

From Marxan to management: ocean zoning with stakeholders for Tun Mustapha Park in Sabah, Malaysia

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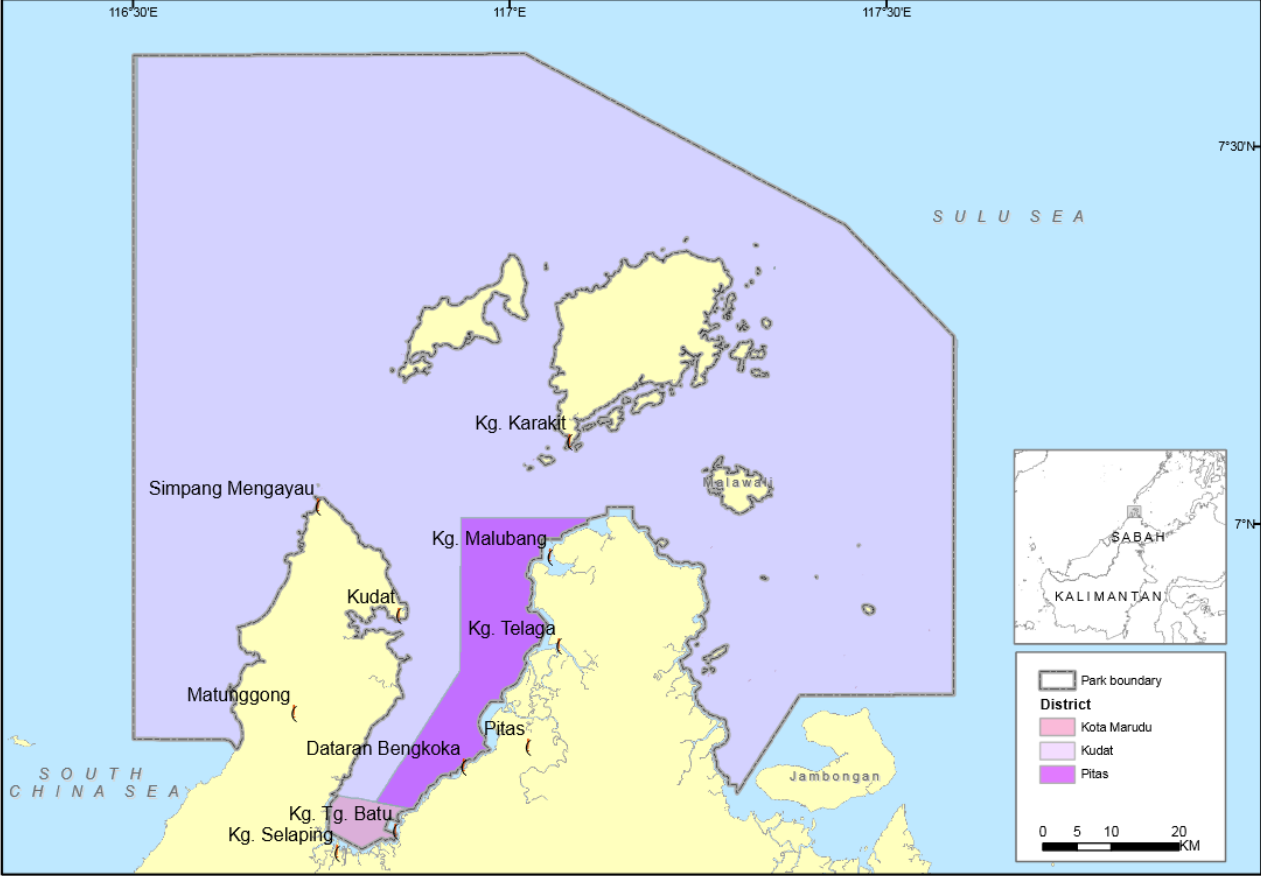


FIG. S1 The proposed Tun Mustapha Park, in Sabah, Malaysia.

