

Atelier ILICO – mars 2023



# PACPATH

Ocean Sciences, Climate and Sustainability Pathways



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Institut de Recherche  
pour le Développement  
FRANCE

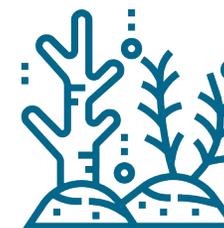


Mathilde Landemard  
IRD-Nouméa

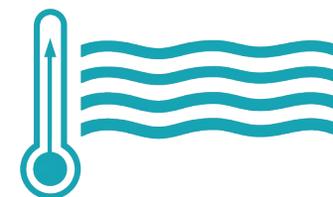
# 3 thèmes



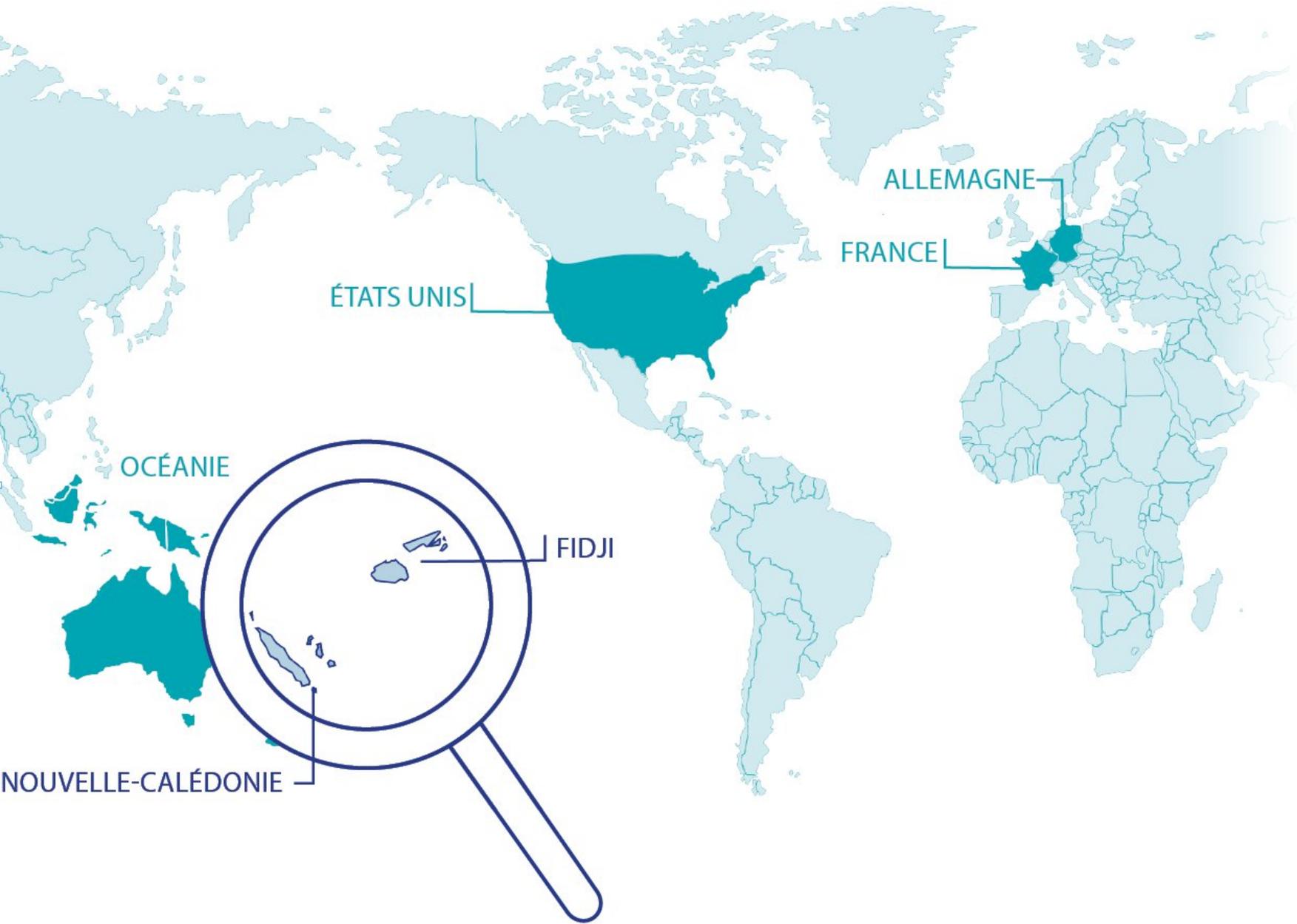
L'ÉROSION CÔTIÈRE  
ET LA MONTÉE DES EAUX



L'ACIDIFICATION ET  
LA DÉSOXYGÉNATION DE L'OCÉAN



LES VAGUES DE  
CHALEUR MARINE



# 2 enjeux

Les habitats marins côtiers



©F. Houlbreque, IRD



90% GBR ont blanchi en 2022 suite à une vague de chaleur marine

Les littoraux



© LNC, Anse Vata, Feb 2023



Vunidogoloa ©Kth.se



# Belmont Forum: “Pathways for Sustainability”

Reconnait qu'une approche intégrée est nécessaire, avec des composantes telles que :

l'économie, la technologie, les institutions,  
l'environnement, le climat, la biodiversité, le bien-être  
humain, les sciences sociales, sciences naturelles,  
partenaires sociétaux.

**Compte tenu de la complexité, une approche de co-conception est essentielle** : La recherche et les résultats doivent être conçus ensemble, avec un groupe diversifié de parties prenantes.

**BELMONT**  
F O R U M

futurearth



2021 United Nations Decade  
2030 of Ocean Science  
for Sustainable Development

The ocean we need for the future we want

# PACPATH Objectifs

Co-conception de trajectoire de durabilité des océans pour les Fidji et la Nouvelle-Calédonie, ce qui signifie :

Une stratégie solide pour la durabilité  
Projets de recherche et indicateurs

**Phase 1 (2022-2023) : Etablir les bases, networking**  
**Phase 2 (2024+) : Projet de recherche**

- Co-construire des projets de recherche océanique et des indicateurs socio-environnementaux
- Renforcer les réseaux, les institutions et les organisations
- Soutenir la gouvernance et l'élaboration des politiques
- Intégrer les connaissances traditionnelles, locales et scientifiques



Workshop Nouméa – oct. 2022



Workshop Suva – fév. 2023

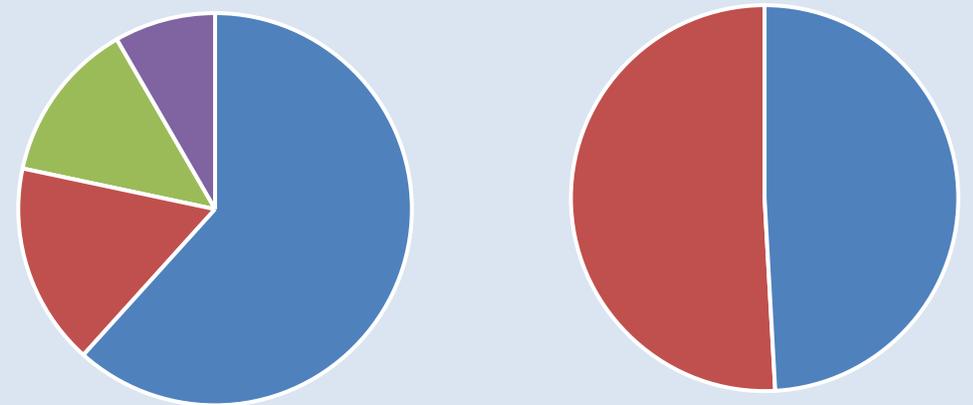
# La stratégie d'identification des parties prenantes : qui devrait être autour de la table ?

