

Typology of Reef Passages



A view
from above

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 **SOC Pacific**
A Sea of Connections



SOCPacific – A Sea of Connections (2018-22)

Funded by:



Principal investigators:



Dr. Elodie Fache



PI: Dr. Annette Breckwoldt

Website:

socpacific.net

Re-embedding coastal & oceanic fisheries in wider-context: exploring socio-cultural, geopolitical & policy connections

Research in 3 study areas: New Caledonia, Vanuatu & Fiji

Thematic areas:

- 1) Social values of places & resources
- 2) Fisheries & conservation
- 3) Policy analysis



Alexandra Nozik

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Contributions in SOCPacific:

“A typology of reef passages” (Breckwoldt et al. 2022) – co-author in publication in *Frontiers in Marine Science*

“Typology approach from visual interpretation of satellite imagery for reef passages around 9 South Pacific islands.” (2022) – First author in data publication in *PANGAEA*.

Further research interest in digital data collection tools

SOCPacific – A Sea of Connections (2018-22)



One example...

In 2019, drawing workshops with 290 children from Fiji and New Caledonia

“Draw the sea and what you and others do in the sea”



<https://socpacific.net/>

<https://www.ird.fr/dessine-moi-la-mer>

Fache et al. 2022. “Draw the sea...”: Children’s representations of ocean connectivity in Fiji and New Caledonia. *Ambio (Special Section, Oceania: A Sea of Connections)*. DOI: 10.1007/s13280-022-01777-1

Typology of Reef Passages – A view from above.

Channels between coral reefs – Reef passages

Any reef channel connecting open water with confined water body or island

'arteries' of the reef system

Cultural & economic value

Land-sea continuum in the ontology of Indigenous Pacific Island communities

Influence species habitat & of interest to fishers, scientists and conservation managers

Crucial for healthy ecosystem functions

Nutrient flows influence local food webs

species migration, fish spawning aggregation

Methodological research interest of the study

Which data is needed for an extensive reef passages typology?

How far can we come with remote sensing data?

Which data sources should be included further?

1

What data is available remotely?
What information can be extracted from this data?

Sources we used/tried:

- RGB-VIS imagery in GoogleEarth (mosaic of different data sources)
- Bathymetry data from GEBCO database
- GADM database for island boundaries

Software:



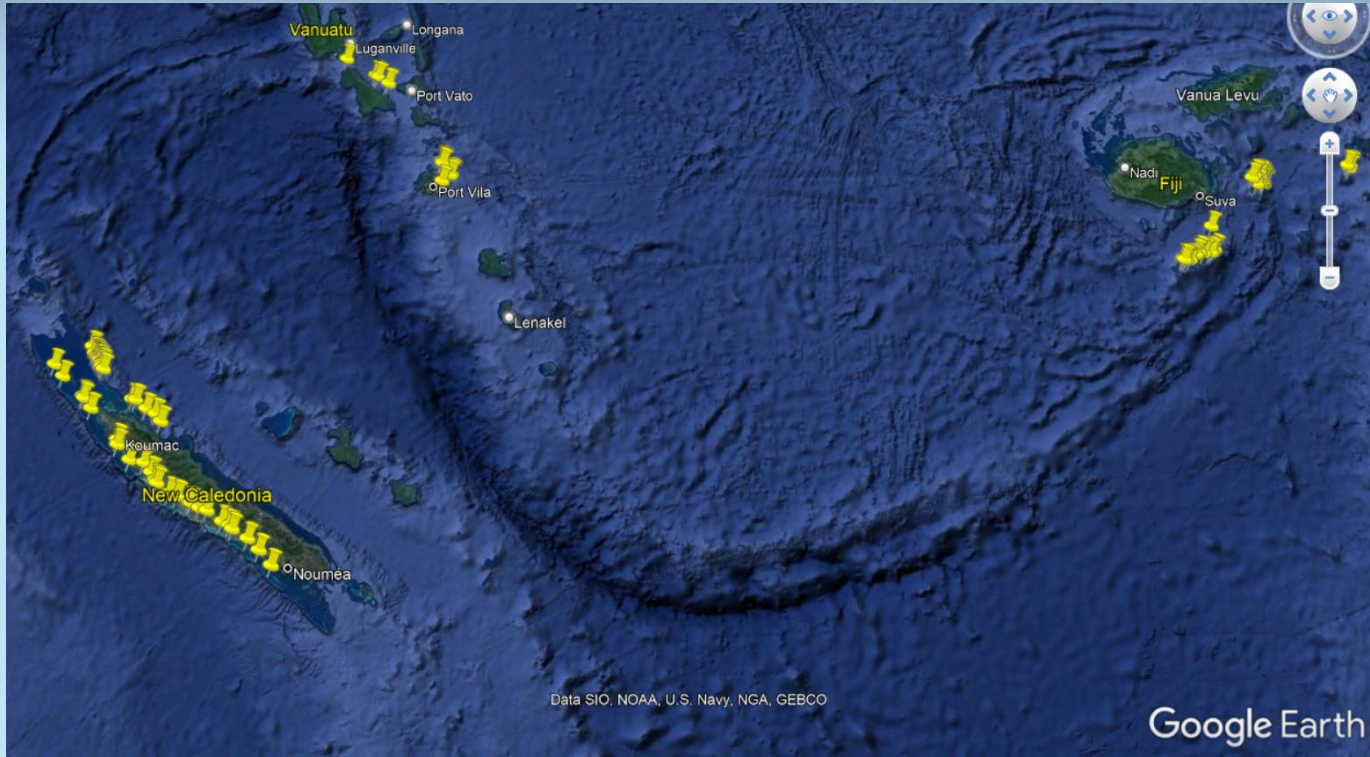
(Expected) extractable information:

