4 of 4

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GEORGE H. BALAZS
BIOLOGIST AND LEADER
MARINE TURTLE RESEARCH

CMA-CGM MATISSE

PACIFIC ISLANDS FISHERIES SCIENCE CENTER
NOAA, NATIONAL MARINE FISHERIES SERVICE
2570 DOLE STREET
HONOLULU, HAWAII 96822-2396
Cell: (808) 286-2899
Office: (808) 983-2902
Fax: (808) 983-2902
gbalazs@honlab.nmfs.hawaii.edu

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- îlot Tighit (Hienghène),
- îlot Hiéghène (Hienghène),

* La nuit du 27 au 28 décembre :
- îlot Néba : 2 équipes sur 2 sites différents (Poum),

* La nuit du 28 au 29 décembre :
- îlot Tiam-Bouéne (Poum),
- plage de la Roche Percée (Bourail)

* La nuit du 29 au 30 décembre :
- îlot Atiré (lagon Sud),

* La nuit du 2 au 3 janvier :
- île Beautemps-Beaupré (Ouvéa).

3 – Bilan des missions terrain

Ce bilan comprend à la fois les missions « vérité terrain » et les missions qui ont été réalisées par la suite sur les sites les plus important de ponte. Ces missions avaient pour but d'obtenir des échantillons génétiques, de poser des bagues sur les tortues et d'étudier les menaces qui pèsent sur ces espèces.

Localité	**date**	**îlot/plage**	**Chef d'équipe**	**Nbr de personnes**	**Travail réalisé**
Poindimié	26.12.06	Bois de Fer	M. Brinker	5	Nuit
	27.12.06	Tibarama	M. Brinker	5	Visite
		Faux Tabac			
		Bois de fer			
		Sable			
	29.12.06	Bayes	M. Brinker	6	Nuit
	30.12.06	Bois de Fer	M. Brinker	6	Visite
		Sable			
		Faux tabac			
	30.12.06	Bayes	M. Brinker	6	Nuit
	31.12.06	Bois de Fer	M. Brinker	6	Visite
		Sable			
		Faux Tabac			
	02.01.07	Bayes	M. Brinker	6	Nuit
	03.01.07	Bois de Fer	M. Brinker	6	Visite
		Faux Tabac			
	06.01.07	Bayes	M. Brinker	7	Nuit
	07.01.07	Bois de Fer	M. Brinker	7	Visite
		Faux Tabac			
	10.01.07	Bayes	M. Brinker	5	Nuit
	11.01.07	Bois de Fer	M. Brinker	5	Visite
		Faux Tabac			
	13.01.07	Bayes	M. Brinker	3	Nuit
	14.01.07	Bois de fer	M. Brinker	3	Visite

		Faux Tabac			
	18.01.07	Bayes	J.Baudat-F.	WWF 1+4	Nuit
	18.01.07	Bois de Fer	M. Brinker	4	Nuit
	23.01.07	Tibarama	M. Brinker	5	Visite
	23.01.07	Bayes	M. Brinker	5	Nuit
	24.01.07	Bois de Fer	M. Brinker	5	Visite
		Faux Tabac			
	26.01.07	Bayes	M. Brinker	5	Nuit
	27.01.07	Bois de Fer	M. Brinker	5	Visite
		Faux Tabac			
		Sable			
Hiéghène	24.12.06	Hiengabat	J.Baudat-F	WWF1+1 ?	Nuit
	25.12.06	Hiengabat	J.Baudat-F	WWF1+1 ?	Nuit
	26.12.06	Hiéghène	J.Baudat. F	WWF1+4	Nuit
	26.12.06	Hienga	H. Blaffart	6	Nuit
	27.12.06	Hienga	H.Blaffart	2	Nuit
	26.12.06	Hiengabat	Guillaume	4	Nuit
	27.12.06	Ouao	Neyrow	2	Nuit
	26.12.06	Thigit	L. Ribot	4	Nuit
	31.12.06	Hienga	L. Ribot	2	Nuit
	11.01.07	Hiengabat	M.Sebille	2 ?	Nuit
	12.01.07	Hiengabat	M.Sebille	2 ?	Nuit
	25.01.07	Hienga	J.Baudat-F	WWF1+4	Nuit
	27.01.07	Thigit	L. Ribot	2	Nuit
Poum	23.12.06	Ouane	H.Blaffart	1	Visite
	27.12.06	Néba	JJ. Cassant	WWF1 + PN 1 + 2	Nuit
	28.12.06	Néba	J.Barrau	3 ?	Nuit
	28.12.06	Tiam-Bouéne	JJ.Cassant	WWF 2 + PN 2 + 1	Nuit
	11.01.07	Ti-Ac	JJ.Cassant	PN 2+2	Nuit
	24.01.07	Kendec	N.Cornuet	PN 2+2	Nuit
Bourail	28.12.06	Roche Percée	D.Laffage	2	Nuit
Ouvéa	02.01.07	Beautemps-Beauprè	L.Verfaille	4	Nuit
	03.01.07	Beautemps-Beauprè	L.Verfaille	3	Nuit
	04.01.07	Beautemps-Beauprè	L.Verfaille	3	Nuit
Yaté	07.01.07	Baie Dowé	D.Fougerolles	5	Nuit
	13.01.07	de la Baie de Dowé au Cap Tô Ndu	D.Fougerolles	4	Visite
Lagon Sud	29.12.06	Atire	C. Goirant	5	Nuit
	31.12.06	Uatérembi	C.Limpus	WWF 3+3	Nuit
	02.01.07	Mbo	M.Pandolfi	PS 2	Visite
		Mbé Kouen			
		Signal			
		Larégnère			
		Goéland			
		Ié			
		Ronde			
		Lange			
	03.01.07	Mba	M.Pandolfi	PS 2	Visite
	04.01.07	Amédée	P.Plichon	PS 4 + 1 Z	Visite

	06.01.07	Rédika	M.Pandolfi	PS 4 + 1 Z	Nuit
	07.01.07	N'Da	M.Pandolfi	PS 4 + 1 Z	Nuit
	07.01.07	Mboré	M.Pandolfi	PS 4 + 1 Z	Visite
		à côté Koko			
		Koko			
	08.01.07	Kouaré	M.Pandolfi	PS 4 + 1 Z	Nuit
	08.01.07	Uié	P.Chavance	PS 4 + 1 Z	Visite
		Gi	P.Plichon		
	09.01.07	Téré	M.Pandolfi	PS 4 + 1 Z	Visite
		Ngé			
		Uatérembi	P.Chavance		
	09.01.07	Ua	M.Pandolfi	PS 4 + 1 Z	Nuit
	09.01.07	Uatio	F.Armand	PS 4 + 1 Z	Nuit
	13.01.07	Ua	H.Géraux	WWF1 + 3	Nuit
	13.01.07	Uatio	S.Mounier	WWF2 + 3	Nuit
	13.01.07	Rédika	YE.Boyeau	6	Nuit
	13.01.07	Plage pointe noire	P.Perrier	4	Visite
		presqu'île Beaupré			
		île Gaua			
		Parsevale			
		Layrle			
		Verte			
	20.01.07	Mba	H.Géraux	WWF1 + 2	Nuit
Île des Pins	18.01.07	Plage Kodjeu/Gadji	S.Mounier	WWF + 1	Visite
	20.01.07	Ana	S.Mounier	WWF 2 +1	Visite
		Ami			
		Nekaâwi			

Tableau 1 : Récapitulatif des actions menées sur le terrain lors de l'Opération Tortues NC 2006/2007, vérité terrain comprise, jusqu'en fin janvier 2007.

Remarque :

Dans la colonne « Nbr de personnes » voici la signification des abréviations :

PS = province Sud	PN = province Nord
WWF = l'association du WWF	Z = ZonéCo
PS 4 + 1 Z = 4 personnes de la province Sud et une personne de Zonéco	WWF 2 + 3 = 2 personnes du WWF et 3 bénévoles.

4- Bilan des participations

Participation	**Description (jusqu'à fin janvier 2007)**	
WWF	Nombre de jours-homme de travail Ahab Downer	15
	Nombre de jours-homme de travail Hubert Géraux	7
	Nombre de jours-homme de travail Hélène Bucco	2
	Nombre de jours-homme de travail Sophie Mounier	76
	Nombre de jours-homme de travail Julien Baudat-Franceschi	5
Bénévoles	Nombre de nuits passées sur les îlots par des bénévoles	36
	Nombre de jours-homme fournis par les bénévoles	283
	Nombre de jours de bateau prêté par des bénévoles	64
PS	Nombre de jours de bateau de la PS	8
	Nombre de nuit passées sur des îlots par la PS	5
	Nombre de jours-homme de la PS pour l'OT (formation incluse)	39
	Nombres de jours-homme de récupération	40
PN	Nombre de jours de bateau de la PN	7
	Nombre de nuits passées sur des îlots par la PN	4
	Nombre de jours-homme de la PN pour l'OT (formation incluse)	16
	Nombre de jours-homme de récupération	14
PI	Nombre de jours-homme de la PI : formation tortue	3
Gouvernement	Nombre de jours de travail fournis par le Gouvernement/DTSI	4
	Nombre de jours-homme du gouvernement pour la formation tortue	3
ZonéCo	Nombre de jours-homme de travail fourni par ZonéCo (formation incluse)	6
Total	**Nombre total de nuits passées sur les îlots ou plages au total**	**45**
	Nombre de fois où des plages ou des îlots ont été visités pour le comptage des traces au total	**54**
	Nombre de jours-homme de travail fournis au total (sans compter les jours de récupération pour les provinces)	**454**

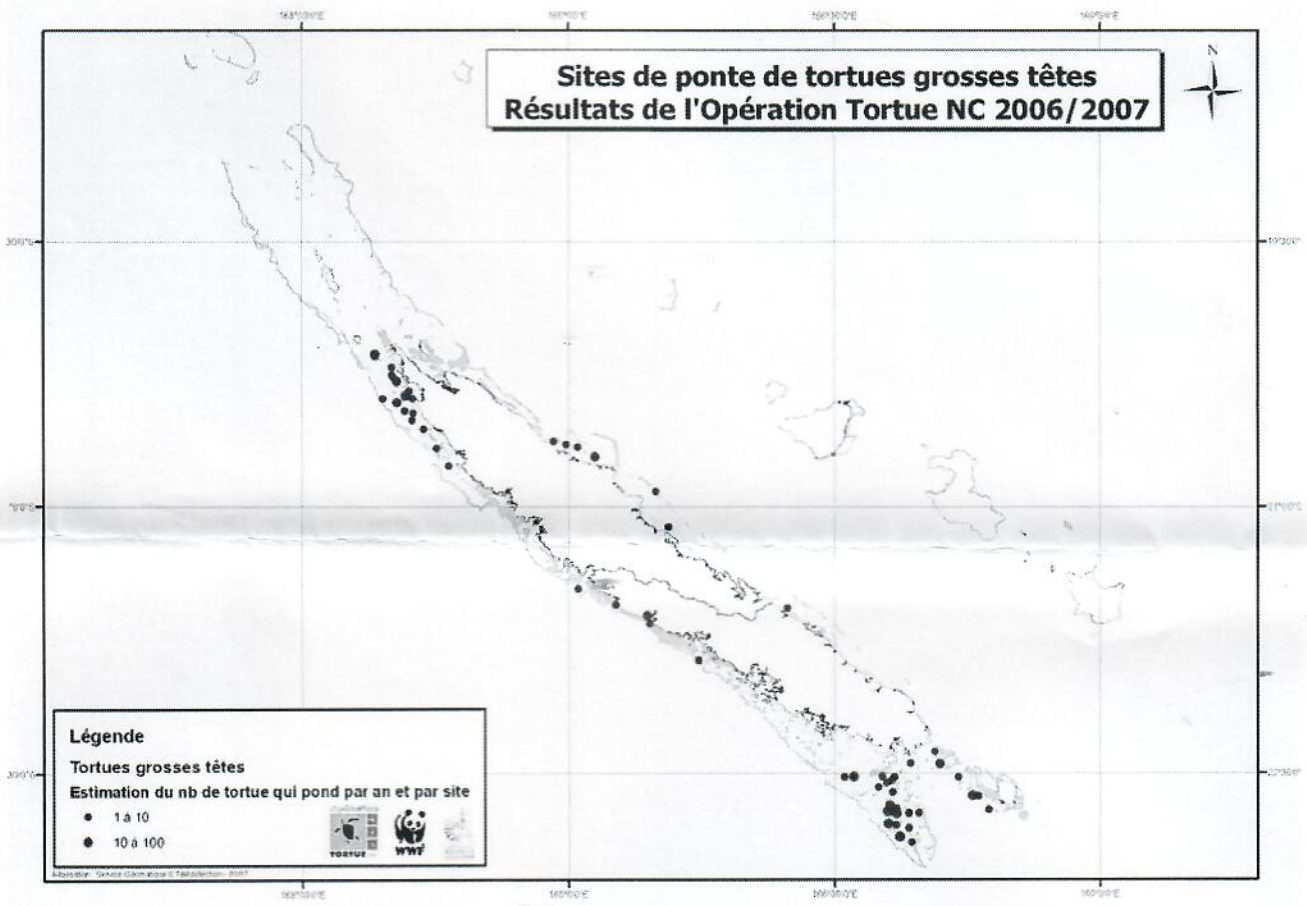
Tableau 2 : Estimation de la participation des différents partenaires à l'Opération Tortue NC 2006/2007 jusqu'à fin janvier 2007.

B – Résultats obtenus

1) – Concernant les sites de pontes

a) Les tortues grosses têtes

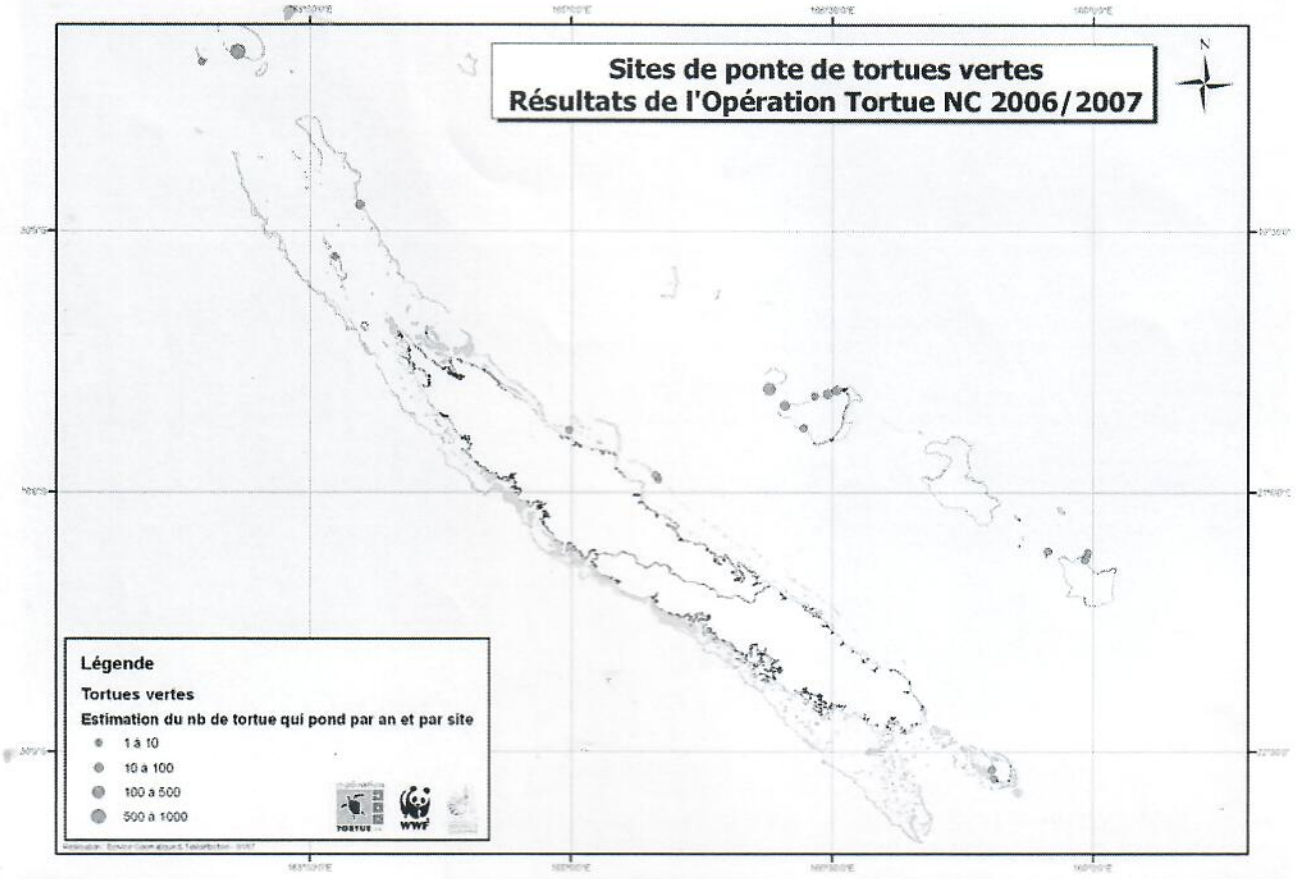
- 51 sites de ponte recensés dont seulement 3 sur des plages de la , tous les autres sur des îlots du lagon de la ,
- estimation du nombre de femelles « grosse tête » qui pondent en NC par an : 200,
- soit : 20% du nombre de femelles qui pondent dans les îles du Pacifique Sud.



Carte n° 2 : Sites de ponte de tortues « grosse tête » (Caretta caretta) recensés par le Dr Colin Limpus lors de l'étude aérienne réalisée par le WWF entre le 27.12.06 et le 03.01.07.

b) – Les tortues vertes

- 22 sites de ponte recensés, dont aucun sur la Grande Terre, très peu sur les îlots du lagon de la Grande Terre, un peu dans les îlots du lagon d'Ouvéa mais essentiellement sur les îlots du récifs des Entrecasteaux,
- estimation du nombre de tortues vertes femelles qui pondent en NC : entre 1000 et 2000, ce qui représente le plus grand site de ponte de tortues vertes de toutes les îles du Pacifique Sud.



Carte n° 3 : Sites de ponte de tortues vertes (Chelonia mydas) recensés par le Dr Colin Limpus lors de l'étude aérienne réalisée par le WWF entre le 27.12.06 et le 03.01.07.

c) - Les autres espèces de tortues marines

- Aucune autre espèce de tortues marines n'a présenté une activité de ponte,
- les tortues « bonnes écailles », assez répandues, fréquentent donc le lagon calédonien pour leur alimentation mais ne pondent pas (de manière significative) en Nouvelle Calédonie.

2) – Les prélèvements génétiques et la pose de bagues

Malgré l'investissement humain et logistique important, le nombre de tortues observées sur le terrain lors de la ponte est faible. Notre objectif était d'avoir 10 échantillons génétiques par espèce et par zone de ponte. Par zone de ponte nous entendons un ensemble de sites de ponte que l'on peut regrouper selon un critère de proximité. Nous sommes loin de nos objectifs. Cependant, les échantillons génétiques peuvent se conserver plusieurs années, donc cette collecte pourra être complétée l'année prochaine.

Dans le tableau suivant, est indiqué le nombre de tortues baguées et collectées génétiquement par zone de ponte et par espèce. Deux zones n'ont pas été prospectées car estimées comme trop peu fréquentées : Maré et l'île des Pins pour les tortues vertes. Une trentaine de tortues « grosse tête » de la Roche Percée ont déjà été prélevées génétiquement il y a deux ans par des étudiants de Colin Limpus avec l'aide de l'ASNNC, donc cela n'a pas besoin d'être refait. De plus la plage de la Roche Percée bénéficie cette année d'une haute surveillance : l'association Bwara Tortue Marine bague les tortues et protège les nids avec l'aide de l'ASNNC. Nous n'avons donc pas jugé utile de travailler sur ce site de ponte. De même, les îlots des récifs des Entrecasteaux ont déjà été bien

Les tortues vertes ignorent les courants

Comment les tortues retrouvent-elles leur chemin en dépit des courants.

