estimate	direct sale to individuals, restaurants, commerces	no	sometimes
C	embarked subsistence fishing	alimentary, sometimes pecuniary, organization of ceremonies	melanesians	M	tribe	formal or informal employment, fishing, agriculture, handcraft.	Difficult to estimate	consumption, gift, occasional sale (in case of financial needs)	direct sale to individuals	no	no
D	on foot subsistence fishing	alimentary, sometimes pecuniary, organization of ceremonies	melanesians	M / F	tribe	formal or informal employment, fishing, agriculture, handcraft.	Difficult to estimate	consumption, gift, occasional sale (in case of financial needs)	direct sale to individuals	no	no
E	Commercial lagoon fishing (artisanal)	pecuniary	melanesians	M	tribe	formal or informal employment, fishing, agriculture.	Touho : 10 declared (20 to 25 non declared), Poindimié : 3 Ponérihouen : 1	consumption, regular sale	direct sale to individuals, commerces market, sometimes to canteens (on demand), peddler for sea cucumber and trochus	not always	yes
F	Commercial deep sea snapper fishery (semi-industrial)	pecuniary	europeans settled since many years	M	township	fishing	Touho : 1 Poindimié : 0 Ponérihouen : 0	permanent sale	peddler who sells in Nouméa	yes	yes

*continued on next page*

**Table 7.2.** Definition of the fishing effort: typology of the different fishermen categories.

Category	Fishing gear types			Characteristics of the activity					
	Boat	Technique	Electronic equipment	Fishing area	Targeted species	Frequency of trips	Required conditions	Fishing time per trip	Average quantity fished per day
A	aluminium, polyester (from 4 to 10 meters) motorised	casting, trolling, jig, bottom line, speargun	often GPS	outer and inner barrier reef, shoals and islets ilots, passes	reef fish, bottom fish and pelagics	1 to 5 days/ months	week-end or holidays	2 to 6 hours	0 to 50 kilos
B	aluminium, polyester (from 4 to 10 meters) motorised	trolling or speargun	GPS	outer barrier reef (speargun), outside the lagoon (isobath 500 to 2000m) (trolling)	pelagic fishes	1 to 5 days/ months, + 1 annual contest per township	week-end or holidays	2 to 6 hours	0 to 200 kilos (when large catch), 2 to 3 catches on average, rarely more than 10 catches
C	aluminium < 6 meters (not always motorised), bamboo rafts	bottom line, speargun, net	none	fringing reef, islets, shoals, sometimes barrier reef and passes when enough fuel	reef fish, bottom fish and pelagics (Spanish mackerel)	1 to 10 days/ months	favorable climat (light wind, clear water,...) especially for travelling to the barrier reef	1 to 3 hours	1 to 30 kilos
D		net, speargun, lance, collecting, cast net, pots (rivers)	none	reef flat on the fringing reef, river mouth, rivers, mangroves	octopus, shells, reef fish, crustaceans	1 to 10 days/ months	Especially king low tides	1/2 to 2 hours	1 to 10 kilos
E	aluminium < 6 meters motorised	bottom line, net, collecting	none	fringing reef, islets, shoals, outer and inner barrier reef	trochus, sea cucumber, reef fish, bottom fish	5 to 15 days/ month	favorable climat (light wind, clear water,...) especially for travelling to the barrier reef where trochus are harvested.	2 to 6 hours	fish : 5 to 40 kilos, trochus : 100kg per month, sea cucumber: 50kg to 100kg per week
F	longliner > 10 meters motorised	long line	GPS, sounder	outside the lagoon du lagon (isobath>800m)	deep sea snappers	7 days/month		4 to 8 hours	40 to 400 kilos depending on the area

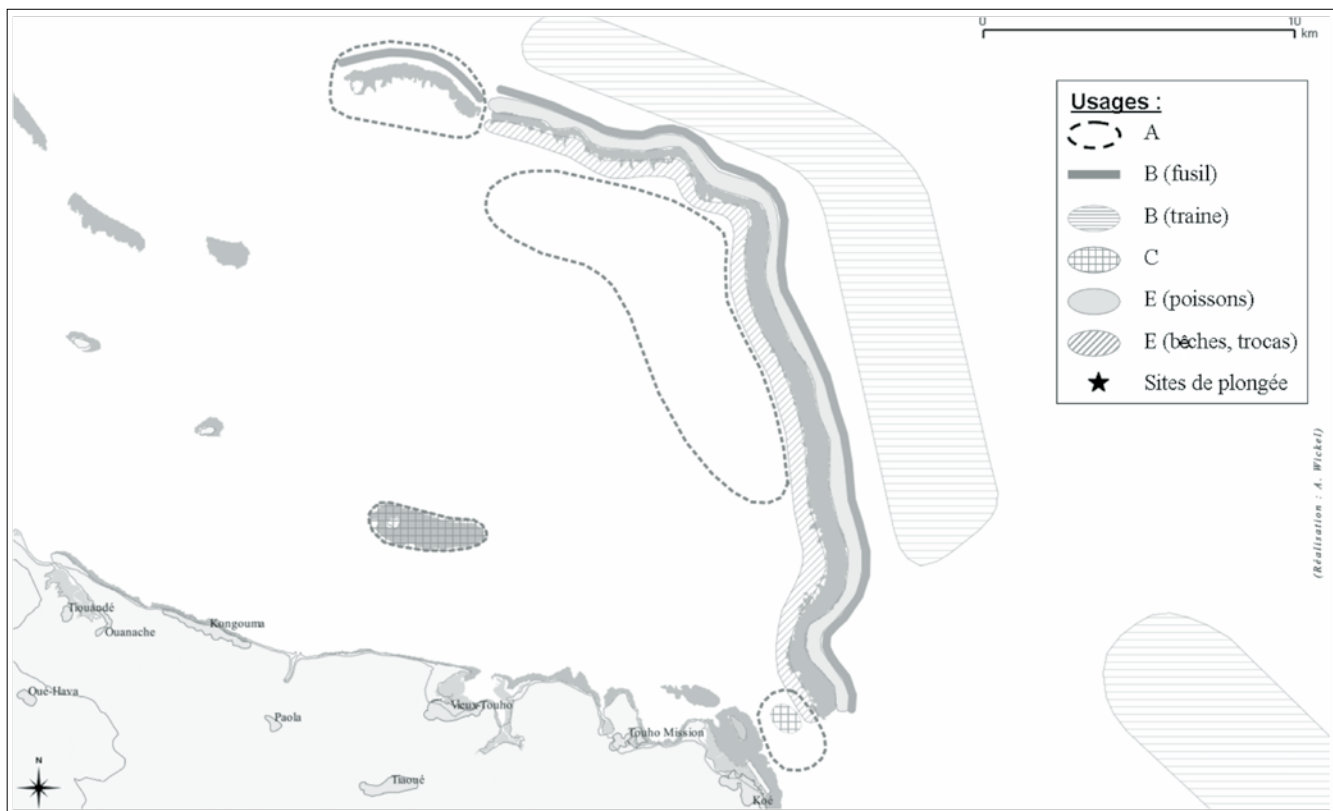
deep sea fishing. On the one hand, figures regarding fishing licenses are not representative because the majority of fishers are not considered as commercial (many fishermen sell without authorization) and because fishermen with licenses practice multiple activities (only 10% of registered fishermen practice their activity full-time (Menu and Hebert, 2006)). Moreover, figures on the number of vessels are not very representative: the category “peche” (i.e. fishing) only includes vessels whose owner already have permission to fish at least once (without verification if the activity continued), and the category “plaisance pure” (i.e. purely recreational fishing) also includes the vessels used for embarked subsistence fishing as well as for commercial lagoon fishing (as they don't have a permit, they cannot be listed in the “fishing” category) (Table 7.3 listing types of boats per communes).

