Climate adaptation in the Torres Strait
Impact modelling

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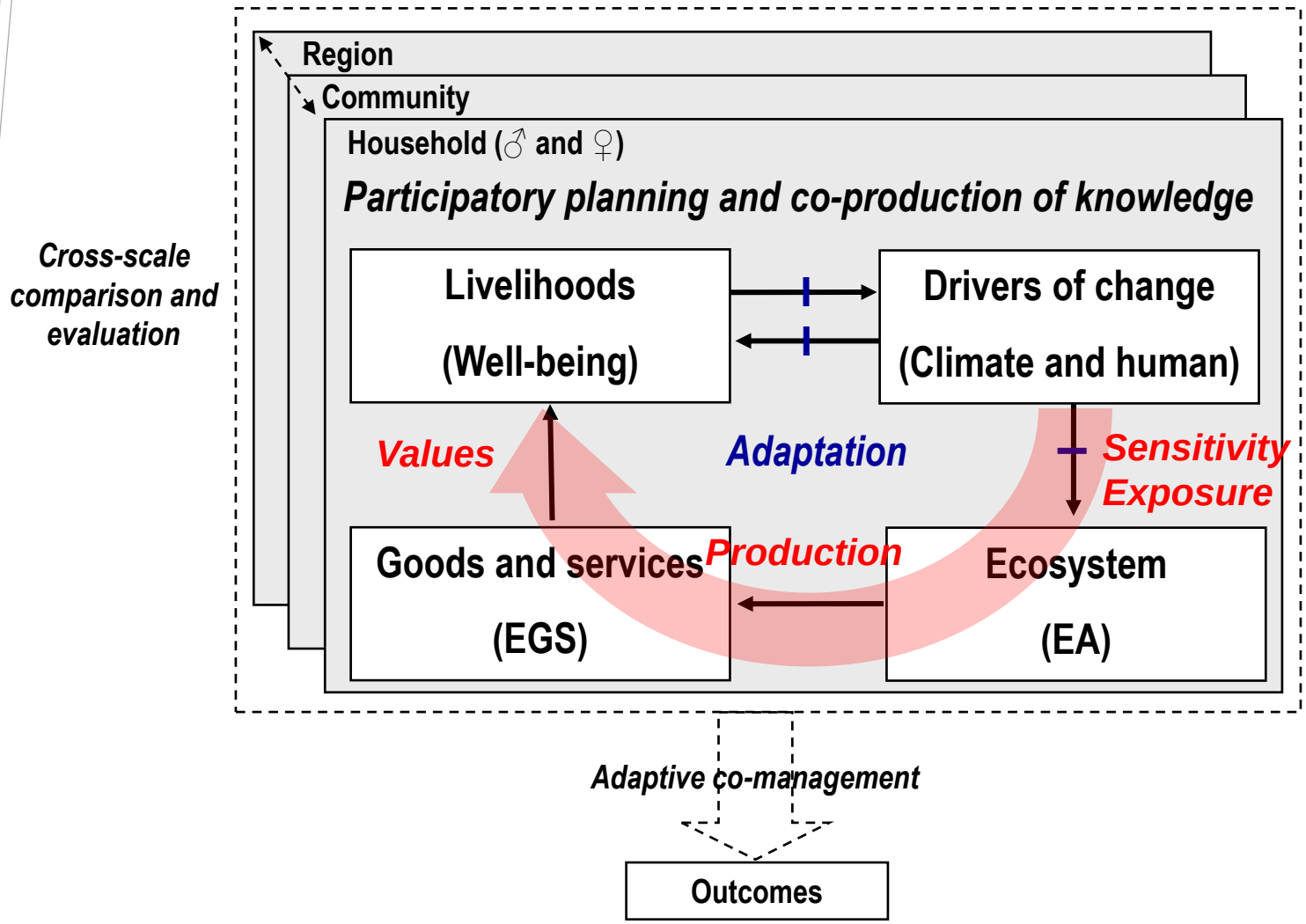
Glossary

- System Drivers and Pressures (SDP)
  - Human (Resource use, Land use, Pollution)
  - Climate (Temperature, Rainfall, Sea level rise, Ocean acidification)
- Ecosystem assets / Habitats
  - Coral Reefs
  - Agricultural land
  - Forest
- Ecosystem goods and services (EGS)
  - Fish
  - Oil palm
  - Water
- Constituents of well-being (CoWBe)
  - Health
  - Income
  - Food security
  - Social cohesion

Conceptual diagram



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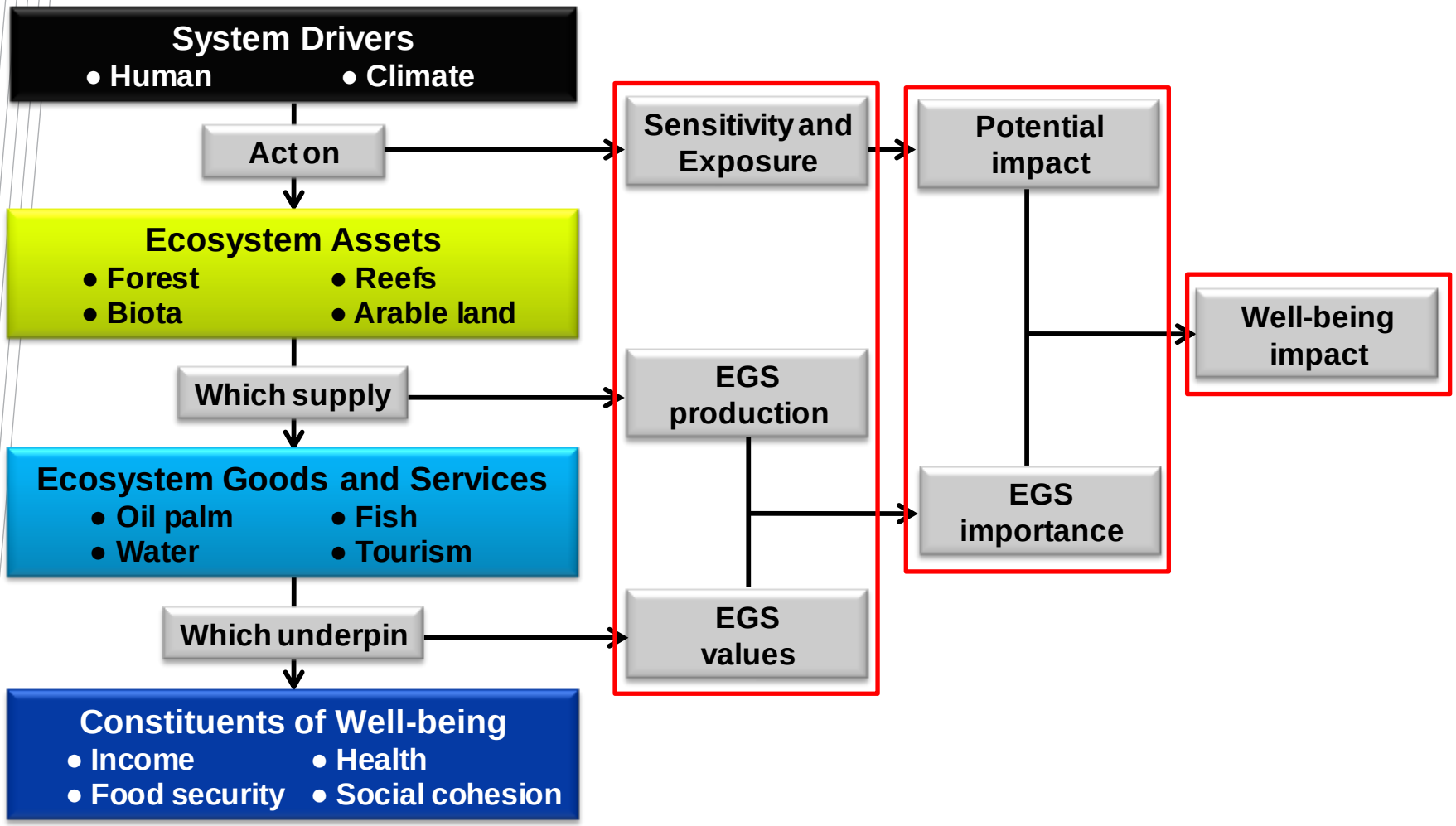
Impact modelling approach



