

# Valuing marine protected areas in Vietnam using choice experiments

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# Objectives of this paper

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- Elicit public preferences for marine conservation measures in Nha Trang bay
- Scrutinise the applicability of Discrete Choice Experiments (DCE) **where the cultural context might affect the way respondents react to the questionnaire material**
- In our case, **this is all about not giving full consideration to the do-nothing-more status quo**
- What are the effects of explicitly modelling this?



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The analysis employs the independent availability logit model with random coefficients to simultaneously account for heterogeneity of preferences and of choice set formation (Campbell and Erdem 2018).

→ *Results show significantly improved model fit when choice set heterogeneity is taken into account.*

# Context

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## Nha Trang Bay

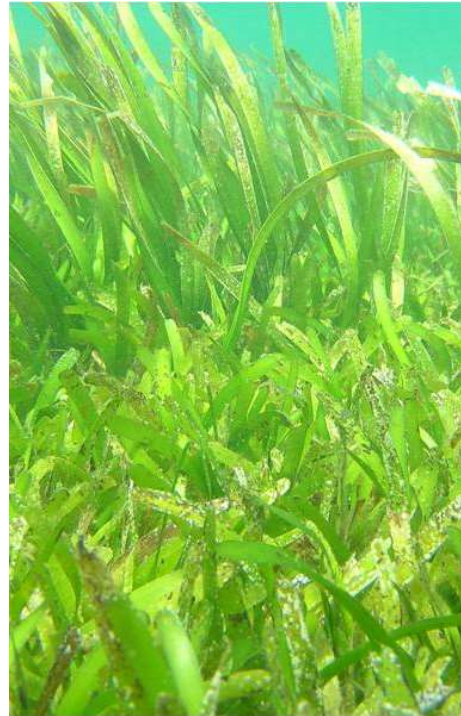
- High level of marine biodiversity

- But many stressors:

  - Sewage waste water from households  
(Nha Trang: 500,000 inhabitants)

  - Aquaculture: pollution from feed and  
fertilizer

  - Plastics waste in water and on beaches



# Increasing pressures

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- Up until the 1990s, the main economic sectors of Nha Trang city and its surrounding Khanh Hoa province were forestry, agriculture and fishing
- But tourism and industrial sectors have seen rapid development
- Nha Trang has grown into a very popular destination for domestic and international tourists.
- Ports, roads, hotels and resorts have not only been built in mainland Nha Trang but also on some of the islands located in the Bay.

# Context

Marine protected area (MPA) in place since 2001

We focus on proposed changes to the environmental management of Nha Trang Bay

- Better treatment of municipal waste water.
- More stringent regulations for aquaculture operators
- Improve the protection of coral reefs and seagrass which filter the water
- More regular collection of plastic waste
- Reduce the use of plastic bags in the city

→ Use a Choice Experiment to understand public preferences and priorities



# Method

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## Choice Experiment:

- People given choice between 2 alternative management scenarios and the current situation (the *status quo*)
- Choice scenarios described in terms of:
  - Water quality: No improvement (ref), large improvement
  - Coral cover: 20% (ref), 30%, 50%
  - Plastic waste: No change (ref), regular waste collection, reduced use of plastic in city
  - Water fee (monthly for 5 years): 0 (ref); 5,000; 10,000; 15,000; 25,000 VND (=1 euro)

Design of questionnaire: 2 focus groups and 4 pilots (n=40 each)

422 respondents, face to face October 2018, Nha Trang city + suburban communes

# Example of choice card



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Description	Current status "No change"	Management Plan A	Management Plan B
Water quality 	No change	Large improvement	No change
Coral cover 	Coral cover 20%	Coral cover 30%	Coral cover 50%
Plastic waste 	No change	Regular waste collection and filtering	Limit use of plastic bags
Additional water fee VND 	VND 0 for your household per month	VND 15.000 for your household per month	VND 5.000 for your household per month
I prefer <input checked="" type="checkbox"/> 	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

6 choice-cards per respondent, 2 blocks



# How do respondents answer the questionnaire?





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But is there a risk of “yea-saying” bias in Vietnamese cultural setting?

- political system
- Environmental programmes: designed and implemented by governmental agencies (Ortmann 2017)
- The general public not routinely consulted (Hostovsky et al. 2010)
- Research shows higher levels of acquiescence in surveys asking for WTP for environmental protection respondents from low-income Asian societies, including Vietnam (Franzen and Vogl 2013)

→ respondents might only consider the 2 change alternatives, and not the status quo

# How do respondents answer the questionnaire?

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75% never choose status quo

74% agree with statement: “It is my duty to contribute at least a small amount to the NTB management plan”.

→ account for choice heuristics (choice set consideration) in data analysis

→ using the “Independent Availability Logit model” (Campbell and Erdem 2018)

→ as well as for preference heterogeneity.

# Accounting for variation in which choices people consider

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Most models assume that every respondent considers all options  $j$  in every choice situation  $t$ .

However, it is conceivable that some respondents do not consider all options on offer: in a choice situation with three options  $j = 1, 2, 3$  a respondent may, for example, systematically ignore the first option (e.g. the status quo), so that for this respondents in fact  $j = 2, 3$ .

Since no explicit information is recorded as to whether a respondent has or has not considered an unchosen option, a latent class framework can be used whereby the probability of a respondent making a series of choices  $y_n$  is conditional on belonging to a certain consideration set class  $c = 1, \dots, C$ .