- Location (coordinates)
- Width of passage
- Surrounding structure (e.g. lagoon)
- Close objects (rivers, roads, settlements)
- Depth
- Reef passages density per length coastline
- Distance to coastline



2

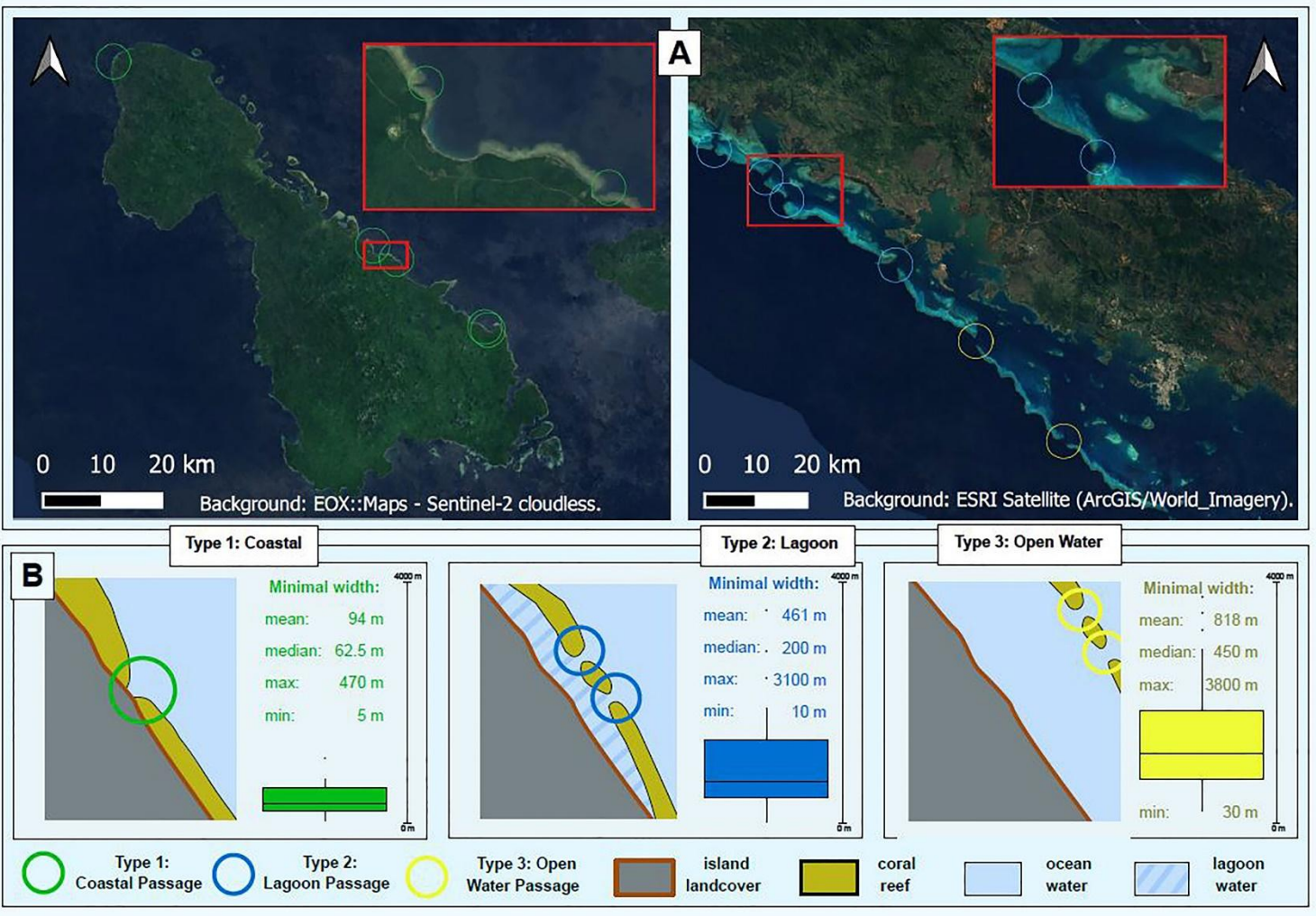
Mapping visible structures in Google Earth: reef passages with location and other parameters



