Online resource 1: Selected extreme events indices ((a) rainfall and (b) temperature) as recommended by the ETCCDI for climate extreme events analysis.

(a) Rainfall		
R20mm	Very heavy rainfall days; Annual count of days when PRCP≥ 20mm	Let PR_{ij} be the daily rainfall amount on day i in period j. Count the number of days where days $PR_{ij} > 20$ mm
R99p	Extremely wet days, Annual total PRCP when daily rainfall amount > 99p	Let PR_{wj} be the daily rainfall amount on a wet day w (PR > = 1 mm) in period i and let PR 99 be the 95th percentile of rainfall on wet days in the 1961–1990 period. If $^{wn}P_W$ W represents the number of wet days in the period, then: $R99p_j = w1/41\ PR_{wj}$, where $PR_{wj} > PR_{wn99}$
CDD	Consecutive dry days; Maximum length of dry spell, maximum number of consecutive days with RR < 1mm:	Let PR_{ij} be the daily rainfall amount on day i in period j. Count the largest number of days consecutive days where PR_{ij} < 1 mm
(b) Temperature		
TXX	Monthly maximum value of daily maximum temperature	Let TXx be the daily maximum temperatures in monthk, period j. The maximum daily maximum temperature each month is then: $TXx_{kj} = \max(TXx_{kj})$
WSDI	Warm spell duration index: Annual count of days with at least 6 consecutive days when TX > 90th percentile	Let *TXij* be the daily maximum temperature on day i in period j and let *TXin90* be the calendar days 90th percentile centred on a 5 day window for the base period 1961–1990. Then the number of days per period is summed where, in intervals of at least 6 consecutive days: $TX_{ij} > TX_{in90}$
TX90p	Warm days, % of days when maximum temperature is > 90th percentile	Let TXij be the daily maximum temperature on day i in period j and let TXin90 be the calendar % day 90th percentile centred on a 5 day window for the base period 1961-1990. The percentage of days is determined where TXij > TXin90

Online resource 2: Extended methods: fishing villages in Manus

Generally, reef fishing on the studied sites is carried out using gill nets, trawlers or night diving. Fishermen prefer to use gill nets and night spear fishing with torches, because they find it easy to catch different sizes and species in large quantities. Destructive fishing methods are also employed, including dynamite fishing, which is used in one of the island communities, and poison method is employed in one of the mainland communities. According to the surveys, the use of dynamite fishing is attributed to the decline in fish catch.

Fishing grounds are communally owned by clans and are either restricted or opened to fishermen from other clans. In PNG, a village or community is made up of clans who own resources such as land, coral reefs, rivers, etc. Clan leaders commonly make decisions on the use of these resources. For the sake of fishing grounds, individual clan members make decisions as to where and when to fish as long as they fish within their own territories. Often dispute over fishing grounds occurs when there is trespassing.

Generally, the fishermen have their own reasons to fish and why they use certain fishing methods. The island communities catch fish mostly for family/individual consumption, for sale or for exchange of garden food they lack on the islands. The mainland communities catch fish intentionally for either monetary or dietary reasons. Mainland communities have a diverse small scale income earning opportunities than the island communities. This includes agriculture (cash crop and food crop), craft, hunting, sale of betelnut, sago, store goods, etc. Income sources for the island communities are limited mostly to marine resources, though few are into crafting and small-scale businesses like operating canteens and boat services.

Online resource 3; House holds survey questionnaire for evaluation of fisher adaptation to climate change in Manus province, PNG, in June-July 2013

I PRELIMINARY INFORMATION

a) Gender: [1] Male [2] Female

b) Age ---------- years

c) Level of education 1. Primary, 2 secondary 3 Tertiary 4,university 5, other

d) Marital status [1] Married [2] Single [3] Divorced [4] De facto

e) Household size -------- **[Number of people that live in a household]**

f) Household Monthly income ---------- **[Net worth of the house hold per month/income including catch for subsistence and for sale]**

g) Main source of income [1] Fishing [2] Employment [3] Agriculture [4] Other

II CAUSALITY

a) Please give us your opinion about the state of the fisheries resources in the last [10-20] years [or during your entire fishing career [xx years]

b) Has the amounts or fish catch increased or decreased over the years? **Please explain**

c) What factors if any might have caused fish catch decline? [list]

d) Can you suggest ways in which **declines** in fish catch be reversed?

e) Are there particular kinds of fish whose population has declines over the years? If yes, which ones?

III CLIMATE CHANGE RISK PERCEPTIONS

a) According to you, which are the top 5 **environmental and/or climatic concerns** in this area?

b) Is managing **risks** arising from extreme weather a major consideration in this community? If Yes why? If No why not? *[managing risks e.g. insurance, contigent plans, microfinance facilities, technology to store fish, technology to fish offshore, etc]*

c) If yes to B above, what climate risks are being addressed?

d) Who/ what is at risk? [e.g. investment, livelihoods, households]

e) When is the impact likely to be felt? OR when are the changes likely to be seen?

f) In your opinion, have changes in weather conditions had any effect on fish catch?

g) Please tell us exactly what the community/leaders is/are doing to address these risks?