# Estimation

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First, a simple MNL

Then, a standard MXL

Then model the choice sets people considered, combining this with MXL

Then see what variables, if any, determine which “consideration set” people fall into

*Multinomial and mixed logit models*

	MNL (WTP space)		MXL (WTP space)			
	Coef.	s.e.	Coef.	s.e.	SD	s.e.
ASC	-0.277 ***	(0.042)	-0.480 ***	(0.001)	0.546 ***	(0.001)
WATER1	0.091 ***	(0.019)	0.111 ***	(0.001)	0.159 ***	(0.000)
CORAL30	0.081 ***	(0.014)	0.076 ***	(0.002)	0.129 ***	(0.003)
CORAL50	0.064 ***	(0.024)	0.064 ***	(0.001)	0.449 ***	(0.001)
WASTE_COLLECT	0.101 ***	(0.022)	0.159 ***	(0.001)	0.175 ***	(0.001)
LIMIT_BAGS	0.090 ***	(0.019)	0.137 ***	(0.001)	0.098 ***	(0.001)
COST	-4.142 ***	(0.399)	4.135 ***	(0.305)	2.357 ***	(0.240)
Log-likelihood	2395		-1666			
Parameters	7		35			
Adjusted rho2	0.033		0.388			
BIC	4846		3607			
Sobol draws	-		1000			

Notes: 2,532 choice occasions over 422 respondents. \*\*\* indicates significance at the 1%-level of confidence.

<sup>a</sup> All but the cost coefficient are assumed to follow a normal distribution. The cost coefficient follows a lognormal distribution with sign reverse. All random coefficients are correlated.

- Poor fit of MNL
- High value of ASC in MXL:  
positive utility from a change
- Lot of preference heterogeneity



## Modelling the choice consideration set


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Initial analysis showed that the best approach was to model **two** consideration set classes:

- i. Consider all options;
- ii. Ignore the status quo option

We thus present a model which uses latent class approach to probabilistically sort people into these 2 groups.

This model is statistically preferred to a model which assumes *everyone* is type (i) above.



*Independent availability mixed logit model*

	IA-MXL (WTP space)	
	Coef.	s.e.
<b>Means of random coefficients</b>		
ASC	0.023 ***	(0.000)
WATER1	0.108 ***	(0.002)
CORAL30	0.072 ***	(0.004)
CORAL50	0.092 ***	(0.008)
WASTE_COLLECT	0.162 ***	(0.003)
LIMIT_BAGS	0.128 ***	(0.001)
COST	5.641 ***	(0.414)
<b>Standard deviation of random coefficients</b>		
ASC	0.355 ***	(0.003)
WATER1	0.133 ***	(0.003)
CORAL30	0.102 ***	(0.004)
CORAL50	0.410 ***	(0.007)
WASTE_COLLECT	0.166 ***	(0.005)
LIMIT_BAGS	0.121 ***	(0.000)
COST	4.430 ***	(0.535)
<b>Class membership probabilities</b>		
Class I (Consider all options)	0.393	
Class ii (Ignore SQ option)	0.607	
Log-likelihood	-1658	
Parameters	36	
Adjusted rho2	0.391	
BIC	3599	
Sobol draws	1000	


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## In words..

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- better fit for a model that explicitly takes into account variation in the consideration set
  - around 39% of people consider all options (type i) ; and 61% do not consider the do-nothing status quo (model outcome, not in descriptive stats)
  - *main factor that determines (probabilistically) which type you are is response to Likert scale on “duty”*
  - ie respondents who agree more strongly with the statement “I think it is my duty to contribute at least a small amount to the Nha Trang Bay management plan” are less likely to consider **all** offered options.
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However, explicitly allowing for variation in the choice consideration set does **not** produce a significant change in WTP estimates for the different attributes within the MPA plan...

...except for 50% level of coral cover

...although it does result in larger values on the whole → implications for CBA

## Results: WTP estimates

### *Mean WTP estimates*

	<b>MNL</b>	<b>MXL</b>	<b>IA-MXL</b>
ASC	-27.66	-47.95	2.29
WATER1	9.08	11.08	10.76
CORAL30	8.12	7.57	7.20
CORAL50	6.41	6.38	9.19
WASTE_COLLECT	10.06	15.91	16.21
LIMIT_BAGS	8.97	13.66	12.82

Notes: In 1,000 VND (0.033 GBP)

Recall: “Water” is improvement in coastal water Q; “coral” is improvement in coral cover; “waste” and “limit” address plastics pollution to bay

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Accounting for choice heuristics:

→ WTP estimates remain unchanged in this study

# Conclusion


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## 1. On preferences for marine environmental management in Vietnam

- Our research shows that there is a demand from a significant share of the local population to address most rapidly-increasing local threats to coastal water quality/ecosystem condition
- **WTP for remedying 'new' environmental problem (plastic pollution) higher than for 'traditional' environmental issues (water quality, coral conservation).**

## 2. On modelling the consideration set

The importance and variation-across-people of status quo bias (not considering the SQ) under alternative cultural settings deserves further scrutiny

- Qualitative work is helpful, no doubt
  - We show analysis can improve model fit by explicitly accounting for choice heuristics.
  - But no significant effect on WTP in our data
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# Thank you

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