Although uses are concentrated over relatively small areas (Figure 7.7 Touho and Figure 7.8 Poindimié and Ponérihouen), low yields come from the gears used and the low population density relative to the area of the lagoon suggests that the overall fishing effort may be of little to no threat for the fish stocks (Labrosse and Letourneur, 1998). One can still note that subsistence fishing (C and D) constitutes the main pressure (yields are only slightly lower than those of yields from commercial lagoon fishing (E), but the number of users is much higher). However, the overall fishing effort for the subsistence (C and D) category is very difficult to

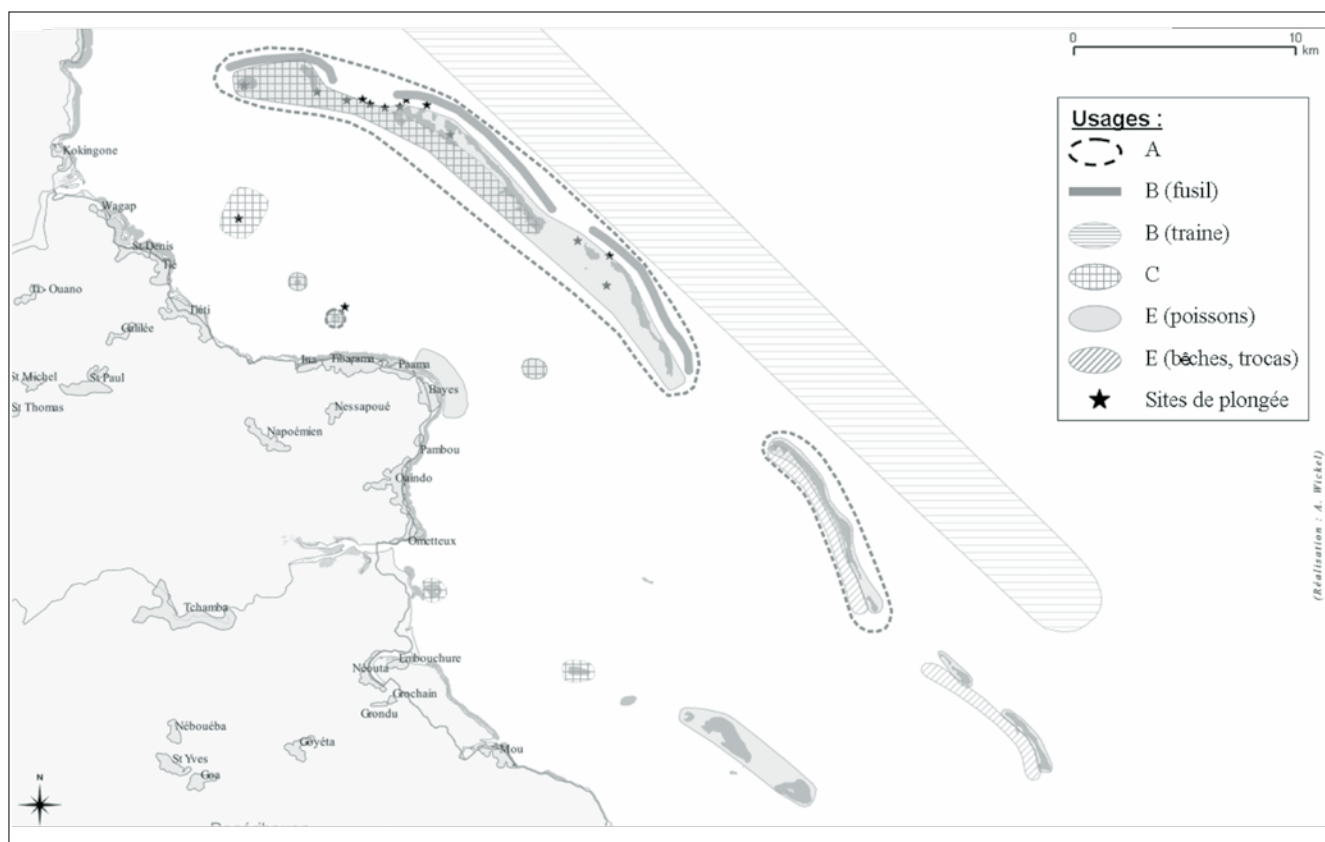
quantify because fishermen are not listed in any register (e.g. no association, no authorization, no marketing channels etc).

However, we can assume that the pressure on the environment is moderate given the gear available and the extent of the fishing areas. This is with the exception of subsistence fishing on foot (D) that focuses on a small area and therefore may involve a higher fishing pressure despite low yields. Some practices may lead to a fishing pressure on species if the recovery capacity of the stocks is not sufficient in comparison to removal. This may be true for the sea cucumber (D), the Spanish mackerel (A and C) and deep sea snapper (F) fishery.

Furthermore, characteristics of local fisheries can provide insight into certain dynamics of fishing pressure. For example, the number of subsistence fishers on foot is proportional to the population of the tribes: fishing pressure per unit area depends on the population and on the size of reef flat in front the tribe (Figure 7.4). One exception occurs when fishing pressure is transferred to a neighboring tribe's reef because another tribe has had their reefs degraded by terrigenous runoffs. Therefore one can assume an increase in subsistence fishing pressure on the fringing reef due to the increase of population (especially among the tribes of neighboring townships) and due to the lack of financial means to buy boats. However, it is possible that this increase is offset by a decrease in the average fishing effort per person due to new lifestyles (e.g. less available time with the increase in



**Figure 7.7.** Map of usages of the marine environment in Touho. *Legend:* Usages (Fusil: speargun; traine: trolling; poissons: fish; bêches, trocas: sea cucumber, trochus; sites de plongée: diving sites).



**Figure 7.8.** Map of usages of the marine environment Poindimié et Ponérihouen. *Legend:* Usages (Fusil: speargun; traine: trolling; poissons: fish; bêches, trocas: sea cucumber, trochus; sites de plongée: diving sites).

**Table 7.3.** Number of vessels by type of activity by township and by length class (*source : SMMPM. Legend:* Nombre de longueur hors tout (mètre) : number of overall length (meters); Localité : location; Type : Type; Total : total; longueur hors tout : overall length; Commerce : commerce; Ecole de voile : sailing school; Location plaisance : recreational charter; Navire administrative : Administrative vessel; Pêche : fishing; Plaisance pure : purely recreational (note that this category also includes vessels belonging to lagoon fishermen who do not hold a fishing license); Support plongeur : diver support).