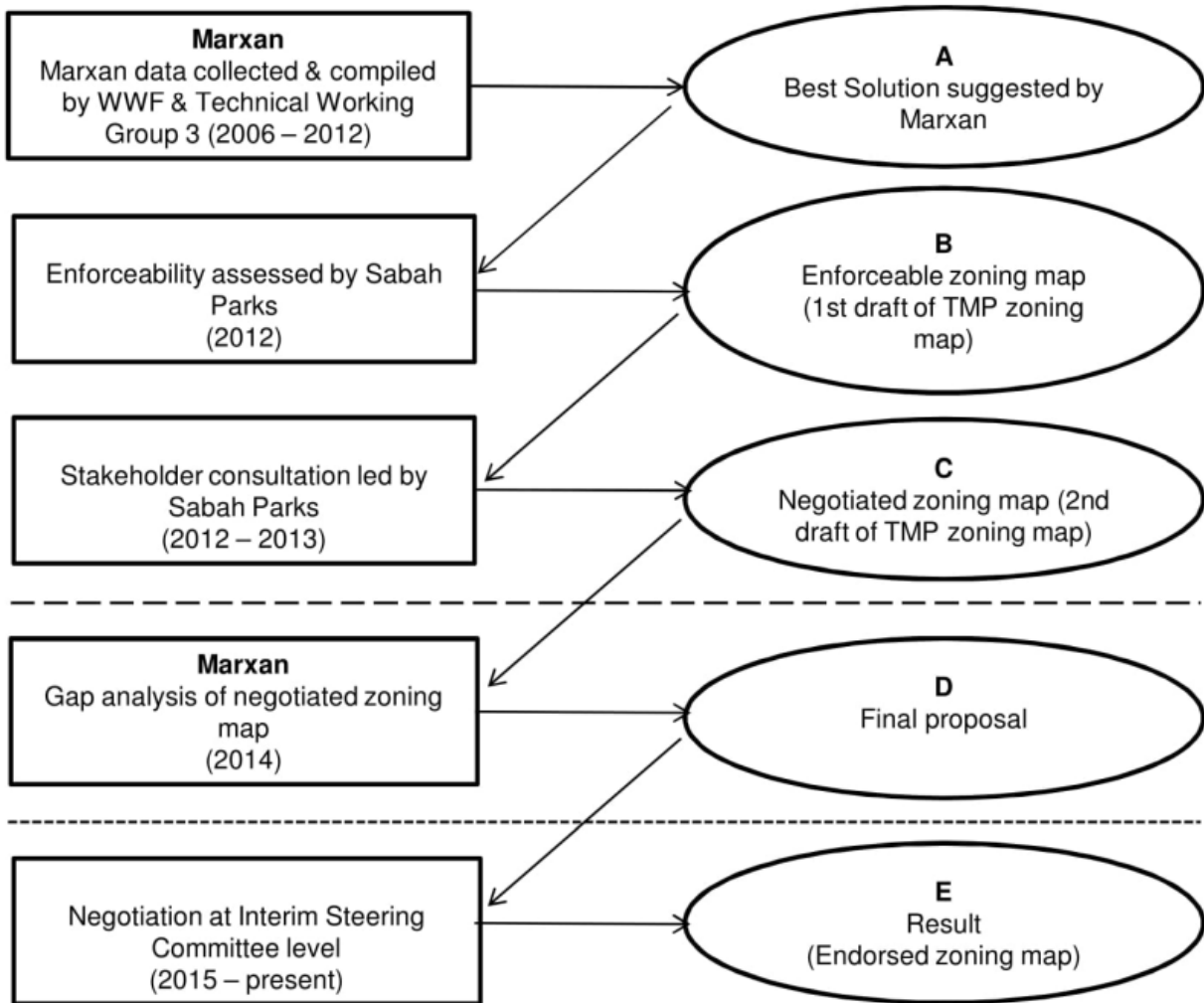


FIG. S2 Full iterative planning process for Tun Mustapha Park (TMP) including two additional stages after the completion of the stakeholder consultation.

TABLE S1 Percentage of conservation features allocated under each zoning type (i.e. preservation, community, and multiple use) at various stages of the zoning process. Not applicable indicates that the conservation feature is not present in the region.