- Qui sont les institutions actuelles concernées par l'impact du changement climatique sur l'ocean et l'ODD 14 ?
- Qui sont les parties prenantes clés ?



*Louis Celliers, GERIC Climate Service Center*

## Représentation lors du workshop de Nouméa (oct.22)

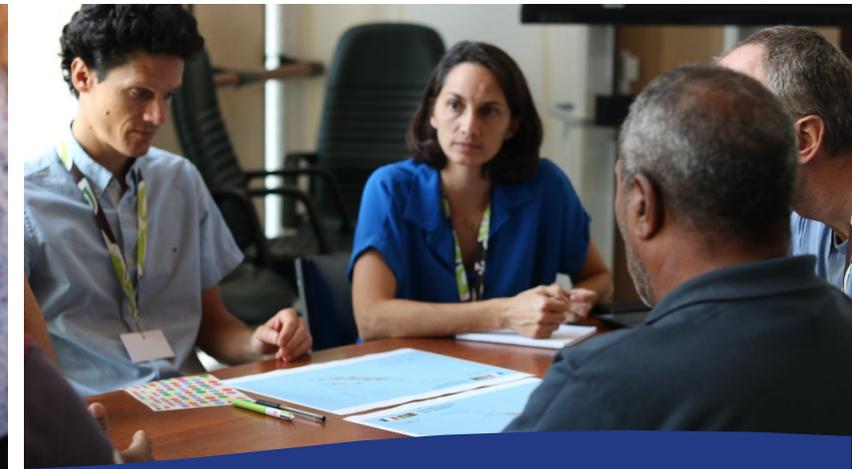


■ New Caledonia ■ Fiji  
■ Regional - South Pacific ■ International  
■ Female ■ Male



# PACPATH Workshop 1.

## Nouméa, Octobre 2022



# PACPATH Workshop 2

## Suva, Février 2023

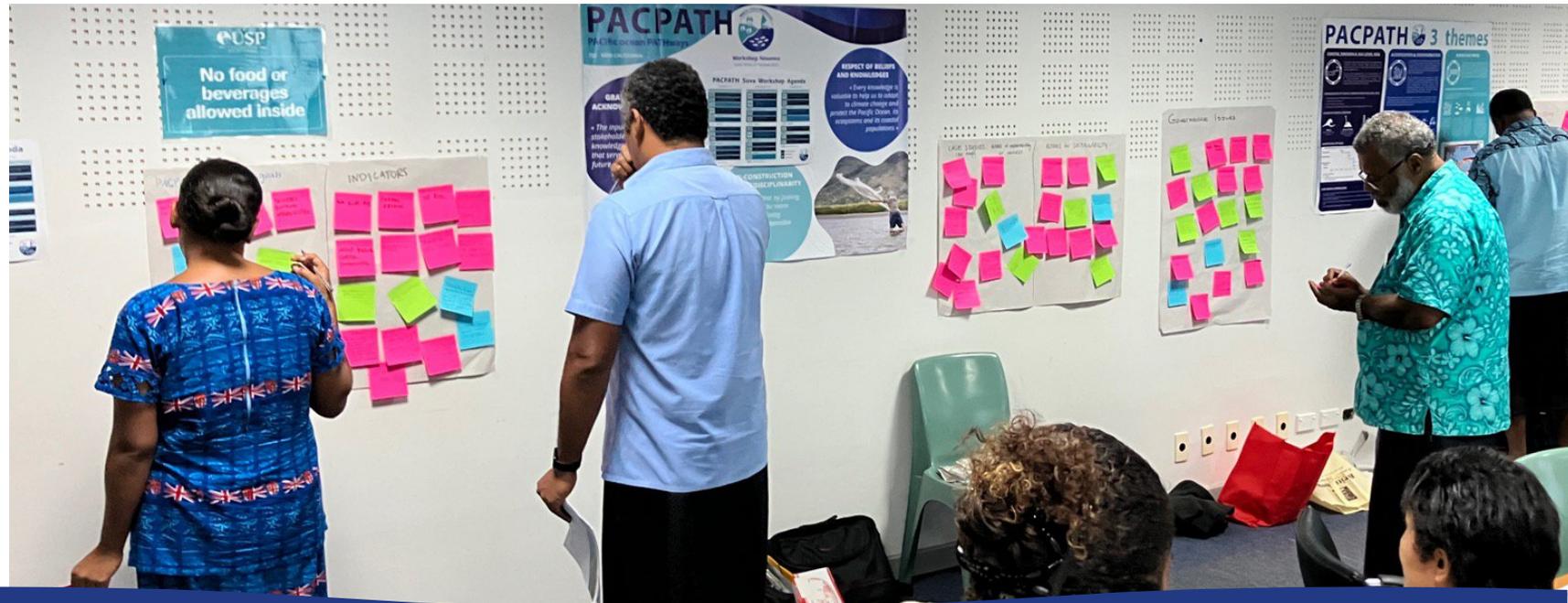




# Part 2 : Partager et s'accorder sur nos valeurs et les menaces qui définissent le territoire



VALUES	THREATS
1. Human Communities	1. - Poor governance - Climate Change - Resource exploitation
2. Traditional Practices	2. - Westernization - Rural to urban drift - traditional roles + obligations not done - hybrid fishing
3. Fresh Water + Marine Ecosystem	3. - Over exploitation - Poor management - lack of awareness - ignorance - greed for \$\$
4. Biodiversity	
5. Traditional Governance	5. - Lack of knowledge of traditional governance by external stakeholders
6. Contemporary Governance (Legislation + Policies)	6. - Lack of consultation + connect between policy + traditional govern
7. Communication	7. - Communication breakdown
8. Indigenous/traditional wisdom + knowledge	8. - lack of knowledge / knowledge transmission - diversion of interests
9. Education	9. - Focus on westernized in school
10. Language	10. - Non-use of language - Language interference - exposure to media etc.