Pour étudier les capacités de navigation des tortues vertes *(Chelonia mydas)*, prenez trois spécimens, équipez-les de balises satellitaires et lâchez-les à plusieurs centaines de kilomètres de leur site de ponte favori, lieu qu'elles chercheront à rejoindre immanquablement. Le fait qu'elles arrivent finalement à destination fait-il d'elles de fines navigatrices ? En fait, si elles corrigent leur cap régulièrement pour se réorienter, elles semblent incapables de compenser la dérive due aux courants. Sur les trois tortues relâchées par Charlotte Girard au large d'Europa, petite île située dans le canal du Mozambique, la plus habile a réussi à retrouver son site après avoir parcouru une distance 5 fois égale à celle l'en séparant en ligne droite, alors que la lanterne rouge a mis 59 jours et couvert 3 515 km au terme de multiples boucles, alors qu'elle n'avait été lâchée qu'à 245 km de l'île. Cependant, « *il ne faut pas trop se fier à ces informations puisque les courants sont responsables en bonne partie de ces longues distances !* » tempère la chercheuse. En retirant l'impact des courants des trajectoires relevées, elle a calculé les « trajets locomoteurs » des tortues, ces trajectoires « virtuelles » qu'auraient parcouru les animaux en l'absence de courant. Ces travaux réalisés sous la direction conjointe de Laurent Dagorn (IRD, UR109) et Simon Benhamou (CNRS, CEFE), et dans lesquels se sont impliqués l'Ifremer, l'université de Pise et le Centre d'étude et de découverte des tortues marines de la Réunion, montrent que les trajets locomoteurs restent bien orientés. Les tortues nagent donc en moyenne dans la bonne direction et les écarts sont dus à leur incapacité à compenser les courants. Si elles ne naviguent pas « à l'estime », et ne semblent pas avoir de « carte mentale » pour s'orienter, comment font-elles pour corriger leur cap et retrouver leur plage ? Les chercheurs soupçonnent les tortues d'utiliser une information géomagnétique pour naviguer en plein océan et des expériences sont en cours pour valider l'hypothèse. Cette étude montre aussi que les tortues ne semblent pas utiliser des informations olfactives en provenance de l'île et véhiculées par les courants. Néanmoins, des expériences antérieures suggèrent qu'elles utiliseraient des informations transportées par les vents. Si les techniques de navigation des tortues marines restent encore mystérieuses, l'étude a le mérite de montrer qu'il faut se méfier des conclusions hâtives fondées uniquement sur des relevés de trajectoires. Les boucles suivies par les tortues doivent-elles être interprétées comme une stratégie de recherche, comme le font certaines fourmis lorsqu'elles pensent approcher de leur nid ? Probablement pas, puisque l'analyse fine des courants montre que ces boucles sont principalement dues à des tourbillons cycloniques et anticycloniques. Les tortues, elles, pensent continuer à progresser dans des directions qu'elles estiment les meilleures pour rejoindre leur objectif. ●

Contact

Charlotte Girard
Charlotte.Girard@cls.fr

En savoir plus

C. Girard, J. Sudre, S. Benhamou, D. Roos, P. Lushi, *Homing in green turtles Chelonia mydas : oceanic courrents act as a constraint rather than as an information source*, *Marine Ecology Progress Series*, Vol. 322 : 281-289, septembre 2006.

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Tortues marines **Chelonia mydas.**

trypanolytique à l'encontre de *T. evansi*, comme de *T. b. brucei*. En revanche, ces mêmes souches ont été détruites au contact d'un sérum normal. Les analyses du sérum infecté n'ont pas permis de détecter la présence de protéine ApoL-1. Cependant, l'ajout d'une quantité normale d'ApoL-1 pure dans le sérum infecté a suffi à restaurer sa capacité à détruire les différentes souches de parasite. Cette déficience en ApoL-1 observée chez le patient est par conséquent clairement à l'origine de l'unique cas d'infection par *T. evansi* identifié à ce jour.

L'analyse de la séquence du gène ApoL-1, effectuée sur l'ADN du patient, révèle que l'absence de l'apolipoprotéine est due à une double mutation affectant sa synthèse. La détermination de la fréquence de telles mutations, au sein des populations en contact avec des animaux infectés, devrait permettre une meilleure évaluation du risque d'émergence de cette nouvelle forme de trypanosomiase. ●

1. Ces recherches ont été conduites par les scientifiques du Laboratoire de parasitologie moléculaire de l'université libre de Bruxelles (Belgique), en collaboration avec Philippe Truc de l'UR177 de l'IRD, les médecins du département de médecine du *Government Medical College* de Nagpur (Inde), de la direction des services de santé de Mumbai (Inde) et de l'OMS (Genève, Suisse).

Contact

Philippe Truc
truc@mpl.ird.fr

To George BALAZS Marine Turtle Research - Hawaii.
Fax nº 00. 1. 808. 983. 2902.

Dear George - E-mails are now working correctly.
This article for your information. I have received from Lui BELL, Sprep copy of the article on Marine Turtles of the South Pacific from Peter Pritchard, absolutely obsolete!
Best regards. Jean Louis d'AUZON

BILAN PRELIMINAIRE DES VOLETS SURVOL ET MISSION TERRAIN DE L'OPERATION TORTUE NC 2006/2007 FEVRIER 2007

Introduction

Rappel : le but de l'Opération Tortue NC 2006/2007 est de compléter les données scientifiques essentielles pour assurer la conservation et la bonne gestion des espèces de tortues marines qui viennent pondre en .

Les objectifs à court terme sont :
1) de recenser tous les sites de pontes des tortues marine en Nouvelle Calédonie
2) d'obtenir une estimation du nombre de femelles tortues qui viennent pondre dans ces sites
3) d'impliquer les collectivités compétentes et les aider à mettre en place des activités de conservation et de gestion des tortues marines
4) de contribuer à changer le comportement de la population calédonienne vis-à-vis de ces espèces pour une meilleure protection et ceci à l'aide d'une campagne de sensibilisation.

Ce bilan préliminaire a pour but de partager les résultats disponibles à ce jour, avec les partenaires, les bénévoles, les associations et plus généralement, avec tous ceux intéressés par l'Opération Tortues NC 2006/2007 et ceci avant le rapport de mission du Dr Colin Limpus, prévu pour mai 2007 et le rapport final de l'Opération Tortues NC 2006/2007, rédigé par le WWF et prévu pour fin mai 2007. Ce document reste donc succinct et s'adresse à un public averti.

Ce bilan se contente de fournir certains résultats bruts sans en faire l'interprétation. Cette interprétation des résultats sera faite dans les deux rapports finaux.
Les résultats exposés ne concernent que les zones étudiées lors de l'Opération Tortue NC 2006/2007 à savoir :

- les côtes de la Grande Terre, de l'île des Pins et des îles Belep,
- les îlots du lagon,
- les côtes des îles Loyauté et de leurs îlots,
- dans les récifs des Entrecasteaux : l'îlot Surprise,
- l'îlot Portail

De plus ce bilan ne prend pas en compte la sensibilisation, volet du projet qui est encore en cours.

A – Bilan des moyens logistiques

1) - Le survol

Le survol de toutes les côtes de , des îles Loyauté et des îlots s'est effectué sur 6 jours, comme prévu, à basse altitude (environ 35m au dessus des plages).
Le survol a été réalisé à l'aide du Cessna 206 (6 places avec ailes hautes) de la société *Verticale Passion*. Cependant, lors du troisième jour de vol, un problème technique est survenu sur la radio de l'avion. Le temps de la réparation, l'avion a été immobilisé deux jours. Pour ne pas prendre de retard, le 4em jour de vol prévu s'est effectué en l'ULM. Puis les 5em et 6em jours à nouveau avec le Cessna 206 remis en état.

étudiés et n'ont pas fait l'objet de prospection sur le terrain (l'ASNNC a bagué environ 3500 tortues vertes et prélevé génétiquement une centaine de tortues vertes sur ces îlots).
* En ce qui concerne les sites de ponte de tortues vertes dans les îlots d'Ouvéa : nous avons prospecté le site de ponte majeur mais nous n'avons pas encore l'autorisation officielle de prélèvement de la part de la province des Îles.

Espèce	**Zone de ponte**	**Nbr de tortues baguées**	**Nbr d'échantillon génétique**
Tortue grosse tête	Nord Est (Poindimié/Hienghène)	0	0
	Nord Ouest (Koumac/Poum)	1	1
	Roche Percée : non prospecté	-	-
	Lagon Sud	3	3
Tortue Verte	Nord Est (Poindimié/Hiénghène)	4	4
	Maré : non prospecté	-	-
	Ouvéa	*	*
	Île des Pins : non prospecté	-	-
	Récifs des Entrecasteaux : non prospecté	-	-

3) – Les menaces

Les données sur les menaces n'ont pas encore été analysées.

Conclusion

Nous avons globalement atteint nos objectifs concernant le survol aérien (malgré la panne de radio lors du 3ème jour de vol). Notre première estimation (qui sera confirmée par une analyse systématique des cartes par la suite) du pourcentage de plages survolées est de 95% de la totalité des plages calédoniennes, qui sont les sites de ponte potentiels. Ce qui confère à ce recensement des sites de ponte de tortues marines le caractère quasi exhaustif que nous souhaitions.

En ce qui concerne les actions sur le terrain, nous avons dépassé notre objectif de 40 nuits passées sur le terrain (avec un total de 45 nuits). En revanche, le nombre de prélèvements et de tortues baguées est inférieur à nos espérances.

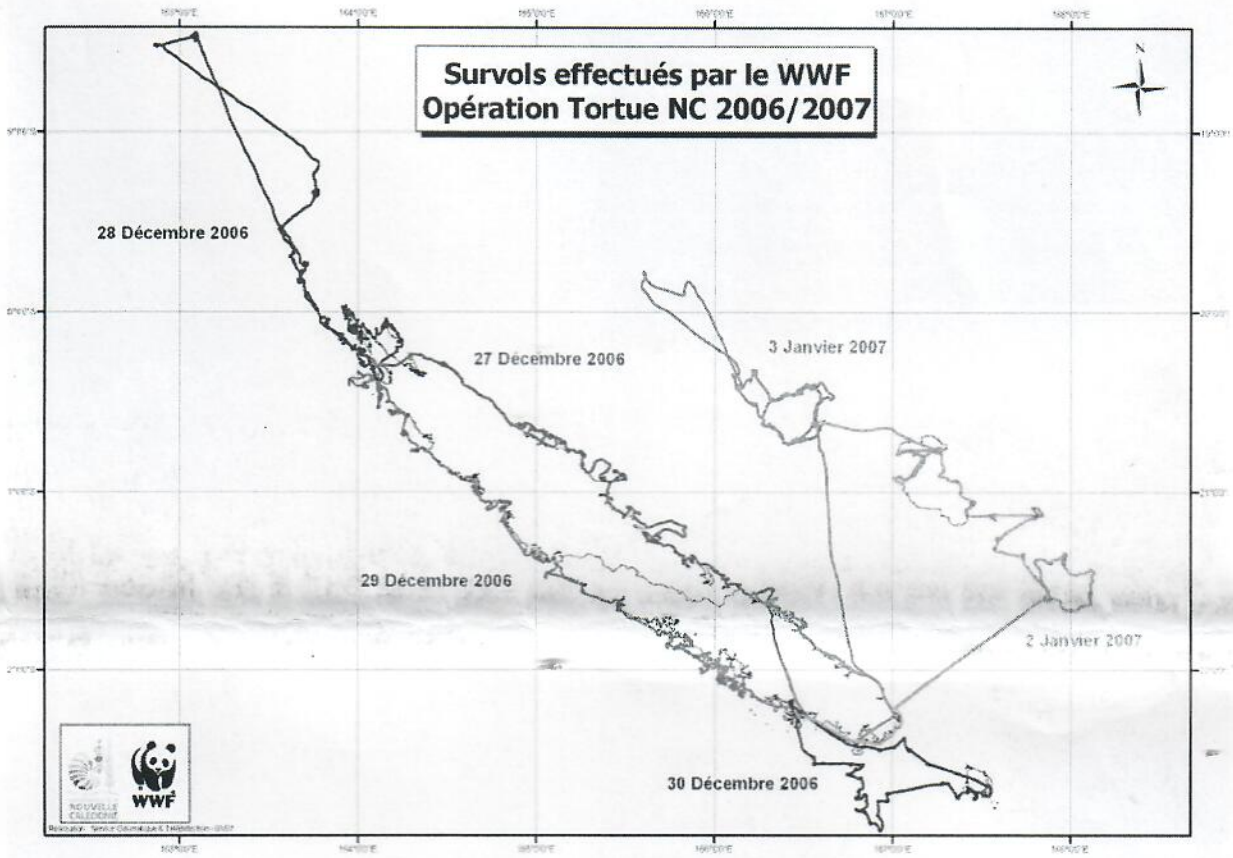
Nous remercions nos partenaires pour leur participation à ce projet, notamment la province Sud pour son soutien et son implication sur le terrain (îlots du lagon Sud), la province Nord pour sa persévérance dans son implication sur les îlots de la zone Nord-Ouest malgré les difficultés logistiques, le Gouvernement au travers de la DTSI qui nous a fourni un soutien technique indispensable et de ZonéCo pour son aide sur les missions de terrain.

Nous remercions les bénévoles qui nous ont fourni des moyens humains et des moyens logistiques énormes (64 jours de bateaux mis à disposition avec, dans la plupart des cas, le carburant offert par le capitaine !).

Enfin, nous remercions le US Fish and Wildlife service et Native Iris Fund qui nous ont fourni les moyens financiers nécessaires à cette opération.

Soit au total :
- 6 jours de survol avec en moyenne 5h30 de vol
- 28 heures et 20 minutes de survol aérien en Cessna 206
- 4 heures et 40 minutes en ULM
- estimation du kilométrage de survol : 5200 km.

Voici la carte des 6 jours de survol. Celui du 30 décembre est le survol réalisé en ULM.



Carte 1 : Tracés GPS des survols réalisés lors de l'Opération Tortues NC 2006/2007 pour le recensement des sites de ponte des tortues marines

2) - La vérité terrain

Nous appelons « vérité terrain » l'ensemble des missions qui ont eu lieu sur le terrain pendant la période du survol aérien (du 26 décembre 2006 au 3 janvier 2007) et qui avaient pour but de fournir des informations complémentaires à celles recueillies par voie aérienne. Des équipes sont allées passer la nuit précédant le survol sur certaines plages ou îlots pour compter le nombre d'anciennes traces, le nombre de tortues montées pendant cette nuit là et relever l'espèce des tortues rencontrées. Ces informations vont êtres comparés à celles obtenues par avion et font partie intégrante de la méthodologie du comptage aérien du Dr Colin Limpus.

Total des sites « patrouillés » pendant la nuit avant le survol : 11.

* La nuit du 26 au 27 décembre :
- îlot Bois de Fer (Poindimié),
- îlot Hienga (Hienghène),
- îlot Hiengabat (Hienghène),

9-19-2012 Wednesday DAY 1 745 AM STARTED WORK

PIT LHF / BATCH I 9/19/2012 N=12

SIZE 1 MONEL TAG

XU 44 "ROSALINDA" ALL PITSLHF

TIME TAG STARTED 0829 @ 9/20/12

4C3C694F65

:washer 32.0 cm CCL 4/92T

Argos = 71920
Tag # = 1051209
Light Carapace COLORED
fecal swab
paper Logo = 1 (RL3)
under fiberglass

WN 72 "Stephanie"

4C3B3F5D06

:solid 31.5 cm CCL

~0820 @ 9/20/12

fecal swab
Argos = 50156
Sat tag # = 1150877
Logo = 6 (RL3)

XU 48 "BATMAN"

4C3D164F33

:washer 31.5 cm CCL

0837 @ 9/20/12 4/92T

fecal swab
argos # : 88058
sat tag: 1051188
Logo = 9 (RL3)

WN 79 "VICTORIA"

4C3B3A4712

solid 36.0 cm CCL

0836 @ 9/20/12 4/92T

fecal swab
Argos # : 41789
Sat tag # = 1151375
Logo = 4 (RL3)

XU 4 "KATE"

4C3C58220F

:solid 31.5 CCL

0820 @ 9/20/12

swab solid
argos # = 52703
Sat tag # = 1151379
Logo = 2 (RL3)
On at 0820 @ 9/20/12

WN 71 "ADRIANNA"

4C3B465E48

washer 4/92T

on 0829 @ 9/20/12

swab
argos # 40476
sat tg # = 1051200
Logo = 5 (RL3)
31.0 CCL

DENISE PARKER
FAX +1-541-867-0505

ED ORK =12

ALL 1 year 7 Months OLD from BOURATE 9/19/2012 Wednesday

SIZE 1 MONEL TAG Pit Tag

4C3B60081D

WN 80 "ANGIE" 34.5 cm CCL 4/92 T

fecal Swab =solid
Argos # = 88056 on 0846
Sat # = 1150882 @9/20/12
Logo = 12 (RL3)

size 1 tag fell off (corrosion) on 9/20/12

WN 87 "GAD"

4C3D1E1432

33.0 CCL 4/92T

swab Washer
Argos # = 88063
Sat # = 1051193 on 0847 @9/20/12
Logo = 7 (RL3)
size 1 metal replaced tag w/ XU65 on R3-4F

XU50 "MARINA"

4C3D23564B

31.5 CCL 4/92T

swab
Argos: 41457 Sat tag # = 1051205
Logo = 10 (RL3)
Washer 0831 @9/20/12

WN95 "CÉLINE"

4C3B4D553D

36.0 CCL 4/92 T
washer 0837 @9/20/12

swab
Argos = 88065
Sat tag # = 1051195
Logo = 11 (RL3)

WN65 "SOPHIE"

4C3B4C571D

solid
0831 @9/20/12
33.0 CCL

swab
Argos = 40719
Sat tag # = 1151373
Logo = 8 (RL3)

WN88 "BLANCHE N."

4C3B5A7852

4/92T
32.5 CCL

swab Argos = 71923
Sat # = 1051211
Logo = 3 (RL3)
washer
0835 @9/20/12

simple

FAX +1-541-867-0505

0/12

5

DAY 1 BATCH 2 9/19/2012 Wednesday
N=10

Pit =

XU13 "CENDRILLON" 4C3C67471F solid on 0829 @9/20/12 41.0 CCL Argos # = 57141 Sat Tag# = 1151382 Logo # = 13 4/92 T

38.0 CCL

XU35 "FRIJOLITO" 4C3C605976 solid 0827 @ 9/20/12 Argos # = 50139 Sat Tag = 1150873 Logo = 16 4/92

XU52 "AMEL" 4C3B493072 washer 0833 @ 9/20/12 35.5 CCL Argos = 88061 Sat Tag: 1051191 Logo = 21 4/92 T

WN45 "PACO" 4C3B382A70 solid 0830 @ 9/20/12 31.0 CCL Argos = 50150 Sat Tag = 1150875 Logo = 14 4/92 T

36.5 CCL

WN57 "RENAUD" 4C3D1B2663 washer 0847 @ 9/20/12 Argos = 40728 Sat Tag = 1051202 Logo = 20 4/92 T

XU55 "MARIMAR" 4C3B4D7C5B washer on @ 0824 9/20/12 35.0 CCL Argos = 29066 Sat Tag = 1051177 Logo = 17 4/44

9/19/2012
Wednesday

Types of ~~SALT WATER CONTACT~~
=washer or solid

4C3D1C2E5A

WN62 "SAMY" =washer 37.0ccL Argos: 42713
Sat Tag: 1051181
Logo: 18
0823 @ 9/20/12 4/92T

4C3B607671

XU73 "HECTOR" =solid 36.5 ccL Argas: 50159
Sat Tag: 1150879
Logo: 19
0825 @ 9/20/12 4/92T

4C3D1B7664

WN41 "CHRISTOPHE" solid 41.0 ccL Argos: 52700
Sat Tag: 1151377
Logo: 22
on 0822 @ 9/20/12 4/92T

4C3C57625E

XU67 "RUBI" washer 36.5 ccL Argos: 29067
Sat Tag: 1051178
Logo: 15
0826 @ 9/20/12 4/92T

BATCH 1: 12
BATCH 2: 10
N = 22 SPOTS
TOTAL FOR DAY 1

DAY 2
9/20/12
Thursday

DOS@

Pit=
XU30
"ALAIN"
4C3C692B05
4/44T
Argos=40475
Sat Tag=1051199
BW=washer
36.5 CCL
Logo=29
1813@9/20/12

Pit=
XU01
"VANESSA"
4C3B600562
Argos=50154
Sat Tag=1150876
solid
4/44
Logo=33
1811@9/20/12
35.0 CCL

Pit=
XU47
"ALBERT"
4C3B417672
Argos=88055
Sat Tag=1051187
washer
4/44T
Logo=26
1810@9/20/12
32.0 CCL

Pit=
WN60
"ARIEL"
4C3D181B12
35.0 CCL
Argos=88059
Sat Tag=1051189
BW=washer
Camille
OLIVE
email: ellimac_dose@hotmail.com
4/44
Logo=24
washer
1808@9/20/12

Pit=
WN89
"JACOB"
4C3B415348
4/44
Argos=41462
Sat Tag=1051206
1814@9/20/12
washer
33.0 CCL
Logo=32

Pit=
WN97
"MARION"
4C3D15100C
4/44
Argos=50147
solid
37.0 CCL
Sat tag=1150874
1811@9/20/12
Logo=30

Volunteer RETIRED AIRCRAFT CONTROL, FRANCE
CHRISTINE MONET
9/20/12 Thursday

Pit= ✓ 4C3C69602D Argos=52702
XU43 "DONATELLO" solid 4/44T Sat Tag=1151378
1812 @9/20/12 CCL 37.0 cm Logo=27

Pit= ✓ 4C3B452174 Argos=41423
WN17 4/44T Sat Tag=1051204
"ZAC" 1816 @9/20/12 washer Logo=31
35.0 CCL Antenna bendable