Impact modelling

1. Impacts to EGS from future Driver and Pressure scenarios
   - Change in EGS state
   - Future impact on livelihoods and well-being

2. Combine with community adaptive capacity to indicate Vulnerability

Approach

Designed: do what is in our practical means to help co-ordinate a respond to currently unfolding and potential future changes in our environment

Information we require (sensitivities value) not always available in the literature
- Consulting our peers and using best available data

The approach is:

- semi-quantitative (relative scale where potential impact is assessed on a scale of 1 to -1)
- level of detail considered sufficient (note: always room for improvements)
- relies on expert opinion and local stakeholder review and modification

Limitations/simplifications to our study (can not consider all aspects)
Point out key assumptions

System Drivers and Pressures (SDP)

- “Business as usual” pressures

- Climate (Scenario A2, medium-high emissions)
  - Temperature, SST
  - Rainfall
  - Sea level rise
  - Acidification
- Human (Population growth - current trajectory)
  - Utilisation
  - Land use
  - Pollution

Assumption: climate and human impacts on habitats (e.g. seagrass/coral reefs) are implicitly accounted for the EGS (plan for this to be explicitly accounted for in future)

Ecosystem goods and services

Agricultural

Banana
Betel nut
Cassava
Chickens
Coconut
Garden vegetables
Mangoes
Pawpaw
Pigs (domestic)
Rice
Sago
Sweet potato
Taro
Yams

Estuarine

Barramundi
Barramundi (aquaculture)
Crabs (blue)
Crabs (mud)
Crocodiles
Crocodiles (farmed)
Finfish coastal (trevally, mullet etc)
Mangrove timber

Forest

Birds
Non-timber building material (palms)
Pigs (wild)
Rusa deer
Rusa deer (farming)
Timber for building/boats/sale
Wallabies

55 EGS in total

Freshwater

Finfish (tilapia, snakehead)
Prawn (Macrobrachyia)
Saratoga
Water (fresh and rainwater)
Water (ground)

Marine

Dugong
Finfish pelagic (queenfish)
Mackerel
Pearlshell (aquaculture)
Pearlshell (goldlip)
Prawn (banana, tiger)
Rock lobster
Sponge (aquaculture)
Sponge (wild)
Tourism (fishing)
Turtles (flatback)
Turtles (green)
Turtles (hawksbill)

Reef

Beche-de-mer
Clams (Tridacnid)
Coral lime
Other molluscs (and from mangrove)
Reeffish
Sharks and rays
Tourism (reef)
Trochus

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Sensitivity to stressors

Sensitivity scored on a scale from:

-1 (acutely negatively sensitive with no prospect for natural adaptation)

to

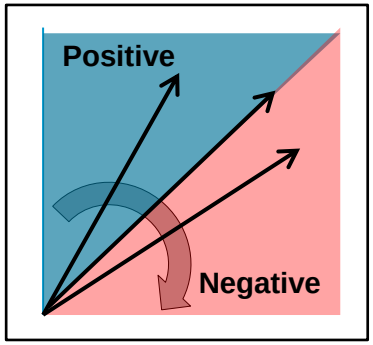
+1 (acutely positively sensitive and/or full adaptation capacity) to the threat

Accounts for factors such as tolerance thresholds (some marine species have acute thresholds e.g. corals and other species have a broader threshold e.g. crocodiles).

Sensitivity: Degree to which an ecosystem asset is affected by or responsive to a driver/stressor.

Consequences to change in stressors

Temperature	In general, the productivity/growth rate of species increases with temperature, up to an optimal temperature, after which it declines with increasing temperature
SLR	Inundation interaction
Rainfall	Agriculture - probably decreased production with decreased rainfall
Acidification	Echinoderms and coral very sensitive (Impacts on calcifying species; calcification)



Potential Impact - cumulative impacts – summed across the multiple stressors (combining the possible positive with negative impact to give overall impact)

Exposure to stressors

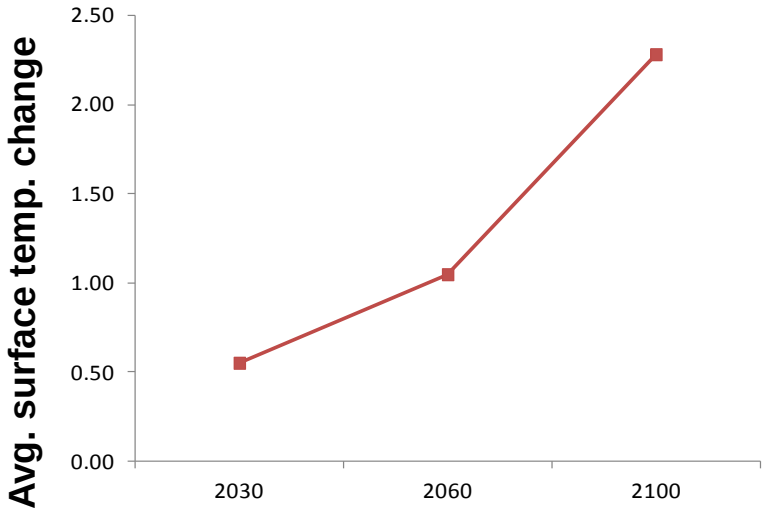
Exposure was assessed against each asset on a scale from:
0 (no exposure/change in stressor)
to
1 (complete exposure/change in stressor).