Nombre de Longueur hors tout (mètre)		Localité			
Type	Longueur hors tout (mètre)	POINDIMIE	PONERIHOUEN	TOUHO	Total
Commerce	De 6 à 8 m	2			2
	Sup à 10 m	1			1
<b>Total Commerce</b>		<b>3</b>			<b>3</b>
Ecole de voile	De 4 à 6 m	1			1
<b>Total Ecole de voile</b>		<b>1</b>			<b>1</b>
Location plaisance	De 4 à 6 m	1			1
<b>Total Location plaisance</b>		<b>1</b>			<b>1</b>
Navire administratif	De 4 à 6 m			1	1
	De 6 à 8 m			1	1
<b>Total Navire administratif</b>				<b>2</b>	<b>2</b>
Pêche	De 4 à 6 m	7	4	8	19
	De 6 à 8 m		1	3	4
	De 8 à 10 m	1			1
	inf à 4 m		2		2
	Sup à 10 m			1	1
<b>Total Pêche</b>		<b>8</b>	<b>7</b>	<b>12</b>	<b>27</b>
Plaisance pure	De 4 à 6 m	84	27	58	169
	De 6 à 8 m	25	3	14	42
	De 8 à 10 m	5	1	3	9
	inf à 4 m	26	17	20	63
	Sup à 10 m	7		1	8
<b>Total Plaisance pure</b>		<b>147</b>	<b>48</b>	<b>96</b>	<b>291</b>
Support plongeur	De 4 à 6 m	2			2
	De 6 à 8 m	2			2
<b>Total Support plongeur</b>		<b>4</b>			<b>4</b>
<b>Total</b>		<b>164</b>	<b>55</b>	<b>110</b>	<b>329</b>

paid employment, increased consumption of food bought in shops etc.). Similarly, the increasing population in the communes generates an increase in recreational fishing pressure on the barrier reef, especially in front of Poindimié commune. Regarding future developments, it is quite possible that the development of the VKP area that accompanies the Koniambo project will generate a large increase in fishing pressure. The population growth expected in this area may lead to an increase of recreational and sport fishers coming from the west coast, as well as new opportunities for local marketing channels that would encourage fishermen on the east coast to increase their practice.

### Conflicts between users

Several tensions were identified among users of the lagoon. The main one is between the subsistence fishers who fish on foot and from small boats (C and D) and the recreational (A) and sports (B) fishers. This is especially the case in Poindimié because the recreational (A) and sport (B) fishers are more numerous. Indeed, subsistence fishers complain of a disproportionate amount of fishing by them when compared to need. Recreational and sports fishers generally have paid employment that is not related to their fishing activity and do not depend on marine resources for food. Subsistence fishers complained about the fact that large quantities are caught (sometimes beyond the quotas according to them) by the recreational (A) and sport (B) fishers in the lagoon (i.e. fishing area) and admit being less bothered by fishing outside the lagoon. However, the typology above shows that it is mainly the recreational (A) and sport (B) fishers who sometimes fish large quantities (not necessarily superior to the quotas that are defined by the number of catches for sport fishing and not defined by kilos as is done for other fishing), and these fishers (A and B) primarily fish outside the lagoon. It is important to note that this conflict is partly due to a misunderstanding of the practices and regulations, fueled by a lack of physical enforcement over the lagoon, and that it could be partly mitigated by clarifying the facts.

The second tension is between the commercial fishers with authorizations and those fishers who sell without authorization, but are already employed (categories A and B) and their purpose in selling is not to meet vital needs as is the case sometimes for some small time fishers.

Finally, there are notable tensions between tribes when the inhabitants of one tribe regularly go fishing in front of the neighboring tribe's area. This may be due to a resource not readily being available (either because the reef is degraded and has little fish or because the population is too large in relation to the size of the reef flat), or due to a resource being less accessible (e.g. tribal regulations that limit harvesting). These conflicts are not currently being managed. Some of these questions have already been raised to the committee created by the institutional services of Province Nord to monitor the overhaul of fishing regulations. This committee is composed of representatives of various local stakeholders tasked to spread information regarding the new regulations

and to voice the views of other local stakeholders. However, these debates have remained at a superficial/higher level and have not lead to tangible solutions. The management committees established during the World Heritage listing for the reefs will provide an opportunity to discuss these issues further.

### Other pressures on the environment linked to marines activities

There are several other impacts that can be identified on the marine environment. Many people report cases of poaching (including over-fishing of fish and clams) for sale through parallel channels.

Diving activities can sometimes cause some damage to the coral with anchors because not all dive sites are equipped with fixed moorings. But the low activity rate and regularity in the choice of sites limit the impact.

Activities related to tourism activities to the islets (campfires, dogs, trampling of eggs, walks) can cause nuisance to the birds. In addition, the breeding season (November to March) corresponds to the summer holidays, meaning an increased rate of activities on the islets.

## IMPACTS FROM HUMAN PRESENCE AND ACTIVITIES IN CATCHMENT AREAS

Few quantitative data are available concerning human impacts of terrestrial origins on the marine environment. Nevertheless, the main impacts are visually identifiable in areas with poorly managed watersheds (e.g. denuded catchment areas). The environments most affected by terrigenous input are the fringing reefs, estuaries and mangroves.

### Terrigenous runoffs

Terrigenous runoffs are the main environmental impact on the marine environment (Figure 7.9 for pressures related to erosion) and geomorphologic conditions facilitate the process of erosion. The primary cause of erosion remains mining. Mining activity remains low in this area but prospective sites significantly affect the south of Ponérihouen. In addition, some mines in Poya, on the west coast, spill over onto the catchment areas linked to the east coast, partly affecting them. Terrigenous runoffs are also related to the construction and maintenance of roads in mountainous areas (crossroads, access to old mills, access to electricity pylons etc.). Finally, erosion due to the presence of invasive species (deer and pig) and to bush fires is not assessed in the area. Erosion is accentuated during heavy rains and is therefore more intense during the austral summer. Some coastal development can also cause a significant and localized terrigenous runoff, which can strongly affect the reefs nearby. The environmental consequences of erosion (bottom covered with silt, loss of biodiversity) are felt in the rivers and on reefs north of the river mouths on which the soil is constantly being pushed by the southeast trade winds.

### Domestic pollution

The second observable environmental impact is domestic pollution. Indeed, the communes have limited equipment and means to deal with the treatment of household waste. Collection is carried out by private companies, but these do not go into all the tribes (the people must bring their own waste to the landfill), and remains a paid service for everyone in the commune, living on tribes or not (however few people pay the subscription for collection). For areas with no collection, wastes that are not burned in the gardens are discarded outdoors (plastic packaging, iron cans etc.) with some of the waste ending up in the mangroves. Finally, the collected wastes are placed in landfills (where they are not treated but just stacked), some of which are located directly on the mangroves such as in Touho. Although the environmental impact remains moderate today because of the low volumes of waste, population growth and changes in consumption patterns could increase the amount of wastes produced in the years to come. For this, a storage facility for household and similar wastes in accordance with regulatory requirements is being created in Touho. Pollution related to the use of chemical products (e.g. pesticides for agriculture and glyphosate for weed control on roadsides), although significant, appears to be relatively low. The few Installations Classified for the Protection of the Environment (ICPE) present in the area are only small (i.e. mechanical workshops, fuel depots, sewage treatment stations) with little environmental risk. Finally, wastewaters from some tribes are not always treated, some wastewaters are discharged directly into rivers that flow into the lagoon.