Pit= ✓ 4C3B494658 Argos=53765
XU11 "2120" solid 34.0 CCL 4/44 Sat Tag=1151381
1814 @9/20/12 Logo=25

Pit= "Charles" 4C3B5B0F4F 31.0 CCL Argos=71922
WN26 (HAS TWO PIT TAGS) 4C3D1E4E47 4/44 Sat Tag=1051210
Logo=41
1750 @9/20/12 washer

Pit= 4C3B4C1A1B Argos=23044
WN56 4/44 Sat Tag=1051222
"JENNIFER" washer 37.0 CCL Logo=28
1818@9/20/12

Pit= ✓ 4C3B545E43 38.5 cc Argos=
XU54 "BRAD" Sat Tag=
Telonics Logo=34
MAZU COIN Model TAM2639
Left Post Central Factory ID 647931
placed on 3rd central

9-20-2012
THURSDAY

PITE Size / TAG

WN81 "GERARD"
4C3D182A4C
washer 4/44 39 CCL
1818 @ 9/20/12
Sat Tag = 1051192
New Argos = 88062
Logo: 23
~~Removable~~ antennae (lower portion

XU5 "FRED"
4C3B3B0A00
4/44 Argos = 88064
Sat Tag = 1051194
~~Argos~~ Logo = 39
washer
1758 @ 9/20/12 ___ CCL

XU39 "FRANKLIN"
4C3B4C052E
Argos = 57153
4/44 Sat Tag = 1150880
___ CCL ~~Argos~~ Logo = 45
solid
1802 @ 9/20/12

WN34 "DAVID"
4C3C631C45
4/44 Argos = 42715
Sat Tag = 1151376
1754 @ 9/20/12 Logo = 36
solid
___ CCL

XU74 "PIERRE" ~~"Franklin"~~
4C3D25284C
Argos = 40725
4/44 Sat Tag = 1151374
Logo = 44
solid
1804 @ 9/20/12 ___ CCL

"JOHNNY"
XU21
4C3B4D491F
Argos = 65436
Sat Tag = 1150881
solid 1748 @ 9/20/12 4/44 T Logo = 38 ___ CCL
Communication plug missing - new one placed in

9-20-2012 Thursday — Released from MATISSE SEPTEMBER 22, 2012

20.7°C SEAWATER 9AM 24° 59.05 S 163° 01.9 EAST

Size 1 Mowel TAG

XU51 — 4C3D215844 — Argos: 88067 — Sat tag: 105119 6 — Logo: 42

"CHRISTIAN" — washer — 4/44T — 1805 @ 9/20/12 — CCL

WN92 — 4C3C5F6209 — Argos: 53755 — 4/44T — Sat tag: 1151380

"DIANA" solid — 1800 @ 9/20/12 — Logo: 43 — CCL

XU61 — 4C3B585836 — 4/44 — Argos: 50158 — Sat tag: 1150878

solid — 1753 @ 9/20/12 — Logo: 35

"AURORE" — CCL

XU33 — 4C3D1D3442 — 4/44 T — Argos: 50157 — Sat tag: 105118 5

"AUDREY" — antennae anterior — Logo: 37

washers 1750 @ 9/20/12 — CCL

"NAT"

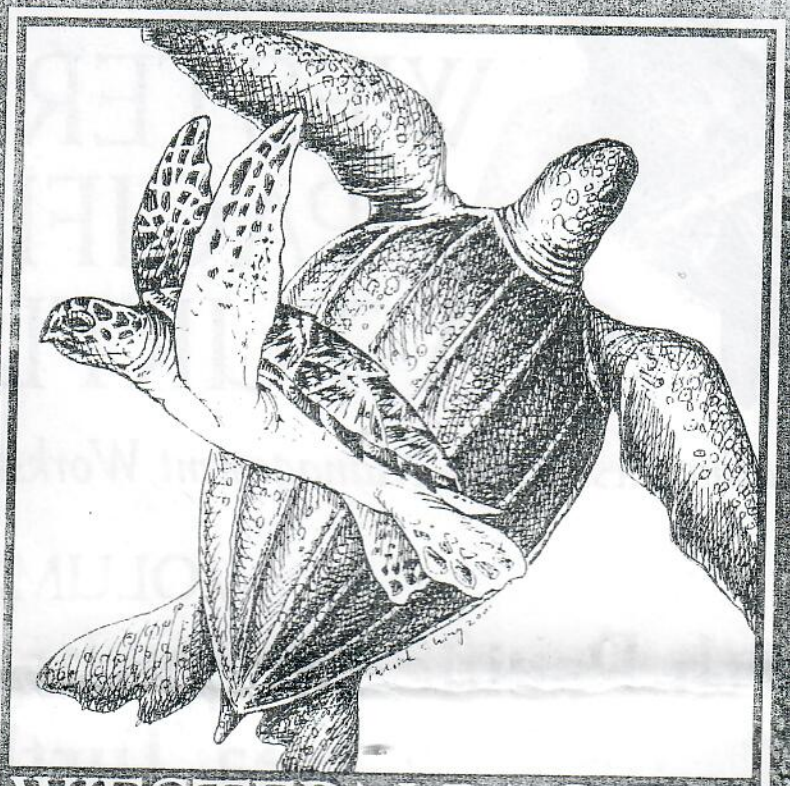
WN78 — 4C3C5C692B — 4/92 — Argos: 91272 — Sat tag: 105123 1

washer — 1755 @ 9/20/12 — Logo 40 — CCL

WN75 — 4C3B3F236A — 4/44 — Argos: 40579 — Sat tag: 105120 1

Logo: 46

washer — 1807 @ 9/20/12 — "MYLENE" — CCL



WESTERN PACIFIC SEA TURTLE

Cooperative Research & Management Workshop

Second Edition, Volume II

North Pacific Loggerhead Sea Turtles

Jean-Louis
see Page 77.
Col Lemperis

PROCEEDINGS OF
THE SECOND

WESTERN PACIFIC SEA TURTLE

Cooperative Research & Management Workshop

VOLUME II

North Pacific Loggerhead Sea Turtles

Coordinated & Edited
by Irene Kinan

Sponsored by the

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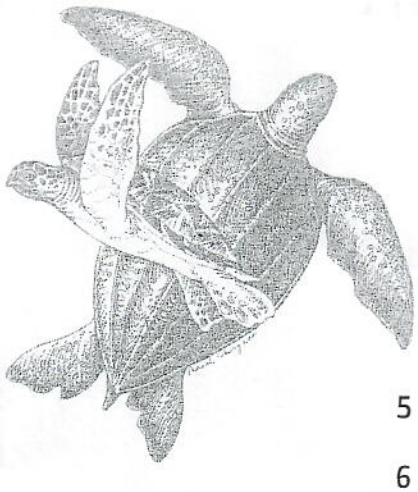

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New Caledonian Loggerhead Turtle Population Assessment: 2005 Pilot Study[1]

Dr. Colin J. Limpus,
Michelle Boyle, and
Tony Sunderland
Queensland Turtle Research

INTRODUCTION

Loggerhead turtle nesting in the North Pacific Ocean is restricted almost entirely to Japan where it is under extensive research and monitoring (Kamezaki et al. 2003).

In the south Pacific, loggerhead turtle breeding is restricted almost entirely to eastern Australia and New Caledonia (Limpus and Limpus, 2003). The eastern Australian population has been extensively monitored and researched, including long term census trends, genetics analysis and demographic studies since 1968 (Limpus, in press). The eastern Australian stock could qualify under IUCN Red-listing criteria as critically endangered as a result of an 86% decline in breeding females over the past 25yr (less than 1 generation). Extensive management actions have been implemented in Australia to conserve this species and to halt the population decline, including (Limpus, in press):

- The vast majority of the loggerhead turtle nesting of eastern Australia in now protected with the National Park estate of the Queensland Parks and Wildlife Service.
- A major portion of the foraging, courtship and inter-nesting habitats used by the species in eastern Australia is managed within the Great Barrier Reef Coastal Marine Park and the adjacent Great Barrier Reef Marine Park, and the Woongarra Marine Park and Moreton Bay Marine Park to the south.
- No harvest of the species by non-indigenous persons in currently permitted in Australia.
- The use of Turtle Exclusion Devices to reduce trawling induced turtle mortality is now mandatory in the trawl fisheries of Eastern Queensland, Torres Strait and northern Australia.
- Fox-baiting in the vicinity of the important mainland nesting beaches to minimize predation of loggerhead turtle eggs has been implemented since the late 1980s.
- Doomed eggs likely to be killed through flooding or erosion on the mainland nesting beaches of the Woongarra Coast are rescued and moved to adjacent safe incubation habitat.

The New Caledonian stock has not been studied in any detail. It is not known if it is a separate stock to the Australian stock that breeds on the opposite side of the Coral Sea. Given that the two nesting aggregations are separated by approximately 1,300km of oceanic water, it is anticipated that they could represent separate stocks. The emerging anecdotal data indicates that the New Caledonia population has undergone a similar major population decline to the Australian population since about the 1970s.

Given the poor conservation status of the other loggerhead turtle populations of the Pacific Ocean (Kamezaki et al. 2003; Limpus and Limpus 2003), there is a high probability that this remaining unstudied Pacific loggerhead turtle population is in urgent need of assistance.

PROJECT AIM

To provide a bench-mark assessment of a loggerhead turtle nesting population at a New Caledonian index rookery.

PROJECT GOALS

The goal of this pilot study is:

- To assess the genetic relationship of the New Caledonian nesting population to the Australian population using mtDNA analysis and microsatellites as required.
- To conduct a two-week tagging census to establish the size of the current nesting population.
- To map the spatial distribution of nesting with respect to the available habitat for the area.
- To quantify some basic demographic parameters for the population including: nesting success, size of adult females, clutch size, egg measurements, nest measurements, frequency of anthropogenic impacts on the turtles (fractures, hooking scars, GTFD tumors) and their nests (dog predation, human interference).
- To train local residents in appropriate methods by which they can continue the monitoring of the population and contribute to its conservation.

[1] Final report to the WPRFMC, Contract No. 04-WPC-03, NOAA award # NA04NMF4410164.

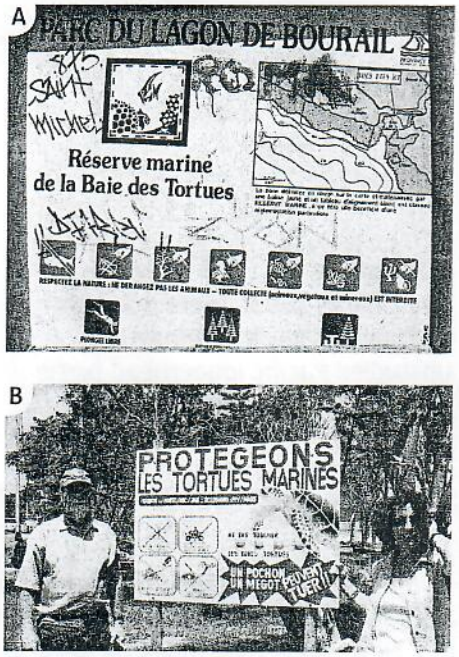

FIGURE 1. *Existing conservation signage in Roche Percée (A to B).* **1A.** *Marine Protected Area sign.* **1B.** *Sign erected by local community to enhance turtle breeding on la Plage de la Roche Percée. Col Limpus and Marile Marteaud, February 2004.*

STUDY SITE

Four beaches were surveyed for turtle nesting in the Bourail district which lies approximately 160 km north of Noumea on New Caledonia's west coast. These beaches are shoreward of a wide natural break, Passe Popinée, in the barrier reef that lies along the southwestern coast of New Caledonia.

There is a marine protected area over these coastal waters (Figure 1A). However, judging by the behavior of the general public, only minimal heed is paid to the regulations. However, some members of the local community have a well established concern for marine turtle conservation as is evidenced by the car-park sign advocating turtle friendly behaviors on the beach (Figure 1B).

FIGURE 2. *La Plage de la Roche Percée*

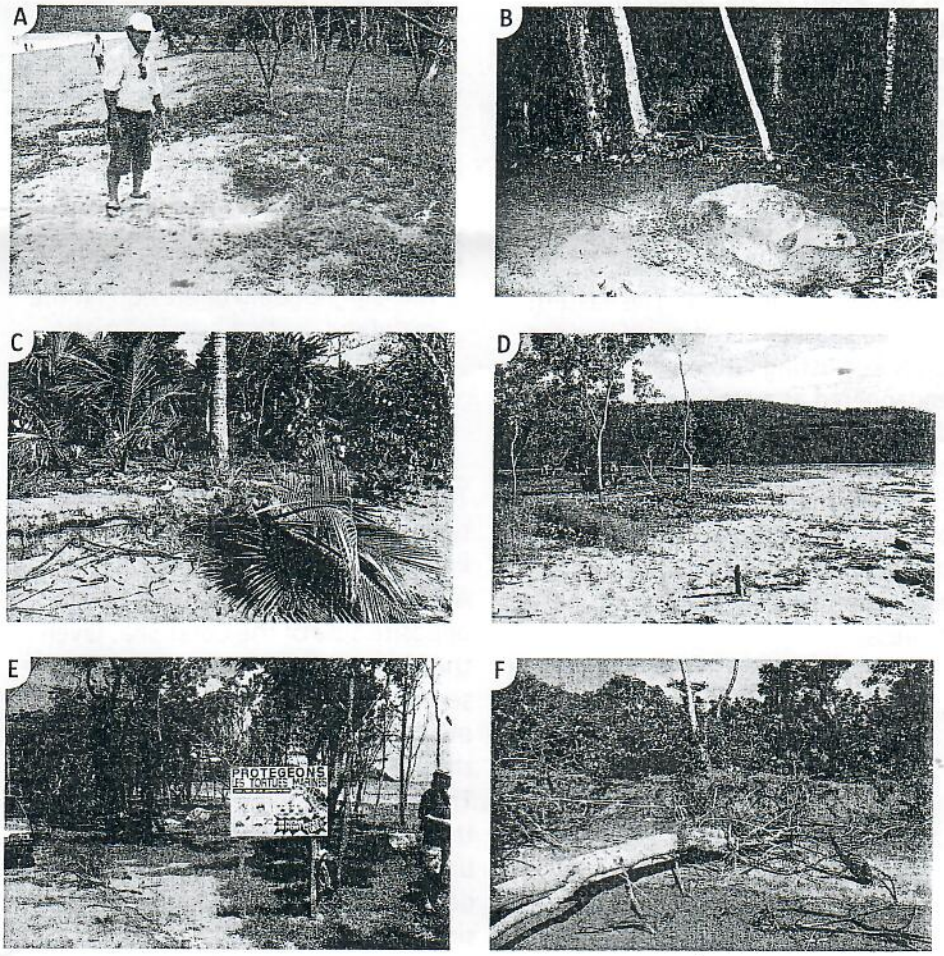

FIGURE 3. *Dune vegetation along la Plage de la Roche Percée (A to F).* **3A.** *Partially cleared dune vegetation at the northern end.* **3B.** *Caretta caretta nesting at the margin of the semi-natural forest along the middle section of the beach.* **3C.** *Revegetation of previously cleared dune in front of housing at the southern end.* **3D.** *Extensively modified dune vegetation at the southern end of the beach.* **3E.** *Sparce vegetation screening between the road and turtle nesting habitat of the frontal dune, northern end of beach.* **3F.** *Erosion of closed forest species in the central beach section.*

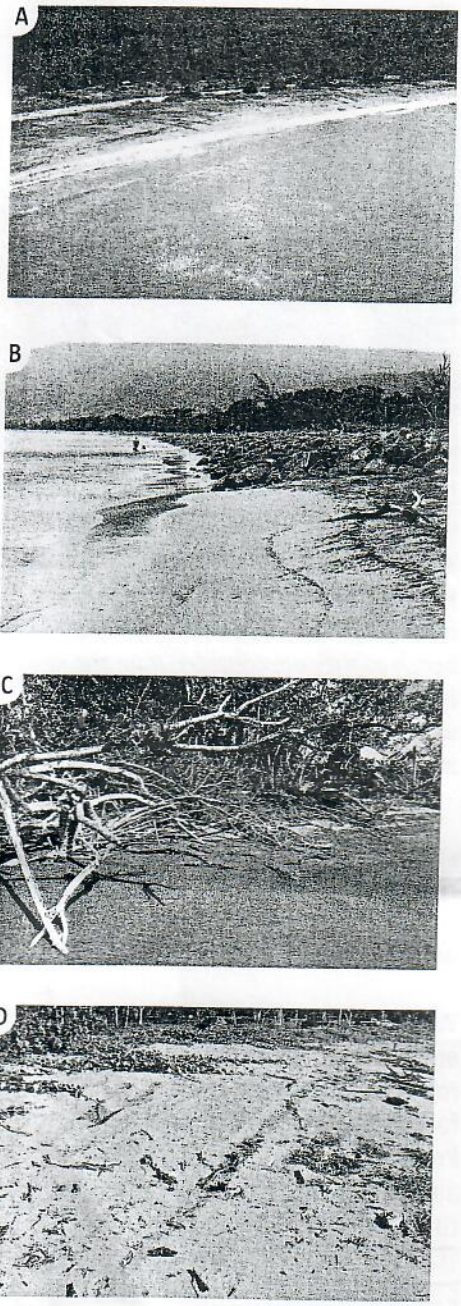

FIGURE 4. *Impacts on the nesting habitat at La Plage de la Roche Percée.* **4A.** *Road immediately behind the nesting habitat at the northern end of the beach. Two sets of turtle nesting tracks are visible.* **4B.** *Rock wall constructed to "protect" real estate from erosion.* **4C.** *Fallen trees and exposed roots prevent turtles from accessing nesting habitat along the eroded dune at the southern end of the beach.* **4D.** *Vehicle tracks across turtle body pits and dune vegetation.*

PLAGE DE LA ROCHE PERCÉE

La Plage de la Roche Percée is the second largest of the Bourail beaches and is approximately 3km in length (21°37.369'S, 165°27.751'E to 21°36.855'S, 165°27.383'E). It extends northward from the mouth of the Nera River (Figure 2). The beach and the associated La Roche Percée settlement and coastal road are contained on the seaward side of a meander of the river that loops close to breaking through the dune system on the northern end of the beach. The Nera River contributes dark sediment directly to La Plage de la Roche Percée and, as a result, the sand of at la Roche Percée is darker in color than the sand on the beaches immediately to the north and south. This dark sand gets very hot during summer days and surface temperatures can be too hot for bare-foot walking.

A band of natural closed forest extends 20-30m behind the central section of the beach. The dunes have been cleared and revegetated with coconut palms and *Casuarina equisitifolia* along parts of the northern and southern ends. In the cleared areas, the frontal dune is vegetated with vines (*Ipomoea pescaprae*) and grasses (Figure 3).

La Roche Percée was first settled by Europeans in 1984 and is now occupied by approximately 30 residential sites. The beach is backed by a bitumen road about 50-100m inland of the low frontal dune (Figure 4a). There is no street lighting associated with this road. A small settlement of 'western style' homes has been built mostly on the inland side of this road. A rock wall has been built of offer "protection' from dune erosion for the road and some of the real estate on the seaward side of the road. This rock wall extends for several hundred metres and spans from below the high tide mark back to the forest margin (Figure 4b) and is located approximately mid-way along the beach, extending for several hundred meters (> 7% of beach) from 21°37.989'S, 165°27.807'E to 21°36.822'S, 165°27.726'E.

A number of the dwellings along the road have significant exterior lighting. Due to the vegetation being absent, scarce or low along the northern end, this lighting causes the beach to be lit up throughout the night. The close proximity of the road and the reduced vegetation also results in vehicle headlights intermittently shining brightly across the beach.

There is considerable evidence indicating that nest erosion is occurring at la Plage de la Roche Percée. Along sections of the southern beach, a 0.5m high erosion bank has developed and remained for at least the last two summers. This erosion bank is cutting further back into the forest with each storm season, causing the undermining of trees that now lie scattered on the beach (Figure 4c). Dune erosion is enhanced by easy vehicle access to the frontal dune at the southern end of the beach. This traffic damages the vegetation that helps stabilize the dunes. It also damages turtle nests (Figure 4d).

PLAGE DE LA BAIE DES TORTUES

Plage de la Baie des Tortues is approximately 0.3km long and lies between two rocky headlands (Figure 5). The dune vegetation has been modified within the remnant Araucaria forest. It is not as subject to erosion as la Plage de la Roche Percée.

A tunnel provides pedestrian access from la Roche Percée to Plage de la Baie des Tortues. However, this access is limited to very low tides.

ILE VERTE

Ile verte lies several kilometers off the coast from la Plage de la Roche Percée in Passe Popinée. The small island has

FIGURE 5. *Plage de la Baie des Tortue*

FIGURE 6. *View of eroded white sand beach and vegetated strand on Ile Verte.*

a white coral sand beach (Figure 6) for approximately one quarter of the island's ~200 m circumference, whilst the remainder of the shore consists of exposed beach rock and boulders. The beach is backed by a 0.5 m erosion bank within several meters of the tree line. Fallen trees along the beach indicate that this beach has been subject to nest erosion in recent years.