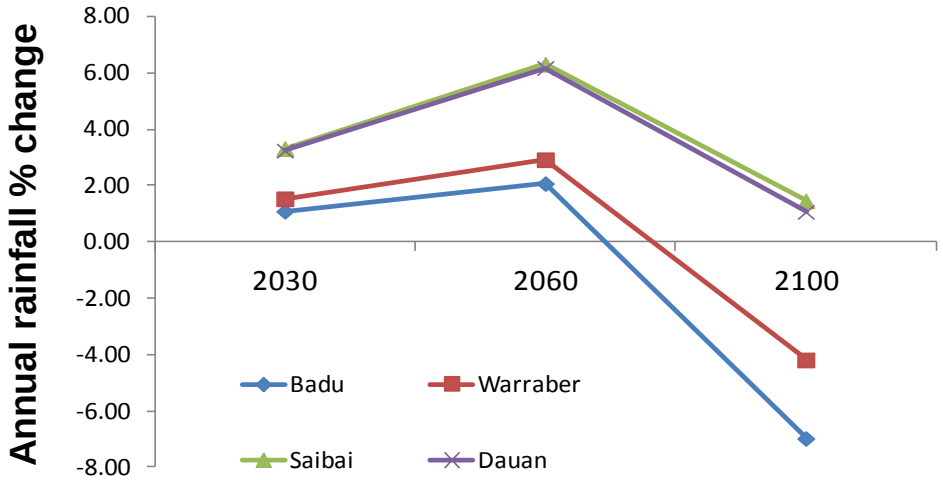
Exposure scores were estimated at future time-step of 2030, 2060 and 2100

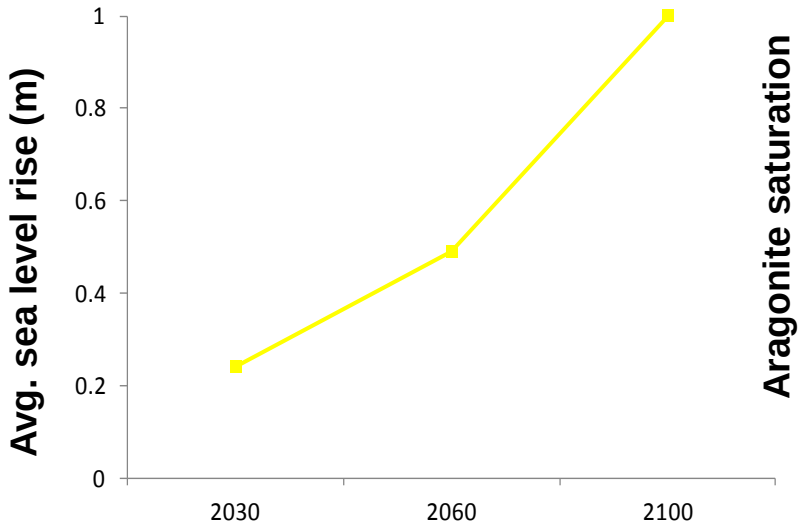
Assumptions: Assessed the projected change in a 30km radius around each community

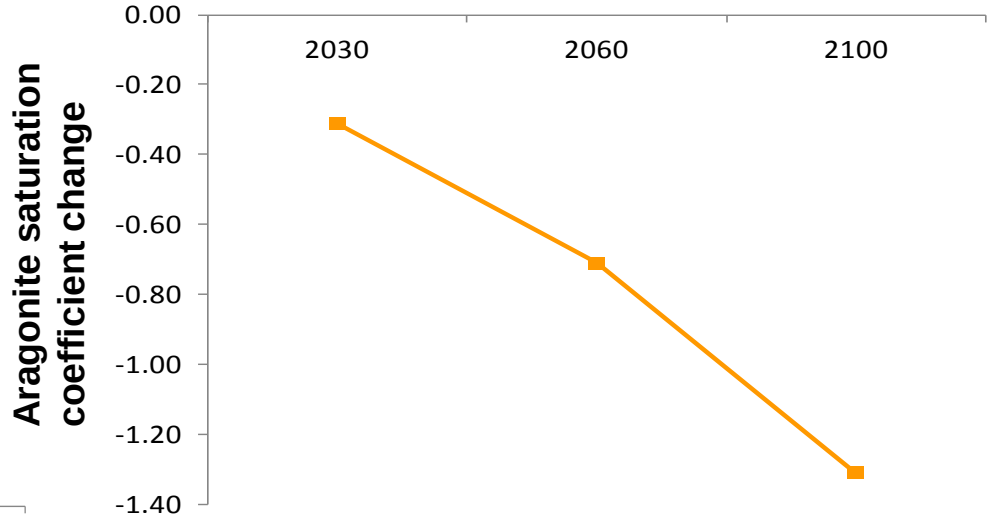
Projections about change stressor – used to determine exposure

Change from 2012 across the Torres Strait;









Threshold – Critical level of population level

Population asset – may no longer provides a service before it is completely exploited (critical level of population level)

Assumption: consider both current population status for each EGS and population level when EGS no longer provides a service factoring this into the potential impact

Simple example to help with interpretation of potential impact/threshold:

Species X			
Current Pop. Status	Pop. level when EGS no longer provides a service	Cumulative potential impact at 2100	Projected pop. level given relative potential impact
0.80	0.20	-0.83	0.13