### Extraction of building materials

The last main observed impact is the extraction of sand and dead coral on the coast. The sand is collected by private companies for use as construction material and dead coral by the communes (for road building), but this activity seems to have ceased today. The dead coral is now taken only in small quantities by individuals for garden earthworks. These extractions exacerbate the coastal geomorphologic dynamics already very active due to favorable factors (regular waves generated by the prevailing southeast trade winds, cyclones, narrow fringing reef etc.). The profiles of the beaches and the morphology of the river mouths are changing rapidly (e.g. loss of shoreline, creation of a cliff, loss of trees etc.). However, a better understanding of the processes involved would be necessary to differentiate the causes of erosion in order to clarify preconceived ideas, to propose appropriate management solutions and to estimate the protective value of the reef.

## ANALYSIS OF THE REPRESENTATIONS OF THE POPULATION REGARDING THE LAGOON AND REEF ENVIRONMENT

### Cultural representations of the marine environment and of biodiversity, status of traditional knowledge

Vernacular knowledge about the marine environment is important as illustrated by the richness of vocabulary specific to species and marine environments (Leblic, 2002; Riviere, 1983 and 1994). But this knowledge is not easily transmitted today to younger generations, and only a few regular fishermen still know precisely the behavior of many species (e.g. diet, habitat, areas and periods of reproduction, migration). Many people consider it important to re-educate young people with such knowledge, but the question of the terms of this transmission arises. Some adults would like for this knowledge to be written in order to benefit from it as well. The Kanak immaterial cultural heritage related to the marine environment is also very rich. According to specific studies conducted in other areas of New Caledonia, the toponyms in Kanak languages and taboo areas mark the marine environment and are sometimes linked to important customary, historical or ecological places (GIE Océanide, 2009). Generally, this knowledge seems to be largely lost today, some seniors still possess important knowledge but do not always transmit it. Thus, in the study area, the majority of fishermen, even those from the tribes say they do not know the taboo areas and use French maritime toponyms. Access or use restrictions linked to these places are therefore not generally respected today. Many people wish for censuses of this heritage be undertaken, but strongly recommend this is conducted on consensual basis as it is a sensitive issue. Some species are considered “totem” of a clan: sharks, turtles, mullets etc., but this link does affect specific practices today. Finally, the traditional currency still used during ceremonies is sometimes manufactured from marine species (e.g. oysters, trumpet shells etc.).

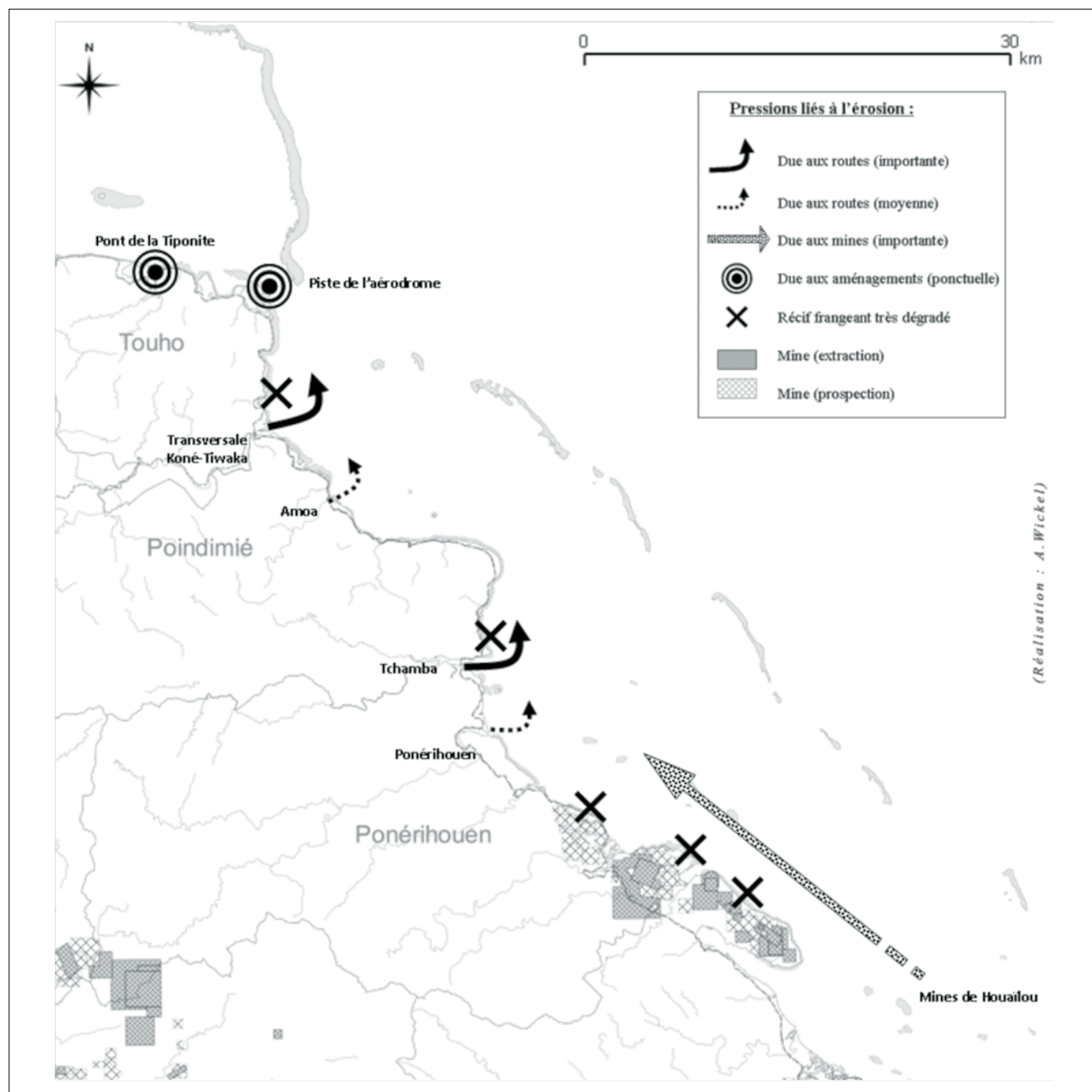
### Perceptions of the health status of the lagoon and reef environment

In general, the perception of the state of the marine environment among local stakeholders is based on short-term observation. Indeed, local institutional services do not possess enough evidence to provide clear estimates of the various pressures and changes in the marine environment. The explanation of the processes by the local population is therefore based on a superposition of experiences and the global news media. But the interpretation of these changes in the marine environment is difficult for local people to understand because they are new standards for people that are not used to monitoring these changes, and for which the vernacular knowledge does not allow for analyses. The extent of damage to the marine environment is therefore estimated by the population by the direct consequences on the local environment (e.g. highly visible impacts, loss of fisheries resources, threats to endemic species), and not according to ecological indicators of disturbance. Moreover, there is a vague



and incomplete media information on overall trends in the global environment (e.g. global climate change, sea level rise, changes in precipitation, international fisheries of key species etc.) that creates some confusion in the interpretation of visible phenomena. The hierarchy of pressures and the explanation of the causes are therefore quite rash. Nevertheless it is sometimes possible to determine differences in perceptions between the different users of the marine environment. Most users find that the reefs are healthy. Only fishermen from the tribes sometimes notice a real degradation of the health of

the fringing reef, which they say has been covered in mud for several decades due to land erosion from mining and road rehabilitation. This assessment is drawn mainly from the areas in the south and near river mouths. The main perceived consequence is the decline of marine resources such as shellfish and fish, because the mud covers their nests and food. Tribal fishermen also notice the degradation of coral but do not always link it with the decline of the resource. Finally, yachtsmen who fish offshore do not usually see signs of terrigenous runoffs on the barrier reef.