LA PLAGE DE LA POE

La Plage de la Poe lies to the north of la Baie des Tortues. It is a long crescent-shaped beach with light colored sand that extends for tens of kilometers. Only the southern end of the beach is accessible by road where some vegetation has been cleared to allow for camping and the construction of a few residential dwellings.

The coast to the south of Nera River consists of rocky shore for a number of kilometres with no ready vehicle access.

METHODS

A survey of marine turtle nesting adjacent to the village of Roche Percée was conducted during 6th - 20th January 2005. A general survey was made by foot during daylight of all accessible beaches in the area. La Plage de la Roche Percée was surveyed each night for a period of 6-8 hours around the high tide and the beach was walked daily during daylight hours. La Plage de la Baie des Tortues was visited regularly during daylight hours as weather permitted, to record nesting activity. Weather conditions during the time of the survey washed away parts of the access road rendering night

FIGURE 7. *Michelle Boyle weighing and measuring Caretta caretta eggs on the beach as they are collected from the nest by Tony Sunderland. Isobell Roy, at right, was a local resident assisting with the monitoring study.*

surveys unsafe. Each nesting crawl was recorded irrespective of whether or not the turtle was sighted and scored for whether or not the turtle had laid.

When nesting turtle turtles were encountered, they were tagged and measured using standard methodology for the Queensland Turtle Research Project (Limpus et al. 1983). Each adult turtles was double tagged with titanium turtle tags (Stockbrands, standard size) in the axillary tagging position on each front flipper (Limpus, 1992). Curved carapace length was measured (± 0.1 cm) with a flexible tape measure from the anterior skin-carapace junction to the posterior edge of the midline junction of the two supra-pygal scutes. Each female was assessed for external damage and injuries.

A sample of clutches were counted within one hour of the turtle completing her nesting, Ten eggs per clutch were selected from top to bottom of the nest for most counted clutches. These eggs were cleaned of sand with a soft bristle brush and with the minimum of rotation before being and measured for diameter with

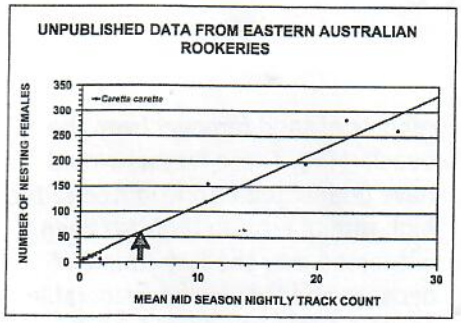

FIGURE 8. *Trend line showing the correlation between the average number of nesting crawls (tracks) per night during two weeks at mid nesting season and the size of the total nesting populations at the same rookery in the same year for eastern Australian Caretta caretta nesting beaches. Arrow denotes the size of the Roche Percée nesting population in 2004-2005. See Text for additional detail.*

vernier callipers and weighed on a digital balance (± 0.1 g) (Figure 7).

Local residents were interviewed to provide additional insights into past knowledge and issues related to turtle populations in the Bourail region.

Sand temperatures were measured at 50 cm below the beach surface using a digital thermometer (± 0.2°C).

Estimation of the size of the total seasonal nesting population based on mid-season nesting density made use of unpublished data from the Queensland Turtle Research Project: Figure 8 summarizes the relationship between the average number of nesting crawls per night during two weeks at the peak of the nesting season and the size of the total annual nesting population measured by total tagging census during months of nightly monitoring at the same rookery. This figure pools annual census data from Mon Repos, Heron Island and Fraser Island.

Genetic samples were taken from nesting female turtles during nesting observations at la Roche Perceé rookery, by means of a small skin biopsy that was removed with a sterile razor blade from the upper shoulder region. Tissue samples were stored in dimethyl sulfoxide 20% (DMSO) saturated with 5M NaCL (without EDTA), routinely used to preserve Chelonid tissue (Dutton, 1996). In the laboratory the tissue samples were removed from the DMSO, rinsed in distilled water, and minced up with a sterile scalpel blade to optimise DNA extraction. Genomic DNA was isolated from the tissue using the ammonium acetate method described by Nicholls et al. (2000).

An 1100 base pair (bp) fragment located in the control region of the mitochondrial genome was amplified with polymerase chain reaction (PCR) methodology, using the primers TCR-6 (5'-GTA CGT ACA AGT AAA ACT ACC GTA TGC C-3') and TCR-1 (5'- GGA TCA AAC AAC CCA ACA GG -3') (Norman et. al 1994).

PCR conditions were optimized using methods described by Cobb & Clarkson (1994). PCR amplifications were performed in a 25 l reaction volume containing, 3ng DNA template, 1x QIAGEN PCR Buffer (containing Tris-Hcl and KCl), 0.32 mM of dNTP, 4mM MgCl2, 0.20 mM of each primer (TCR1 + TCR6), and 0.5 units of Taq DNA polymerase (QIAGEN). The PCR amplification conditions were as follows: 95C for 2 mins followed by 34 cycles at 94C for 25 sec, 48C for 15 sec, 72C for 45 sec with a final extension at 72C for 5 sec. PCR amplifications included a negative (DNA free) control reaction to test for contamination.

The amplified products were electrophoresed in low-melt agarose gels and exised from 1.5% agrose gels and purified using a gel extraction kit (QIAGEN). Quantification of DNA concentrations were performed with ImageJ software (http://rsb.info.ih.gov.ij). Cycle sequencing reactions were conducted with the primers TCR1 and TCR6 in ET terminator half reactions according to manufacturers instructions and analysed in the Genetic Analysis Facility in James Cook University's Advanced Analytical Centre, on a MegaBase 1000 (Amersham BioSciences). Resulting sequences were edited with Sequencher 4.2.2 (Gene Codes Inc), and manually aligned using Se-AL v 2.0a11. Variability at sites was verified with associated chromatograms.

RESULTS

ORAL HISTORY

Numerous locals were spoken to regarding the history of la Roche Percée and the local turtle populations. Comments from four groups have been included below.

Laurence Langlois (January 2005): a local Kanak resident whose father was a fisherman.

According to Mr Langlois, dugong (*Dugong dugon*) and turtles (*Chelonia mydas* and *Caretta caretta*) were once numerous in the area of la Roche Percée. However, their numbers have been greatly reduced. While all species were hunted by local people, dugong and C. mydas were the preferred species. Grosse Tête (local name for *C. caretta*) egg consumption and the harvest of females when they were ashore was common by locals. 20-30 years ago an average of 6 Grosse Tête nested per night at la Roche Percée, with a maximum of 20-35 on some nights.

Prior to extensive tree-felling of the surrounding mountains in 1988, 'the beaches were whiter in color ... the water was much clearer and turtles could be seen in the water from 100m away... this is no longer the case'.

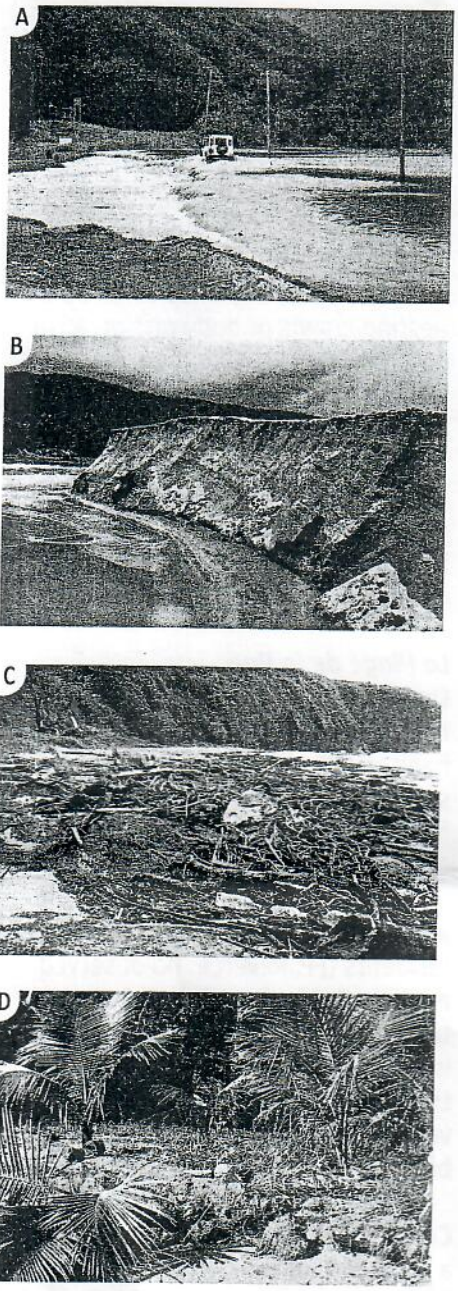

FIGURE 10. *Illustrations of the impact of Cyclone Kerry on the beaches in the Bourail district.* **10A.** *The Nera River cut through the road at the northern access to Roche Percée.* **10B.** *2 m erosion bank at the northern end of la Plage de la Roche Percée.* **10C.** *Flood debris accumulated on la Plage de la Baie des Tortues.* **10D.** *Erosion of vegetation on the southern end of la Plage de la Roche Percée.*

Cyclonic winds generated heavy surf on the beach at la Roche Percée. The wet conditions that occurred throughout the study period caused considerable damage to the road to Baie de Tortues. This prevented nightly observations of that beach as had been originally intented. High water levels prevented access to the Baie de Tortues via the pedestrian tunnel route.

Cyclone *Kerry* brought high rainfall that caused flooding of the Nera River. The river overflowed its backs to cut across the access road to Roche Percée at the northern end of the beach (Figure 10A), effectively leaving the village as a small island. This north river outflow eroded large volumes of sand from the northern end of the beach (Figure 10B). Large amounts debris was washed to sea from both river mouths and substantial amounts of this debris washed onto nearby beaches (Figure 10C). In some localized areas, the debris was thick enough to impede turtle access to nesting habitat. Because the cyclone center lay to the west of the main island of New Caledonia, the winds along this west coast area were not onshore. Therefore, this cyclone had minimal storm-surge impact on the beaches. There was, however, some fresh erosion of the dunes at this time (Figure 10D).

Because of the heavy rain during the cyclone, local residents did not participate in the night-time training and monitoring until after the rain had abated. Thus, we only had three nights of effective community participation in the project. Similarly, participation by members of ASNNC who had to drive up from Noumea and visits by the local media were limited to the last few days of the survey.

Table 1. Sand temperatures measured at 50 cm below the beach surface within the open sand dune nesting habitat of la Plage de la Roche Percée following Cyclone *Kerry*.

Date January 2005	Time (hr)	Temperature (°C)
14th	21:45	28.5
15th	00:39	28.2
15th	11:35	29.2
16th	02:42	29.3
20th	04:00	30.2

SAND TEMPERATURES

Sand temperatures at nest depth (50 cm) were recorded within the open sand of the dune nesting habitat of la Plage de la Roche Percée after the heavy from Cyclone Kerry had ceased (Table 1). Unfortunately, these data do not provide a measure of the normal sand temperatures at nest depth for this beach. Sand temperatures will have been lowered below normal by the heavy cyclonic rain. These temperatures do, however, demonstrate the rapid rise in temperature that occurs at nest depth, following the cessation of heavy rain during the summer months. The rising temperature as the survey finished indicated that this should be a warm beach, well above the pivotal temperature (28.7°C. Limpus et al. 1985) for eastern Australian population. It is presumed that this would be a female-producing beach for *C. caretta* in New Caledonia.

GENETICS

Thirty nesting female *C. caretta* were sampled for the genetics study. Of the 30 samples, 28 (93%) were found to be haplotype CC-P1, and 2 (7%) were found to be haplotype CC-P5 (Figure 11). No new haplotypes were discovered.

The identified haplotypes (CC-P1 & CC-P5), and the frequencies at which they occur, parallel those found throughout the east Australian rookeries. Therefore, based on the current understanding of stock structure, the New Caledonian

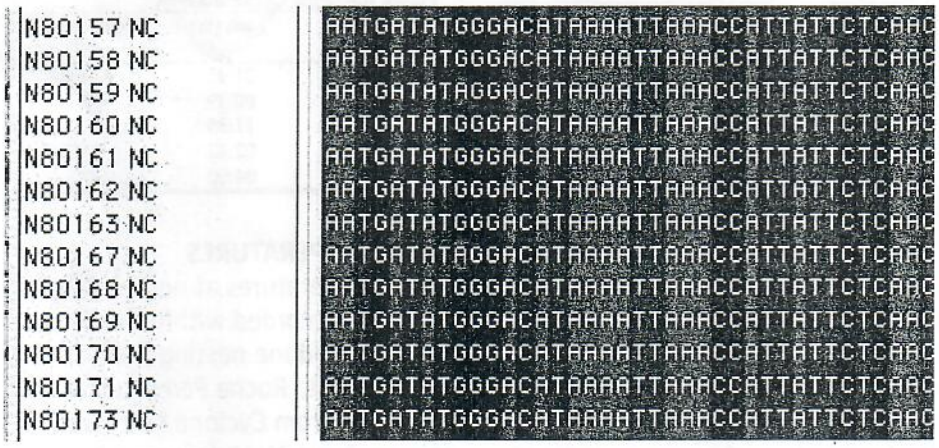

FIGURE 11. *Examples of genotypesA region of the aligned mtDNA sequences of Caretta caretta from La Roche Percee. Illustrated is the base*

and Eastern Australian nesting populations cannot be defined as separate genetic stocks. These data are being included in Michelle Boyle's PhD thesis (James Cook University) and are being prepared for peer-reviewed scientific publication.

This is an unexpected result given the approximately 1,300 km separation of the New Caledonian and eastern Australian breeding sites. The samples have been banked with other genetic samples from the Queensland Turtle Research Project and they will be made available for future analysis as new genetic analytical tools are developed.

TURTLE BIOLOGY

Only *C. caretta* was recorded nesting on any of the beaches surveyed.

NESTING CENSUS

La Plage de la Roche Percée

During the survey period, 6-19 January, a total of 76 crawls by nesting turtles were recorded on la Plage de la Roche Percée. See Table 2 for a summary of nightly beach census scores. The mean number of *C. caretta* nesting crawls during the census period was 5.4 per night (SD = 3.4; range=1 - 13; n = 14 nights). During the same period, the mean number of clutches laid was 3.0 per night (SD = 2.1, range = 1 – 9, n = 14 nights)

Of the 76 beachings, 43 resulted in successful laying of clutches, whilst the remaining 33 were unsuccessful nesting crawls (i.e. clutches were not laid) (Table 3). This equates to a nesting success of 57%. The majority of tracks and nests were at the northern end of the beach. Throughout the survey 40 beaching by turtles were not observed, but were subsequently recorded from the tracks. These included 15 clutches laid and 25 unsuccessful nesting crawls.

La Plage de la Baie des Tortues

During the survey period, January 6-19, 2005, a total of 2 crawls by nesting turtles were recorded on la Plage de la Baie des Tortues. See Table 2 for a summary of nightly beach census scores. The mean number of *C. caretta* nesting crawls during the census period was 0.14 per night (SD = 0.36; range=0 - 1; n = 14 nights). During the same period, the mean number of clutches laid was 0.14 per night (SD = 0.36; range=0 - 1; n = 14 nights).

Both these nesting crawls resulted in successful nesting, although neither turtle was observed for its nesting

Ile verte

Ile verte was visited for one hour on January 19, 2005 during daylight hours. The entire beach was surveyed on foot and no evidence of turtle nesting crawls or body pits or hatchling tracks were identified. This was consistent with the oral reports given by J-P. Revercé.

While no turtle nesting was identified, the island was terrestrial habitat for sea kraits, Laticauda sp. (sea snakes).

La Plage de la Poe

Only approximately the southern most kilometer of potential nesting habitat along la Plage de la Poe was surveyed on foot on January 6, 2005. No evidence of turtle nesting crawls or body pits or hatchling tracks were observed. This was consistent with the oral reports given by local residents (J-P. Revercé: no observed nesting. D. Marteaud: only 1 nesting turtle observed) that turtle nesting is rarely observed on this beach. In the absence of access to a suitable vehicle for driving the beach, this beach was not surveyed further.

Combining the data for all beaches, a total of 45 *C. caretta* clutches were laid in the two week period January 6-19, 2005. This is a minimum estimate of the number of female *C. caretta* nesting during one renesting interval at approximately mid-breeding season. Thirty-one of these females were tagged. The combined beaches nightly nesting attempts were 5.5 beachings per night at La Roche Percée for the same period. This period overlapped the late December – early January peak density of the *C. caretta* nesting season in Queensland (Limpus, 1985). Applying the relationship between the mean number of beachings per night at the peak of the Queensland *C. caretta* nesting season and the total nesting

Table 2. Nightly census count of *Caretta caretta* nesting crawls, clutches laid, predated and emerging, Bourail District, January 2005.

Date	La Plage de la Roche Percée				La Plage de la Baie des Tortues			
January 2005	Tracks	Clutches			Tracks	Clutches		
		Laid	Predated	Emerged		Laid	Predated	Emerged
Prior to arrival	NA	NA	NA	NA	5 visible	NA	NA	NA
6th	7	3			0	0		
7th	5	2			0	0		
8th	1	1			0	0		
9th	5	2			1	1		
10th	10	6			0	0		
11th	3	2			1	1		
12th	13	9			0	0		
13th	10	3			0	0		
14th	4	4			0	0		
15th	4	2			0	0		
16th	4	2			0	0		
17th	3	2			0	0		
18th	5	2	1	2	0	0		
19th	2	2			0	0		

Table 3. Summary of *Caretta caretta* nesting success with respect to observed and missed nesting crawls on beaches in the Bourail District, January 2005.

	Observed	Not observed (tracks only recorded)	Total
La Plage de la Roche Percée			
Laid	28	15	43
Did not lay	8	25	33
Total beaching	36	40	76
La Plage de la Baie des Tortues			
Laid	0	2	2
Did not lay	0	0	0
Total beaching	0	2	2

Table 4. Distribution of successful *Caretta caretta* nesting locations by habitat during 6-19 January 2005.

	Under trees	In grass or vines	In bare sand
Dune crest	0	4	35
Beach slope	0	1	3
Below high tide line	NA	NA	2

population for the entire season (Figure 7), the 5.5 beachings per night in the present study translates to approximately 60-70 *C. caretta* nesting on this coast for the entire 2004 – 2005 breeding season.

NESTING BEHAVIOUR

Of the 76 recorded nesting attempts, only two occurred during daylight (3% daylight nesting attempts) and both resulted in successful laying.

Five females that were unsuccessful in a recorded nesting attempt were recorded returning for a subsequent attempt. On average, a turtle that failed to nest was most likely to return on the following night (SD = 0.71, range = 0 – 2 d, n = 5). One of these females was missing the entire right hind flipper and failed to successfully dig an egg chamber on two consecutive nights because of this damage. When she returned on the 3rd consecutive night and was again observed to be unsuccessful in digging an egg chamber, an artificial egg-chamber was dug under her while she was digging. She accepted this hole as a nest and laid 137 eggs. The remaining four females that were recorded on their return, following an unsuccessful nesting attempt, each successfully laid on their next return. Given the incomplete interception of the nesting turtles, these data are consistent with the concept that females that return to the sea following unsuccessful nesting attempts do not drop their eggs at sea, but return on subsequent nights for further nesting attempts.

The majority of the turtles (89%) laid their eggs in bare sand habitat, rather than within vegetated areas (Table 4). 4% of clutches were laid below the high tide level and should not have incubated due to flooding. Although not quantified, the significant erosion at both extremities of the beach occurred on the low density nesting areas of the beach and had minimal impact on the incubation of the clutches.

The majority of the nesting occurred on the northern side of the rock wall and in front of the area with houses. Numerous turtles came ashore in front of the rock wall and, with no beach above high tide in front of the wall, they turned back with out laying. No turtles crossed the rock wall to nest. Fewer turtles attempted to nest south of the rock wall. In this section, where turtles came ashore in front of fallen trees, they usually were unsuccessful in nesting.

SIZE OF NESTING FEMALES

The size of nesting female *C. caretta* at la Roche Percée is summarised in Table 5 and Figure 12. The mean size of nesting females was 95.1cm CCL.

Table 5. Summary of measurements of nesting female *Caretta caretta* and their eggs, nests and hatchlings at la Roche Percée during the mid 2004-2005 breeding season.

