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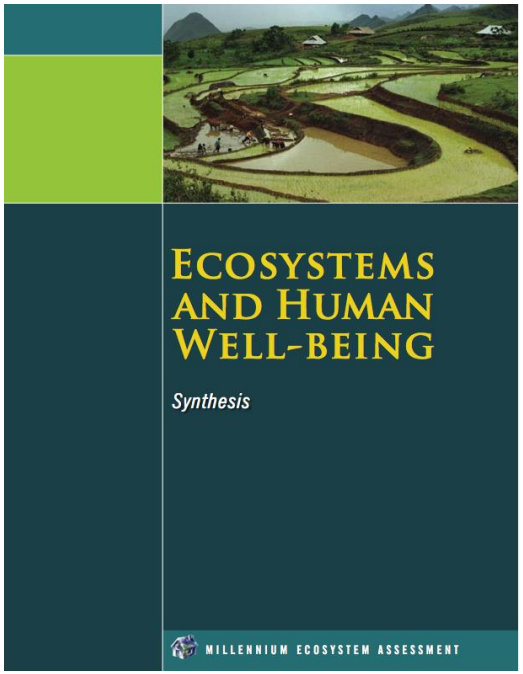
Diversity of perceptions and utility of marine ecosystem services

Kazumi Wakita[1], Zhonghua Shen[2], Taro Oishi[3], Nobuyuki Yagi[2], Hisashi Kurokura[2], Ken Furuya[2]

[1] Tokai University
[2] The University of Tokyo
[3] Fukuoka Institute of Technology

Ecosystem services

The benefits people obtain from ecosystems (MA, 2005)

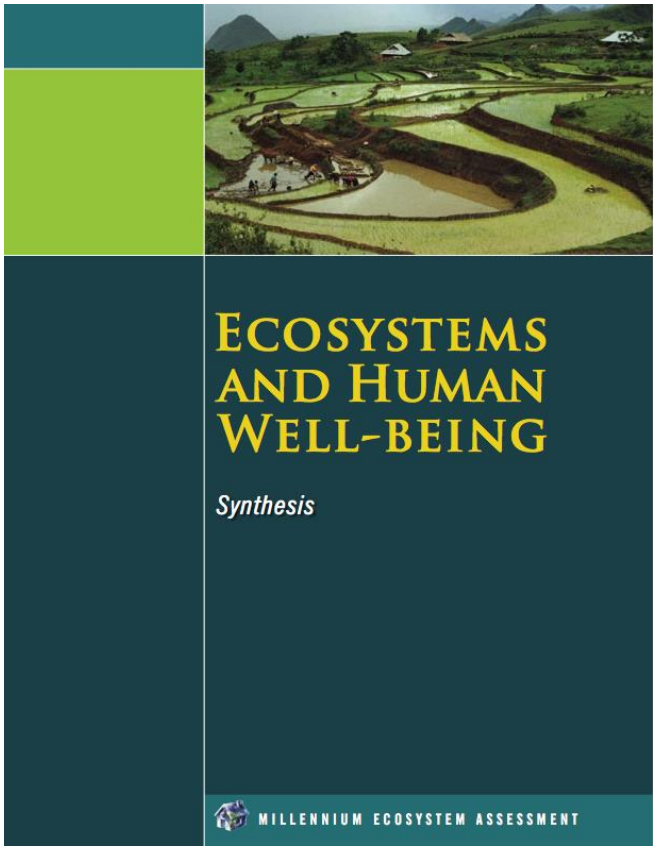


Valuation of ecosystem services: one of the tools that support decision-making in environmental management

Notable research has accumulated. (Bingham et al., 1995; Costanza et al., 1997; De Groot et al., 2002; Loomis et al., 2000)

Four groups of ecosystem services at Millennium Ecosystem Assessment in 2005 and other previous publications

- **Provisioning** (food, fresh water)
- **Regulating** (Climate regulation)
- **Cultural** (Aesthetic, recreational)
- **Supporting** (Nutrient cycling, primary production)

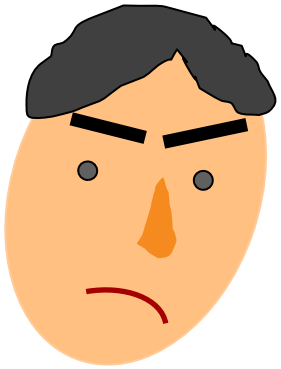


However…

The general public's perception of ecosystem is quite different from what is conceptualized by conventional economists. (Kumar and Kumar, 2008)

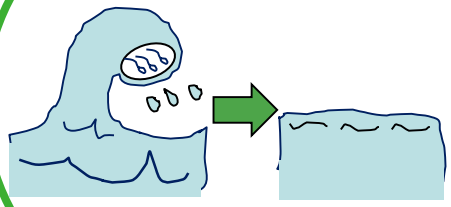
There is variation in how the value or importance of ecosystem is viewed and expressed, depending on different disciplines, cultural norms, philosophical views, and schools of thought. (Goulder and Kennedy, 1999)

Our question: How do people perceive marine ecosystem services?