**Figure 7.9.** Map of pressures related to erosion. *Legend (box):* Due aux routes (importante): *due to roads (important)*; Due aux routes (moyenne): *due to roads (medium)*; Due aux mines (importante): *due to mines (important)*; Due aux aménagements (ponctuelle): *due to infrastructures (localized)*; Récif frangeant très dégradé: *highly degraded fringing reef*; Mine (extraction): *Mine (extraction)*; Mine (prospection): *Mine (prospection)*. In text: Transversale Koné-Tiwaka: *Koné-Tiwaka crossroad*; Amoa, Chamba (names of valleys); Mines de Houailou: *Mines in Houailou*.

The presence of invasive species is rarely mentioned by the users of the marine environment. Tourism operators report a few cases of crown-of-thorn starfish (a coral predator) being present (native species) that are mainly localized and in low density. The inhabitants of the tribes along the rivers attribute the extinction of some species to imported species (tilapia, Florida turtle). According to the population, the main terrestrial species that may increase pressures on the marine environment is the Pine tree as it burns more easily and facilitates the processes of erosion related to forest fires. Deer and pigs are not mentioned as responsible for the increase in the erosional processes.

Fishermen find no particular change to non-fished iconic species (e.g. whales, dolphins and sharks). Tribal people report cases of misuse of nets (sometimes left several days on the reef flat), that can trap juvenile sharks living in the mangroves. Most users have observed an increase in stocks of Maori wrasse (*Cheilinus undulatus*) and turtles since the establishment of fishing regulations for these species.

#### **Perceptions on the availability of marine resources**

The decline of marine resources is mainly perceived by the fishermen from the tribes who notice a decrease in total catches of reef fish, crustaceans and shellfish, although stocks remain adequate for nutritional needs. Cited causes for this decline are overfishing (due to population growth and new techniques) and terrigenous runoffs. The most affected areas are therefore the fringing reefs in places where terrigenous runoffs are important, and the islets nearby townships (Tibarama islet in front of Poindimié, Ouao islet in front of Vieux-Touho) that are highly visited by recreational and sports fishers.

The majority of fishermen are concerned about the sharp decline of migratory fodder fish (sardines and anchovies) which they have noticed for the past two or three years. If these species are sometimes eaten, they are most often used as bait and their decrease has thus an impact on other fisheries.

Some people also mention the diminishing stocks of Spanish mackerels because fishing takes place before the breeding season, when the Spanish mackerels are full of eggs (October to December). However, consumption of these fish is during the holiday season, and any decision to postpone the fishing after the spawning period should take into account the social aspect of this fishery. The inhabitants of the tribes along the rivers mention the disappearance of a species of mullet ("black mullet"), but the cause is uncertain. Finally, some cases of poaching are mentioned (e.g. turtle fishing, overfishing of tuna or clams).

Regarding future developments, the main concerns surround the development of the VKP area because it could lead to increasing numbers of recreational fishers (category A) during the weekend, new informal sales opportunities and therefore an increase in subsistence fishing (categories C and D). Commercial lagoon fishers (category E) have noticed a decrease in sea cucumbers and trochus. These

fishers attribute to this to the periods of overfishing linked to export market prices (years 1930/1940, years 1980/1990), and perceive this as a potential obstacle to the development of their activity. The commercial deep sea snapper fishers (category F) notice the decline of snapper stocks, a species also vulnerable to overfishing because of slow rates of growth and reproduction.

#### **Perceptions of other stressors exerted on the lagoon and reef environment**

Most users notice strong pollution from domestic waste (mostly cans and plastic packaging). However, recreational and sport fishers seem more bothered by this pollution than people living in tribes. This difference in perception can partly be explained by a difference in awareness and education: sport and recreational fishers are better informed about the decomposition time of plastics (but not necessarily on the environmental consequences of this pollution). In addition, these fishers have a recreational use of the marine environment, which they appreciate in part for its aesthetic aspect that is strongly altered by the presence of plastic waste on islets or beaches. In contrast, tribal residents notice this pollution in the mangroves where they go fishing, but the wastes (which are already embedded and therefore less visible) do not interfere directly in their activity. However, some tribal residents are sensitive to the chemical pollution used as herbicide alongside roads and sometimes in crop fields.

Coastal erosion is mostly observed by the inhabitants of the tribes living along the coastline, as signs of the movement of the coastline are highly visible (trees and coastal amenities falling, coastline moving back several meters in some places, changing shapes of the islets and river mouths etc.). Although cyclonic waves are sometimes pointed out, the main evoked stressor is sea-level rise due to global climate change, but this analysis is based solely on media information, not on concrete observations. In contrast, people living near former sand and coral extraction sites attribute changes in the coastline to these extractive activities.

### **REPRESENTATIONS OF MANAGEMENT MODES TO IMPLEMENT**

#### **Representations of management processes**

In general, the various stakeholders that were interviewed (including institutional) agree on the prevalence of links between catchment areas and the marine environment in the hierarchy of pressures on the lagoon. Although these findings are generally based only on observations, priority actions in terms of environmental management must involve the terrestrial environment according to the population. Regarding land erosion, management ideas are not well defined just as biological and ecological processes at work are not always understood. However, the necessity for garbage collection is perceived by all stakeholders. If this action is considered a personal responsibility for commune inhabitants, those living in tribes see it as a duty for the public authorities. This

may explain the absence of collection in large parts of the tribes area.

However, expectations concerning the management of marine resources are more precise, particularly among residents of the tribes because the fishery resource is for them a significant and non-replaceable dietary contribution. Although if the reduction of resources is partly attributed to increased fishing pressure, it is seen as cyclical (linked to increasing needs and to new technologies rather than over-fishing per fishers), and a dependency on fisheries resources remains central. Thus, fisheries management tools must absolutely adapt to the uses and needs of the people in order to be accepted. The inhabitants of the tribes thus consider that fishing regulations must take into account the specific uses and the high social issue (ceremonial fisheries), but also adapt the restrictions in relation to needs (subsistence fishing should not be limited too much because the dietary issue is important and there are few alternatives, as opposed to recreational fishing). Tribal fishing regulations are challenged also when they are too restrictive in relation to needs. Although the areas subject to strong pressures are often identified (i.e. mangroves, islands, river mouths) users insist on the fact that fishing should not be totally banned in these localities because alternative options are rare.

This management concept is reflected in the design of a “marine reserve”, seen primarily as a tool for re-populating stocks in order to perpetuate fishing practices. The “tribal marine reserves” are generally subject to tribal regulations but remain open to certain types of fishing that can be practiced only by people from the tribe. But the interviewed fishers mentioned they are able to accept the establishment of marine protected areas completely closed to fishing as long as it allows for the rebuilding of stocks so that the area is later reopened for the fishery (the principle of rotating reserves). This management concept has been illustrated/ shown in concrete terms for the turtle: tribal fishermen have noticed an increase in turtle stocks so now many people want to reopen the turtle fishery. Additionally residents of the tribes sometimes undertake individual initiatives to cope with various threats such some people planting mangroves to protect the coastline from erosion and to recreate fish breeding areas, others “breed” clams in the holes on the reef flat so the populations can self re-stock without being caught.

