Measuring economic value of whale conservation

Comparison between Australia and Japan

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July 13, 2016 @ IIFET 2016 Scotland

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Motivation

- Different people may value whale conservation differently.
  - Whale watchers, environmentalists, …
  - Australian and Japanese
- Growth in whale watching (Baily2012; Chen 2011; Cisneros-Montemayor et al. 2011)
  - Direct expenditure for whale watching (O'Connor, et al. 2009):

million USD	1998	2008
Worldwide	300	873
Australia	12	31
Japan	4	7

Research question

- What aspect of whale conservation is valued in Australia and Japan? Who values each aspect most?
  - Whale watchers in Australia have high WTP for whale conservation.
  - In Japan who values whale conservation?
- Why do we want to know?
  - To understand fundamental difference over whale conservation between Australia and Japan.
  - To design conservation programs that suit current citizens' needs and preferences.

Summary of surveys

- Web-based surveys in Australia and Japan in Feb 2016
- Main items
  - Attitudes towards various environmental issues including whaling and conservation of endangered species
  - Choice experiment
  - Socio-economic characteristics
- Sampling: pre-screened based on sex, age, and residential regions (Japan only)
- Final sample: 2,254 (Australia) and 5,100 (Japan)
- For this study: 2,254 Australians and 1,356 anti-whaling Japanese

Summary stats of Japanese sample

	Japan		
	Full sample $N = 5{,}100$	Anti-whaling $N = 1{,}356$	Test
Gender (female = 1)	0.5	0.7	**
	(0.5)	(0.5)	
Age (years)	46	45	**
	(14)	(14)	
Household size (persons)	2.8	2.8	
	(1.3)	(1.3)	
Children under 18 in household (persons)	0.5	0.5	
	(0.9)	(0.9)	
Education (years)	14.8	14.6	**
	(2.1)	(2.1)	
Annual household income, pre-tax (thousands in USD)	54	54	
	(39)	(40)	

Notes: Standard deviation in parenthesis. ** shows significance from Wilcoxon-Mann-Whiteney test.

Design of choice experiment

- Additional conservation actions
  - Ban on whaling, Protection programme, or Both
- Target whale species: Current Red List status
  - Threatened or not
- Target whale species: Whether or not can be seen on whale-watching and nature & wildlife tours
  - Seen or not
- Cost to your household each year for the next 20 years (yen)
  - $10, 30, 50, 70, 90

- Conditional logit model estimation and marginal WTP (Annual household payment for 20 years)

$$\Pr(Choice_i) = \frac{\exp(\beta' x_{i,choice})}{\sum_{j=choice} \exp(\beta' x_{i,choice})}$$

	Australia		MWTP (USD)	Japan		MWTP (USD)
Cost in USD	-0.017	**		-0.036	**	
Ban on whaling	0.402	**	23.65	0.170	**	4.77
Ban + protection programme	0.733	**	43.12	0.317	**	8.93
Target whale: threatened	0.219	**	12.88	0.254	**	7.16
Target whale: whalewatching	0.022		1.29	-0.048		-1.34
# of observations	38,862			24,408		
Wald Chi^2 (df=5)	1007.2	**		535.3	**	

MWTP = $-\beta_{\text{attribute } i} / \beta_{\text{cost in USD}}$

Robust SE: * p<0.05; ** p<0.01

- Marginal WTP (Annual household payment for 20 years) using latent class model

$$\Pr(Choice_i) = \sum_{q=1}^{Q} \Pr\left(Choice_i | class = q\right) \Pr\left(Class = q\right)$$

Japan	Class 1 (46%)		US$	Class 2 (54%)		US$
Cost in USD	-0.03	**		-0.52	**	
Ban on whaling	0.70	**	23.3	0.28		0.5
Ban + protection programme	0.94	**	31.3	0.50		0.1
Target: threatened whale	0.81	**	27.0	0.26		0.5
Target: for whalewatching	0.18	**	6.0	-0.46		-0.9
# of observations	24,408					
Log Likelihood	-4,877					

MWTP = $-\beta_{\text{attribute } i} / \beta_{\text{cost in USD}}$

* p<0.05; ** p<0.01

- Characteristics of classes using logit model

$$\Pr(Class = q|i) = F_{i,q} = \frac{\exp(\theta_q' z_i)}{\sum_{j=choice} \exp(\theta_q' z_i)}$$

Dep. variable: 1 if belonging to Class 1 (High WTP)	
Gender (1 if female)	0.379**
Age	-0.005
# of persons in household	0.018
Children (1 if having children under 18)	0.110
Education (1 if completing university or more)	0.365**
Income in USD	-0.000
Importance of conserving threatened species, 1-5 scale	0.415**
Have seen whales on whale watching tours	0.228
Whale knowledge indicator, 1-25 scale (25=know most)	0.052**
Amount donated for environmental protection	0.015*
# of observations: 1,088; Log likelihood: -711	

* p<0.05; ** p<0.01

- Marginal WTP (Annual household payment for 20 years) using latent class model

Australia	Class 1 (67%)		US$	Class 2 (33%)		US$
Cost in USD	-0.0004			-0.12	**	
Ban on whaling	0.84	**	2,100	-0.13		-1.08
Ban + protection programme	1.35	**	3,375	-0.43	**	-3.58
Target: threatened whale	0.53	**	2,050	-0.31	**	-2.58
Target: for whalewatching	0.22	**	550	0.03		0.25
# of observations	38,860					
Log Likelihood	-10,639					