Conservation feature	Preservation zone	Community zone	Multiple use zone
Accounting for Marxan best solution			
Region 1			
Dugong	30.1	23.9	46.0
Estuary	88.6	0.0	11.4
Fishing	18.5	30.0	51.5
Fringing exposed	30.3	23.5	46.2
Fringing semi-sheltered	30.1	27.4	42.1
Fringing very sheltered	29.9	14.1	55.6
Limestone exposed	33.1	34.0	32.4
Limestone sheltered	56.9	38.0	1.2
Mangrove	57.0	10.5	32.4
Patch exposed	28.4	5.7	60.6
Patch semi-sheltered	30.0	15.5	54.5
Patch sheltered	31.2	49.8	18.8
Seagrass	49.7	26.6	21.6
Turtle feeding	30.0	25.2	44.7
Turtle nesting	29.0	24.2	39.1
Region 2			
Dugong	30.1	36.2	33.8
Estuary	77.9	1.3	20.1
Fishing	13.2	30.0	56.7
Fringing exposed	30.2	51.9	17.8
Fringing semi-sheltered	30.0	30.7	39.2

Fringing very sheltered	36.4	14.9	48.6
Limestone exposed	Not applicable	Not applicable	Not applicable
Limestone sheltered	Not applicable	Not applicable	Not applicable
Mangrove	54.9	27.2	17.8
Patch exposed	29.4	11.9	56.7
Patch semi-sheltered	30.0	14.3	55.5
Patch sheltered	31.8	6.8	61.3
Seagrass	52.2	44.6	2.8
Turtle feeding	30.0	37.4	32.5
Turtle nesting	40.1	20.4	33.7

Region 3

Dugong	31.7	18.4	49.9
Estuary	30.8	11.6	57.6
Fishing	14.2	30.0	55.7
Fringing exposed	Not applicable	Not applicable	Not applicable
Fringing semi-sheltered	30.0	46.8	22.7
Fringing very sheltered	34.6	36.4	27.8
Limestone exposed	Not applicable	Not applicable	Not applicable
Limestone sheltered	Not applicable	Not applicable	Not applicable
Mangrove	60.3	3.8	35.8
Patch exposed	Not applicable	Not applicable	Not applicable
Patch semi-sheltered	60.5	26.1	13.1
Patch sheltered	Not applicable	Not applicable	Not applicable
Seagrass	43.9	56.1	0.0
Turtle feeding	30.0	37.8	32.2
Turtle nesting	57.7	30.6	10.6

Region 4

Dugong	37.3	44.8	18.0
Estuary	98.9	0.0	0.9
Fishing	17.6	30.0	52.4
Fringing exposed	30.3	14.9	54.6
Fringing semi-sheltered	30.7	25.3	31.6
Fringing very sheltered	Not applicable	Not applicable	Not applicable
Limestone exposed	Not applicable	Not applicable	Not applicable
Limestone sheltered	Not applicable	Not applicable	Not applicable
Mangrove	55.2	0	44.7
Patch exposed	30.8	26.1	39.4
Patch semi-sheltered	54.5	0.4	44.9
Patch sheltered	Not applicable	Not applicable	Not applicable
Seagrass	95.7	1.3	3.1
Turtle feeding	30.0	27.6	42.3
Turtle nesting	30.3	18.8	34.7

Accounting for Sabah Parks

Region 1

Dugong	34.6	46.4	17.8
Estuary	100.0	0.0	0.0
Fishing	29.4	42.2	27.7
Fringing exposed	51.1	35.6	13.3
Fringing semi-sheltered	31.1	48.5	20.1
Fringing very sheltered	80.4	4.4	15.0
Limestone exposed	2.5	89.1	7.8
Limestone sheltered	76.4	19.9	0.0
Mangroves	86.9	0.7	1.4
Patch exposed	0.0	25.3	69.5

Patch semi-sheltered	4.1	38.4	57.4
Patch sheltered	8.9	80.5	10.6
Seagrass	79.3	17.8	0.7
Turtle feeding	31.4	49.6	16.8
Turtle nesting	33.3	44.7	22.0
Region 2			
Dugong	39.3	43.0	16.0
Estuary	36.2	61.7	0.0
Fishing	20.5	31.5	46.8
Fringing exposed	39.9	59.6	0.5
Fringing semi-sheltered	50.9	35.3	13.7
Fringing very sheltered	39.9	60.0	0.0
Mangroves	57.4	1.4	0.0
Limestone exposed	Not applicable	Not applicable	Not applicable
Limestone sheltered	Not applicable	Not applicable	Not applicable
Patch exposed	39.7	9.5	48.7
Patch semi-sheltered	27.8	26.2	45.8
Patch sheltered	79.9	8.7	11.4
Seagrass	27.2	69.8	2.7
Turtle feeding	25.5	48.9	24.2
Turtle nesting	0.0	22.0	73.9
Region 3			
Dugong	32.6	16.0	50.3
Estuary	38.8	50.4	10.9
Fishing	24.5	36.0	38.9
Fringing exposed	Not applicable	Not applicable	Not applicable
Fringing semi-sheltered	9.5	88.5	1.8