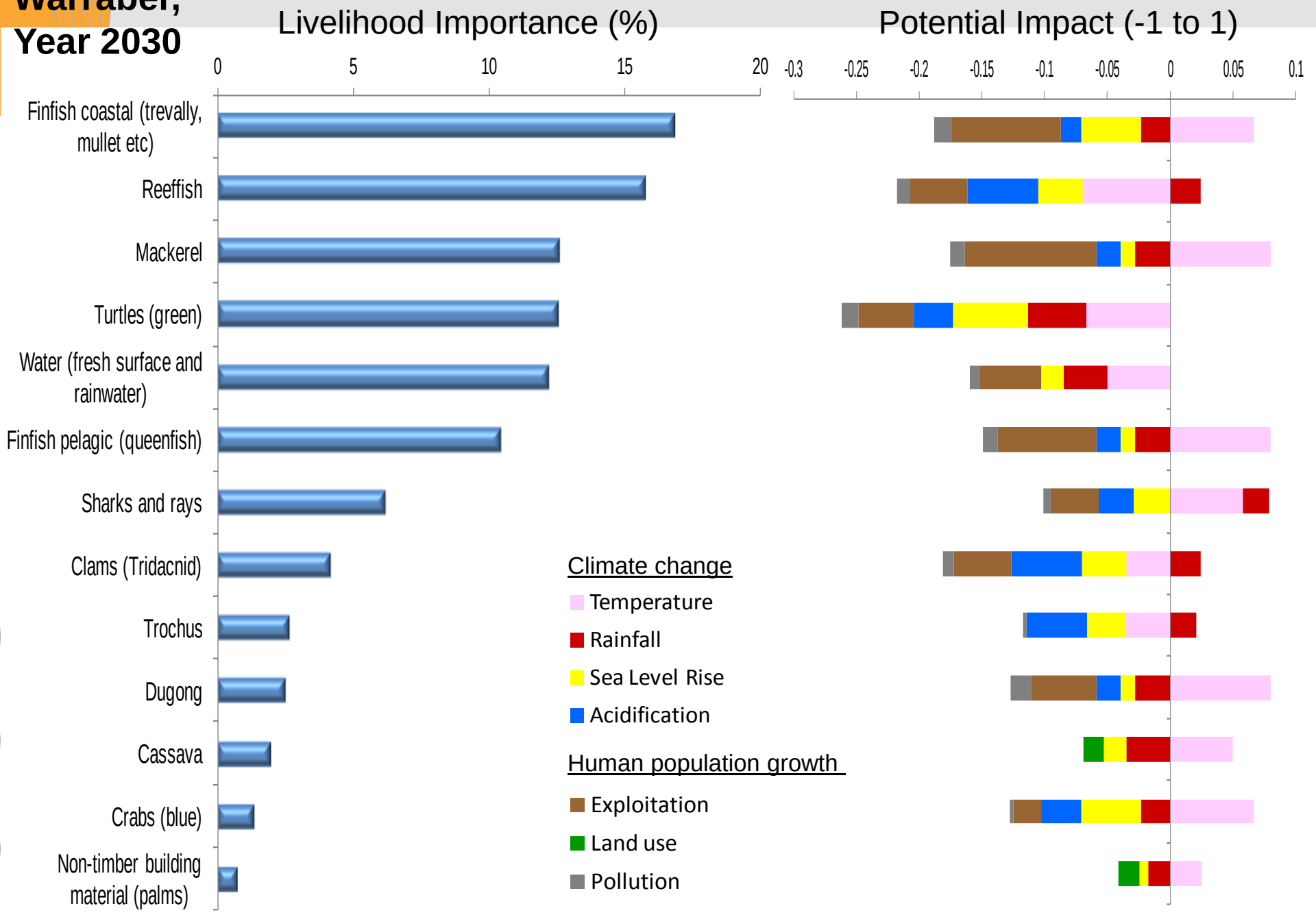
Threshold exceeded below critical level

Re-capping on variables

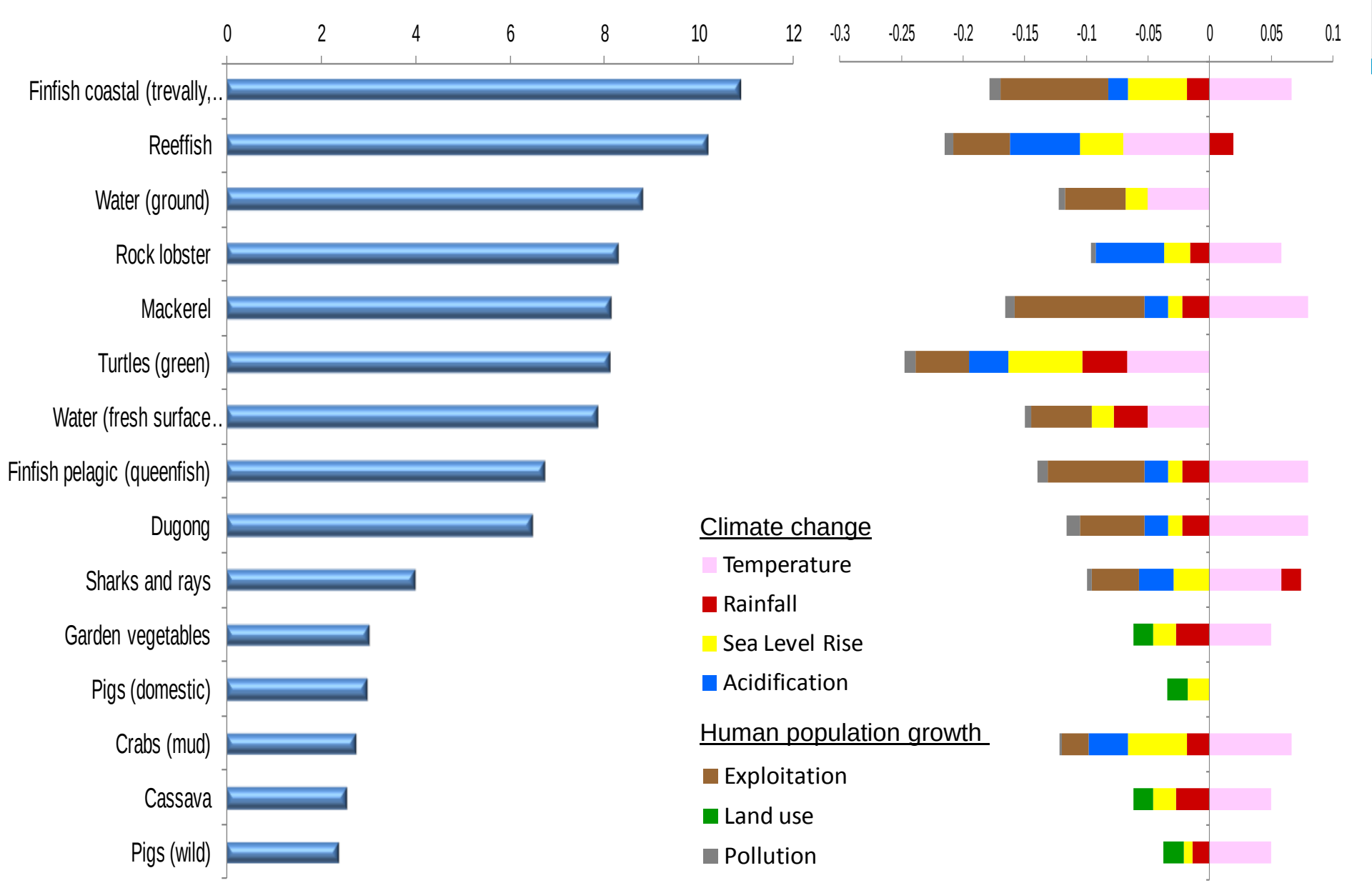
55 alternative assets (populations):	List presented above
15 Communities in the Torres Strait:	Badu, Boigu, Dauan, Erub, Hammond, Yam, Kubin, Mabuiag, Masig, Mer, Poruma, Saibai, St Paul, Ugar, and Warraber
7 stressors/pressures:	Temperature, rainfall, Sea Level Rise, Acidification, Utilisation, Land use, Pollution
3 alternative time-steps:	2030, 2060 and 2100