#### **Perceptions of the inclusion of the reefs under UNESCO guidance**

In general, the listing of the reefs as a World Heritage site is known by all users, but the goals of management and the project framework (limits of the zone and the interlocutors) are not explicit to the population. As a result the population remains wary regarding the results of this listing. The different types of fishers see it as a potential increase in regulatory constraints that generates fears about the project. Some recreational fishers perceive it as an opportunity to change attitudes towards environmental conservation (including

waste management) by raising awareness. However, for the people living in tribes, regulatory compliance is rather attributed to increased surveillance rather than changing attitudes of users. The heritage aspect highlighted by this project is understood by recreational and sport fishers, but not always by the people from the tribes that generally do not know the label (even the very concept of “heritage”). However, the awareness of heritage (in the sense of common heritage to pass on to future generations) may be reflected in the perception of the marine environment among people of the tribes. Indeed, the concept of preserving a resource (and the environment) so that future generations can benefit from it is essential in the eyes of the population, given the high dietary dependency in regards to marine resources. In addition, some people of customary law status see in this project an opportunity for the identification and recognition of the Kanak intangible cultural heritage, including toponymy, vernacular names of species and habitats, and taboos areas. In contrast, the sensitivity regarding legitimacy of speech, usages and properties attached to such knowledge requires taking all precautions in the census and enhancement process of this heritage.

#### **CONCLUSIONS ON THE USE VALUE AND LOCAL ISSUES OF THE LAGOON AND REEF ENVIRONMENT IN THE PONÉRIHOUE, POINDIMIÉ AND TOUHO AREA**

The total value of the environment can be calculated by the goods and services provided to the communities. It consists of use, non-use, and option (potential future uses) values. The different study results previously outlined allow drawing of a qualitative summary on the use value of the marine environment in the study area. Option and non-use values cannot be described as this requires interviewing non-user stakeholders of the lagoon on a very large scale (David *et al.*, 2007) that was not possible during this study. Use value refers to both the services the environment provides directly to humans (direct use value) and those used indirectly such as protection, control and assimilation functions that the environment provides (indirect use value) (Pascal, 2010). This value will not be evaluated here from an economic standpoint because the goods and services rendered by the marine environment cannot be precisely quantified using mostly qualitative data. Nevertheless, it is possible to qualitatively characterize this value.

#### **Direct use value of the lagoon and reef environment**

##### *Economic value of fisheries*

The formal fisheries sector accounts for 20 registered jobs and some of these fishers practice other activities. Added to this are others hired by fishers with a permit. The absence of a formal marketing channel limits job creation in the processing and marketing stages of products. Concerning the informal sector, sale (even occasional) of subsistence fishing

products is a source of income for a large share of families residing in tribes.

The exact calculation of the income generated in both formal and informal sectors, is impossible because the fishing industry is not structured: the fishing effort is difficult to estimate precisely (variable trip frequency and average catch quantities, mixing of species) and the marketing channel is hard to describe (percentage of sale is variable, numerous landing and marketing points, variable prices, sales logbook not informed in detail by professionals).

#### *Dietary value of the fisheries*

The survey on the consumption of local marine products shows that 69% of the surveyed population consumes them at least three times a week (Figure 7.10). Moreover, one can note that a majority of consumed products come from subsistence fishing: 84% of respondents report a partial consumption of caught products, and 40% of given products (Figure 7.11). However, it is difficult to precisely quantify the annual consumption, and even more detailed studies encounter difficulties because of the seasonal variability of the catch and the difficulty for respondents to accurately estimate the quantities consumed (Labrosse and Letourneur, 1998). An estimate of the economic value of self consumed resources by equivalence of protein replacement is difficult, especially since consumed species are varied, and some of them are not sold (and have no price comparison).

#### *Direct use value of other extractive activities*

The mining of sand doesn't seem to generate anymore employments today (sand extraction companies have apparently stopped their activity, and communes have apparently stopped the extraction of coral debris used for landfill). Mangrove wood is used for building huts (roof structure), although these architectural models seem to have become scarce. Finally, mangrove plants are used in local pharmacopoeia, and beyond possible uses by the pharmaceutical industry, are an alternative to purchasing medicine from pharmacies.

#### *Socio-cultural value of fisheries*

Seafood products are highly consumed during customary or religious ceremonies, and during various local cultural events. Some species are also used to make the traditional currency used in weddings and other customary ceremonies. These fisheries allow for the honoring of the various exchanges necessary to maintain social ties.

#### *Direct use value of non-extractive activities*

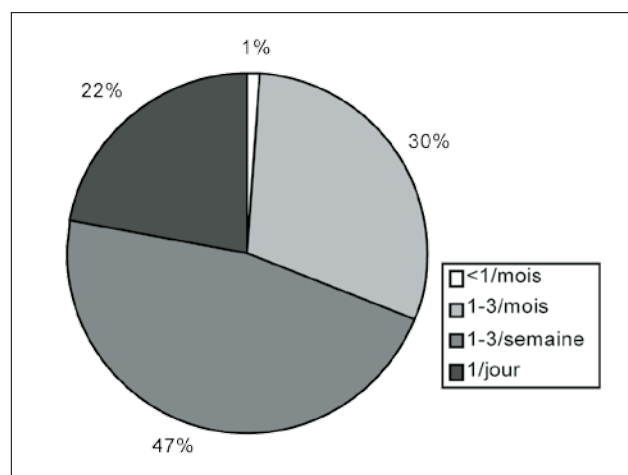
The tourism sector accounts for a dozen jobs through diving clubs, some sports fishing activities and marine transport to local islets. These activities are quite limited today, thus limiting their impact on the marine environment. Tourism potential is important in view of the rich local natural heritage. However, as expressed by the respondents, any large scale tourism development project (even in the way of

ecotourism) should take into account local realities and be established with the full involvement of the population.

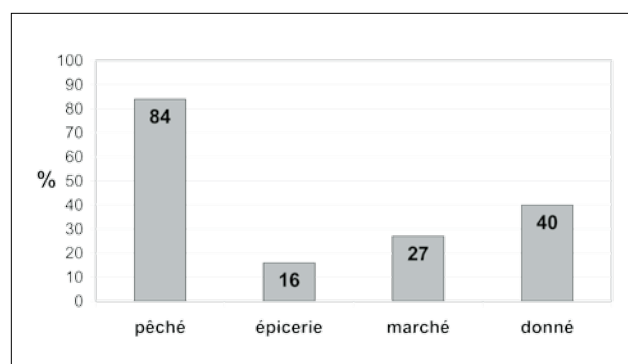
Additionally, the local natural heritage contributes to the attractive image of the area highlighted by the inclusion of the reefs as a site on the World Heritage list, and may therefore also benefit other local tourism activities not directly related to the marine environment (hotel, cottages, campgrounds, restaurants) (Pascal, 2010). This heritage also brings a recreational value to local residents, mainly for recreational and sports fishers. Finally, marine biodiversity also has an educational value: it is a familiar environment for local people, and is therefore often used in raising environmental awareness, especially among children in primary schools.