Fringing very sheltered	0.0	4.2	0.0
Limestone exposed	Not applicable	Not applicable	Not applicable
Limestone sheltered	Not applicable	Not applicable	Not applicable
Mangrove	74.4	3.5	0.0
Patch exposed	Not applicable	Not applicable	Not applicable
Patch semi-sheltered	18.0	82.0	0.0
Patch sheltered	Not applicable	Not applicable	Not applicable
Seagrass	0.0	100.0	0.0
Turtle feeding	55.4	37.6	6.7
Turtle nesting	77.0	0.1	0.0
Region 4			
Dugong	42.1	57.9	0.0
Estuary	99.9	0.0	0.0
Fishing	25.3	37.7	37.0
Fringing exposed	53.5	29.7	16.4
Fringing semi-sheltered	14.6	62.7	9.9
Fringing very sheltered	Not applicable	Not applicable	Not applicable
Limestone exposed	Not applicable	Not applicable	Not applicable
Limestone sheltered	Not applicable	Not applicable	Not applicable
Mangrove	91.0	0.03	0.0
Patch exposed	49.2	0.0	47.3
Patch semi-sheltered	99.4	0.4	0.0
Patch sheltered	Not applicable	Not applicable	Not applicable
Seagrass	4.2	95.5	0.0
Turtle feeding	46.1	35.7	18.1
Turtle nesting	25.5	61.2	7.3
Accounting for stakeholders			

Region 1

Dugong	17.8	60.3	16.0
Estuary	0.0	98.6	0.0
Fishing	15.7	59.3	21.5
Fringing exposed	41.5	47.7	10.7
Fringing semi-sheltered	4.8	74.7	20.1
Fringing very sheltered	0.0	83.7	15.0
Limestone exposed	0.0	91.6	7.8
Limestone sheltered	0.0	95.8	0.0
Mangrove	0	0	0
Patch exposed	3.9	32.9	63.2
Patch semi-sheltered	43.6	39.4	17.0
Patch sheltered	0.0	89.4	10.6
Seagrass	3.5	95.8	0.7
Turtle feeding	21.7	59.4	13.1
Turtle nesting	2.9	75.1	22.0

Region 2

Dugong	15.6	46.5	12.9
Estuary	0.0	3.6	0
Fishing	31.7	36.8	28.8
Fringing exposed	16.3	59.8	0.3
Fringing semi-sheltered	11.4	59.8	8.8
Fringing very sheltered	0	23.6	0
Mangrove	0	0	0
Patch exposed	73.1	6.8	20.1
Patch semi-sheltered	58.6	17.7	23.9
Patch sheltered	55.5	35.4	8.5

Seagrass	27.2	54.5	2.7
Turtle feeding	29.5	53.0	11.3
Turtle nesting	38.8	22.0	35.1
Region 3			
Dugong	21.6	24.5	50.3
Estuary	0	49.6	0
Fishing	2.7	37.6	34.2
Fringing exposed	Not applicable	Not applicable	Not applicable
Fringing semi-sheltered	6.5	49.5	1.9
Fringing very sheltered	0	99.3	0
Limestone exposed	Not applicable	Not applicable	Not applicable
Limestone sheltered	Not applicable	Not applicable	Not applicable
Mangrove	0	0	0
Patch exposed	Not applicable	Not applicable	Not applicable
Patch semi-sheltered	0	15.3	0
Patch sheltered	Not applicable	Not applicable	Not applicable
Seagrass	0	0.0	0
Turtle feeding	1.5	65.0	1.7
Turtle nesting	0	0	0
Region 4			
Dugong	0	98.6	1.4
Estuary	0	99.7	0
Fishing	22.1	49.8	28.1
Fringing exposed	23.2	74.8	1.8
Fringing semi-sheltered	9.3	77.2	
Fringing very sheltered	Not applicable	Not applicable	Not applicable
Limestone exposed	Not applicable	Not applicable	Not applicable