Typology of Reef Passages – A view from above.

3

Results from Visual interpretation of differences between data points & proposal of three visually distinguishable reef passage types



Type 1 ('Coast'): Passages where the reef is adjacent to the coast (i.e. a fringing reef), with no water body between the passage and the coast

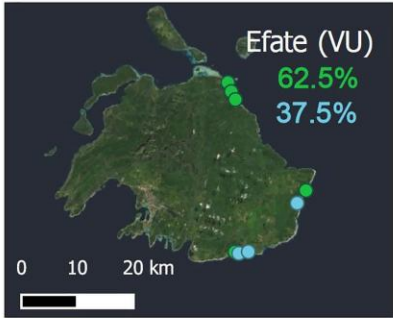
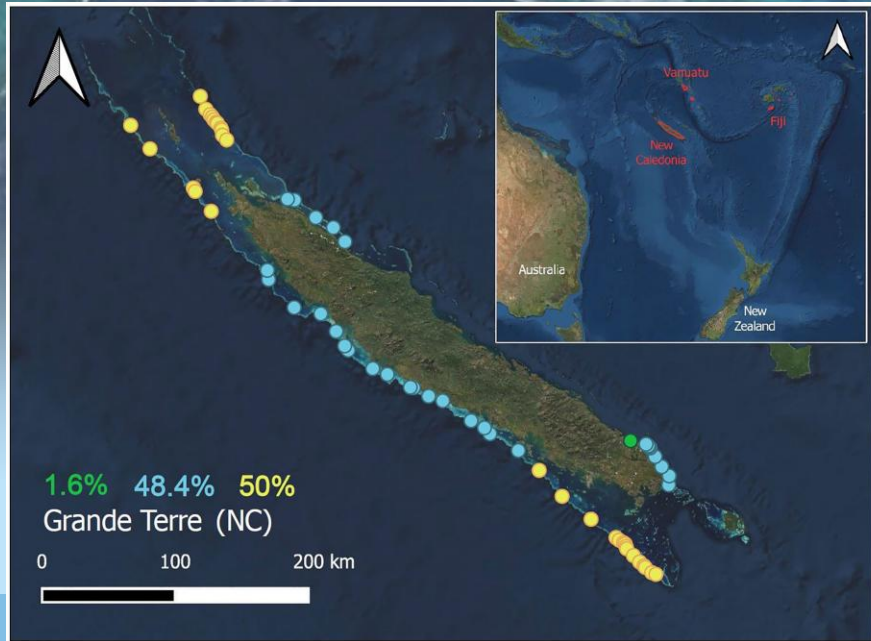
Type 2 ('Lagoon'): Passages where the reef builds a lagoon around the island (i.e. a barrier reef), with a passage between possibly different 'inside- and outside-reef' water bodies

Type 3 ('Open Water'): Passages in reefs located at larger distance from the coast (also barrier reef), with at least one of the reefs on either side entirely separated from the coast by deeper waters

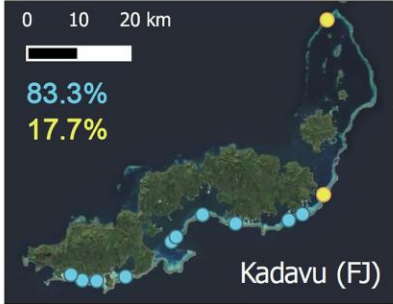
Typology of Reef Passages – A view from above.