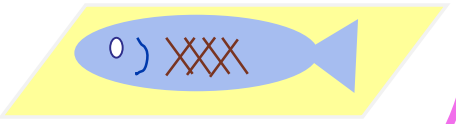
1st Objective

Regulating services



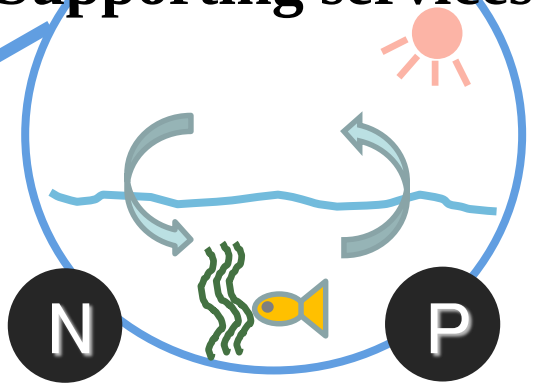
Cultural services

Provisioning services



Marine ecosystem services

Supporting services



Jargon to share

Utility : satisfaction experienced by the consumer of a good or service

Why "utility" is important in marine and coastal management?

- It forms the basis of decision-making which usually involves choices among alternatives.

Key concept and hypothesis

2nd Objective

- Explore the utility that residents derive from marine ecosystem services, and how this influences their behavioural intentions for marine conservation.

Key concept: "indispensability"

A presumption:

the higher the perceived indispensability, the greater the utility.

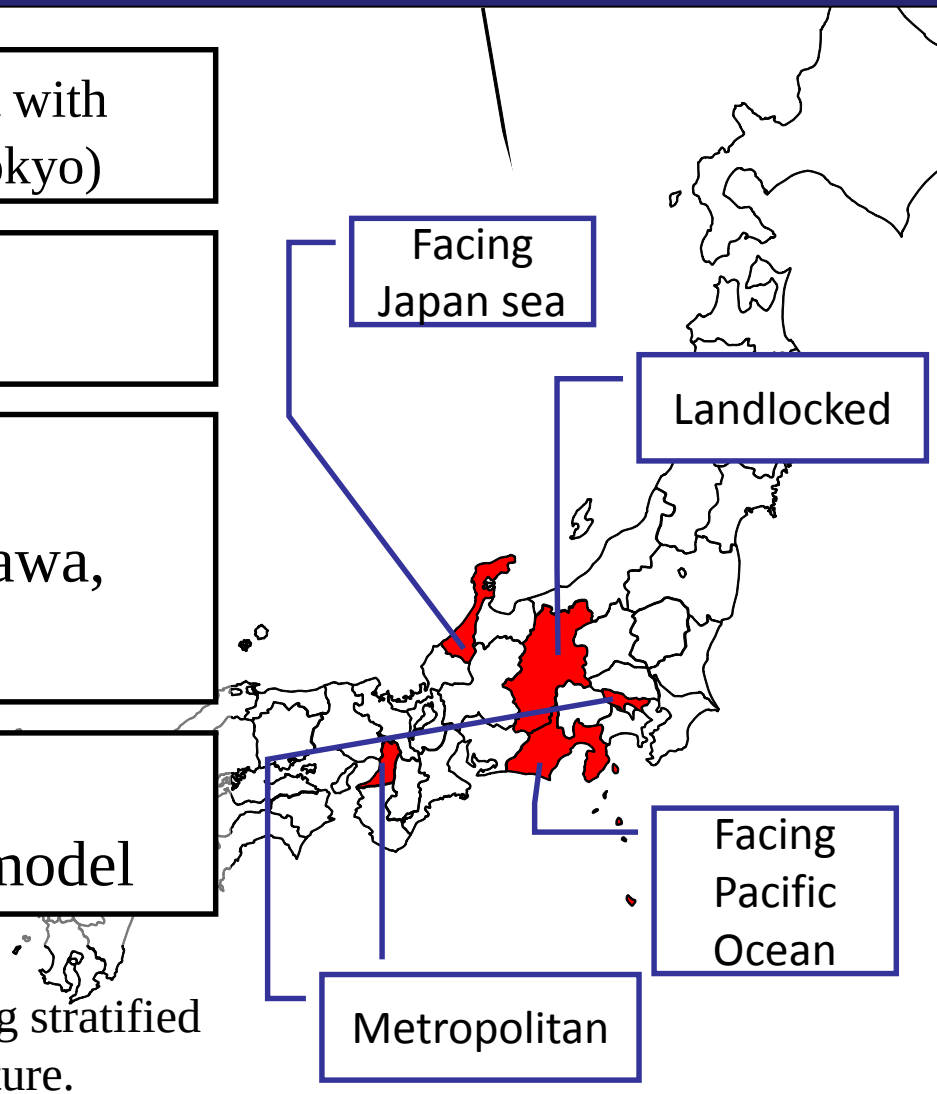
⬇

A hypothesis:

the higher the indispensability, the greater its influence on enhancing behavioural intentions for marine conservation.