Parameter	Measurements			
	Mean	SD	Range	Sample size
Curved carapace length (cm)	95.13	5.508	83.1 – 107.0	30
Eggs per clutch	113.6	35.37	60 - 186	13
Egg diameter (cm)	4.16	0.13	3.86 – 4.42	126 eggs from 13 clutches
Egg weight (g)	39.48	3.82	31.3 – 47.0	116 eggs from 12 clutches
Yolkless egg per clutch	0	-	-	13
Multiyolked eggs per clutch	0.08	0.28	0 - 1	13
Nest depth, bottom (cm)	56.3	4.62	51 – 59	3
Hatching success (%)	86.9	2.33	85.2 – 88.5	2
Incubation to emergence success (%)	81.5	0.47	81.2 – 81.8	2
Hatchling straight carapace length (cm)	4.39	0.13	4.19 – 4.48	10 hatchlings from 2 clutches
Hatchling weight (g)	21.15	2.26	19.2 – 26.6	10 hatchlings from 2 clutches

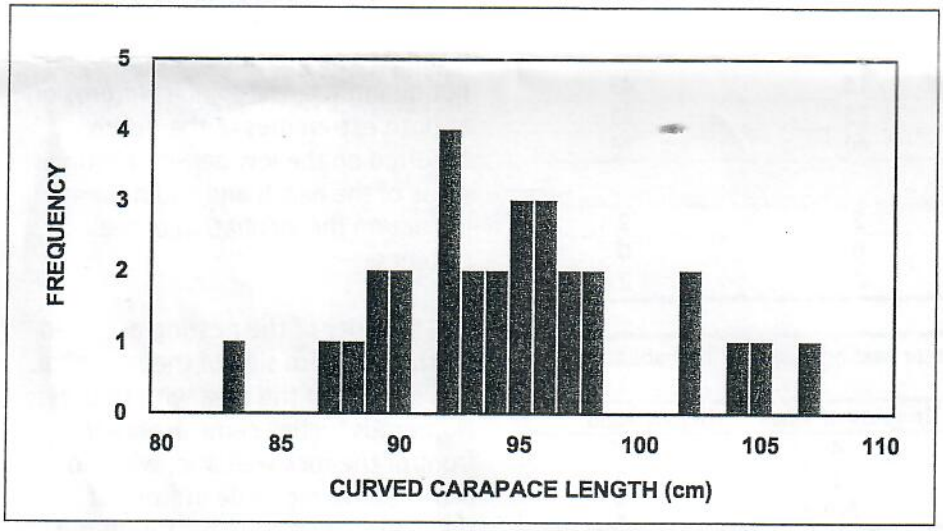

FIGURE 12. *Frequency distribution for size of nesting female Caretta caretta at la Roche Percée.*

These nesting *C. caretta* were recorded laying on average 113.6 eggs per clutch that were 4.16 cm in diameter and weighed 39.5 g (Table 5). No yolkless eggs were recorded in this sample of 13 clutches and only 1 multi-yolked egg (double yolked egg, diameter = 4.82 x 5.14 cm, weight = 68.9 g) was recorded.

The first hatchling emergence from nests was recorded on 18 January 2005. However, given the storm conditions of the preceding week and extensive erosion of the fore dune, there is the possibility that some clutches may have emerged on an earlier date and escaped detection. The incubation success recorded from these two clutches was: hatch success = 86.9% of eggs laid and 81.5% of eggs produced hatchlings to the beach surface (Table 5).

FIGURE 13. *Michelle Boyle excavating a nest to assess incubation success. Hatchlings had run from this nest during the previous night.*

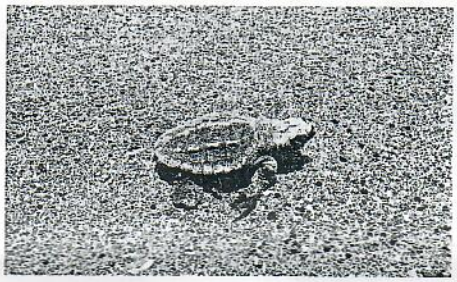

FIGURE 14.A. *Caretta caretta hatchling*

FIGURE 14.B. *Caretta caretta hatchling and track.*

HATCHLINGS

Hatchlings from the two emerged clutches measured 4.40 cm SCL and weighed 21.1 g (Table 3). These hatchlings were the typical dark brown color for the species (Figure 14a). They crawled with the typical alternating gait for hatchlings for this species (Figure 14b). All 10 hatchlings examined had the standard scale count for the species of: 1 nuchal, 5 vertebrals, 2 supra-pygals, 5/5 costals, 12/12 marginals, 3/3 post-occulars, no pre-occulars, 3/3 infra-marginals and 0 intergulars

The post parietal scutes were variable with frequencies of: 1 with 2 scutes, 1 with 3 scutes, and 8 with 4 scales.

INJURIES AND DISEASE

Significant injuries from both natural and anthropogenic sources were recorded for five of the nesting females:

- R24764: large healing fracture to the right side of the carapace (Figure 15a) possibly resulting from a boat-strike.
- R24771: healing shark bite to the right shoulder (Figure 15b). This bite probably occurred during courtship.
- Two females were each missing almost 100% of the right hind flipper: R24359, R24369. These turtles had difficulty in preparing their egg chambers.
- R24361: missing the left marginal rim of the carapace equivalent to the area of the posterior four left marginal scutes; completely healed.

None of the 30 nesting females had external fibropapilloma tumours.

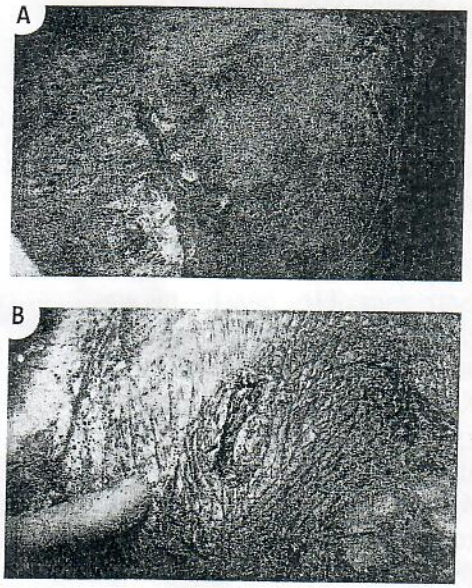

FIGURE 15. *Recent injuries to nesting female Caretta caretta.* **15A.** *Healing fracture in carapace of R24764.* **15B.** *Healing recent shark bite to the shoulder of R24771.*

FIGURE 16A. *Dog-predated Caretta caretta clutch. Tony Sunderland discussing dog predation issues with local residents, Claudia and Eric.*

FIGURE 16B. *Two of the regularly observed dogs that were free-ranging on la Plage de la Roche Percée.*

HARVEST AND PREDATION

People removed at least one nesting female, R24771, from the beach after she had laid her clutch and before she had returned to the sea on 16 January. She was presumably killed. Multiple local folks reported that at least two other nesting females had been similarly taken from the beach earlier during the nesting season, including one at Christmas. This represents a harvest of at least 5% of the season's total nesting population.

Free-ranging dogs were plentiful on the beach throughout the day and night during the survey period (Figure 16). While they were not recorded to harass the nesting turtles, at least one clutch of eggs was observed destroyed by dogs. Local residents reported that numerous clutches of eggs have been destroyed by dogs at la Roche Percée each summer.

Based on reports from local residents, a small number of eggs appear to be eaten by people from the district. No human removal of eggs was observed during the survey period.

Ghost crabs, *Ocypode cordimana*, were abundant along the beach. These crabs were large enough to prey on turtle hatchlings. While hatchling predation was not observed, these crabs were seen preying on frogs and bivalves along the beach.

TRAINING AND EDUCATION

This project could not have succeeded without the assistance and support of J-Louis d'Auzon, President of Association pour la Sauvegarde de la Nature Neo-Caledonienne and other members of the Association. Before the team traveled to Bourail, J-Louis organized for the team to spend half a day at the Noumea Aquarium assisting the staff with tagging of their turtles in preparation for their release. A discussion session explaining the function of the present study occurred at that time.

As was expected following the preliminary February 2004 visit to the site, the local residents were enthusiastic towards participation in the project and being trained in turtle monitoring methods. However, Cyclone *Kerry* dampened their enthusiasm. As a result, local folks only participated in the field work during the last few nights. Through out the study, locals participated on five nights with 1 – 15 persons per night.

A public education night was held in the outdoor dining area of the village hotel on January 18, 2005 (Figure 17). Two local folks, Isabell Roy and Ingrid Vallejo-Torres, assisted Michelle in preparation of the slide presentation

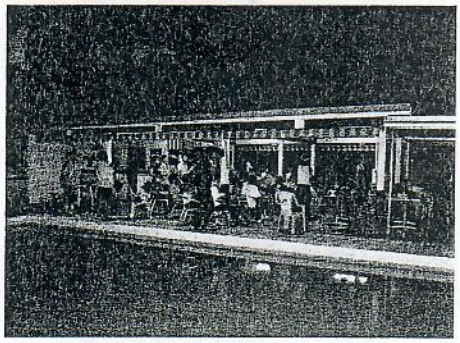

FIGURE 17. *Public education: An illustrated talk on turtle biology and the current research project was given to local residents and media in the lounge of L'Hotel de la Roche Percée.*

Table 6. Capture history of Green turtle, *Chelonia mydas*, tag number T91659.

Date	Location	Capture history
Dec 1984 – Jan 1985	Heron Island, southern Great Barrier Reef	Ashore for nesting • Curved carapace length (CCL) = 109.5cm
Dec 1989 – Jan 1990	Heron Island, southern Great Barrier Reef	Ashore for nesting • CCL = 110.5cm • Remigration interval = 5yr
Dec 1995 – Jan 1996	Heron Island, southern Great Barrier Reef	Ashore for nesting • CCL = 112.5cm • Remigration interval = 6yr
March 2005	Tiari, north of Pouebo, western New Caledonia	Captured in seagrass habitat. • Killed and eaten

so that it was presented in French and also facilitated the answering of questions following the presentation. Approximately 50 persons attended this slide presentation on sea turtle biology and conservation. The talk also served to acquaint the broader local community with the purpose of the study.

A full kit, including datasheets, tag applicators, tags, measuring tapes, helmet and head spot, was left with J-Louis to facilitate continued monitoring of the area. In addition, electronic copies were also left with these folks of: 1) powerpoint presentation prepared for the Public education night, and 2) copies of our data sheets.

Turtle tags used for this study were chosen to be integrated with the existing ASNNC turtle tagging project in New Caledonia, rather than introduce tags with an Australian address for this short term study. This was facilitated by J-Louis. A full copy of all data from this project will be lodged with ASNNC.

The team has maintained an ongoing communication with the local folks. This has lead to at least one new reporting of a tagged turtle captured by a fisherman. It was an Australian tagged green turtle that was captured and eaten in northern New Caledonia (Table 6).

Loggerheads (*C. caretta*) in the size range of "about 70 to 85 centimeters long" are regularly encountered foraging in the reefs, channels and sea grass areas to the north of Bourail. They occur there all year round. Up until May 2005, no tagged *C. caretta* had been seen.

Following the visit to the Aquarium and the education night, the project was aired on local TV news broadcasts. The project was also reported in the local news paper.

MANAGEMENT ISSUES

A range of human activities was negatively impacting both the nesting habitat and the nesting turtles, their eggs and hatchlings.

Erosion

The erosion of the beach in recent years has threatened housing and the adjacent road. This is a continuing problem. The local government has responded by depositing rocks along approximately 7% of the beach. The rocks extend to below the high tide mark and prevent turtles from accessing the nesting habitat along this portion of the beach. While this rock wall appears to have placed within the most preferred nesting habitat for La Roche Percée, no turtles successfully laid along the section of the beach with the rock wall during the time of the survey.

The continuing erosion of the beach is causing concern among local residents and local government. Some residents are advocating for this rock wall to be significantly extended. If this occurs it will further decrease the amount of suitable nesting habitat for the turtles.

The least stable areas occur at both ends of the beach. This was particularly evident on the southern end of the beach during Cyclone Kerry. During the time of the survey a sand cliff formed that was unsurmountable by nesting turtles. As a result turtles were returning to the water, without successfully laying in this section of the beach.

We consider that beach erosion and the proposed extension of the rock wall pose a significant threat to the viability of this turtle nesting population.

Housing and traffic lighting
There was intense lighting of the beach area from housing and from traffic headlights on the northern end. The house lighting that was of concern was primarily the external lights. There were strong outside security lights that remained on throughout the night with at least two houses near the northern end of the beach. This lighting caused the beach to be brightly illuminated and was strong enough to impair the night vision of the research team. While there was little evidence of turtles returning without laying because of this lights, there remains the concern that new females recruiting to the nesting population will avoid using brightly illuminated beaches. The long-term decline in nesting turtle numbers in response to increased illumination of beaches has been observed at others rookeries and is a distinct possibility here at Bourail.

Because the survey did not occur during the primary hatchling emergence period, the effect that this lighting would have on hatchling orientation was not documented. Changes to the light horizons that occur with passing traffic were relatively intermittent and should not significantly impair hatchling orientation under current traffic densities. This can be expected to change with increased development and tourist visitation to the district.

Vehicles on dunes
Vehicles have access to the nesting habitat at the southern end of the beach. Vehicle traffic on the beach is damaging nests where vehicle tracks occur over nesting sites and is retarding vegetation growth. Where vehicle damage to dune vegetation is excessive, there is the increased risk of beach erosion.

Dogs
There is a large dog population within the La Roche Percée community. Many of these dogs are free to roam the nesting beach. Residents reported that dogs often dug into nests and destroyed developed eggs on a regular basis.

Boating
There were no reports of turtle strandings that could be attributed to boat strike. The quiet waters of the Bay offshore from the nesting beach will be the inter-nesting habitat used during the summer months by the females, while they are preparing their successive clutches for laying. During the survey most boats departed the boat ramp (at the entrance of the river mouth) and headed directly out to the reef. While very little motorboat activity was observed in the Bay, jet skis were observed travelling back and forth and at speed in the bay during the survey period. This activity would be disturbing to any turtles using these shallow waters.

Poaching
During the survey, one nesting female was removed from the beach by humans. Local informants reported nesting turtles being removed from the beach at a rate of approximately 2-3 per year. This has not been validated. There was one report of eggs being removed from a nest. The traditional inhabitants of the area, Kanak people, appear to have a greater desire to utilize the turtles and eggs as food than the folks of European origin.

DISCUSSION

Within the Pacific Ocean region, *C. caretta* breeding is restricted to the western margin (Figure 18). In the North Pacific, nesting only occurs within Japan (Kamezaki et al. 2003). In the South Pacific, nesting is rarely encountered outside of eastern Australia (south Queensland and northern New South Wales), New Caledonia and Vanuatu (Limpus and Limpus, 2003). In contrast with the well known eastern Australian nesting population (Limpus, 1985), the nesting distribution in New Caledonia and Vanuatu remains incompletely described. With about 60-70 nesting females annually, the Bourail District *C. caretta* nesting population is the largest currently known within New Caledonia. In the absence of more comprehensive surveys, Roche Percée is identified as a suitable index beach for on going monitoring the population status of *C. caretta* within New Caledonia. This assessment is based on the combination of the size of the annual nesting population and the accessibility of this mainland nesting beach for ongoing monitoring, even under adverse weather conditions.

Based on the results of the present study, the *C. caretta* nesting populations of New Caledonia and eastern Australia should be regarded as forming a single management unit. Allowing for the small sample size of the population at Roche Percée, the size of nesting females, the number of eggs per clutch, the size and weight of the eggs and the size and weight of hatchlings (Table 5), this representative New Caledonian nesting population is very similar to the respective parameters measured at eastern Australian rookeries (Limpus, 1985). This similarity in reproductive parameters is what would be expected from rookeries within a single genetic stock. Until more comprehensive data area available from the New Caledonian rookeries, it is recommended that values derived at the Australian *C. caretta* rookeries be used to describe the relevant reproductive biology at the New Caledonian rookeries.

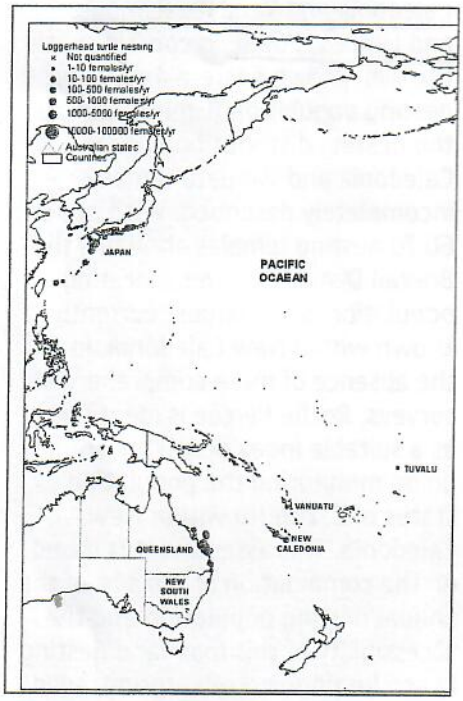

FIGURE 18. *Distribution of loggerhead turtle, Caretta caretta, nesting within the Pacific Ocean region (Source Limpus and Limpus, 2003). Dots denote nesting sites.*

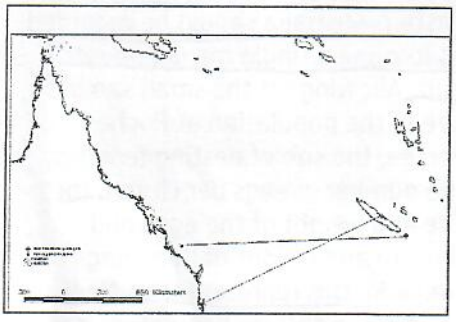

FIGURE 19. *Identified foraging areas for two adult female Caretta caretta that bred in New Caledonia. Crosses denote nesting sites. Dots denote feeding sites.*

Migration data are available from only two New Caledonian nesting females to link the nesting populations to their dispersed foraging areas (Limpus, 1994; Limpus and Limpus, 2001). Both females migrated from feeding areas in eastern Australia to New Caledonian rookeries (Figure 19) and subsequently returned, each to the same feeding area from which she began her breeding migration.

It can be assumed that the *C. caretta* that foraging in New Caledonian coastal in areas, like off Bourail (see above) and Ile des Pines (Beloff, 1997) will include turtles that breed both at the Australian rookeries (Limpus and Limpus, 2003) and at New Caledonian rookeries.

Again, until data are specifically available from a wider range of foraging areas, it is recommended that the demographic parameters described for the species in eastern Australian foraging areas and the associated demographic modelling (Chaloupka, 2003) be applied for investigating the potential responses of the New Caledonian populations to anthropogenic impacts and their potential responses to management options.

There are some discrepancies among the reports from local informants: Laurence Langlois recollected that 20-30 years ago an average of 6 Grosse Tête nested per night at la Roche Percée, with a maximum of 20-35 on some nights. This is similar to estimates provided by Jean-Pierre Revercé, also a local man who grew up in the region, who suggests that around 30 years ago, during the peak of the nesting season, 5-6 loggerheads laid clutches at la Roche Percée per night, and at the most 10 per night. Other reports claim that nesting loggerheads once numbered in the hundreds on any given night within the breeding season. However, the general consensus was that there had been a decline in the amount of nesting that occurs annually on the Bourail District beaches over recent decades.

A decline in the New Caledonian nesting population would be consistent with the substantive declines in *C. caretta* breeding recorded at the sites where monitoring has occurred elsewhere in the Pacific Ocean basin. It would be appropriate then for steps to be taken to improve the conservation outlook for *C. caretta* in New Caledonia. In particular, at nesting beaches, such as those in the Bourail District, there are a number of actions that can be taken by the local community that will contribute to improving reproductive success for the species:

- Reduce erosion and increase the stability of the dunes that are the nesting habitat:
  - planting of suitable vegetation that will stabilize the beach;
  - excluding vehicle traffic from the frontal dunes. This action would reduce loss of eggs due to being run over in the nests.
- Extension of the existing rock wall as a solution to erosion should be avoided.
- Dense vegetation should be planted along the dunes. While this will contribute to reduced erosion of the dunes, it also will provide the beach with protection from lighting.
- Where possible, it is recommended that a 1.5km darkness zone be maintained around these nesting beaches. Dark beaches are the preferred management option for maintaining sustainable turtle populations. Altered light horizons resulting from the continued expansion of housing development within this community can be minimized via the use of appropriate turtle-friendly lighting including:
  - Low pressure sodium vapor lights should be used where road lighting is required along roads and for external lighting of buildings;
  - Security lighting visibly from the beach should be turned on by proximity sensors rather than being turned on continuously throughout the night;
  - Intermittent slowly flashing lights can be used to mark walking tracks.

- It is recommended that vehicle traffic be kept from access to the turtle nesting habitat of the frontal dunes of these beaches. This has already been achieved in some sections of beach through the use of a line of closely placed large rocks to obstruct vehicle access (Figure 3e).
- Turtle nesting would benefit from restricting boating activity to defined navigation channels while limiting boat speed within the waters immediately off the nesting beaches. While boating activity does not appear to be a pressing management issue at present, it can be expected to increase with increased development of the area and increased tourist visitation.
- Local residents should be encouraged to manage the dog population to prevent them from wandering the dunes throughout the night.
- Local laws relating to harvest of turtles should be enforced. If the local Kanak people are permitted to harvest turtles and/or eggs, then the following general principals can be applied to ensure that the harvest can be sustainable:
  - At least 70% of the clutches of eggs should produce hatchlings. The loss of eggs to dog predation, to erosion and to human harvest need to be collectively regulated to ensure that sufficient hatchlings are produced.
  - The harvest of nesting females should not exceed 10% of the annual recruitment rate to the nesting population. Based on eastern Australian populations, this would translate to no more than 10% of 30% = 3% of the total annual nesting population, i.e. about a maximum of 2 adult females annually.
  - The management of a sustainable level of take should be addressed by the Kanak elders.