Limestone sheltered	Not applicable	Not applicable	Not applicable
Mangrove	0	0	0
Patch exposed	65.2	5.7	29.1
Patch semi-sheltered	0	99.9	0
Patch sheltered	Not applicable	Not applicable	Not applicable
Seagrass	25.9	21.6	0
Turtle feeding	46.0	33.1	20.8
Turtle nesting	30.4	67.9	0

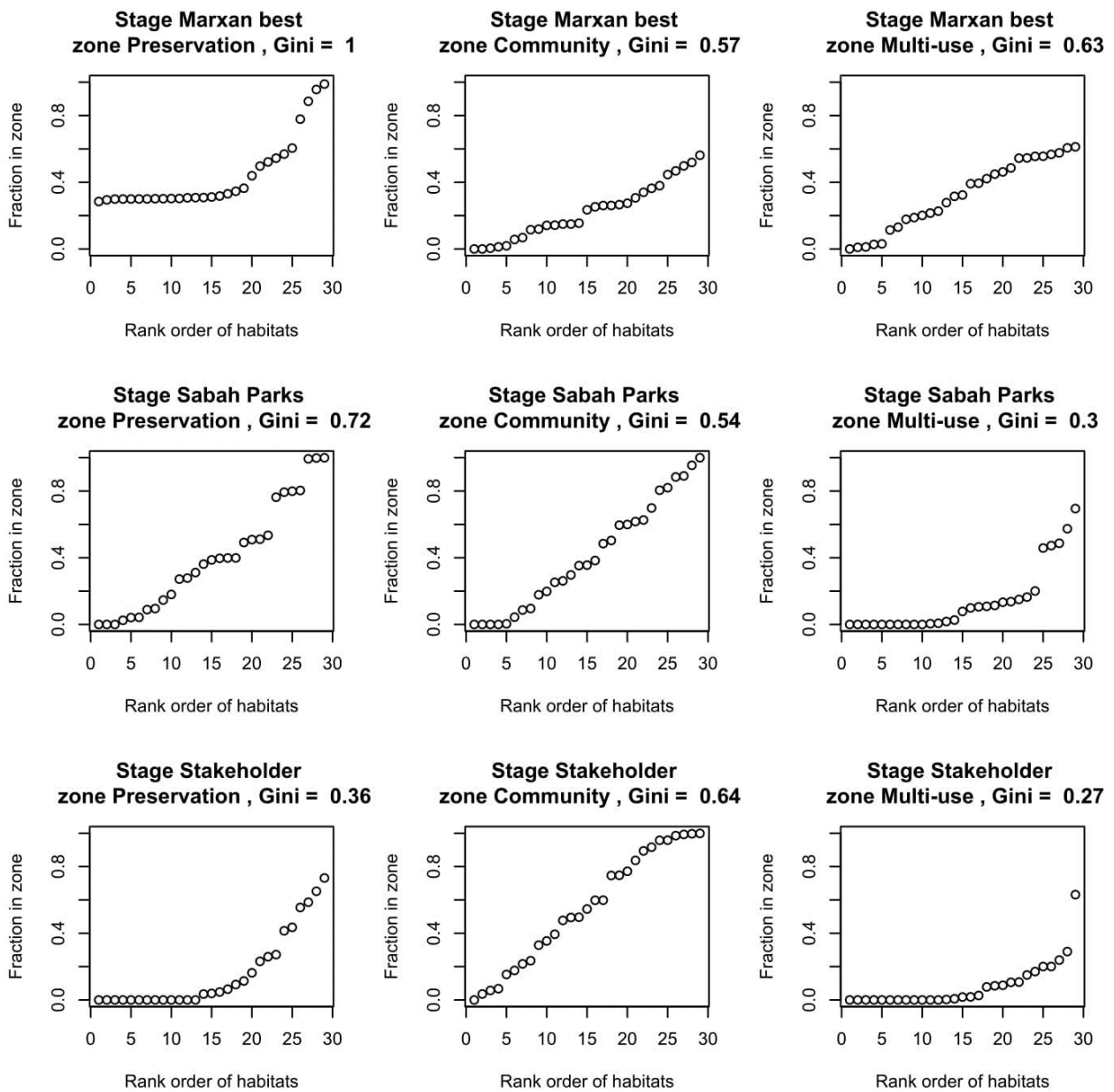
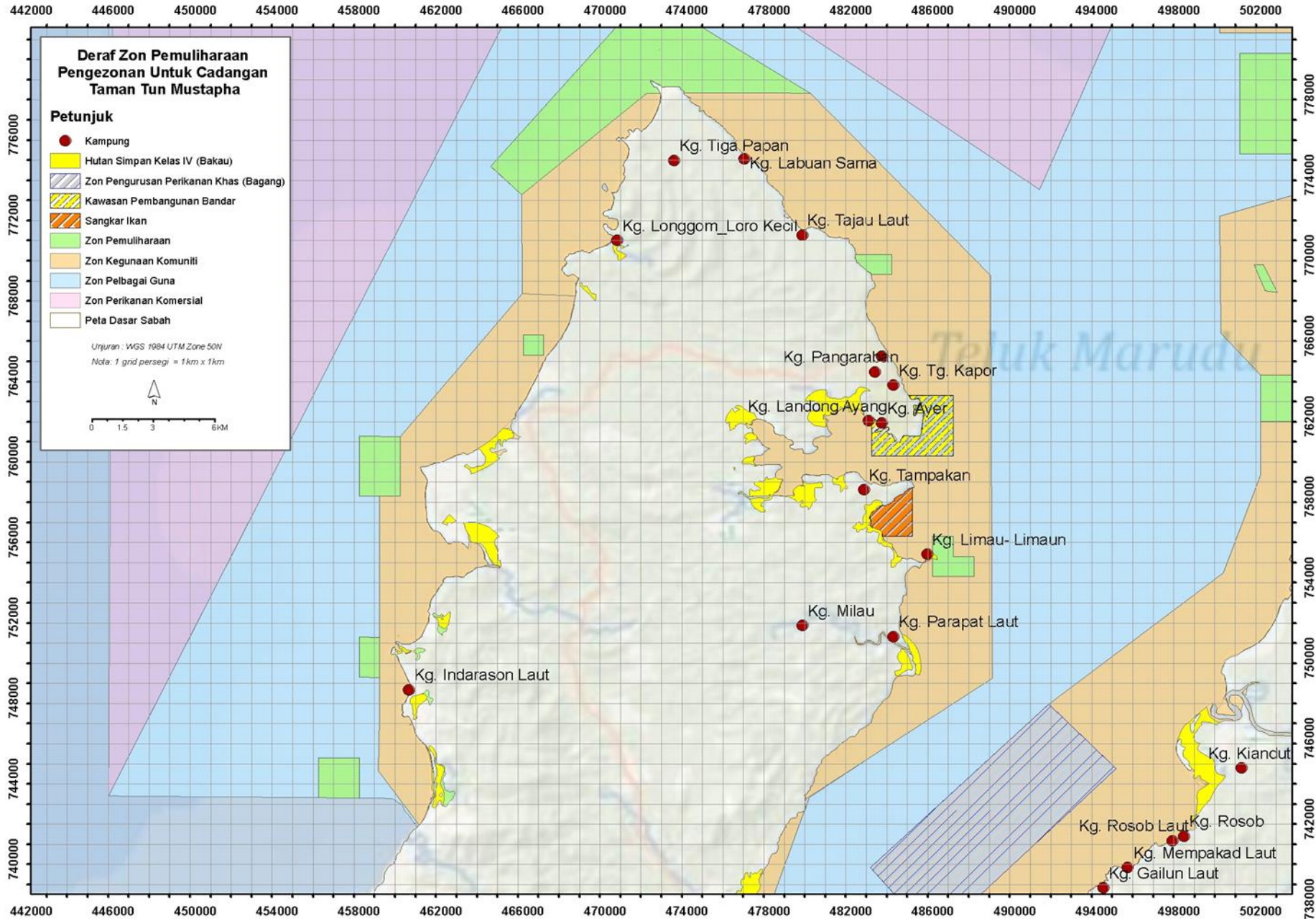


FIG. S3 Habitat representation within each zone at each stage of the zoning process, calculated using a modified Gini coefficient (higher values indicate more even habitat/feature representation).