# Part 3 : Identifier les indicateurs

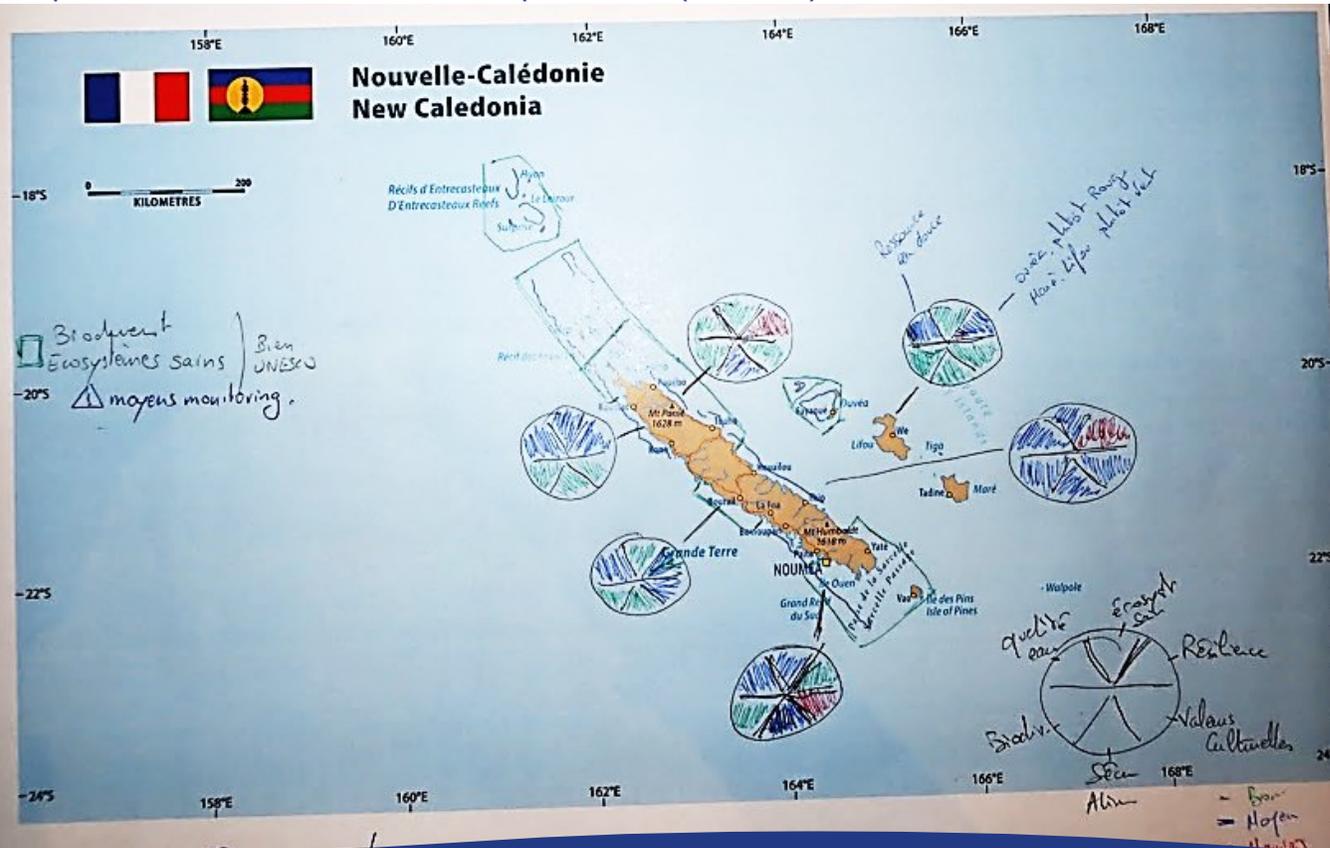
Sea Temperature	Fiji	New Caledonia	total	% Fiji	% New Caledonia
Anomalies	5	4	9	63%	44%
Average and seasonal max T	3	5	8	38%	56%
Total	8	9	17	100%	100%

Coral Reef and Associated Habitats	Fiji	New Caledonia	total	% Fiji	% New Caledonia
Mangroves (change in extent and use)	3	10	13	33%	48%
Seagrass (change in extent, richness, and density)	4	4	8	44%	19%
Coral Health (change in extent of live coral)	1	5	6	11%	24%
Change in use (tourism, fish, pleasure)	1	2	3	11%	10%
Total	9	21	30	100%	100%

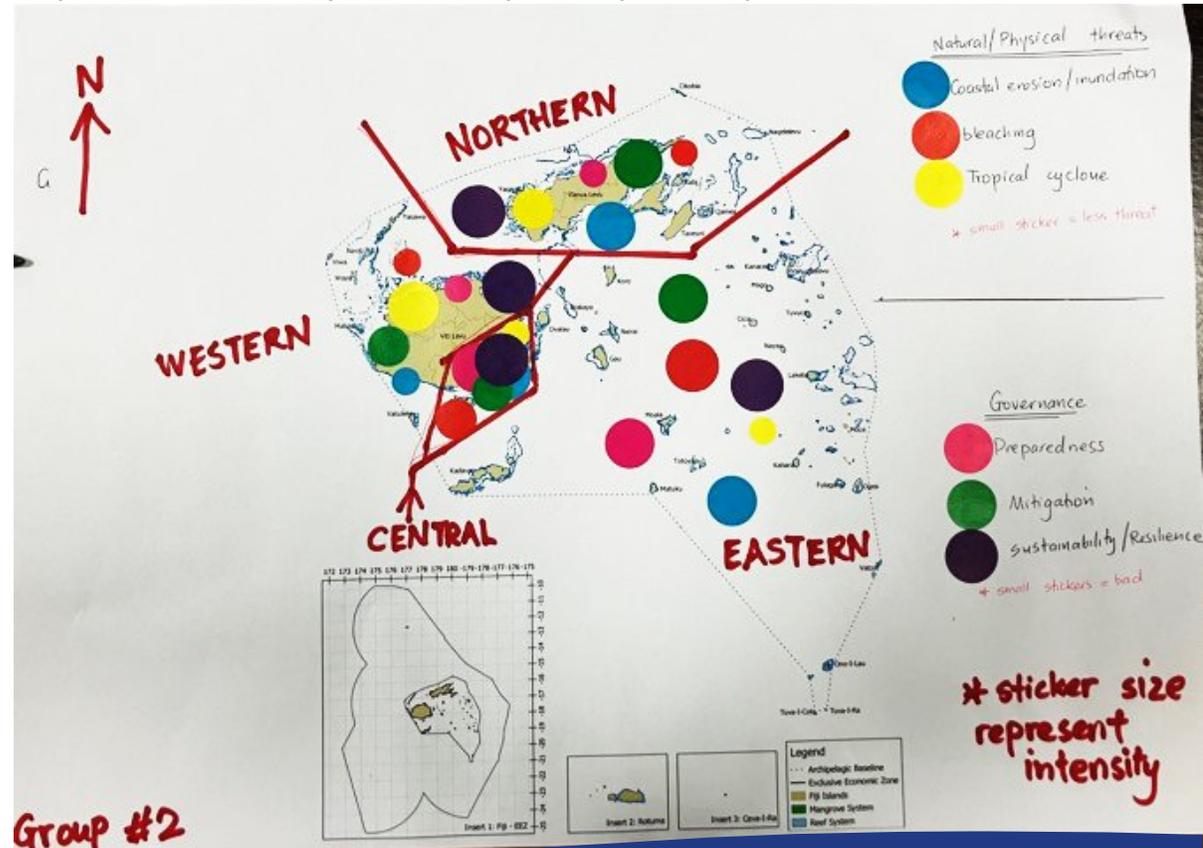
Overfishing	Fiji	New Caledonia	total	% Fiji	% New Caledonia
Stock Size	1	6	7	7%	27%
CPUE	2	3	5	13%	14%
Food Security	1	3	4	7%	14%
Presence of iconic species	3	1	4	20%	5%
Species composition	1	3	4	7%	14%
Fish size	1	2	3	7%	9%
Lack of employment in fish sector	2	0	2	13%	0%
Prices	0	2	2	0%	9%
Fecundity	1	1	2	7%	5%
Women in Fisheries	1	0	1	7%	0%
Distance Traveled	0	1	1	0%	5%
Revenue	1	0	1	7%	0%
Size composition	1	0	1	7%	0%
Total	15	22	37	100%	100%