#### **Indirect use value of the lagoon and reef environment**

The reef also plays a vital role in protecting the coastline. It attenuates wave action, which offers protection against coastal erosion and allows mangroves to grow. More indirectly, ecological reef processes on the one hand provide the necessary physical materials to supply beaches, and also constitute a biological substrate for many species. Further considerable protection is offered by the reef against a tsunami (a possible but not negligible risk due to significant seismic



**Figure 7.10.** Consumption frequency of fisheries resources (n=90)



**Figure 7.11.** Means consumed fisheries resources procurement of (n=90).

activity present in Vanuatu located about 400 km from the area, and to housing concentration on the coast) .

Mangroves reduce wave action as well, thus providing protection against coastal erosion and tsunami risk (UNEP-WCMC, 2006). It is a habitat and breeding area for many species which are sold and consumed (e.g. fish, crustacean shellfish). Moreover, this environment contributes to the ecological systems' resilience towards cyclones, tsunamis, and climate change impacts, including rising sea level (Gilman *et al.*, 2006). Finally, mangroves have a sediment filtering and stabilizing role, preventing the reefs from being covered with silt and destroying them.

Finally, coral reefs and marine organisms as a whole (plankton, bacteria, seagrass beds, mangroves, fish etc) are among the most efficient natural carbon sinks in the world and capture more than half of the sequestered biological carbon in the world (Nellemann *et al.*, 2009).

### Major issues of the concerned territory

The values of goods and services provided by the lagoon and reef environment allow one to draw several conservation issues:

- economic issues:
  - protection against waves: decreased cost of preventing and repairing damage (bank protection, reparation of infrastructures and buildings),
  - carbon sequestration at a much lower price than that of machinery, significant hidden costs regarding the impact on climate disruption related to the amount of carbon released into the atmosphere in the event of degradation (Nellemann *et al.*, 2009)
- an issue of civil protection for persons residing on the coast: protection against tsunamis,
- an issue of food security: the reef ensures the availability of resources for much of the population who could not buy the equivalent in protein intake,
- an issue of social cohesion not only through the ceremonial, seasonal and special fisheries (for making traditional currencies) but also because the decline in resources is a significant risk for increased conflicts between users.

These issues are mainly focused on the fringing reefs (especially for the tribes adjacent to the communes) and on islets close to the villages. And in these areas, the high dependency on food, real-estate pressure, and the few economic alternatives available to the population increase the vulnerability of the coastal eco-social system (Goffin, 1998) in the face of demographical, environmental and economical fluctuations. But these are the areas most impacted by the various threats (including anthropogenic stressors from the catchment areas). Conservation of the lagoon and reef environment (especially the fringing reef) is therefore necessary to minimize the various risks involved.

## GENERAL RECOMMENDATIONS IN TERMS OF ENVIRONMENTAL MANAGEMENT

### Specific management activities/acts expressed by local stakeholders

Demands for an increase in the development of the DPM (Public Maritime Domain) remain small. Some users wish that land areas on the islets be equipped with facilities in order to reduce pressure on the wildlife present (e.g. shearwaters, turtles etc.). The main expectations include better information on the fragility of the environment, marking the trails to cross the islets, the installation of fixed rubbish bins and barbecues, and forbidding access to dogs. Moreover, stakeholders from the tourism sector consider it advantageous to install additional moorings near dive sites to avoid breaking the coral with anchors. Twenty moorings have already been installed by one of the operators, and an application was submitted to the provincial services to equip an additional dozen sites. Finally, harbor users sometimes notice the obstruction of entrance channels and wish for clearing work to be done on the entrances.

All users wish for a better collection of garbage (collection in the tribes, beaches and islets). The people from the tribes also seek information on the effects of daily waste pollutants (e.g. bags and cigarettes). The commercial deep sea fishers think the stock management of deep sea snapper is important because it is a sedentary fish. The fishers consider it important to undertake studies whilst the area is still rich. Requests for studies on the toponymy of customary marine and taboo areas are numerous. However, this heritage is sometimes linked to questions of territory legitimacy, and studies on the subject should be made by consensus according to collectively validated protocols. The ADCK (Agency for the Development of the Kanak Culture) specializes in this type of study and already has work methods established on these principles.

### General support regarding management of fisheries resources

#### Marine protected areas

Many residents of the tribes wish for the establishment of marine protected areas to preserve or restore fish stocks. However, the different stakeholders (e.g. customary representatives, subsistence fishers and commercial fishers) are aware of having different wishes regarding the choice of sites and actions to be implemented based on their issues. They are therefore ready to discuss these issues through a participatory management project, where they could be represented by stakeholder types so that their interests are taken into account. Other users of the marine environment are not opposed to the establishment of marine protected areas but also want to be involved during the consultation phase. The different users are seeking scientific expertise on the level of fish stocks to assess the management needs. However, most stakeholders emphasized the need to not permanently close an area to fishing, which corresponds to their concept of a

management regime aimed at rebuilding stocks so that fishing practices are sustainable. The various possible solutions (e.g. rotating marine protected areas, seasonal regulations etc.) remain to be defined with the local stakeholders according to the concerns and the ecological efficiency of these different tools in the interest of the environment and the fishing pressure. The acceptance of this type of management action is therefore subject to this condition.

### *Regulation*

The various users of the lagoon approve the existence of regulations for the conservation of fisheries stocks. However, current regulations are not easily accepted, especially by subsistence fishers who consider the quotas to be too restrictive and wish that dietary issue of this fishery be taken into account more. In addition, residents from the tribes insist on the incompatibility of the establishment of quotas with ceremonial fisheries. Indeed, during these fisheries, the few boat owners are required to fish for tens or even hundreds of people. However, the environmental code (CE) of Province Nord provides for special permits to exceed the quota for customary ceremonies (article 341-45, CE de la province Nord), but many fishers are not familiar with the regulations, and some confusion may be the source of tensions between users. It is therefore important to clarify the existing regulations with the public. Finally, according to some fishers, the quotas are not sufficient to adequately mitigate the impacts of fishing pressure because they do not take into account the species fished. They believe it would better to spread the fishing effort by establishing species quotas.

### *Surveillance*

The population of the tribes supports an increased surveillance over the lagoon to ensure the compliance of regulations. According to many respondents, the lack of control leads to cases where fishing quotas are breached, or even in the poaching of protected species. The main request is for increased controls at landing sites and in the marine protected area of Doïmen (located near the study area) to ensure the efficiency of management rules enacted. Commercial lagoon fishers also call for a regulation of alternative sales channels that generate, according to them, quota violations.

### **Involvement of local stakeholder in a management project**

#### *Opportunities*

The population from the tribes is familiar with the concept of environmental management as evidenced by the numerous management initiatives in different tribes (e.g. marine protected area, fishing regulations etc). Indeed, the importance of dietary and economic issues related to subsistence fishing often induces a strong desire to preserve stocks. Fishing pressure on the marine environment appears quite low, and the establishment of an environmental management project should not require highly restrictive regulations concerning the uses of the marine environment. However, as in all environmental management projects, all regulations must

be adapted to the practices and organizational modes of the locality in order to be accepted and ultimately to be effective.

Several social or customary networks are structural and may constitute a support for the dissemination of information. However, the multiplicity of these networks indicates many spheres of “power” and implies a degree of caution in their mobilization in terms of representativeness of the population.