These issues need to be addressed by an education campaign directed to both the local residents and the local government.

ACKNOWLEDGEMENTS

This project was conducted as part of the Queensland Turtle Research Project. It was funded in part by a grant from the Western Pacific Regional Fisheries Management Council (Contract No. 04-WPC-030). The project could not have achieved without the invaluable assistance of the Association pour la Sauvegarde de la Nature Neo-Caledonienne and in particular the President, J-Louis d'Auzon. Marile and Daniel Marteaud provided assistance with accommodations. Numerous local residents provided oral background information on the region and its turtles and assisted with the beach studies. This assistance is acknowledged and appreciated.

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Appendix 1:
North Pacific Loggerhead Turtle – Threat Mix

RISK MATRIX: THREATS RANKED (1-4)
1 = High threat level; high importance to take action
2 = Medium threat level
3 = Low threat level; low importance to take action
4 = No threat level (not applicable)
Unk = unknown threat (but could potentially be a threat, once more is known)

High level threats versus medium level threats ranked and/or prioritized based on tasks that are within reason to implement given available monetary resources.

THREAT	ADULTS	JUVENILES	HATCHLINGS	EGGS
Threats to Nesting Beaches				
Direct harvest (humans)	4	4	4	4
Coastal construction (disruption of nesting & hatching activities)	1	4	4	2
Nest predation by domestic, native and/or feral animals	4	4	3	3[a]
Artificial lighting	2.5	4	2.5	4
Data deficiencies (nesting activity, identify nesting beaches, determine and monitor trends, nesting beach origins, define stock boundaries, genetics)	3	4	3	3
Threats to Nesting Habitat				
Degradation due to erosion-control measures, jetties, breakwaters	1	4	4	1
Sand removal & mining practices	2.5	4	4	2.5
Vehicular driving/ Foot traffic	2	4	1.5	1.5
Degradation by upland, coastal erosion, siltation (mining), river armoring, dams	1	4	4	1
Ceremonial purposes[b]	4	4	1	4
Global warming* (increasing sand temperature, sea level rise)	2	4	4	2
Typhoon	1.5	4	4	1.5

THREAT	ADULTS	JUVENILES	HATCHLINGS	EGGS
Threats to turtles in marine habitats				
Direct harvest	1[c]	1	4	4
Data deficiencies (distribution, abundance, migration, growth rates, survivorship, threats on foraging grounds)	2	2	4	4
Entanglement and ingestion of marine debris	2	2	3	4
Boat collisions	3	3	4	4
Incidental take in Fisheries				
Longline	1	1	4	4
Purse seine	3	3	4	4
Trawl	1	1	4	4
Gillnet	1	1	4	4
Pound nets/traps/pots	3	3	4	4
FADs	3	3	4	4
Hook and line	3	3	4	4
Other				
Disease	3	3	4	4
Predation	3	3	4	4
Threats to marine habitat				
Data deficiencies (identification of important foraging habitat)	1.5	1.5	4	4
Degradation of reefs by boating, diving, human use activities	2 (Unk)	4	4	4
Degradation by coastal erosion, siltation, including mining, logging, pollution	3	3	4	4
Degradation of pelagic habitat by oil trans-shipment[d]*	2.5	2.5	4	4
Bioaccumulation of heavy metals through prey ingestion*	Unk	Unk	4	4
Commercial red crab fishery[e]	Unk	Unk	4	4

[a] Depending on the beach, egg predation by ghost crabs and ants takes place. In addition, a raccoon, introduced from the U.S., may prey on eggs and hatchlings – this may be an emerging issue.

[b] In Hamamatsu (Shizuoka Prefecture), an NGO relocates eggs to hatchery and holds loggerhead hatchlings longer than normal after they hatch to be released en masse on a set calendar day, for the purpose of educating and attracting tourists and local media. Hatchlings are released during the day, after spending their frenzy period in a tank. Threat is therefore high for hatchlings in this area only.

[c] There is minimal direct harvest by 3-4 communities in Japan of non-nesting loggerheads of minimum size of 70 cm. This is likely decreasing due to education and outreach efforts. The direct harvest of loggerheads off Baja California, Mexico is still occurring at high levels and is the primary reason this threat is ranked "high." Few adults are taken - mainly juveniles and subadults.

[d] There are proposals for installation of several Liquid Natural Gas facilities off southern California and Baja California, Mexico. This is an emerging issue.

[e] While this fishery is currently non-existent, if a commercial fishery for pelagic red crabs does emerge, this could have serious impacts on loggerheads foraging off Baja California, since this is one of their primary food sources.

Denise

Foraging habitats of loggerhead turtles (*Caretta caretta*) nesting in Bourail – New Caledonia determined by satellite tracking.

Superflu? Most of the information on loggerhead turtle (Caretta caretta) populations of the Western pacific, particularly movements and distribution, come from the work carried out in Australia. Two genetically distinct stocks have been identified there, the western and eastern Australian genetic stocks. The eastern Australia population is the most significant in the southern Pacific Ocean (Limpus 2008). Nesting is concentrated in southern Queensland, foraging areas are more widely distributed (Anon, 2012).

With between 10 and 20% of the spawning population, it has been estimated that New Caledonia harbors the second largest loggerhead population in the western Pacific after that of Australia (Etaix-Bonin et al., 2011). Furthermore the beach at Roche Percée in Bourail has been classified as one of the largest rookeries of the country (Mounier, 2007).

Evidence suggests that females nesting in New Caledonia may also be part of the same genetic stock as the Eastern Australian population (Boyle 2006).

Flipper Tags

To date, only a few migrations have been recorded between breeding areas in Australia and foraging areas in New Caledonia (Fig 1). Two turtles have also been recorded migrating to breed outside of Australia: at the Isle of Pines south of the main Island of New Caledonia and on the mid-East coast of the main Island of New Caledonia (Limpus and Limpus, 2001).

As part of a broader collaborative research on loggerhead movements carried out by the Aquarium des Lagons and NOAA, National Marine Fisheries Service Pacific Islands Fisheries Science Center, the agency provided 3 TAM4410 ARGOS MARINE TRANSMITTER to track breeding females from the main rookery in Bourail. Three adult nesting loggerhead turtles were thus equipped with satellite transmitters on that beach in three different occasions at approximately the same time of year (Fig 2):

1. 20 February 2007 – CCL=91,0 cm
2. 3 February 2011 – CCL=88,3 cm
3. 6 February 2012 –CCL=89,4 cm

All three turtles followed different routes and reached three different foraging zones (fig 3) on either side of Cape York peninsula for the first two and in Trobriand Islands in Papua New Guiney. They travelled an average of 92 days to reach their destination distant from over 2500 km of the nesting beach.

Most interesting is Turtle n°2 which went through the Torres Strait to reach its foraging zone in the gulf of Carpentry. The only previous records of loggerhead turtles crossing over to these waters were turtles coming from the East Australian rookeries.

This new track would tend to confirm that the loggerhead nesting stock of New Caledonia and the East Australian stock are part of the same population.

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R. Farman (&) _ O. Chateau

Laboratoire d'écologie marine – Aquarium des lagons Nouvelle-Calédonie, BP R4, 98851 Nouméa cedex, Nouvelle-Calédonie.

e-mail: richard.farman@aquarium.nc

e-mail: olivier.chateau@aquarium.nc

Fig. 1

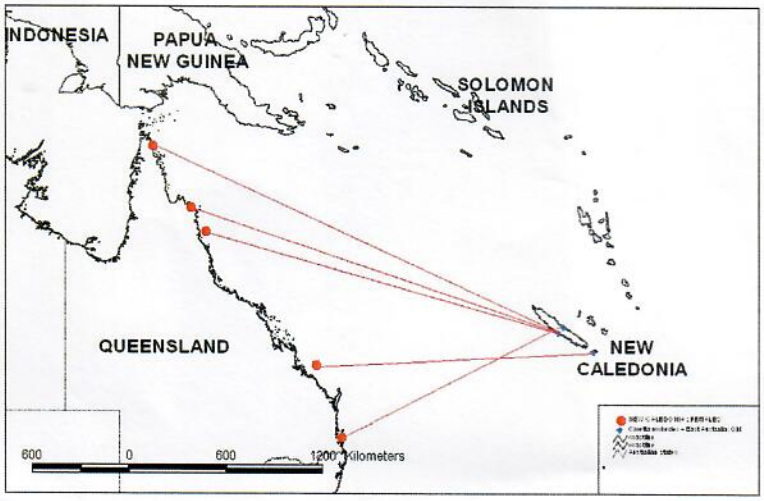
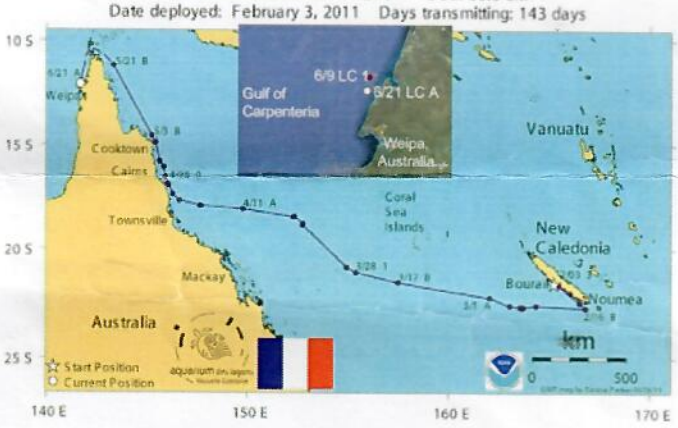


Fig.2

Fig 3 (à faire redessiner et grouper sur une seule carte?)

Update as of 24 Apr 07:
2007 movement of post-nesting Bourail loggerhead turtle, ID 41462
released from Roche Percee, Bourail, New Caledonia
ST-20 transmitter Duty Cycle: 6 hours on, 48 hours off Curved Carapace Length: 91.0 cm
Date Deployed: February 20, 2007 Days Transmitting: 63 days
Straight line distance traveled: 2575 km Mean Travel Speed: 1.7 km/hr

Update as of 6/26/2011:
2011 movement of post-nesting loggerhead turtle, ID 23483
TAM-4410 transmitter 6/48 CCL: 88.3 cm
Date deployed: February 3, 2011 Days transmitting: 143 days



Update as of 4/18/2012:
2012 movement of post-nesting loggerhead turtle "The Wall", ID 25312
TAM-4510 transmitter Duty cycle: 6/48 SCL: 89.4 cm
Date deployed: February 6, 2012 Days transmitting: 72 days

WWF completes first New Caledonia wide marine turtle survey - one more tool for the conservation of a future UNESCO World Heritage site

Introduction

The **New Caledonia Country Program** of the **WWF-France** lead the first ever **New Caledonia country-wide survey to determine the distribution and population size of nesting marine turtles** in December 2006 and January 2007. The results will guide the ongoing **Ecoregional Analysis** of the **New Caledonia Marine Ecoregion**, and WWF's already considerable contribution to the promotion of **practical scientific knowledge** and the evolving **management plans** for the **"world's largest"** lagoon, very likely to be inscribed on the **UNESCO World Heritage List** in 2008.

The study was coordinated by veterinarian and ethologist, **Dr. Sophie Mounier** (a consultant working on behalf of the WWF-France in New Caledonia) and with the technical assistance of marine turtle expert, **Dr. Colin Limpus** of the Queensland Department of Environment. Funding for this study was provided by the **United States Fish and Wildlife Service** and the **Native Iris Foundation**. In kind technical and logistical assistance was provided by several **New Caledonia governmental agencies**, and a great number of local **WWF volunteers**. Asia Pacific Marine Turtle Programme Coordinator, **Ms. Liz McLellan**, provided - and continues to provide - very appreciated moral, technical, and financial support.

Methods

During the survey, the **presence / absence of turtle tracks**, **species type**, and other relevant **geographical and ecological data** were collected by observers flying in a Cessna 206 at +/- **100 knots** and at approximately +/- **100 feet** of altitude over more than **95%** of New Caledonia's mainland and island beaches. The flights occured over a **six day period**, at a rate of +/- **six hours per day**, beginning at "first light", and at low tide, and covered a total of some **5000 plus klms** (see attached figures).

Simultaneous to the overflights, some **11 ground truthing teams** consisting of approximately **100 individuals** (WWF staff, WWF volunteers & local provincial environmental protection agents etc.) surveyed a series of known and suspected turtle nesting sites to record the **species type** and **morphomogical data** of nesting turtles, **record or place tags**, to obtain **genetic samples**, and site specific data pertaining to **perceivable threats** to nesting turtles. Some 35 survey **team leaders** underwent a **"marine turtle data collection protocol"** training session with Dr. Limpus. This unprescedented **"capacity building"** training session, and coupled with the field missions, has **exponentially increased the in-country capacity** to study and monitor nesting turtle populations.

Results

The **results** of the survey confirm the previously identified nesting populations of **Green turtles,** *Chelonia mydas* (several thousand nesting females per year and thus **the most important nesting site in the Pacific Island Nation** for this species), and **Loggerhead**

turtles, *Caretta caretta* (200 nesting females and thus **20% of Pacific Island Nation population** for this species).

On the other hand, the **survey also effectively dispels** the some 30 year old theory concerning the **existance of a nesting** population of **Hawksbill turtles,** *Eretmochelys imbricata,* which was thought to exist in the Loyalty Island group.

Conclusion and Outlook

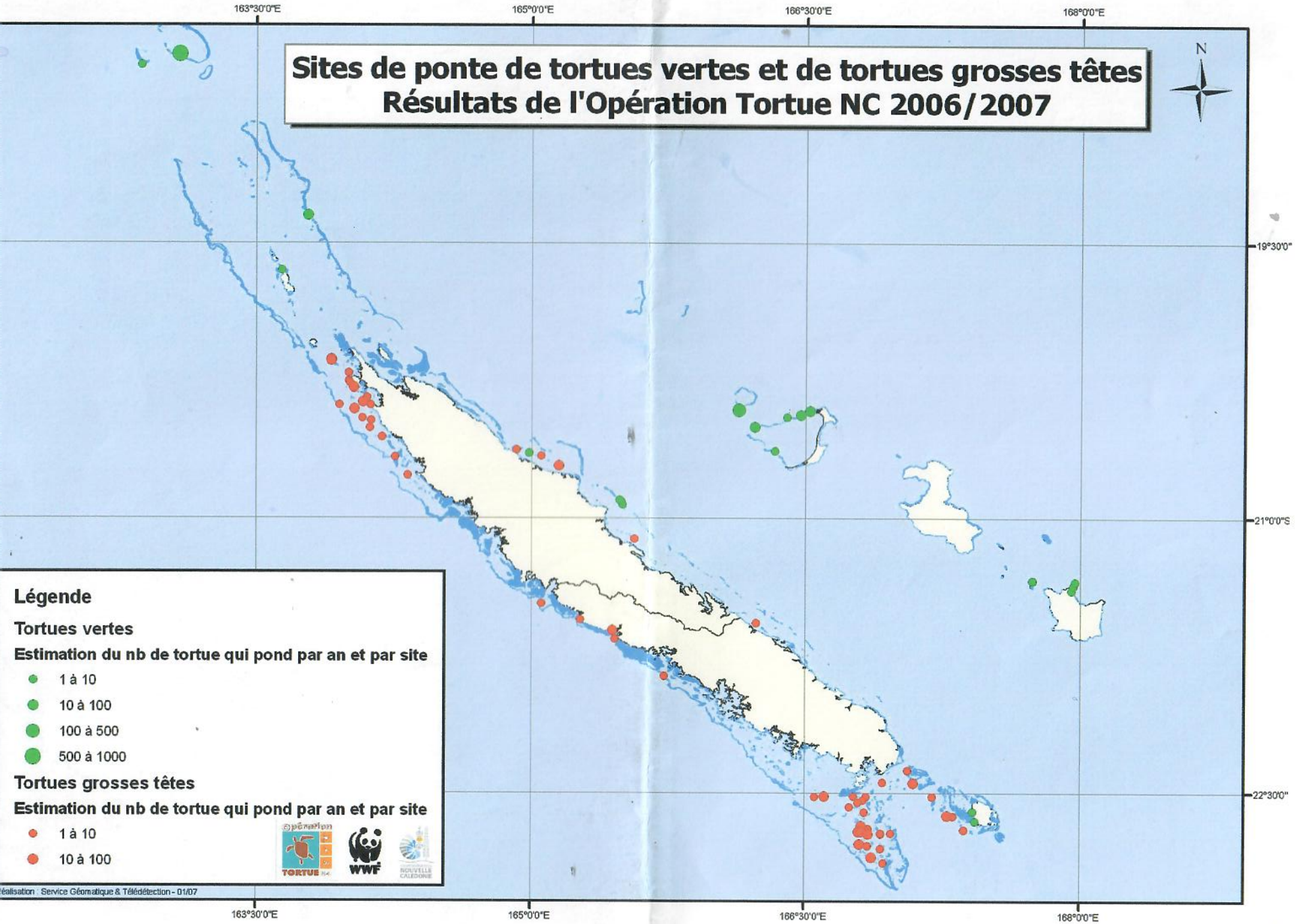
The results of this turtle survey provide **direly needed country-wide information** about keystone marine species which IUCN lists as **threatened** (Green turtles) and **vulnerable** (Loggerhead turtles). The **training session, field missions**, and **aerial overflights** have effectively **"trained" a fresh batch** of heretofore inadequate number of individuals capable of performing **turtle survey and monitoring missions**.

The **cartographic and ecological results** of the survey will be used to **guide the development** of an adequately ambitious **conservation strategy and action plan** for marine turtles and their nesting sites, and associated **monitoring protocols** to guage success and correct ill-adapted measures. Efforts will also be focused on increasing the number of recovered **turtle tags** as there is thought to be **hundreds, if not thousands** currently retained by caledonians. **Turtle hunting/fishing became illegal** in the two provinces of the "big island" in 2006. Laws alone, will not protect turtles so we aim to produce and distribute a **+/- 15 minute documentary** to school and communities in order to **enhance awareness** about the dwindling numbers of these **culturally and ecologically** important animals.

Provided the resources are available, the **WWF sponsored turtle survey will continue in 2007/2008** during the peak nesting season, in order to collect additional **ecological and morphological information**, and a sufficiently large number of **genetic samples** for proper "population" estimates and analyses.

New Caledonia Country Program of the **WWF-France** is planning to conduct a **Vision and Strategy workshop** in November 2007, in culmination of the ongoing **Ecoregional Analysis** of the **New Caledonia Marine Ecoregion**. If ressources are available, it would be useful to organise a **"New Caledonia Marine Turtle"** specific workshop in advance of the November 2007 workshop in order to generate adequately specific **conservation reccomendations for these keystone species**, which can be validated and adopted in november.