# Part 4 : Représenter les indicateurs identifiés sur les cartes

Représentation de la NC – Workshop Nouméa (oct.2022)



Représentation de Fidji – Workshop Suva (fév.2023)



Group #2

# Part 5 : Créer le contenu de la carte socio-environnementale



# Carte socio-environnementale



## What coastal environment for our children ?

The first New Caledonia socio-environmental Report Card



**PACPATH**  
PACific ocean PATHways



**BELMONT**  
FORUM



### With climate change, coastal communities in New Caledonia are or will be faced with displacement and degradation of their environment and quality of life, generating uncertainties

This qualitative assessment, drawn up during an expert workshop convened by the PACPATH project, aims to highlight the impacts of climate and societal changes on the coastal communities of New Caledonia. The participants laid the foundations for research and adaptation solutions. This map shows the priorities identified and the corresponding indicators.

Coastal erosion is a problem that has a lasting impact on the environment and society. Predictable population and infrastructure displacements will force a rethinking - anticipating and prioritizing - of coastal development policies and their evolution. The loss of customary lands and sacred sites is even more impactful in a culturally organized society with clans of the sea and clans of the land. The degradation predicted by the IPCC of coral reefs and associated ecosystems (seagrass beds, mangroves) leads to uncertainty about the future of food sources for many communities, further aggravated by the different pollutions. These impacts on coastal environments are increasing with the acceleration of sea level rise, ocean warming and watershed pressures.



©IRD

### The PACPATH project seeks to identify sustainability pathways towards resilient coastlines

The process of developing this socio-environmental map is collaborative and includes a diverse group of stakeholders

Addressing the pressing issues that affect coastal populations requires a process that includes members of all components of society: research institutes, government departments, policy makers, customary authorities, civil society organizations, NGOs, indigenous associations, etc. In a collaborative context, we can understand how the effects of sea level rise, ocean warming, ocean acidification and deoxygenation are perceived. The PACPATH project, for "Sustainability Trajectories for the Pacific Ocean" involves active collaboration at all stages to assess vulnerabilities, identify priorities, propose co-constructed research to consolidate tools and means for adaptation and mitigation, and accompany public policies.

The United Nations defines sustainability, or sustainable development, as "meeting the needs of the present without compromising the ability of future generations to meet their own needs."

### Climate change accelerates problems in coastal communities

Important environmental changes are already underway

The IPCC 2022 reports produce unequivocal scientific conclusions: ocean temperatures will increase with exacerbation of marine heat waves well beyond the tolerance thresholds of tropical marine organisms; sea level will continue to rise and the ocean will continue to acidify and deoxygenate. These phenomena weaken seagrass beds, mangroves and corals as well as the shoreline protection and fish habitat they provide. The vulnerability of populations is increased: erosion, risk of flooding and fishing stocks.

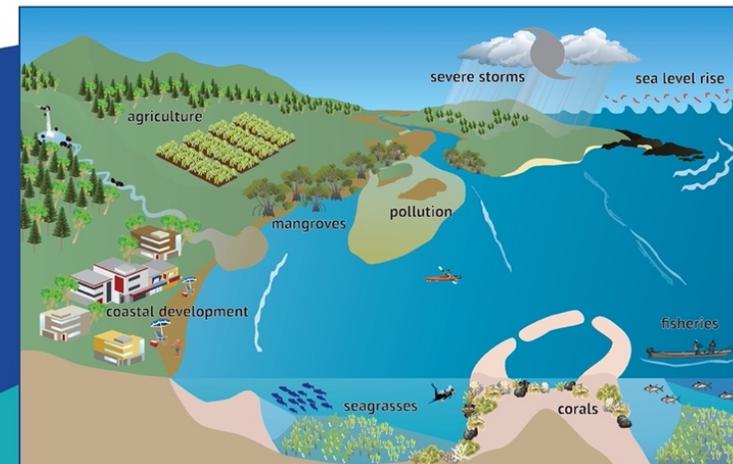


In Touho, some inhabitants have already been relocated due to coastal erosion. ©IRD

### The land, the sea and the people are connected

The characteristics of the land, the sea and the people are inseparable

What happens upstream of the coastline affects coastal communities and resources. Water pollution due to human activities, including that induced by bushfires, development, mining activities and pollutant discharges, affects the health of ecosystems and their vulnerability to climatic factors. In addition, the installation of infrastructure along the coast can increase the vulnerability of the communities that depend on it (roads, buildings, etc.). The figure below illustrates how the effects of these processes are linked.





Coastal erosion is already affecting many of New Caledonia's coasts. People living in coastal areas are being forced to move to higher ground while losing their cultural resources. Suggested indicators for coastal erosion are the monitoring of the evolution of the coastline, the extent of land vulnerable to extreme events, the number of people relocated and the areas revegetated for coastal protection, the well-being and local knowledge, especially with regard to the associated land issue, as well as the awareness of customary authorities.



Nutrients, terrigenous particles, wastes, and chemical contaminants in watersheds contribute to the loss of marine biodiversity, which makes marine ecosystems more vulnerable to climate pressures and ultimately threatens food security. Suggested indicators include measures of the quantity of pollutants related to land degradation from all human activities.



Rich biodiversity provides a variety of food options for local communities, supports economic opportunities related to tourism, and is a sign of a healthy and resilient ecosystem. Reefs, seagrass beds, and mangroves provide critical habitat for marine life that supports coastal fisheries and offers protection from waves, erosion, and flooding. Proposed indicators include the vitality of these habitats, the presence of key fish and coral species, and tourism-related jobs and economic opportunities. Indirect measures of biodiversity could include community well-being and local and traditional knowledge of resources.