3

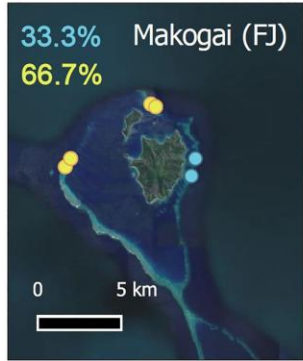
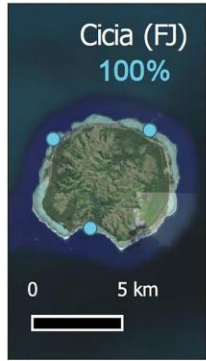
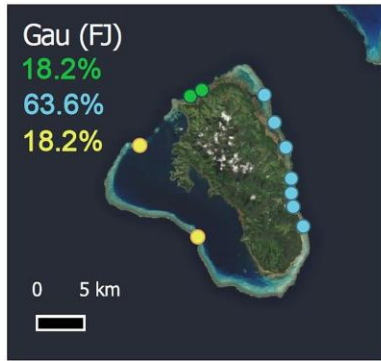
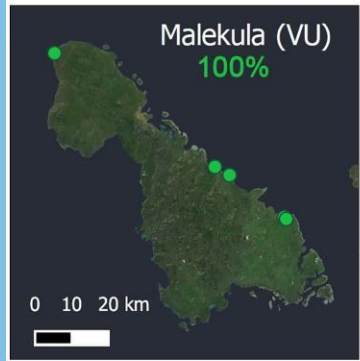
Results



Type 1 ('Coast'):
Passages where the reef is adjacent to the coast (i.e. a fringing reef), with no water body between the passage and the coast



Type 2 ('Lagoon'): Passages where the reef builds a lagoon around the island (i.e. a barrier reef), with a passage between possibly different 'inside- and outside-reef' water bodies



Reef passages
 ● Coastal Passages
 ● Lagoon Passages
 ● Open Water Passages

Map sources: Island outlines from the Database of global Administrative Areas. Background: ESRI Satellite (ArcGIS/World_Imagery).

Type 3 ('Open Water'):
Passages in reefs located at larger distance from the coast (also barrier reef), with at least one of the reefs on either side entirely separated from the coast by deeper waters

4

Suitability of RS data: Analysis of parameters with potential relationship to the reef passage type

Criterion type	Passage Parameter	Remote sensing (incl. aerial and drone) imagery	On the ground measurements	Local interviews and observations
Morphological/Geophysical	Location	x	x	
	Distance from coast	x	x	
	Widths	x	x	
	Depths	(x)	x (and bathymetric maps)	
	Submersion at low tide (e.g., falls dry or not?)	(x)	x	
	Length	x	x	
	Impacts of rivers	(x)	x	X (incl. perceptions)
	Geomorphological features	(x)	x	(x)
	Lagoon (e.g. water depth, enclosure by reef, to refine Type 2 categorization)	(x)	x	x
	Physical/Oceanographic	Currents / tidal condition		x
Wind and wave directions			x	x
Water temperatures		(x)	x	x
Salinity			x	(x)
Soundscape			x	x
Nutrient flow			x	x
Pollution (e.g. plastic)		(x) (dispersing pollution)	x	x
Physical/Oceanographic & Socio-cultural	Connectivity to inhabited areas (incl. accessibility)	(x)	x	x
	Cultural connections and roles			x
	Community uses/activities (based on location and type of reef passage)		(x)	x
	Other human uses (incl. management and conservation activities)		x	x
Ecological	Human History		x	x
	Natural history		x	x
	Frequenting marine fauna (size, abundance, identity, purpose (e.g. feeding))		x	x
	FSA's (yes/no; multispecies)		x	x
	Coral composition		x	(x)
	Other benthic habitats		x	x

Methods...

Need for complementary fieldwork data

In general: strengths and weaknesses of satellite imagery

Which data is needed for an extensive reef passages typology?
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5

Discussion,
Outlook,
Open Questions.

Reef passage width and distance to coast

Exchange of water amounts and content

Connection to rivers

Environment-human interaction

Reef passage water volume

Ecological functions

Connection to built-up areas and roads

Other topological, physical and hydrodynamic features: reef passage depth & length, water speed and temperature, tidal conditions, density of passages along the coast

Economic role of reef passages

Socio-cultural meaning of reef passages

Physical properties of reef passages

Links & Contact

Publication in Frontiers in Marine Science

Breckwoldt A, Nozik A, Moosdorf N, Bierwirth J, Fache E, Ferse S, Ford A, Mangubhai S, Pelletier D and Piovano S (2022) A Typology for Reef Passages. *Front. Mar. Sci.* 9:786125. <https://doi.org/10.3389/fmars.2022.786125>

Data publication in PANGAEA

Nozik, Alexandra; Breckwoldt, Annette; Becker, Ronja; Fache, Elodie; Piovano, Susanna (2022): Typology approach from visual interpretation of satellite imagery for reef passages around 9 South Pacific islands. *PANGAEA*, <https://doi.org/10.1594/PANGAEA.942568>

Website of the SOCPacific Project

<https://socpacific.net/>



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