IV CURRENT ADAPTATION OPTIONS [could be direct or those with adaptation as co-benefit]

a. Are you aware of any efforts directed at reducing the impacts of weather related changes on fishing? Please give us examples of these

b. What is the frequency of these actions and who [what agencies? NGOs?] is involved?

c. According to you, how effective do you think current actions/efforts have been?

i. Very effective
ii. Moderately effective
iii. Neither effective nor ineffective
iv. Slightly ineffective
v. Not effective at all
vi. Not sure

d. How much money [estimate] has been spent on these efforts/actions/activities in the least 2 years?

e. In your own opinion, are there some alternative measures securing your livelihoods that have not been tried?

V ROLE OF SHADOW STATE ACTORS

b. Are you aware of any individual, groups or organisations who have knowingly or unknowingly acted in a manner to improve the future sustainability of fisheries? Please give details of these and how they have done this. [rationale is to bring up the social capital]

c. In your opinion, how can working together as a fishing community help overcome some of the problems you mentioned earlier?

d. In general, how do you assess fisher community group(s) actual influence on decision making at the local level?

e. What conditions must be in place or reinforced to maintain or increase the effectiveness of community groups which are present in this area?

VI FISHING AS A LIVELIHOOD ACTIVITY

f. For how long have you been fishing?

g. How much time do you commit to fishing every week?

h. What other economic activities [list] do you have besides fishing?

i. How does the income from fishing compare with those from other activities?

j. If you were to choose only one occupation which one would that be? Please explain why?

k. Would you wish your children to take up fishing as an occupation or would you rather they have a different occupation? Please explain your answer

VII GOVERNANCE ISSUES [for key stake holders/experts AND fishermen]

l. Are there any policies that link climate change/extreme weather with fisheries development? Please explain [yes/no]

m. In your opinion, what impact has technological change [in general] had on fish catch? [Be specific in the type of technology in the answer]

n. Do the current policies/strategies and plans include provisions to address the impacts of climate change on fishing?

o. Do the emergency planning services take into account climate change? Please explain

p. Have you briefed your elected members/higher authority on any key risks arising weather related changes that affect fishing?

q. Are infrastructure developments with a lifespan of more than 20 years required to factor in climate change?

r. On a scale of 1-5, how effective are the existing infrastructure in fulfilling their intended purpose?

s. In what way(s) can considerations of future climate risks be incorporated into the fisheries development?

Online resource 4: Summary of Social Adaptive Capacity dimensions, and indicators, and the corresponding summary responses of broadly categorized responses. The SAC indicators appear in Figure 3 (a-q). DK= don't know. With the exception of binary responses, scores and calculated as the mean number of the response categories mentioned by respondents in each villages.

SAC dimension	**Indicators with labels on Figure 3**	**Response categories**
1. Situation awareness	(a) Status of fisheries	1= Declined; 0= has not changed/DK
	(b) Attributing factors;	Destructive gear; Overexploitation; Habitat destruction; Pollution and land-based activities; Environmental change; Poor policy/management
	c) Reversing decline	Gear management; Closures; Reduce pollution; Land based activities; Alternative livelihood (curb overexploitation); Conservation of corals (restoration through planting, stop coral harvesting); Creating awareness
2. Climate change risk perceptions	(d) Managing weather related risk a major consideration	1=Yes; 0=No
	(e) Climate risks being addressed	None=0; Sea level rise/coastal erosion/flooding; Fish decline; Water security; Food security/food storage; Cross-cutting
	(f) Who/What is at risk?	Community as a whole; Resources
3. Current adaptation options	(g) Efforts directed at reducing climate change mediated impacts on fisheries	Alternative livelihoods; Gear management Restoration of corals & mangroves; Marine Protected Areas/community Closures; No efforts/don't know; Migration; Establishment of coastal infrastructure; Community; participation/involvement; Enhancing water security/storage
	(h) Who is involved?	NGOs; Government agencies; No one/don't know; Individuals; Clan
	(i) Alternative livelihood options	No other; Coral farming; Employment; Small business enterprise; Subsistence farming; Aquaculture; Poultry/livestock keeping; Microfinance options; Tourism/ecotourism; Cash crops & silviculture; Don't know; let kids decide
4. The role of non-state actors	(j) Are you aware of anyone working to improve future sustainability of fisheries?	Yes/No
	(k) What is it & how was it done?	Closures; Gear management; Restoration; Water security; Awareness; Alternative livelihoods
	(l) Who was involved?	NGO's; Government agencies; Other

	What conditions must be in place to maintain/increase/reinforce the effectiveness of community groups present in the area?	Traditional way of living; Dialogue; consultations; Leadership Legislation; manegemt and protection regulations; Empower young people, clans, & community; Nothing/Don't know Cooperate with NGO's & government agencies; Enforcent of existing regulations Working at clan level & committee rather than broader community; Capacity building of community (finance, training)
	(m) Your assessment of the fisher community group's influence on decision making level	High, Moderate, None
5. Fishing as a livelihood	(n) Estimate of time spent fishing	Duration in years & no. of days/week
	(o) Preferred occupation for their children	Fishing Small business enterprise Other/get employment
6. Governance	(p) Have you briefed your elected member or higher authority on key risks arising weather related changes that affect fishing?	yes/No
	(q) On a scale of 1-5, how effective are the existing infrastructure in fulfilling their intended purposes?	High, low, moderate