- Whole of system
- Multiple impact

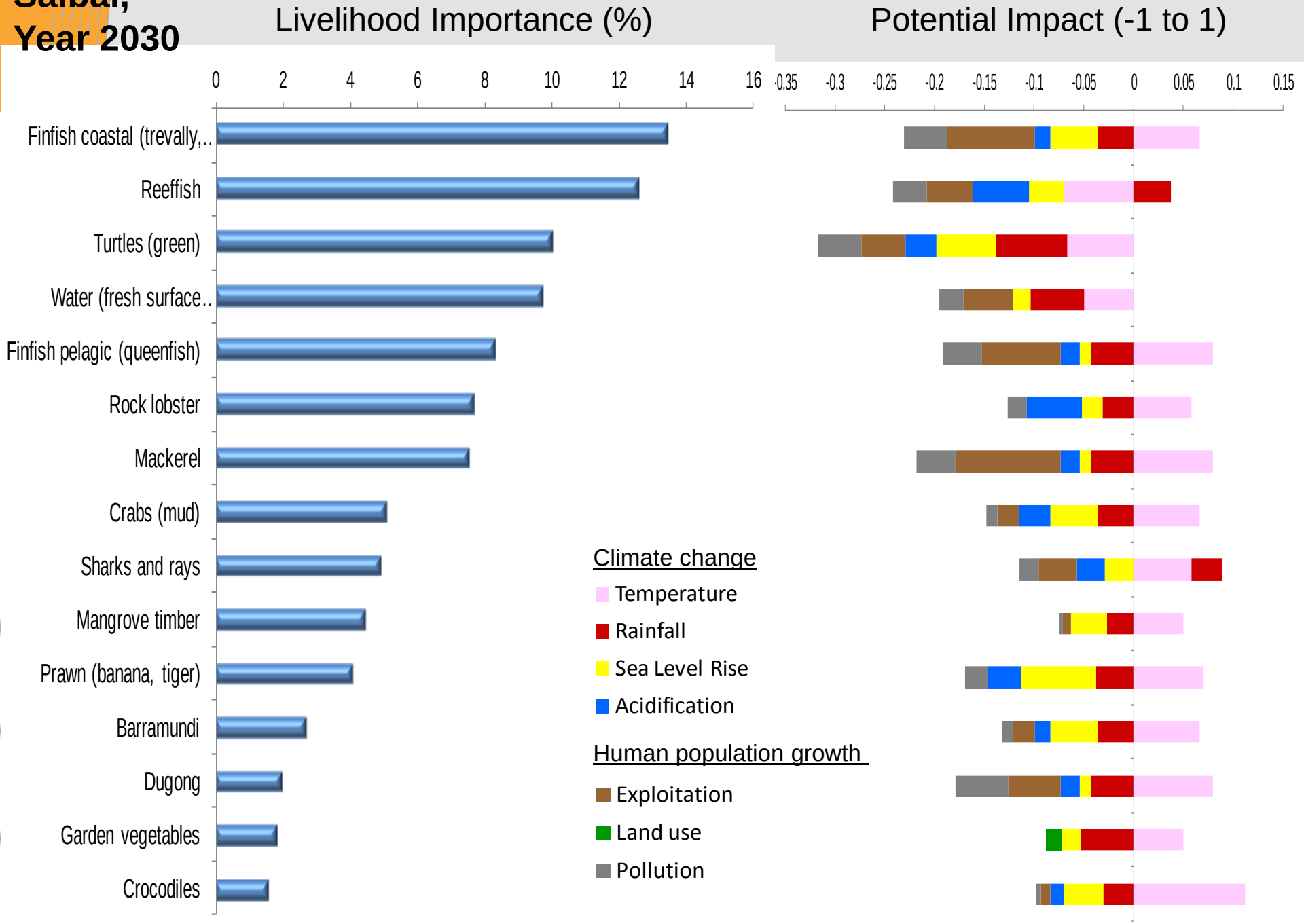
Warraber, Year 2030



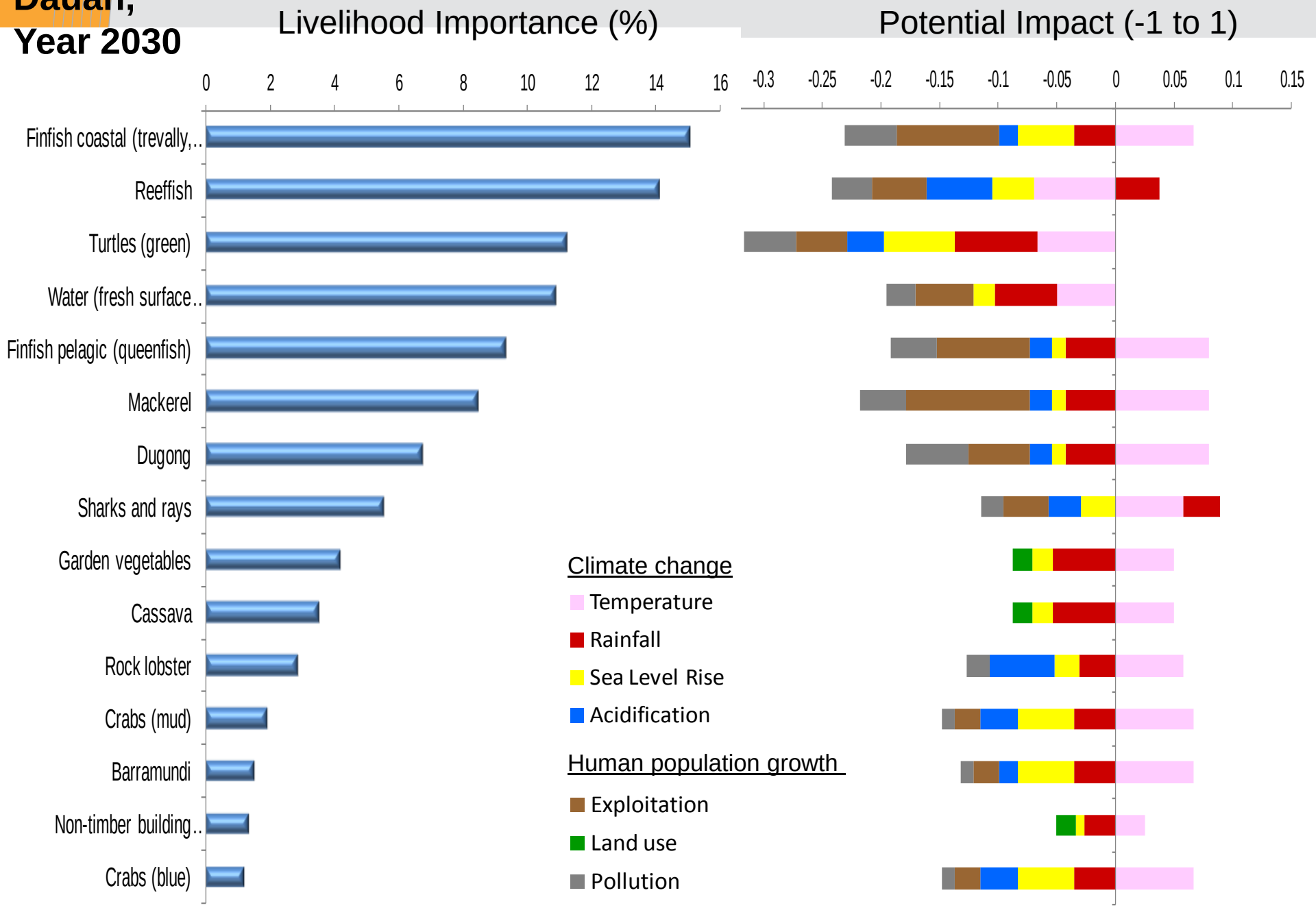
Badu, Year 2030



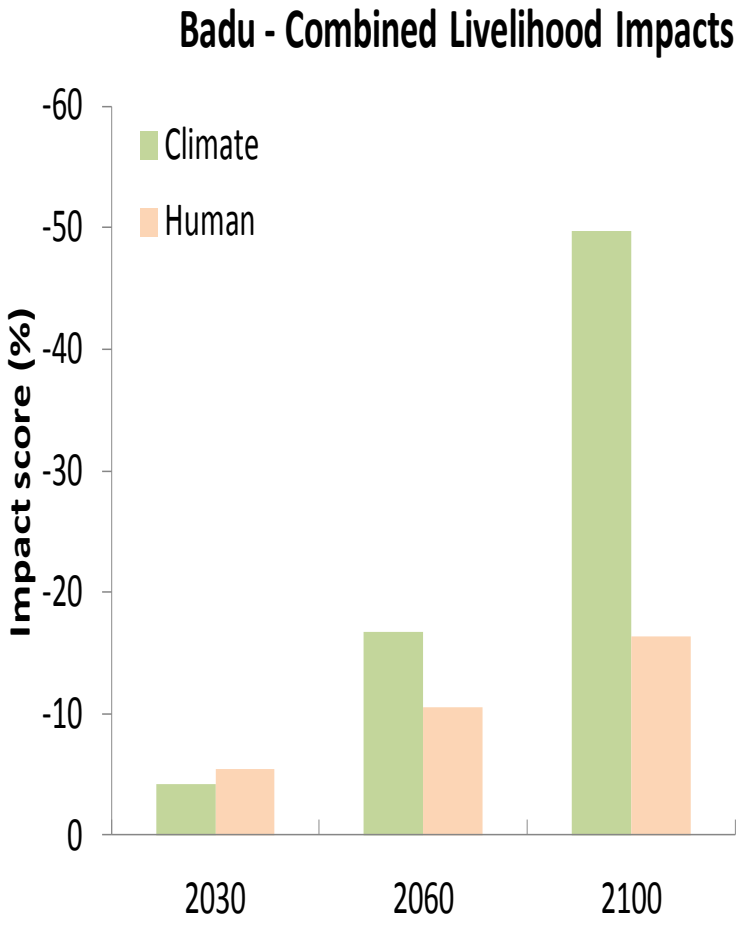
Saibai, Year 2030

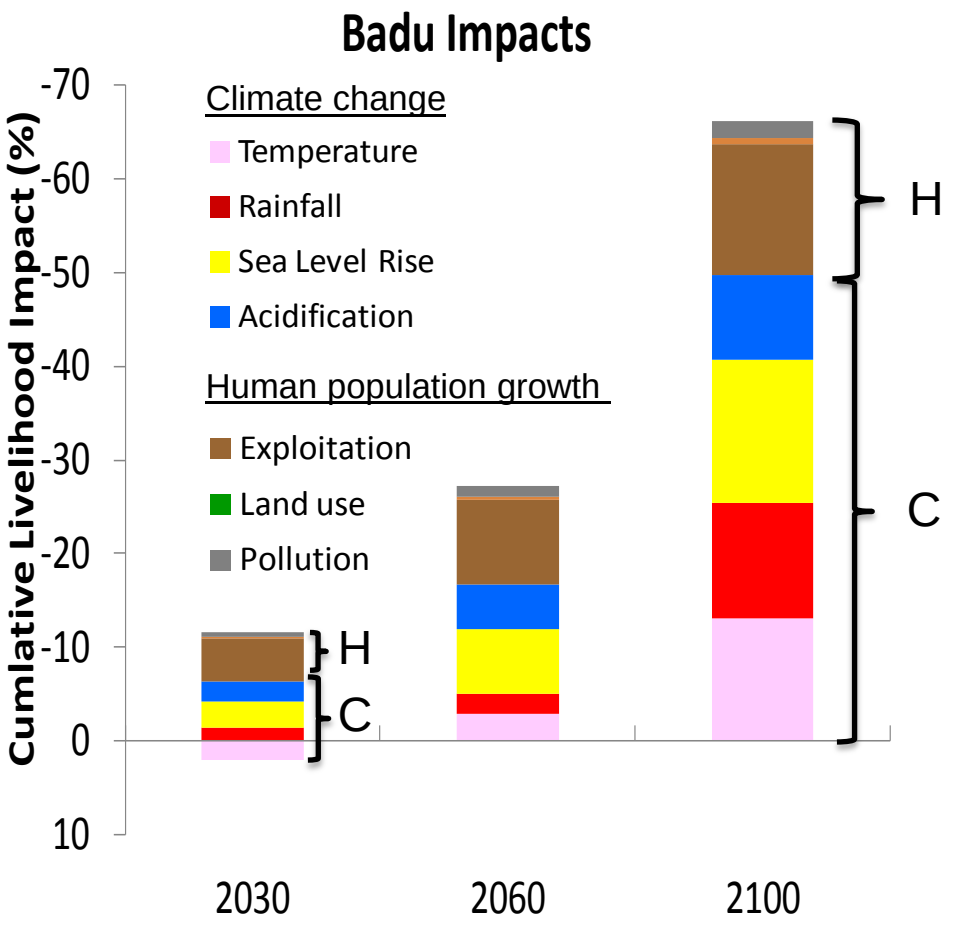


Dauan, Year 2030



Climate Vs Human Impacts

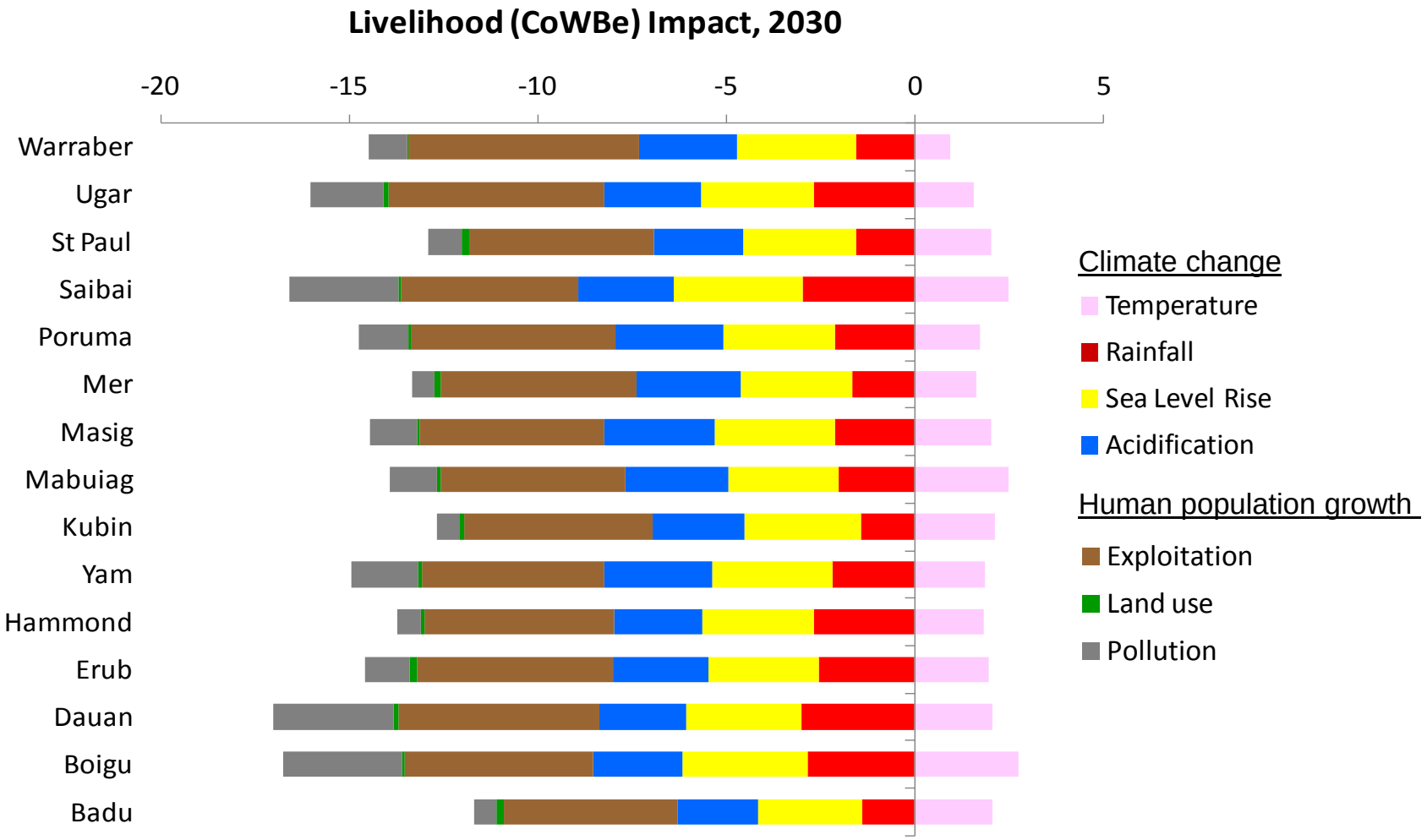




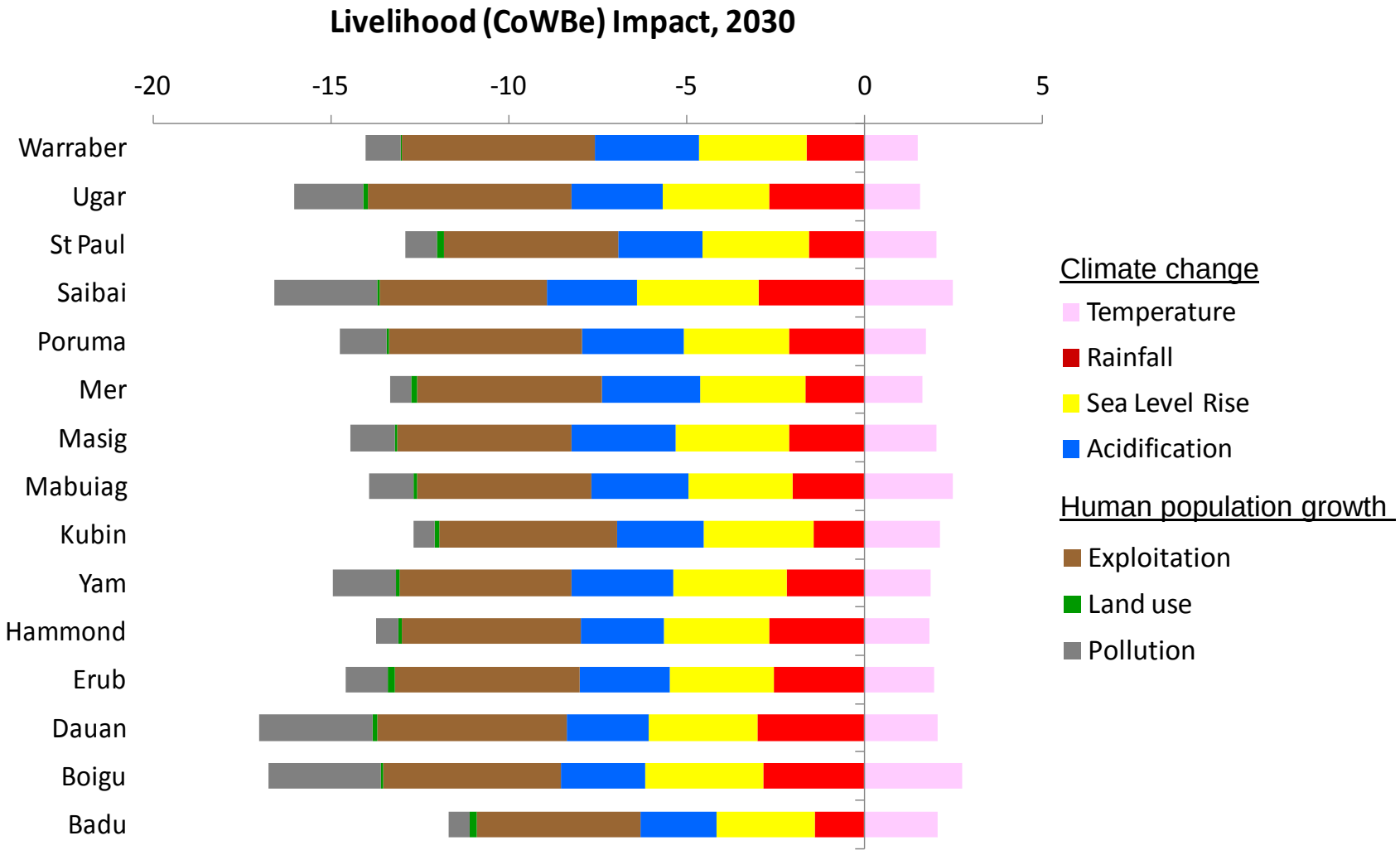
Frequency of exceeded threshold – Critical level of population level

Community	2030	2060	2100
Badu	0	0	3; Turtles (flatback, green and hawksbill)
Boigu	0	0	6; Finfish, turtles, clams and reef-fish
Dauan	0	0	6; Finfish, turtles, clams and reef-fish
Erub	0	0	3; Turtles (flatback, green and hawksbill)