Sense of confidence in the future availability of food is an important measure of community well-being. For Greater Noumea, it represents the difficulty of access to marine and terrestrial food resources for low-income residents. Indicators to be developed include changes in fish catches, the health of fish stocks, and the displacement of fish breeding and nursery areas. Other indicators could include the extent of salinization of soils and croplands and the ratio of fish for market to fish for subsistence.



Consideration of local knowledge, uses, and traditions can be an important indicator for the management and governance of coastal lands and resources. Suggested indicators include the degree of integration of cultural issues in population displacement, local knowledge of traditional seasonal weather indicators, and the intergenerational transmission of this knowledge. They may also represent the erosion of cultural heritage related to the sea due to lifestyle changes, particularly in Noumea.



Harvesting more fish than is sustainable results in fewer fish available for market and subsistence. This means that effort is required to catch the same amount of fish and the availability of fish in the future may be uncertain. Potential indicators of overfishing include fish size, stocks, species diversity, market prices, and catch per unit effort (the amount of fish caught for the same amount of fishing time and effort). Two areas are shown in orange for specific species.



Infrastructure and activities related to economic development have a direct effect on coastal erosion and water pollution (housing, agriculture, etc.) Understanding these threats allows for management and planning to address them. The proposed indicators are related to the assessment and monitoring of development and planning activities.

### And the temperature?

Ocean temperature and its warming during marine heat waves is an essential variable that can cause coral bleaching or even death, algal blooms that disrupt the natural cycle of marine ecosystems by affecting water quality and substrates. Toxic algae, in particular, threaten food security, for example during ciguatera episodes. Ocean temperature is not displayed as a felt variable but is measured elsewhere, notably with the Reeftemps observatory. Temperature indicators include changes in seasonal mean, seasonal maximum, number and duration of warm events, and bleaching events.

# Examples of sites illustrate how coastal communities are affected by climate change in New Caledonia

These processes are representative of what happens in coastal areas

Coastal habitability, water quality, and marine ecosystem health are identified as critical and vulnerable values along the entire coastline to varying degrees. This map identifies areas that illustrate these issues and the impacts they have on coastal communities. Examples of sites illustrate how coastal communities are affected by climate change in New Caledonia.



The Eastern New Caledonia has areas of poor water circulation in partially enclosed bays, resulting in poor water quality and high temperatures, as well as massive fish kills. Others, particularly those affected by mining waste, experience flooding, river bed erosion and poor soil health, leading to population displacement to areas where there is less risk of flooding, but where soil conditions are poor and cultivation is more difficult.

Photo : Poro mine, Monéo bay, Houailou ©Thierry Malé



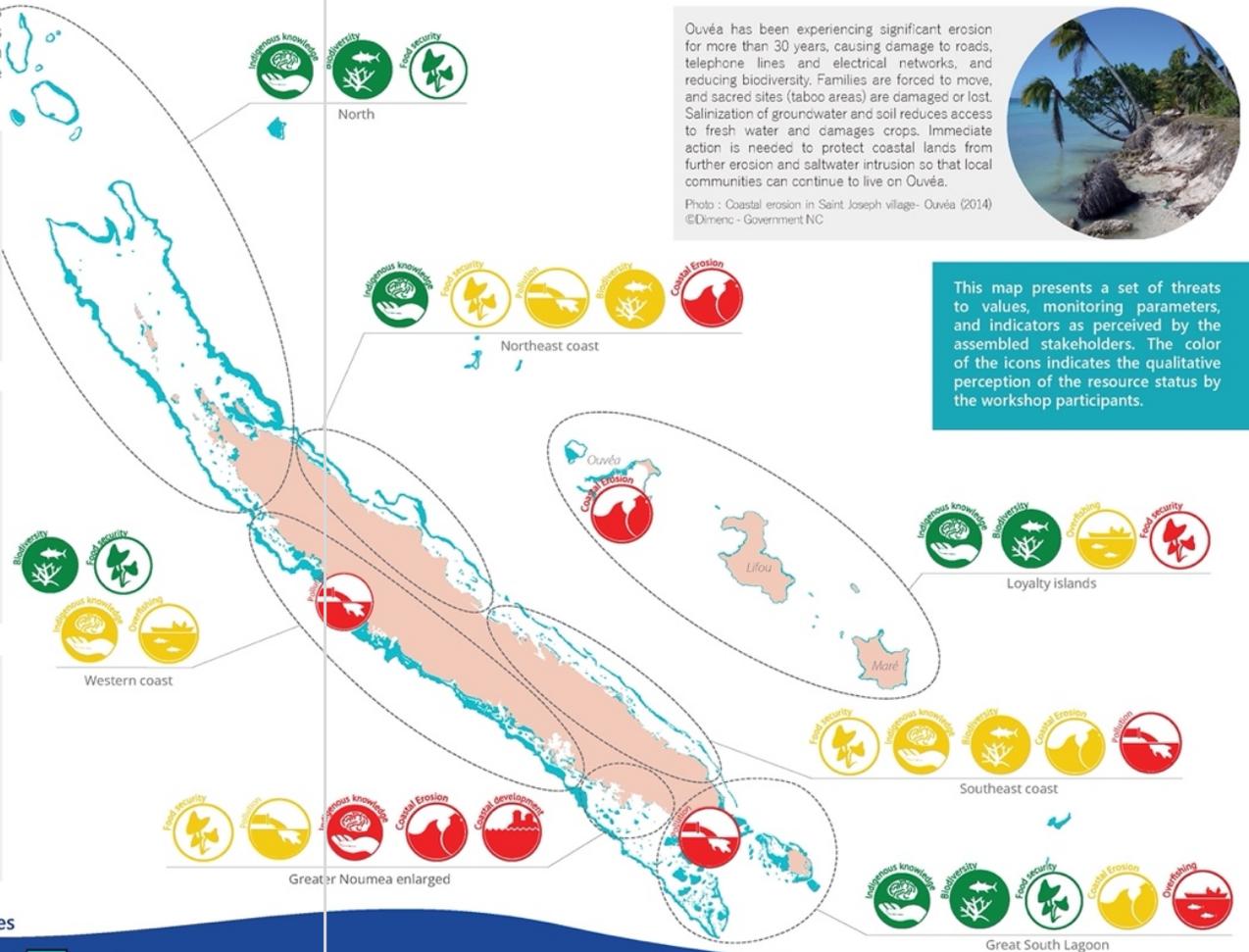
The Western coast of New Caledonia illustrates how communities are affected by agricultural and pastoral management. Heavy rains during cyclones and storms cause significant water flows from the watersheds to the lagoon and the use of fertilizers on agricultural lands causes (or can cause) a strong degradation of the water quality of the rivers and the lagoon. Coral reefs here, as throughout New Caledonia, are damaged by high water temperatures. This reduces the availability of fish for coastal communities.