SUPPLEMENTARY MATERIAL 1 Feedback form for public consultation on the zoning of Tun Mustapha Park.

Respondent information	
Name:	Contact no.:
Village:	Age (years) :
Gender : <input type="checkbox"/> Male <input type="checkbox"/> Female	
Race: <input type="checkbox"/> Sungai <input type="checkbox"/> Suluk <input type="checkbox"/> Bajau <input type="checkbox"/> Dusun Bonggi <input type="checkbox"/> KDM Rungus <input type="checkbox"/> Ubian <input type="checkbox"/> Other (please specify)	
Nationality: <input type="checkbox"/> Malaysian <input type="checkbox"/> Permanent resident <input type="checkbox"/> Non Malaysian <input type="checkbox"/> Other (please specify)	
Education level: <input type="checkbox"/> None <input type="checkbox"/> Primary school <input type="checkbox"/> High school <input type="checkbox"/> Other (please specify)	
Occupation: <input type="checkbox"/> Small-scale fisher <input type="checkbox"/> Head of village <input type="checkbox"/> PJKKK* <input type="checkbox"/> Commercial fisher <input type="checkbox"/> Farmer <input type="checkbox"/> Other (please specify)	
*Pengerusi Jawatankuasa Kemajuan dan Keselamatan Kampung (Chairman, Village Development & Security Committee)	
Number of children in school:	
Estimated salary: <input type="checkbox"/> <RM 200 <input type="checkbox"/> RM 200–500 <input type="checkbox"/> RM 500–1,000 <input type="checkbox"/> > RM 1,000	
Are you a member of any clubs or organizations? <input type="checkbox"/> JKKK* <input type="checkbox"/> Fishers’ association <input type="checkbox"/> Traders’ association <input type="checkbox"/> Political organization <input type="checkbox"/> Other (Please specify)	
*Jawatankuasa Kemajuan dan Keselamatan Kampung (Village Development and Security Committee)	
What fisheries activities do you usually do? <input type="checkbox"/> Quick fishing <input type="checkbox"/> Hook & line/net <input type="checkbox"/> Harvesting sea cucumbers <input type="checkbox"/> Other (Please specify)	



ZONING PLAN

Based on the map of the Tun Mustapha Park zoning plan above, provide your feedback on the zoning and suggested activities in the tables below (you may also add comments directly on the map).

Zone	Mark (/)					Remarks
	Totally agree	Agree	Not sure	Disagree	Totally disagree	
Commercial fishing zone						
Community use zone						
Multiple use zone						
Conservation zone (<i>Tabungan Ikan</i>)						

Comments and suggestions based on proposed zones:

Zones	Mark (/)					Remarks
	Totally agree	Agree	Not sure	Disagree	Totally disagree	
Commercial fishing zone						
Community use zone						
Multiple use zone						
Conservation zone (<i>Tabungan Ikan</i>)						

Comments and suggestions based on proposed activities:

General knowledge on proposed Tun Mustapha Park

Do you agree on the following subjects?	Mark (/)				
	Totally agree	Agree	Not sure	Disagree	Totally disagree
Objectives of Tun Mustapha Park gazettelement					
The concept of gazettelement: 'Multiple use park that practises co-management, with community involvement in the management'					
Participation by communities in management of natural resources in the community use zone					
Collaboration with government agencies involved in the management of Tun Mustapha Park					

What is your hope for the Tun Mustapha Park zoning plan?

Mark (/)

Purse seine and trawlers will operate only in the commercial fishing zone.

Fishers will not lose their rights to fish in the area.

Fish bombing and cyanide activities will be abolished.

Other sources of income (e.g. tourism) will be introduced.

Other (Please specify) _____

Do you agree with the proposal by the State Government to gazette Tun Mustapha Park?

- Agree Not sure Disagree

Give reasons:

Is the information provided in this public consultation understandable?

- Yes Not sure No

Give reasons:

Other suggestions:

THANK YOU FOR YOUR PARTICIPATION