Hammond	0	0	5; Finfish, turtles and sponge
Yam	0	0	4; Finfish and turtles
Kubin	0	0	3; Turtles (flatback, green and hawksbill)
Mabuiag	0	0	3; Turtles (flatback, green and hawksbill)
Masig	0	0	3; Turtles (flatback, green and hawksbill)
Mer	0	0	0
Poruma	0	0	3; Turtles (flatback, green and hawksbill)
Saibai	0	0	6; Finfish, turtles, clams and reef-fish
St Paul	0	0	4; Finfish and turtles
Ugar	0	0	3; Turtles (flatback, green and hawksbill)
Warraber	0	0	3; Turtles (flatback, green and hawksbill)

Communities - Total Impact, 2030



Communities - Total Impact, 2030



Livelihood Impacts, 2030

Community	Well-being Impact 2030	Well-being Impact 2060	Well-being Impact 2100
Badu	-9.6	-27.2	-66.1
Kubin	-9.8	-30.0	-72.5
St Paul	-10.2	-30.1	-71.2
Mabuiag	-10.8	-31.7	-72.6
Mer	-11.2	-31.5	-63.9
Hammond	-11.3	-32.6	-75.3
Warraber	-11.8	-33.4	-72.2
Masig	-11.8	-33.3	-66.5
Erub	-12.0	-32.5	-61.6
Poruma	-12.2	-34.0	-69.3
Yam	-12.4	-34.2	-70.3
Ugar	-13.5	-35.9	-68.4
Boigu	-13.6	-36.4	-71.4
Saibai	-13.7	-36.0	-69.6
Dauan	-14.3	-36.9	-69.5

Livelihood Impacts, 2060

Community	Well-being Impact 2030	Well-being Impact 2060	Well-being Impact 2100
Badu	-9.6	-27.2	-66.1
Kubin	-9.8	-30.0	-72.5
St Paul	-10.2	-30.1	-71.2
Mabuiag	-10.8	-31.7	-72.6
Mer	-11.2	-31.5	-63.9
Hammond	-11.3	-32.6	-75.3
Warraber	-11.8	-33.4	-72.2
Masig	-11.8	-33.3	-66.5
Erub	-12.0	-32.5	-61.6
Poruma	-12.2	-34.0	-69.3
Yam	-12.4	-34.2	-70.3
Ugar	-13.5	-35.9	-68.4
Boigu	-13.6	-36.4	-71.4
Saibai	-13.7	-36.0	-69.6
Dauan	-14.3	-36.9	-69.5

Livelihood Impacts, 2100

Community	Well-being Impact 2030	Well-being Impact 2060	Well-being Impact 2100
Badu	-9.6	-27.2	-66.1
Kubin	-9.8	-30.0	-72.5
St Paul	-10.2	-30.1	-71.2
Mabuiag	-10.8	-31.7	-72.6
Mer	-11.2	-31.5	-63.9
Hammond	-11.3	-32.6	-75.3
Warraber	-11.8	-33.4	-72.2
Masig	-11.8	-33.3	-66.5
Erub	-12.0	-32.5	-61.6
Poruma	-12.2	-34.0	-69.3
Yam	-12.4	-34.2	-70.3
Ugar	-13.5	-35.9	-68.4
Boigu	-13.6	-36.4	-71.4
Saibai	-13.7	-36.0	-69.6
Dauan	-14.3	-36.9	-69.5

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Thank you

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