Photo : Nera bay after Ruby depression (2022) ©FranceTV Info



In coastal areas near Noumea, coastal erosion has recently caused severe damage in the densely populated and economically important area of Anse Vata. Extensive and costly repairs and erosion prevention infrastructure are being constructed to reduce future erosion of beaches and nearby hotels and restaurants. In this area of the coast, more land should be set aside for mangrove expansion, which is needed to support natural flood control and erosion reduction.

Photo : Anse Vata beach in Noumea ©LNC



Ouvéa has been experiencing significant erosion for more than 30 years, causing damage to roads, telephone lines and electrical networks, and reducing biodiversity. Families are forced to move, and sacred sites (taboo areas) are damaged or lost. Salinization of groundwater and soil reduces access to fresh water and damages crops. Immediate action is needed to protect coastal lands from further erosion and saltwater intrusion so that local communities can continue to live on Ouvéa.

Photo : Coastal erosion in Saint Joseph village- Ouvéa (2014) ©Dimenc - Government NC



This map presents a set of threats to values, monitoring parameters, and indicators as perceived by the assembled stakeholders. The color of the icons indicates the qualitative perception of the resource status by the workshop participants.

**Resource condition**

- Good (Green)
- Moderate (Yellow)
- Degraded (Red)

**Landscapes**

- Land (Light Brown)
- Coral reefs (Light Blue)

## 2 retraitses d'écriture sur des sujets clés

### Objectifs

- ✓ Identifier les intérêts et les acteurs potentiels de la prochaine phase du projet
- ✓ PACPATH Bilan de la Phase 1
- ✓ Plan d'action de la Phase 2
- ✓ Renforcer et amener les étudiants dans les prochaines phases du projet

### Trois valeurs générales :

1. Les habitats marins et côtiers
2. L'érosion côtière
3. La gouvernance



# Implication des étudiants dans PACPATH



**Salanieta Kitolelei**  
PhD Student



**Jasha Dehm**  
PhD Student



**Salote Nasolo**  
Masters Student



**Andra Whiteside**  
PhD Student



**Matthew Chinappa**  
Masters Student



**Shilpa Lal**  
PHD Student



**Lilly Baumann**  
Environmental Sciences Student



**Marjan Braun**  
Environmental Sciences Student



**Ben Sigabalavu**  
Civil Engineering



**Nayal Nand**  
Civil Engineering

# WP1 - Habitats marins : Une planification collaborative, cohérente et durable

**Objectif : Évaluer et améliorer la santé des environnements marins côtiers**

## Animation

- Brian Stockwell (USP Marine Studies) Academics, 20%
- Asena Steiner, (WCS) NGO, 40%
- Matthew Chinappa, (USP-Master) Student, 60%

## Participants

- Heath Kelsey, 20%
- Salanieta Kitolelei, 100%

## Autres

- Elodie Fache
- Annette Breckwoldt
- Sophie Cravatte
- Catherine Sabinot
- Shilpa Lal, ...

### Projets transverses

REEF PASSAGES  
MARINE HEAT WAVES  
OCEAN ACIDIFICATION

## COMMENT POUVONS-NOUS ?

1. Évaluer la santé des écosystèmes
2. Elaborer un système national de surveillance
3. Traduire ce système au niveau local
4. Améliorer la santé des récifs et des océans
5. Impliquer les communautés côtières dans le processus de surveillance



# WP2 - Erosion côtière et habitabilité

## Animation

- Alexandre Ganachaud (IRD) Academics, 50%
- Maleli Qera, (CCC) NGO, ?%
- Ben Sigabalavu, (USP-Civil E) Student, ?%
- Jasha Dehm, (USP-PhD), Support rep, 50%

## Participants

- Mathilde Landemard ~ 40%
- Ruci Veitaukitoga ~40%
- Salote Nasole ~30%
- Jasha Dehm ~50%
- Nayal Nand ~40%

## Autres

- Nicolas Rocle, SPREP
- SPC-physical oceanography division

## COMMENT POUVONS-NOUS :

1. Etablir une base de référence, une mesure de l'érosion et surveillance
2. Comprendre la dynamique littorale en fonction des cycles climatiques régionaux
3. Différencier l'érosion anthropique de l'érosion due aux impacts induits par le climat
4. Mesurer les impacts de l'érosion sur les habitats marins et côtiers
5. Mesurer les impacts de l'érosion sur les communautés humaines côtières
6. Identifier et adopter des connaissances et des pratiques traditionnelles et des méthodes alternatives pour atténuer l'érosion du littoral
7. Développer une plateforme de communication afin d'atténuer, d'adapter ou de limiter la menace que représente l'érosion côtière pour les communautés côtières.



# WP3 - Gouvernance : La prise de décision basée sur les processus pour un changement positif

## Animation

- Joeli Veitalaki Academics/Villager, %
- Matereti Mateiwai, (CO) Gov, %
- Atunaisa Qorovarua, (FLMMA) NGO, %
- XXX Student, %