$MWTP = -\beta_{attribute\ i} / \beta_{cost\ in\ USD}$

* p<0.05; ** p<0.01

- Characteristics of classes using logit model

Dep. variable: 1 if belonging to Class 1 (High WTP)	
Gender (1 if female)	0.32**
Age	-0.02**
# of persons in household	-0.05
Children (1 if having children under 18)	-0.06
Education (1 if completing university or more)	0.02
Income in USD	0.00
Importance of conserving threatened species, 1-5 scale	0.76**
Have seen whales on whale watching tours	0.04
Whale knowledge indicator, 1-25 scale (25=know most)	0.07**
Amount donated for environmental protection	0.02**
# of observations: 1,827; Log likelihood: -975	

* $p<0.05$; ** $p<0.01$

Results summary

- The importance of whale watching emerged after accounting for heterogeneity.
  - Whale watching experience per se may not increase it?
- Conserving threatened whales is important for both Australian and Japanese.
- High income is not associated with high WTP for neither countries.
- Female, conservationists for threatened species, having whale knowledge, and environmental donators are high WTP groups for both countries.

Discussion

- As the whale-watching industry expands, WTP for whale conservation may increase?
- In Japan, awareness to conserving threatened species and demographics explain high WTP.
- As more people think conserving threatened species important, whale conservation may be more demanded in Japan.
  - Australians and full-sample Japanese currently perceive it differently.

Thank you!

- Acknowledgements
  - This research is partially funded by JSPS Grant-in-Aid for Specially Promoted Research (26000001), the Environment Research and Technology Development Fund (S-15) of the Japanese Ministry of the Environment, Term III Environmental Economics for Policy Studies of the Japanese Ministry of the Environment, and PICES.

Summary stats of respondents

	Australia		Japan	
	Population	Sample	Population	Sample
Gender (female = 1)	0.5	0.5	0.5	0.5
		(0.5)		(0.5)
Age (years)	38	43	52	46
		(16)		(14)
Household size (persons)	2.6	2.7	2.4	2.8
		(1.4)		(1.3)
Children under 18 in household (persons)	0.68	0.9	0.42	0.5
		(1.2)		(0.9)
Education (years)	13.0	14.0	11.5	14.8
		(2.8)		(2.1)
Annual household income, pre-tax (thousands)	107 AU$	78 AU$	5,150 JPY	6,264 JPY
		(53)		(4,444)

Note: Standard deviation in parenthesis

Methodology

- Conducted population-representative surveys
- Used contingent valuation (CV) in dichotomous choice format
  - Identify important factors to explain high WTP using logit model (both pro- and anti-whaling)
- Used choice experiment
  - Identify important factors to explain high WTP using latent class conditional logit model (anti-whaling only)

Contingent scenario: WTP (Australia)

	No cost	Additional costs	
	Case A (status quo)	Case B-1	Case B-2
Cost	None.	***At cost*** each year for the next 20 years.	***At cost*** each year for the next 20 years.
Next year and after	Continues with ***no protection*** programme for all the species in the above table.	Implements ***a ban on Japan's whaling Antarctic Minke Whale*** and ***no protection programme*** for the other whale species in the above table.	Implements ***a complete ban on Japan's whaling*** all the species in the above table.
The expected result after 60 years is	•Maintaining the current population trend.	• a ***50% increase*** in the Antarctic Minke Whale population, compared with Case A. Also assume that the probability of the sightings during whale watching increases by 50%. • For the other species, the current population trend is expected to be maintained.	• a ***50% increase*** in the population of all the species, compared with Case A. Also assume that the probability of the sightings during whale watching increases by 50%.

Contingent scenario: WTP (Australia)

Whale Species	Whale watching sites	IUCN Red List status	Current population trend	Total catches by Japan in 2013
Antarctic Minke Whale	Australia		Unknown	251
Sperm Whale	Japan	Threatened	Unknown	1
Common Minke Whale	Japan		Stable	95
Sei Whale		Threatened	Unknown	100
Common Bryde's Whale			Unknown	28

Results

- Logit model, marginal effects at the means

Dep. variable: 1 if pay at bid level	WTP	
Bid Amount	0.000	**
Gender (1 if female)	-0.056	**
Age	0.002	**
# of persons in household	-0.002	
Children (1 if having children under 18)	-0.043	*
Education (1 if completing university or more)	0.028	
Country (1 if Australia)		
Income, USD	0.000	**
# of observations	3,225	
Likelihood ratio Chi^2 (df=1)	191.19	**

* p<0.05; ** p<0.01

1 if pay at bid level	Model 1	Model 2	Model 3	Model 4	Model 5
Importance of conserving threatened species, 1-5 scale	0.352 **				0.273 **
1 if seen whales at zoos/aquariums		0.016			-0.052
1 if seen whales on whale watching tours		0.064 *			0.153
1 if seen whales in nature but not on whale watching		0.047			0.055
1 if never seen whales		-0.074 **			-0.209
Whale knowledge indicator, 1-25 scale (25=know most)			0.096 **		0.076 **
Amount donated for environmental protection				0.019 **	0.014 **
Socio-economic covariates	Yes	Yes	Yes	Yes	Yes
# of observations	3,113	3,225	3,225	3,225	3,113
Likelihood ratio Chi^2 (df=1)	246.1 **	217.2 **	293.6 **	211.0 **	331.8 **