The participatory management approach currently favored in management projects, as being carried out with the World Heritage site listing for these reefs, corresponds to the expectations of the population in terms of the consideration of issues and involvement opportunities in territory management. Moreover, the different users seem to want collective consultations to express their issues with other stakeholders and to find consensual solutions to different needs.

### *Levels and terms of organization with the population of customary law status in the area*

To address environmental management issues in a participatory and integrated manner, it is necessary to obtain support and approval of the area\* and district customary authorities. On the other hand, for the definition and implementation phases of management, the level of intervention is more difficult to define.

Regarding decision making related to fisheries management and maritime territories, the levels (i.e. area, district, and tribe) correspond to the different types of space ownership. Thus, concerning the management of the fringing reef, tribes are relatively autonomous and do not seem to appeal to the district for establishing regulations at the tribal level. In contrast, for decisions regarding the rest of the lagoon area, the district level seems more appropriate, apart for areas subject to clan claims (e.g. some islets or taboo areas etc.).

But in any case, contemporary customary allegiance relations transcend tribal and clan levels, and are also expressed at the district level. Thus, some Small Chiefs will not be able make decisions without consulting the district council. It is therefore important that the population provides a unanimous opinion at the district level. In addition, the district council bears a legitimate representative role at the administrative level because it is responsible for circulating information between people and the area\* council. Although this intermediary role of the district council should not be short-circuited, it is not a decision level but only one for the transmission of information and for the validation of decisions after consultation with representatives of the population. Thus, any environmental management project covering several coastal tribes of the area must find its course at the level of the district councils.

---

\* Translator's note: original word in french “aire”. In New Caledonia, the term “aire coutumière” translated literally as “customary area” corresponds to a level of customary authority. See the structure of the organizations of the Kanak society – Figure 7. 6.

However, the various issues that impede the customary scene today reinforce power games within the districts, undermining the theoretically collegial and consensual value of decisions validated at this level. The customary administrative authority of the districts cannot be considered as legitimate to represent or to make decisions for the tribes for a project without a preliminary collective validation of the authority as a foundation to be built first.

Moreover, one can note significant difficulties in transmitting information across the customary population, related in part to the instability of the contemporary social organization. Despite public consultations carried out at the district and tribe levels by institutional services for the recently revised fisheries regulations and for the participatory management project of the reefs listed as a World Heritage site, many people said they had clearly not been informed or consulted on these issues. The population from the tribes emphasizes the need to facilitate access to information about the consultation process.

### Recommendations

To facilitate the acceptance of environmental management projects, it therefore seems essential that representatives of the population are identified and validated collectively to ensure they are legitimate and representative. Indeed, this step will make it possible to facilitate the collective validation process for decision making, and reduces the risk of manipulation for the management of projects.

Two main practical recommendations can be drawn from this study concerning the implementation of environmental management project in the area. First, it is important to incorporate certain “logistical” features in the consultation process to ensure circulation of information (e.g. regular on site presence, flexibility in work schedules etc). If the work at the district level is an advantage in terms of logistics for cooperative work, then the advantages of working at this level should be considered only after the process has been permanently established.

Concerning the construction phases of participatory management, it seems essential to decipher the overlapping levels of legitimacy and the terms of representativeness to be able to work with the population. However, understanding these mechanisms (not to resolve them but to avoid reinforcing or crystallizing internal power struggles) requires a prior acceptance of the project to the population. People are often reluctant to deliver such information without being fully involved early in a project that would justify consideration of these issues. Some people clearly express a fear of data manipulation, as well as a feeling of lassitude towards not being involved in the development of projects. It is then necessary to initially establish the degree of participatory action (degree of autonomy that may benefit a management committee, types of possible management actions, acceptable legal arrangements).

### REFERENCES

- David G., Herrenschmidt J-B., Mirault E. 2007. Valeur sociale et économique des récifs coralliens du Pacifique Insulaire. Projet 1A4 du programme CRISP.
- GIE Océanide (Wickel A.). 2009. Étude de la toponymie coutumière marine et des sites d'intérêt patrimonial en Zone Côtière Ouest. Patrimoine mondial de l'UNESCO. Province Sud de Nouvelle-Calédonie.
- Gilman E., H. Van Lavieren, J. Ellison *et al.* 2006. Pacific Island Mangroves in a Changing Climate and Rising Sea. UNEP Regional Seas Reports and Studies n° 179. United Nations Environment Programme, Regional Seas Programme. Nairobi.
- Guiart J. 2004. Une clé de la société canaque, les réseaux d'identité partagée. Le Rocher-à-la-voile. Nouméa.
- Goffin L. 1998. L'environnement comme éco-socio-système. *In* : Loriaux M. Populations et développements : une approche globale et systémique. Académia-Bruylant/L'Harmattan. Louvain-La-neuve et Paris. Pp 199-230.
- Journal Officiel de Nouvelle-Calédonie. 13 mars 2001. Règlement intérieur du conseil coutumier Païci Camuki, Délibération n°01/D du 20 décembre 2000. p. 1405.
- Labrosse P. et Letourneur Y. 1998. Définition et mise en œuvre de méthodes de suivi des stocks et de la pression de pêche des poissons d'intérêt commercial des lagons de la Province Nord de la Nouvelle-Calédonie. Conventions Science de la mer. Biologie marine, n°21. ORSTOM. Nouméa.
- Leblic I. 1999. Pêcheurs kanak et politiques de développement de la pêche en Nouvelle-Calédonie. *In* : Blanchet G. Les petites activités de pêche dans le Pacifique Sud. IRD. Paris. Pp 119-141.
- Leblic I. 2002. Classification des poissons dans quelques langues de Nouvelle-Calédonie. *In* : Colombel V. et Tersi B. Lexique et motivation. Peeters. Paris. Pp 115-142.
- Menu S., Hébert P. 2006. Les lagons de Nouvelle-Calédonie : diversité récifale et écosystèmes associés. Dossier d'inscription des lagons au Patrimoine mondial de l'humanité. Rapport Sven Menu Consultant. Nouméa.
- Nellemann C., Corcoran, E., Duarte, C. M. *et al.* 2009. Blue Carbon A Rapid Response Assessment. United Nations Environment Programme. GRID-Arendal.
- Pascal N. 2010. Écosystèmes coralliens de Nouvelle-Calédonie. Valeur économique des services écosystémiques. Partie 1 : Valeur financière. IFRECOR. Province Sud de Nouvelle-Calédonie et CPS.
- Province Nord. 2008. Code de l'environnement. Assemblée du 24 octobre 2008.
- Rivierre J-C. 1983. Dictionnaire Païci-Français. Selaf. Paris.
- Rivierre J-C. 1994. Dictionnaire Cèmuhi-Français. Selaf. Paris.



- UNEP-WCMC. 2006. In the front line : shoreline protection and other ecosystem services from mangroves and coral reefs. UNEP-WCMC. Cambridge.
- Institut de la Statistique et des Études Économiques ((ISEE 2009). Key figures. Website: <http://www.isee.nc/anglais/keyfigures/keyfigures.html>
- Institut de la Statistique et des Études Économiques (ISEE). 2004. Statistiques « fiches communes ». Website : [isee.nc/portraitcommune/presentcommune.html](http://isee.nc/portraitcommune/presentcommune.html).