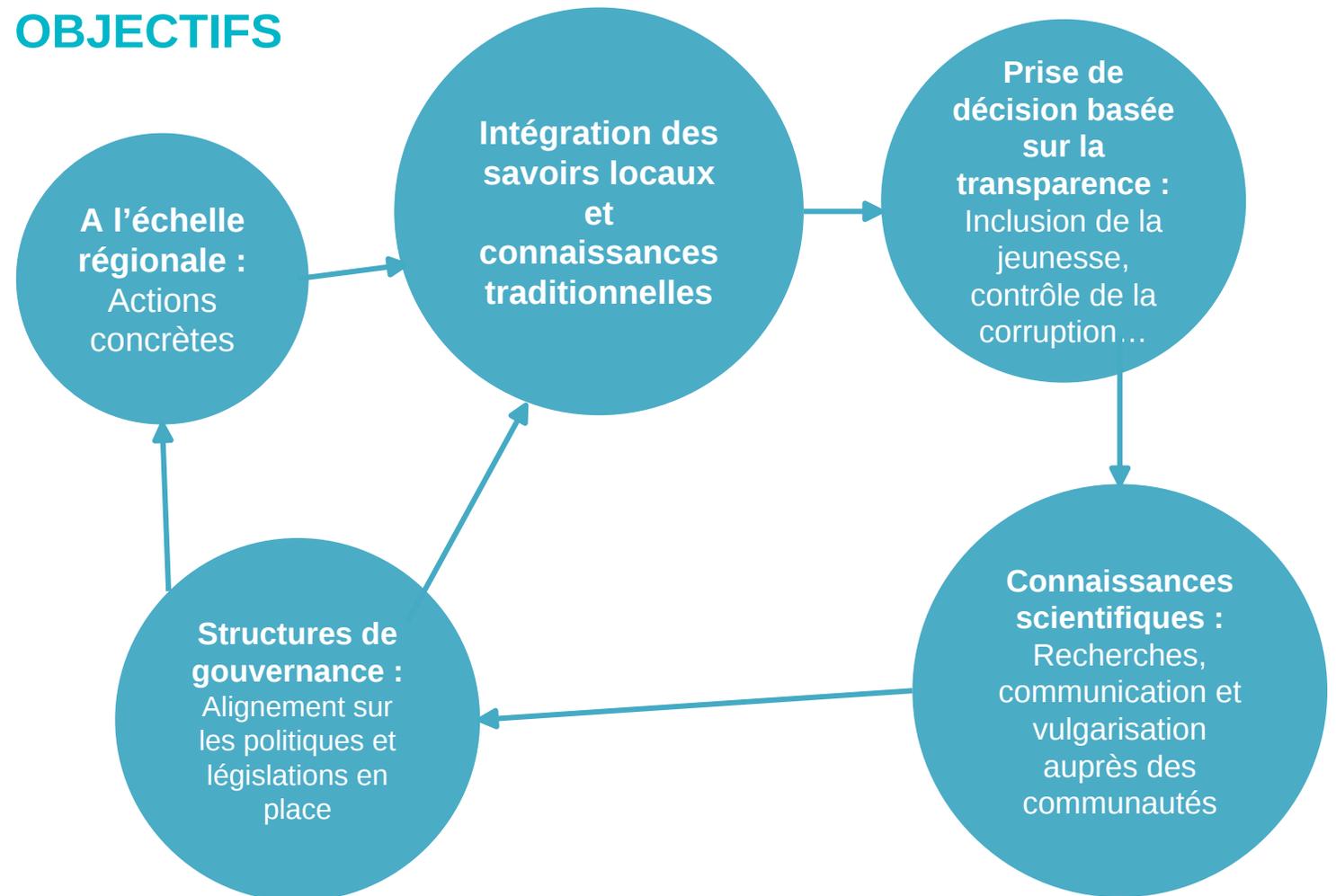
## Participants

- Mathilde Souchon, 15%
- Eferemo Kubunavanua, 15%
- Maria Manez Costa, 5%
- Louis Celliers, 10%
- Albert Whippy, 5%
- Soweri Rokoiga, 15%

## Others

- CSO, private, CROP agencies, ...

## OBJECTIFS





# Lien de PACPATH avec ReefTemps

1. L'observation soutenue est essentielle
2. Le principe FAIR est essentiel, de même que les possibilités d'accès aux données d'une manière appropriée
3. La population locale souhaite être informée et impliquée
4. Les collectivités ont besoin d'une décision à court terme et d'une vision à long terme



- Température : (universel et de base) besoin de communication
- Ph : souligné par les participants
- Vagues : de la recherche à la surveillance ?
- Salinité : pas abordé dans PACPATH

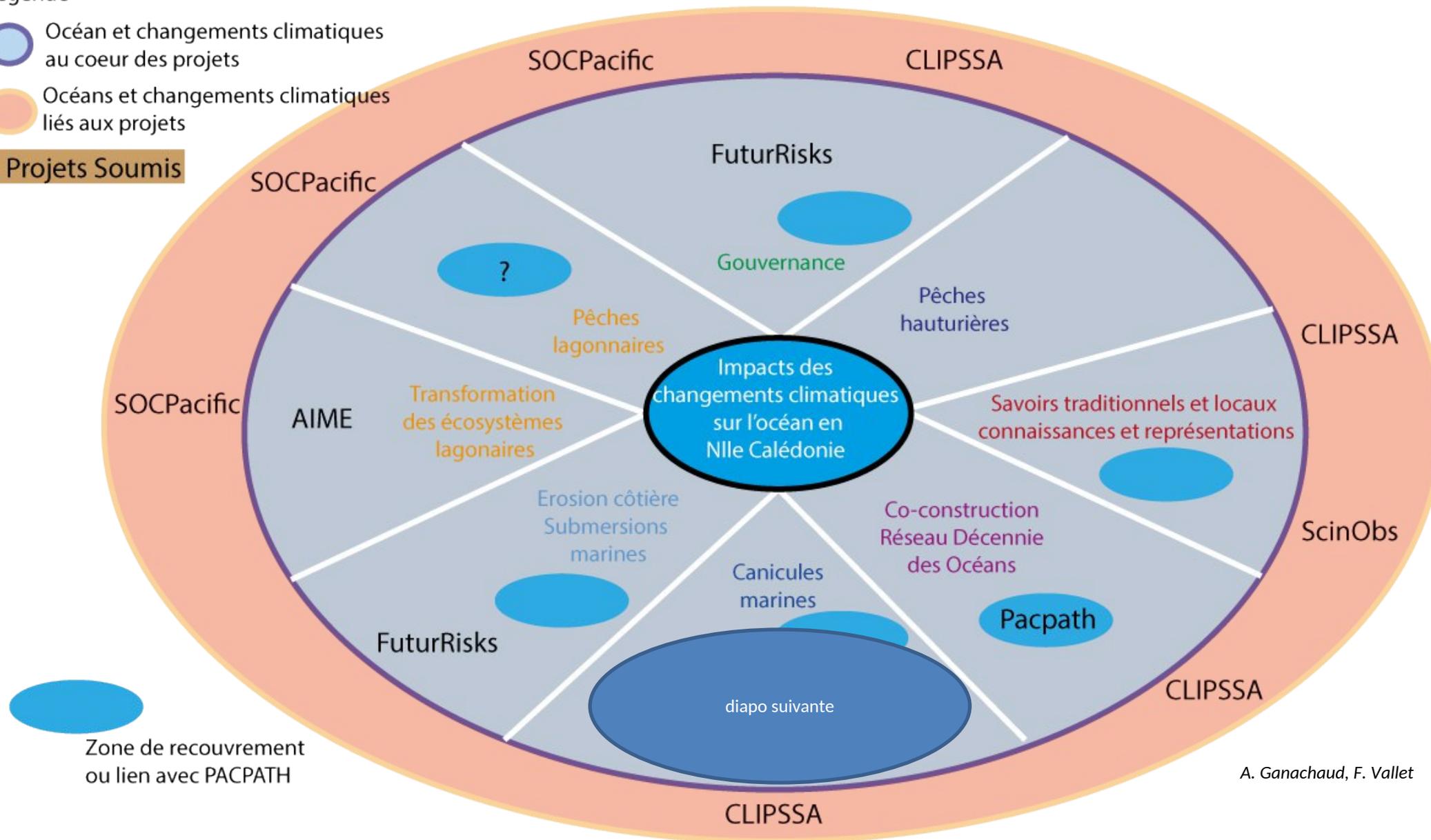
# Complémentarité des énergies déployées

Légende

 Océan et changements climatiques au coeur des projets

 Océans et changements climatiques liés aux projets

**Projets Soumis**



# Partners and SSC

## Science Society Council

- USP : Brian Stockwell
- SPC : Katy Soapy
- UNC : Valerie Burtet
- SPREP : Nicolas Rocle
- Gov of NC: TBN
  