Sites de ponte de tortues vertes et de tortues grosses têtes
Résultats de l'Opération Tortue NC 2006/2007



Légende

Tortues vertes

Estimation du nb de tortue qui pond par an et par site

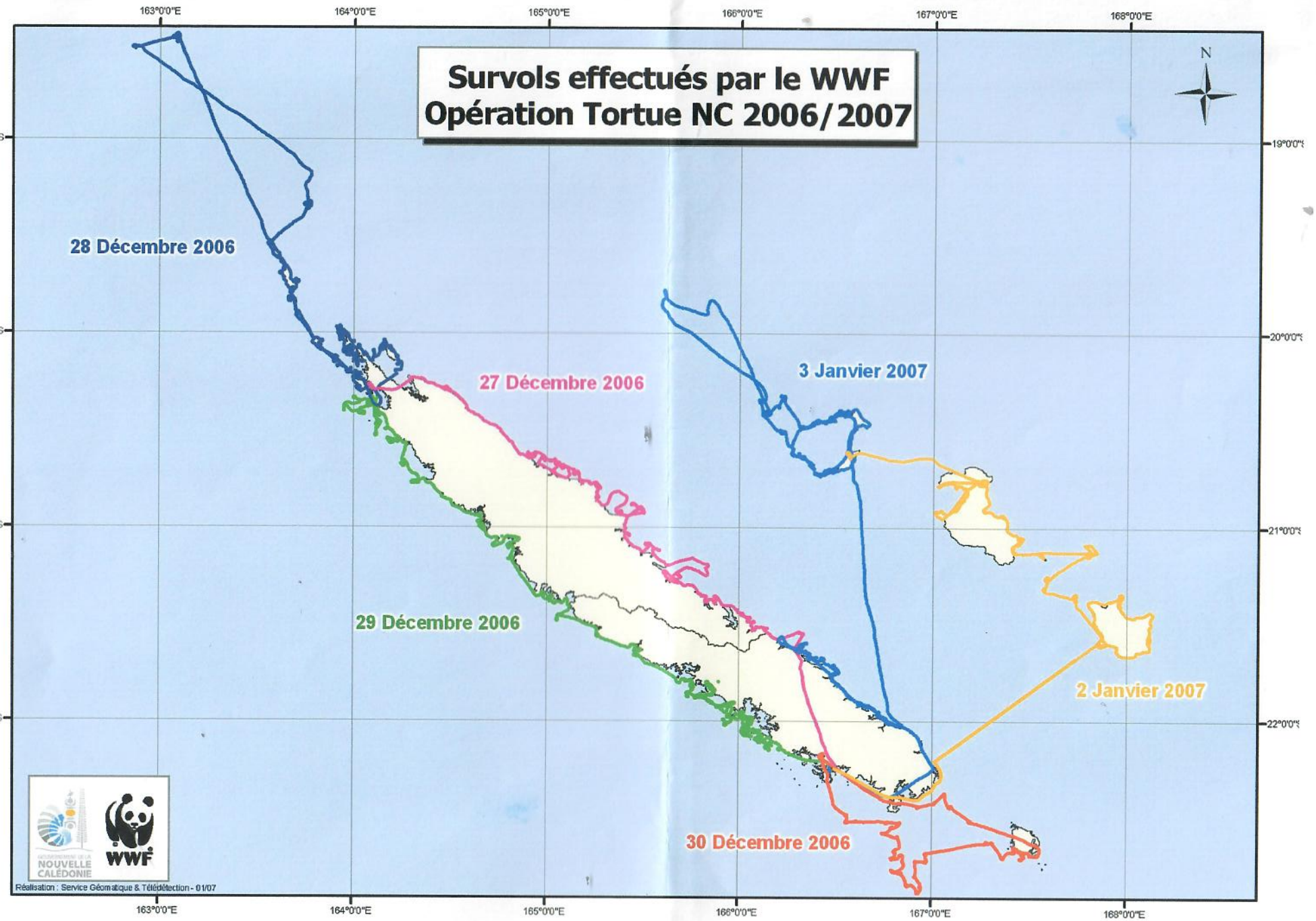
- 1 à 10
- 10 à 100
- 100 à 500
- 500 à 1000

Tortues grosses têtes

Estimation du nb de tortue qui pond par an et par site

- 1 à 10
- 10 à 100

Réalisation : Service Géomatique & Télédétection - 01/07


Survols effectués par le WWF
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NOUVELLE CALÉDONIE
WWF
Réalisation : Service Géomatique & Télédétection - 01/07

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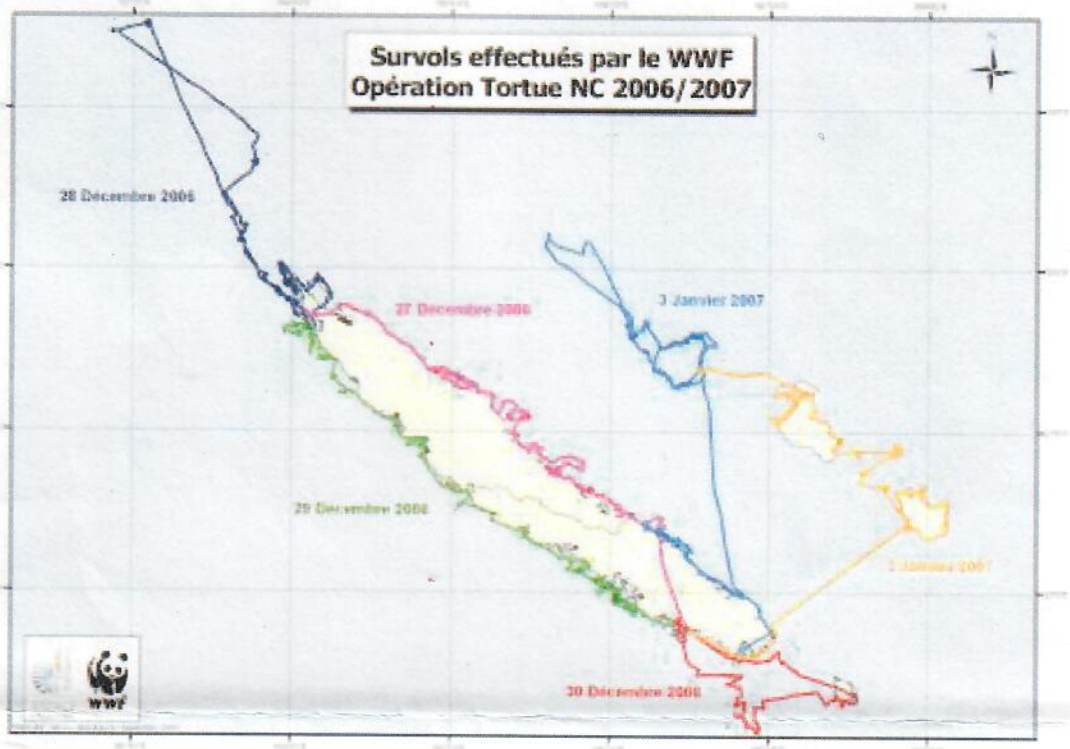
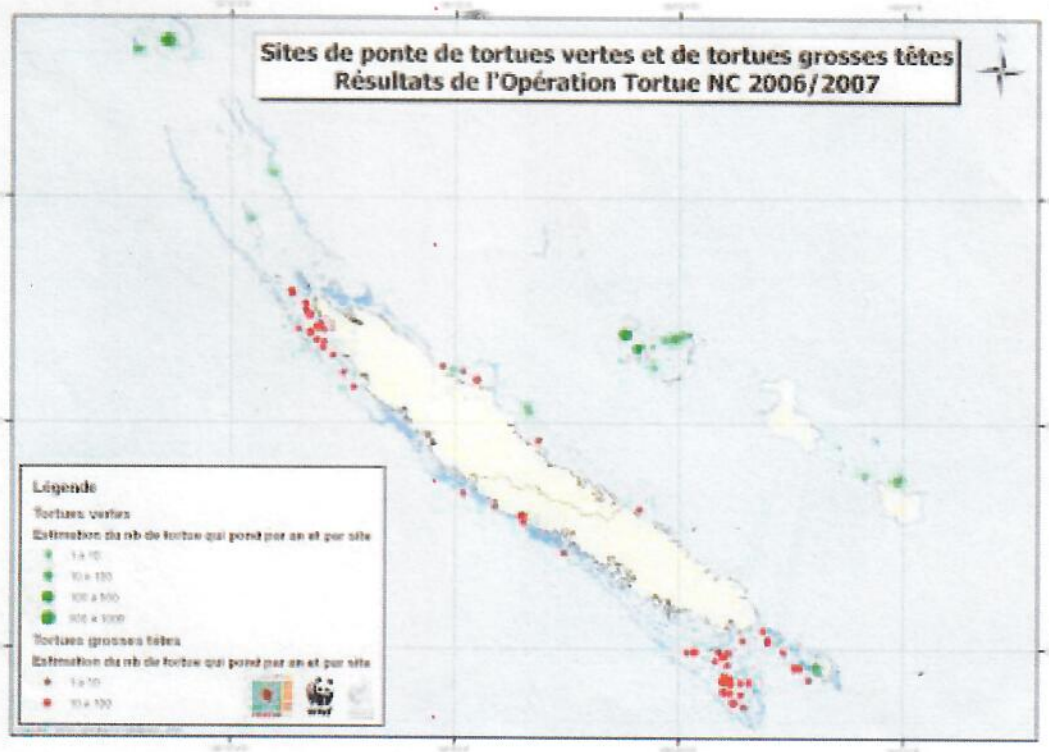
Provided the resources are available, the **WWF sponsored turtle survey will continue in 2007/2008** during the peak nesting season, in order to collect additional **ecological and morphological information**, and a sufficiently large number of **genetic samples** for proper "population" estimates and analyses.

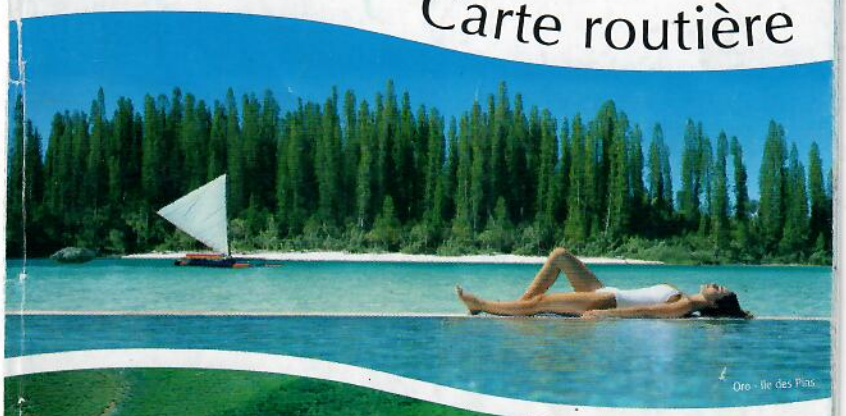
New Caledonia Country Program of the **WWF-France** is planning to conduct a **Vision and Strategy workshop** in November 2007, in culmination of the ongoing **Ecoregional Analysis** of the **New Caledonia Marine Ecoregion**. If ressources are available, it would be useful to organise a "**New Caledonia Marine Turtle**" specific workshop in advance of the November 2007 workshop in order to generate adequately specific **conservation reccomendations for these keystone species**, which can be validated and adopted in November.


Survols effectués par le WWF
Opération Tortue NC 2006/2007
28 Décembre 2006
27 Décembre 2006
3 Janvier 2007
29 Décembre 2006
30 Décembre 2006
WWF


Sites de ponte de tortues vertes et de tortues grosses têtes
Résultats de l'Opération Tortue NC 2006/2007
Légende
Tortues vertes
Tortues grosses têtes
WWF

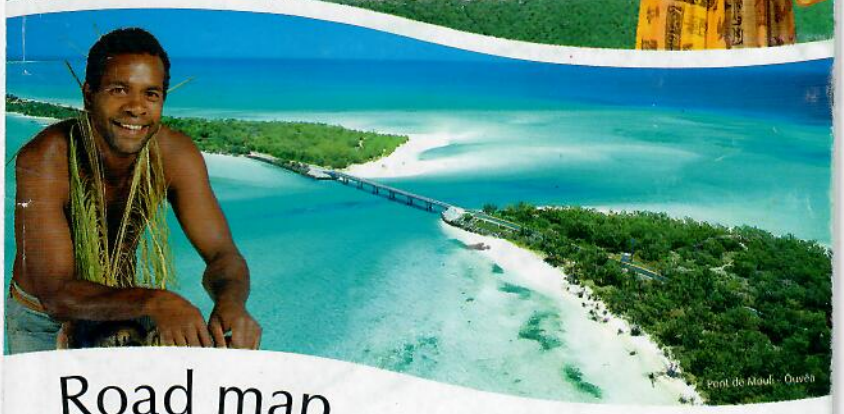
Nouvelle-Calédonie

Carte routière



Ore - Ile des Pins

Cœur de Voh



Pont de Mouli - Ouvéa

Road map

New Caledonia

Bonne route. Conduisez prudemment.
Have a nice trip. Drive Safely.

Echelle / Scale
1:650.000
Edition 2004

Offert par
With compliments of

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Tourisme *Point Sud*

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Auckland : (64) 9 585 0257 / info-akl@nctps.com
Nouméa : (687) 24 20 80 / info@nctps.com

Internet : www.nctps.com

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N° vert (free call) : 05 75 80
E-mail : office-tourisme@canl.nc

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NORD

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BP 115 - 98845 Nouméa Cedex - Nouvelle-Calédonie
E-mail : info@tourismeprovincenord.nc
Internet : www.tourismeprovincenord.nc

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Informations générales & réservations
113, avenue Roger-Laroque - Anse-Vata
Tél. : (687) 28 93 60 - Fax : (687) 28 91 21

Direction - Informations aux professionnels
27, rue de Sébastopol - Immeuble Central 1
Tél. : (687) 27 66 27 - Fax : (687) 27 48 27
BP 343 - 98845 Nouméa Cedex - Nouvelle-Calédonie
E-mail : dil@iles-loyaute.com - **Internet :** www.iles-loyaute.com

Légendes / *Keys*

Commune *Village*	KONÉ Koohnê
Tribu *Tribe*	Pagou
Lieu-dit *Place*	Moindah
Route principale *Main road*	RT1
Route principale en terre *Main dirt road*	RPN3
Route secondaire *Secondary road*	
Piste *Dirt track*	
GR - Sentier de grande randonnée *Walking track*	
Point d'information touristique *Tourist Information Office*	
Randonnée pédestre, centre équestre *Rambling, horse-back riding*	
Golf, centre de plongée *Golf, scubadiving*	
Hôtel/gîte, camping *Accomodation, camping site*	
Plage, aire de pique-nique *Beach, picnic area*	
Aérodrome, port, station service *Airport, port, petrol station*	
Mise à l'eau, cascade, phare *Boat ramp, waterfall, lighthouse*	

Réalisation : Point GED • 28 50 42
Flash : EIP Gutenberg - Impression : Artypo

Route secondaire
Secondary road

Piste
Dirt track

GR - Sentier de grande randonnée
Walking track

Point d'information touristique
Tourist Information Office

Randonnée pédestre, centre équestre
Rambling, horse-back riding

Golf, centre de plongée
Golf, scubadiving

Hôtel/gîte, camping
Accomodation, camping site

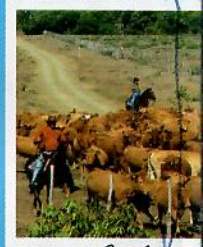
Plage, aire de pique-nique
Beach, picnic area

Aérodrome, port, station service
Airport, port, petrol station

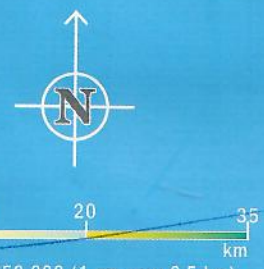
Mise à l'eau, cascade, phare
Boat ramp, waterfall, lighthouse

Réalisation : Point GED • 28 50 42
Flash : EIP Gutenberg - Impression : Artypo

Cœur de Voh



Stockmen



Carte au 1 : 650 000 (1 cm pour 6,5 km)

Temps moyens entre localités
(Calculés sur une vitesse moyenne de 85 km/h)

	Boulouparis	Bourail	Canala	Farino	Hienghène	Houaïlou	Kaala-Gomen	KONÉ	Kouaoua	Koumac	La Foa	Moindou	Népoui	NOUMÉA	Ouégoa	Poindimié	Ponérihouen	Pouébo	Pouembout	Poum	Poya	Sarraméa	Thio	Tontouta	Touho	Voh	Yaté
Boulouparis	1:02																										
Bourail	1:07	1:18																									
Canala	0:29	0:40	0:38																								
Farino	3:37	2:34	2:44	3:14																							
Hienghène	1:52	0:50	1:00	1:30	1:44																						
Houaïlou	3:19	2:16	3:34	2:56	1:48	3:06																					
Kaala-Gomen	2:21	1:18	2:36	1:58	1:24	2:08	0:57																				
KONÉ	1:11	1:18	0:31	0:41	2:12	0:28	3:38	2:40																			
Kouaoua	3:31	2:28	3:47	3:09	1:35	3:19	0:12	1:10	3:50																		
Koumac	0:26	0:36	0:41	0:03	3:11	1:26	2:52	1:55	0:45	3:05																	
La Foa	0:35	0:27	0:50	0:12	3:02	1:17	2:43	1:45	0:54	2:56	0:09																
Moindou	1:53	0:50	2:09	1:31	1:50	1:40	1:17	0:26	2:55	1:36	1:27	1:18															
Népoui	0:52	1:55	2:00	1:21	4:29	2:45	4:11	3:13	2:03	4:24	1:18	1:27	2:45														
NOUMÉA	3:56	2:53	4:12	3:33	1:10	2:55	0:37	1:35	4:15	0:24	3:30	3:21	2:01	4:48													
Ouégoa	2:45	1:43	1:52	2:23	0:51	0:52	1:57	1:00	1:21	2:10	2:19	2:10	1:26	3:38	2:02												
Poindimié	2:25	1:22	1:32	2:02	1:12	0:32	2:18	1:20	1:00	2:31	1:59	1:50	1:48	3:17	2:22	0:20											
Ponérihouen	4:19	3:16	2:54	3:57	0:42	2:26	1:05	2:07	2:55	0:52	3:53	3:44	2:33	5:12	0:28	1:33	1:54										
Pouébo	2:15	1:12	2:31	1:52	1:30	2:02	1:03	0:05	2:34	1:16	1:49	1:40	0:20	3:07	1:40	1:05	1:26	2:07									
Pouembout	3:00	3:08	4:26	3:48	2:07	3:51	0:52	1:50	4:30	0:39	3:45	3:36	2:16	5:03	0:56	2:50	3:10	1:24	1:55								
Poum	1:36	0:33	1:51	1:13	2:09	1:23	1:43	0:45	1:55	1:55	1:09	1:00	0:17	2:28	2:20	1:45	2:05	2:47	0:39	2:35							
Poya	0:33	0:43	0:33	0:04	3:18	1:33	3:00	2:02	0:37	3:12	0:07	0:16	1:34	1:25	3:37	2:26	2:06	4:04	1:56	3:52	1:16						
Sarraméa	0:32	1:35	0:24	1:02	4:09	1:24	3:51	2:53	0:56	4:04	0:58	1:07	2:26	1:24	4:28	3:18	1:57	4:55	2:48	4:43	2:08	1:05					
Thio	0:19	1:22	1:27	0:49	3:57	2:12	3:38	2:40	1:31	3:51	0:45	0:55	2:13	0:32	4:16	3:05	2:45	4:39	2:35	4:31	1:55	0:52	0:52				
Tontouta	3:05	2:02	2:12	2:43	0:31	1:12	1:50	0:52	1:40	2:03	2:39	2:30	1:19	3:57	1:42	0:19	0:40	1:14	0:58	2:43	1:38	2:46	3:38	3:25			
Touho	2:43	1:40	2:59	2:21	1:47	2:31	0:35	0:22	3:02	0:48	2:17	2:08	0:48	3:36	1:12	1:22	1:43	1:39	0:28	1:27	1:07	2:24	3:16	3:03	1:15		
Voh	1:48	2:51	2:56	2:18	5:26	3:41	5:07	4:09	3:00	5:20	2:14	2:24	3:42	0:56	5:45	4:34	4:14	6:08	4:04	6:00	3:24	2:21	2:21	1:28	4:54	4:32	
Yaté																											

Average time between localities
(Based on a speed of 85 kph)

Distances (en km) entre localités

	Boulouparis	Bourail	Canala	Farino	Hienghène	Houaïlou	Kaala-Gomen	KONÉ	Kouaoua	Koumac	La Foa	Moindou	Népoui	NOUMÉA	Ouégoa	Poindimié	Ponérihouen	Pouébo	Pouembout	Poum	Poya	Sarraméa	Thio	Tontouta	Touho	Voh	Yaté
Boulouparis	89																										
Bourail	96	111																									
Canala	42	57	54																								
Farino	308	219	233	276																							
Hienghène	160	71	85	128	148																						
Houaïlou	282	193	304	250	153	264																					
Kaala-Gomen	200	111	222	168	120	182	82																				
KONÉ	101	111	45	59	188	40	309	227																			
Kouaoua	300	211	322	268	135	282	18	100	327																		
Koumac	37	52	59	5	271	123	245	163	64	263																	
La Foa	50	39	72	18	258	110	232	150	77	250	13																
Moindou	161	72	183	129	157	143	110	37	248	137	124	111															
Népoui	74	163	170	116	382	234	356	274	175	374	111	124	235														
NOUMÉA	335	246	357	303	100	248	53	135	362	35	298	285	172	409													
Ouégoa	235	146	160	203	73	75	167	85	115	185	198	185	122	309	173												
Poindimié	206	117	131	174	102	46	196	114	86	214	169	156	151	280	202	29											
Ponérihouen	368	279	247	336	60	208	93	180	248	75	331	318	217	442	40	133	162										
Pouébo	192	103	214	160	128	174	90	8	219	108	155	142	29	266	143	93	122	181									
Pouembout	356	267	378	324	180	328	74	156	383	56	319	306	193	430	80	241	270	120	164								
Poum	136	47	158	104	184	118	146	64	163	164	99	86	25	210	199	149	178	237	56	220							
Poya	47	62	48	7	281	133	255	173	53	273	10	23	134	121	308	208	179	346	165	329	109						
Sarraméa	46	135	35	88	354	120	328	248	80	346	83	96	207	120	381	281	166	419	238	402	182						
Thio	28	117	124	70	336	188	310	228	129	328	65	78	189	46	363	263	234	396	220	384	164						
Tontouta	263	174	188	231	45	103	157	75	143	175	226	213	112	337	145	28	57	105	83	231	139						
Touho	232	143	254	200	152	214	50	32	259	68	195	182	69	306	103	117	146	141	40	124	96						
Voh	154	243	250	196	462	314	436	354	255	454	191	204	315	80	489	389	360	522	346	510	290						
Yaté																											

Distances (km) between localities

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Auckland : (64) 9 585 0257 / info-akl@nctps.com
Nouméa : (687) 24 20 80 / info@nctps.com
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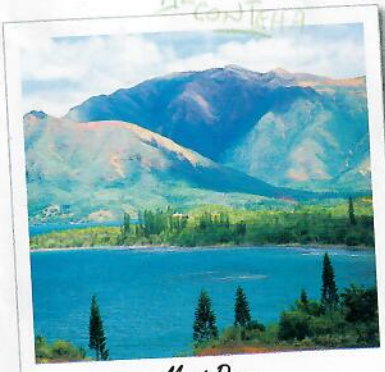
Place Georges Guillermet
Tél. : 41 69 11 - Fax : 41 92 01
E-mail : lafoatourisme@canl.nc
Internet : www.lafoa.com
Ouvert : du lundi au vendredi de 8h à 17h30 et de 9h à 17h les week-ends et jours fériés. / Open from Monday to Friday from 8 am to 5.30 pm and from 9 am to 5 pm on weekends and public holidays.