- Provinces of NC:
  - North - Ambre Diazabakana
  - Loyalty - Dominique Taine
  - South - Emmanuel Coutures
  
- Customary Senate of NC
- USP ambassador students:
  - Jasha Dehm
  - Salanieta Kitolelei
- UNC ambassador students
  - Lucie Gosset (New?)
  - Maxime Duphil (New?)
- WP leaders and co leaders







# Projets connexes aux Canicules marines (©MaHeWa, S. Cravatte, A. Ganachaud)

Vers un savoir faire sur les Canicules marines

Financé

Soumis

TICTAC:  
PNMC - IRD  
Chesterfield - Entrecasteaux  
Equipement et mission  
CDD prévisibilité  
0.5 thèse

MSc M. Chinappa  
Fiji

Instrumentation

Ecosystèmes lagunaires

Thèse R. Le Gendre  
IFREMER  
Physique lagon NC

Pêches hauturières

Thèse S. Lal CPS  
Physique Pac SW

Thèse B. Pagli  
IRD Physique PF

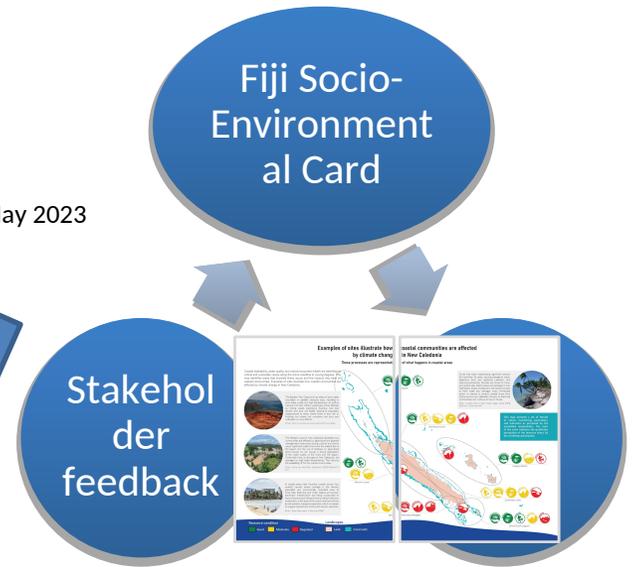
HEAT: Fonds Pacifique  
NC / PF / W-F  
Physique; prévisibilité;  
co occurrence  
canicules terrestres

# PACPATH roadmap

Phase 1:  
Consultation

- What is important? Threats ?  
Indicators ?

By May 2023



Phase 2: write  
a research  
project

- Involve stakeholders and  
students

By Oct 2023

Phase 3:  
implement  
research

- Includes training and feedback

2024-2028+

Research that serves community needs

Regular stakeholder feedback



Food Security in Coastal Communities	Fiji	New Caledonia	total	% Fiji	% New Caledonia
Healthy Fish stock	7	2	9	41%	10%
% cultivatable land (Salinization)	0	4	4	0%	19%
Community Health	3	0	3	18%	0%
Daily Fish Ratio	1	2	3	6%	10%
Educational Opportunity	3	0	3	18%	0%
Displaced populations of fish, reproduction, grow	1	2	3	6%	10%
Fish Size	0	3	3	0%	14%
% for sale (fish?)	0	2	2	0%	10%
Mortality events	0	2	2	0%	10%
Change in species landed	0	2	2	0%	10%
Revenue through sales	1	0	1	6%	0%
Zones closed	0	1	1	0%	5%
CPUE	1	0	1	6%	0%
Time/distance traveled	0	1	1	0%	5%
<b>Total</b>	<b>17</b>	<b>21</b>	<b>38</b>	<b>100%</b>	<b>100%</b>

Responsible Coastal Development	Fiji	New Caledonia	total	% Fiji	% New Caledonia
Understanding threats	7	5	12	64%	17%
Existence of a plan or public policy	2	7	9	18%	24%
Inclusive consultation	1	7	8	9%	24%
Reserved lands	1	5	6	9%	17%
Tracking coastal development	0	5	5	0%	17%
<b>Total</b>	<b>11</b>	<b>29</b>	<b>40</b>	<b>100%</b>	<b>100%</b>

Indigenous and Local Knowledge	Fiji	New Caledonia	total	% Fiji	% New Caledonia
Include traditional governance	4	6	10	24%	30%
Knowledge of traditional and seasonal indicators	1	6	7	6%	30%
Language	4	1	5	24%	5%
Fishing Practices	2	2	4	12%	10%
Use of local names for flora and fauna	3	1	4	18%	5%
Weather and climate indicators	1	2	3	6%	10%
Totems and idioms	1	1	2	6%	5%
Knowledge of culturally significant sites	0	1	1	0%	5%
Ecological apartheid	1	0	1	6%	0%
<b>Total</b>	<b>17</b>	<b>20</b>	<b>37</b>	<b>100%</b>	<b>100%</b>

Marine and Coastal Biodiversity	Fiji	New Caledonia	total	% Fiji	% New Caledonia
Well being of local community	2	4	6	20%	17%
Indigenous and local resource knowledge	2	4	6	20%	17%
Precise fish and coral counts	2	4	6	20%	17%
Market survey	1	4	5	10%	17%
Presence of iconic species	1	2	3	10%	8%
Presence of high value species	1	1	2	10%	4%
Scientific surveys-transects	0	2	2	0%	8%
Catch or CPUE	1	1	2	10%	4%
Population density	0	1	1	0%	4%
Tourism	0	1	1	0%	4%
<b>Total</b>	<b>10</b>	<b>24</b>	<b>34</b>	<b>100%</b>	<b>100%</b>

Pollution	Fiji	New Caledonia	total	% Fiji	% New Caledonia
Impacts on food and water security	3	3	6	38%	16%
Mine exploitation	0	5	5	0%	26%
Water quality	0	4	4	0%	21%
Shift toward imports	0	3	3	0%	16%
Scientific studies/baseline studies	3	0	3	38%	0%
Livelihood impacts	1	1	2	13%	5%
Health impacts	0	2	2	0%	11%
Loss of economically important species	0	1	1	0%	5%
Visualization of point source	1	0	1	13%	0%
Total	8	19	27	100%	100%

Erosion	Fiji	New Caledonia	total	% Fiji	% New Caledonia
Vulnerability to cyclones and tsunamis	1	7	8	14%	32%
Pas du .....	1	5	6	14%	23%
Identifying populations who have to move	1	3	4	14%	14%
Number of trees planted	2	1	3	29%	5%
Reinforce Mangroves	0	3	3	0%	14%
Progression of salinization	1	1	2	14%	5%
Sea Level	1	1	2	14%	5%
Grass cover rate	0	1	1	0%	5%
	7	22	29	100%	100%