Moindou

• Le Fortin de Téremba / Fort Teremba

Animations / *Events*
• Spectacle Son et Lumière de Téremba tous les deux ans (le prochain en juin 2005) / *Teremba Sound and Light Show (every 2 years – next one in June 2005).*


Mont Dore

Mont-Dore

• Les vestiges du village de Prony / *The village of Prony vestiges*
• L'aiguille sous-marine de Prony / *The underwater Prony needle*
• Le village de la Conception et son église / *La Conception village and church*
• Le Mont Dore et sa source / *Mont Dore and its natural water source*
• La plage de Plum / *Plum beach*

Animations / *Events*
• Journées du Patrimoine du Mont-Dore (septembre) / *Mont-Dore Heritage Days (September)*

Point i Mont Dore
Tél./Fax : 43 33 44
E-mail : tourismemontdore@lagoon.nc
Heures d'ouverture : du lundi au vendredi de 8 à 16h, le samedi et dimanche de 8h à 12h.
Open from Monday to Friday from 8 am to 4 pm. From 8 am to noon on weekends.

Nouméa

• Le centre culturel Tjibaou / *Tjibaou Cultural Centre*
• L'Aquarium de Nouméa / *Nouméa Aquarium*
• Le musée de Nouvelle-Calédonie / *New Caledonia Museum*
• Le marché de Nouméa / *Nouméa's market*
• La bibliothèque Bernheim/ *Bernheim Public Library*
• La cathédrale Saint-Joseph / *Saint-Joseph Cathedral*
• Le parc zoologique et forestier Michel Corbasson / *Botanical and Zoological Garden*
• Le musée de la Ville de Nouméa / *Nouméa City Museum*
• Le musée de l'Histoire maritime / *Maritime History Museum*
• Le Musée géologique / *Geological Museum*
• Point de vue et sentiers du Ouen Toro / *Ouen Toro walkways and viewpoint*


Centre Culturel Tjiba

Chefferie / *Chieftainry*

Les enceintes de Chefferies ne sont pas des sites à visiter. Il vous est demandé de ne respecter ces lieux sacrés pour les habitants.
The Chief's houses and their surrounds are not open for visiting. You are asked not to of special customary importance to the residents.

Nouvelle-Calédonie

Carte routière

Road map

New Caledonia

Bonne route. Conduisez prudemment.
Have a nice trip. Drive Safely.

Echelle / Scale
1:650.000
Edition 2004

Découvrez la Province Sud

Discover the Southern Pro

Boulouparis

- Le golf et la rivière de la Ouenghi / La Ouenghi river and golf course
- Ilot Ténia / *Ténia islet*

Animations / Events

- Fête du Cerf et de la Crevette (mai) / *Deer and Prawn Festival (May)*
- Festival de la Bande dessinée (août) / *Comic strip Festival (August)*
- Marché de Tomo le 1er dimanche du mois / *Tomo village local produce market (every 1st Sunday of month)*
- Courses hippiques / *Horse races*

Bourail

- La plage de Poé / *Poé beach*
- Le musée historique de Bourail / *Bourail History Museum*
- La Roche Percée / *Pierced Rock*
- Le cimetière néo-zélandais / *The New Zealand cemetery*

Animations / Events

- Foire agricole de Bourail (août) / *Bourail Agricultural Fair (August)*

Dumbéa

- Le point de vue du Mont Koghi et ses sentiers / *Mount Koghi viewpoint and walkways*
- Le Golf municipal de Dumbéa / *Dumbéa public golf course*
- La rivière de Dumbéa / *Dumbéa river*

Animations / Events

- Fête de l'Omelette Géante (avril) / *Giant omelette Festival (April)*
- Marché de Koutio le 3e dimanche du mois / *Koutio village local produce market (3rd Sunday of month)*
- Marché du Parc Fayard les 1er et 3e samedis du mois / *Fayard Park local produce market (1st & 3rd Saturday of month)*

Point i Dumbéa Tourisme
Mairie de Dumbéa
Tél. /Fax : 41 40 15
E-mail : pointi@lagoon.nc
Internet : www.dumbea.net

Forêt des monts Koghi

Farino

- Le marché de Farino le 2e dimanche du mois / *Farino market (every 2nd Sunday of month)*
- Les promenades en forêt à pied ou en quad / *Bush walking and ATV rides*

La Foa

- Les tribus de Oua Tom et de Oui Poin / *Oua Tom and Oui Poin tribes*
- La Place Georges Guillemet / *Georges Guillemet Square*
- La presqu'île Lebris / *Lebris Peninsula*
- La plage de Ouano / *Ouano beach*

Animations / Events

- Festival du Cinéma de La Foa (juin) / *La Foa village Film Festival (June)*

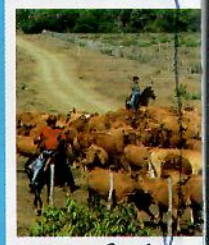
Point i La Foa Tourisme

Comprenant les communes de Moindou, Farino et Sarramea

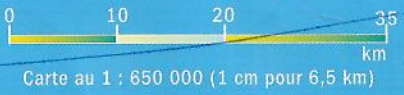
Airport, port, petrol station

Mise à l'eau, cascade, phare
Boat ramp, waterfall, lighthouse

Réalisation : Point GED • 28 50 42
Flash : EIP Gutenberg - Impression : Artypo



Stockmen



Carte au 1 : 650 000 (1 cm pour 6,5 km)

	Boulouparis	Bourail	Canala	Farino	Hienghène	Houaïlou	Kaala-Gomen	KONÉ	Kouaoua	Koumac	La Foa	Moindou	Népoui	NOUMÉA	Ouégoa	Poindimié	Ponérihouen	Pouébo	Pouembout	Poum	Poya	Sarraméa	Thio	Tontouta	Touho	Voh	Yaté
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KONÉ	1:11	1:18	0:31	0:41	2:12	0:28	3:38	2:40																			
Kouaoua	3:31	2:28	3:47	3:09	1:35	3:19	0:12	1:10	3:50																		
Koumac	0:26	0:36	0:41	0:03	3:11	1:26	2:52	1:55	0:45	3:05																	
La Foa	0:35	0:27	0:50	0:12	3:02	1:17	2:43	1:45	0:54	2:56	0:09																
Moindou	1:53	0:50	2:09	1:31	1:50	1:40	1:17	0:28	2:55	1:36	1:27	1:18															
Népoui	0:52	1:55	2:00	1:21	4:29	2:45	4:11	3:13	2:03	4:24	1:18	1:27	2:45														
NOUMÉA	3:56	2:53	4:12	3:33	1:10	2:55	0:37	1:35	4:15	0:24	3:30	3:21	2:01	4:48													
Ouégoa	2:45	1:43	1:52	2:23	0:51	0:52	1:57	1:00	1:21	2:10	2:19	2:10	1:26	3:38	2:02												
Poindimié	2:25	1:22	1:32	2:02	1:12	0:32	2:18	1:20	1:00	2:31	1:59	1:50	1:46	3:17	2:22	0:20											
Ponérihouen	4:19	3:16	2:54	3:57	0:42	2:26	1:05	2:07	2:55	0:52	3:53	3:44	2:33	5:12	0:28	1:33	1:54										
Pouébo	2:15	1:12	2:31	1:52	1:30	2:02	1:03	0:05	2:34	1:16	1:49	1:40	0:20	3:07	1:40	1:05	1:26	2:07									
Pouembout	3:00	3:08	4:26	3:48	2:07	3:51	0:52	1:50	4:30	0:39	3:45	3:36	2:16	5:03	0:56	2:50	3:10	1:24	1:55								
Poum	1:36	0:33	1:51	1:13	2:09	1:23	1:43	0:45	1:55	1:55	1:09	1:00	0:17	2:28	2:20	1:45	2:05	2:47	0:39	2:35							
Poya	0:33	0:43	0:33	0:04	3:18	1:33	3:00	2:02	0:37	3:12	0:07	0:16	1:34	1:25	3:37	2:26	2:06	4:04	1:56	3:52	1:16						
Sarraméa	0:32	1:35	0:24	1:02	4:09	1:24	3:51	2:53	0:56	4:04	0:58	1:07	2:26	1:24	4:28	3:18	1:57	4:55	2:48	4:43	2:08	1:05					
Thio	0:19	1:22	1:27	0:49	3:57	2:12	3:38	2:40	1:31	3:51	0:45	0:55	2:13	0:32	4:16	3:05	2:45	4:39	2:35	4:31	1:55	0:52	0:52				
Tontouta	3:05	2:02	2:12	2:43	0:31	1:12	1:50	0:52	1:40	2:03	2:39	2:30	1:19	3:57	1:42	0:19	0:40	1:14	0:58	2:43	1:38	2:46	3:38	3:25			
Touho	2:43	1:40	2:59	2:21	1:47	2:31	0:35	0:22	3:02	0:48	2:17	2:08	0:48	3:36	1:12	1:22	1:43	1:39	0:28	1:27	1:07	2:24	3:16	3:03	1:15		
Voh	1:48	2:51	2:56	2:18	5:26	3:41	5:07	4:09	3:00	5:20	2:14	2:24	3:42	0:56	5:45	4:34	4:14	6:08	4:04	6:00	3:24	2:21	2:21	1:28	4:54	4:32	
Yaté																											

Temps moyens entre localités
(Calculés sur une vitesse moyenne de 85 km/h)

Average time between localities
(Based on a speed of 85 kph)

	Boulouparis	Bourail	Canala	Farino	Hienghène	Houaïlou	Kaala-Gomen	KONÉ	Kouaoua	Koumac	La Foa	Moindou	Népoui	NOUMÉA	Ouégoa	Poindimié	Ponérihouen	Pouébo	Pouembout	Poum	Poya	Sarraméa	Thio	Tontouta	Touho	Voh	Yaté
Boulouparis	89																										
Bourail	96	111																									
Canala	42	57	54																								
Farino	308	219	233	276																							
Hienghène	160	71	85	126	148																						
Houaïlou	282	193	304	250	153	264																					
Kaala-Gomen	200	111	222	168	120	182	82																				
KONÉ	101	111	45	59	188	40	309	227																			
Kouaoua	300	211	322	268	135	282	18	100	327																		
Koumac	37	52	59	5	271	123	245	163	64	263																	
La Foa	50	39	72	18	258	110	232	150	77	250	13																
Moindou	161	72	183	129	157	143	110	37	248	137	124	111															
Népoui	74	163	170	116	362	234	356	274	175	374	111	124	235														
NOUMÉA	335	248	357	303	100	248	53	135	362	35	298	285	172	409													
Ouégoa	235	146	160	203	73	75	167	85	115	185	198	185	122	309	173												
Poindimié	206	117	131	174	102	46	196	114	86	214	169	156	151	280	202	29											
Ponérihouen	368	279	247	336	60	208	93	180	248	75	331	318	217	442	40	133	162										
Pouébo	192	103	214	160	128	174	90	8	219	108	155	142	29	266	143	93	122	181									
Pouembout	356	267	378	324	180	328	74	156	383	56	319	306	193	430	80	241	270	120	164								
Poum	136	47	158	104	184	118	146	64	163	164	99	86	25	210	199	149	178	237	56	220							
Poya	47	62	48	7	281	133	255	173	53	273	10	23	134	121	308	208	179	346	165	329	109						
Sarraméa	46	135	35	88	354	120	328	246	80	346	83	96	207	120	381	281	168	419	238	402	182						
Thio	28	117	124	70	336	188	310	228	129	328	65	78	189	46	363	263	234	396	220	384	164						
Tontouta	263	174	188	231	45	103	157	75	143	175	226	213	112	337	145	28	57	105	83	231	139						
Touho	232	143	254	200	152	214	50	32	259	68	195	182	69	306	103	117	146	141	40	124	96						
Voh	154	243	250	196	462	314	436	354	255	454	191	204	315	80	489	389	360	522	346	510	290						
Yaté																											

Distances (en km) entre localités

Distances (km) between localities

Plage de Poum

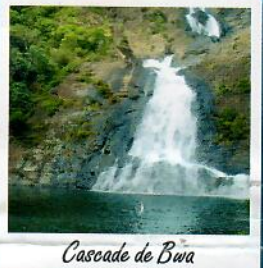
Cœur de Voh

Légendes / *Keys*

Commune *Village*	KONÉ / Koohnê
Tribu *Tribe*	Pagou
Lieu-dit *Place*	Moindah
Route principale *Main road*	RT1
Route principale en terre *Main dirt road*	RPN3
Route secondaire *Secondary road*	
Piste *Dirt track*	
GR - Sentier de grande randonnée *Walking track*	
Point d'information touristique *Tourist Information Office*	
Randonnée pédestre, centre équestre *Rambling, horse-back riding*	
Golf, centre de plongée *Golf, scubadiving*	
Hôtel/gîte, camping *Accomodation, camping site*	
Plage, aire de pique-nique *Beach, picnic area*	
Aérodrome, port, station service	

Bac de la Ouaième

« La Poule » de Hienghène



Cascade de Bwa

"Bac de la Ouaième"
Passage gratuit
Free passage

OUVÉA
Iaii

HIENGHÈNE
TOUHO
POINDIMIÉ
KONÉ
Koohnê
POUEMBOUT
PONÉRIHOUEN
HOUAÏLOU
Waa wi luu
KOUAOUA
CANALA
Népoui
POYA
BOURAIL
AL CONTRA

Ouvéa *Iaai*	Saint-Joseph	Trou Bleu d'Anawa	Waadrilla	Ouloup	Lekine	Mouli
Saint-Joseph	7					
Trou Bleu d'Anawa	18,5	10,5				
Waadrilla	26,3	18,3	7,8			
Ouloup	29,3	21,3	10,8	9		
Lekine	38,5	30,5	20	18,2	9,2	
Mouli						

Distances (en km) entre localités

Lifou *Drehu*	Falaise Jokin	Xepenehe	Aérodrome Wanaham	Centre de Wé	Dueulu	Quai de Wé	Plage de Luengoni	Mu	Xodre
Falaise Jokin	17,7								
Xepenehe	26	8,3							
Aérodrome Wanaham	33,2	26,9	21,6						
Centre de Wé	52,4	46,1	40,8	19,2					
Dueulu	36,5	30,2	24,9	3,3	22,1				
Quai de Wé	61,7	55,4	50,1	28,5	47,3	25,2			
Plage de Luengoni	68,7	62,4	57,1	35,5	54,3	32,2	7		
Mu	75,4	69,1	63,8	42,2	61,4	39,3	14,1	7,1	
Xodre									

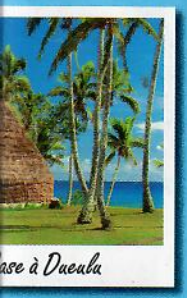
Distances (km) between localities

Maré *Nengoné*	Kurine	Aérodrome / La Roche	Trou de Bone	Roh	Nece	Tadine centre (port)	Cengeite
Kurine	16,2						
Aérodrome / La Roche	28,4	12,2					
Trou de Bone	42,5	26,3	14,1				
Roh	41,4	25,2	13	13,4			
Nece	38,9	22,7	13,5	21,4	8		
Tadine centre (port)	47,2	31	21,8	32,7	19,3	8,3	
Cengeite							

	Thio	Tontouta	Touho	Voh	Yaté
Nouméa	74	309	291	278	260	126	107	417	386

OUVÉA
Iaii
Passe de la Baleine
Pléiades du Nord
Teouta-Ounes
Weneki
Heo St-Joseph
Gossanah
Takedji
Ognat St-Thomas
Wadrilla
Kop Hwagei
Banutr
Wasaüjeeü
Fayaoué
Ouloup (St-Gabriel)
Wakat
Ognahut (St-Paul)
Pléiades du Sud
Lekine
Fayawa
Baie de Mouly
Mouli
Ouvéa
Plage de Mouli
LIFOU
Drehu
Dokin
Nanemuhata
Natchaom
Mucaweng
Siloam
Tingeting
Hanawa
Hunete
Kumo
St-Paul
Easo
Xepenehe
Hnathalo
Nang
Kirinata
Baie du Santal
RT2
Luecila
Wé
Baie de Chateaubriand
Dueulu
Peng
Qanono
Hapetra
Hnaase
Traput
Jozip
Wedumel
Hnadro
Hnaeu
Wassagne
Thuahaick
Inagod
Hmeleck
Luengoni
Kedeigne
Joj
Mou
Wiwatul
Baie Wadra
Xodre
Eneféji
Lifou
Case à Dueulu
MIÉ
rama
Tiakan
L'Embouchure
PONÉRIHOUEN
Mou
RPN3
Monéo
Néavin
Bwa
Baie Lebris
Sommet Arago
(Gwa Pauliarin)
Kau'raa
HOUAÏLOU
Waa wi luu
Nessa Kouya
(Nérhexa i Kwéaa)
Né kwé
Parawiy
Gondé
(Go mõ dè)
Nédivin
(Nédii vâraâ)
Méareu
(Mèè aree)
Põrõõ
Né waa
Baie de Koua
Coula
(Kuru raa)
Gwa Dere
Kua (Wa')
RPN3
Wénèè
Cascade de Bwa
Bouirou
Ny
Né awa
KOUAOUA
Mé Kwaré
Piton Duperré
Baie de Canala
Azareu
Potê
Gwa Ruviano
Méa-Mébara
Ouassé
(Teè)
Néméara
Wabe
Bwa Méyu
Mé Adéo
Konoé-Chaoué
RPN3
Négropo
CANALA
Baie de Nakéty
Nandaï
Mé Ori
Koh
Haouli
(Xêwiri)
RPN3
Nakéty (Pènuî mê Nèkètè)
Trois Frères
Table Unio
Emma
(Amââ)
Mont Canala
BOURAIL
Nessadiou
Gouaro
Pic Orezzoli
RP10
Ouroué
THIO
"Route à horaires de Petchécara" (13 km)
One way road of Petchécara (13 km)
De Thio vers Nakéty : heures rondes impaires
From Thio to Nakéty at odd hours
De Nakéty vers Thio : heures rondes paires
From Nakéty to Thio at even hours

Plage de Mouli



ase à Dueula

Plage de Yédjélé

"Route à horaires de Petchécara" (13 km)

One way road of Petchécara (13 km)

De Thio vers Nakéty : heures rondes impaires

From Thio to Nakéty at odd hours

De Nakéty vers Thio : heures rondes paires

From Nakéty to Thio at even hours

Cascade de Bwa

"Route à horaires de Petchécara" (13 km)
One way road of Petchécara (13 km)
De Thio vers Nakéty : heures rondes impaires
From Thio to Nakéty at odd hours
De Nakéty vers Thio : heures rondes paires
From Nakéty to Thio at even hours

Plage de Kuto

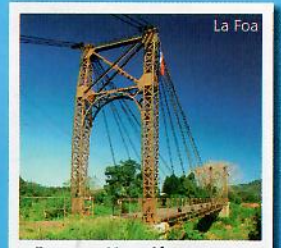
Cutes de la Madeleine

Place des Cocotiers

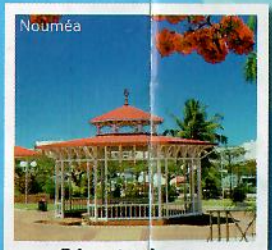
ILE DES PINS
Kunie

Tadine centre (port)
Cengeite

"Route à horaires de Petchécara" (13 km)
One way road of Petchécara (13 km)
De Thio vers Nakéty : heures rondes impaires
From Thio to Nakéty at odd hours
De Nakéty vers Thio : heures rondes paires
From Nakéty to Thio at even hours



Passerelle « Marguerite »



Place des Cocotiers

Chutes de la Madeleine

Maré Nengoné	Kurine	Aérodrome / La Roche	Trou de Bone	Roh	Nece	Tadine centre (port)	Cengeite
	16,2						
	28,4	12,2					
	42,5	26,3	14,1				
	41,4	25,2	13	13,4			
	38,9	22,7	13,5	21,4	8		
	47,2	31	21,8	32,7	19,3	8,3	

Plage de Luengoni			
Mu			
7			
Xoadre			
14,1	7,1		

calities


aquarium des lagons
Nouvelle-Calédonie