An online survey was conducted on human utility of marine ecosystem services and behavioral intentions for marine conservation

Survey method	Online survey (contract with Macromill and Univ. of Tokyo)
Survey period	February 15-17, 2013
Respon-dents	1,100 residents * (Tokyo, Osaka, Ishikawa, Nagano, Shizuoka)
Analysis methods	- Factor analysis - Structural equation model



* Ultimately 814 responses were used after being stratified according to the gender and age per each prefecture.

Steps of research

Online Survey

Perception of Marine Ecosystem Services by respondents

Factor Analysis

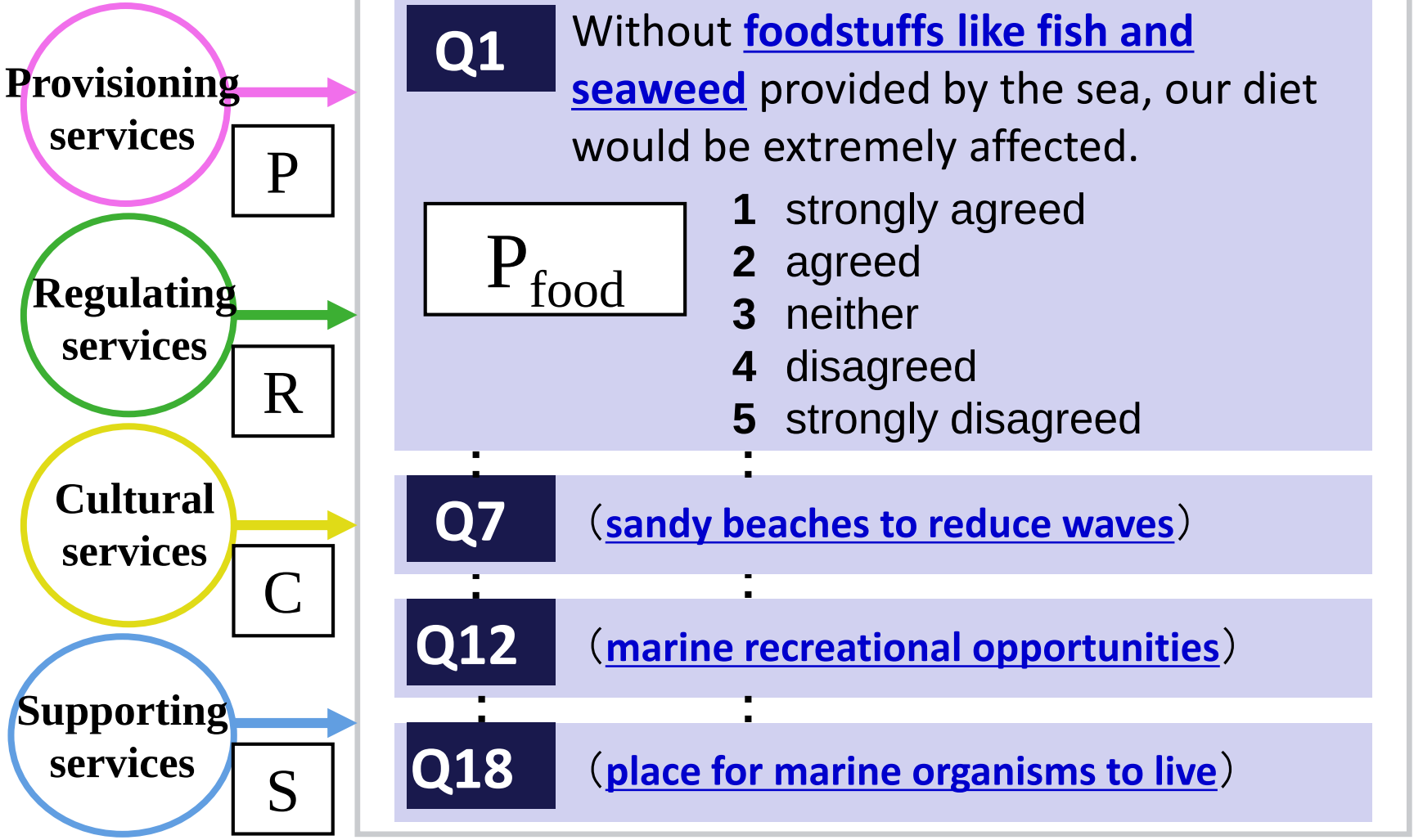
Classification of Marine Ecosystem Services by respondents

Structural Equation Model

Causal relationships between perceived value of Marine Ecosystem Services by respondents and their intentions of behaviour for marine conservation

Questionnaire items

- **18 questionnaire items on marine ecosystem services developed ← based on a review of existing literature**

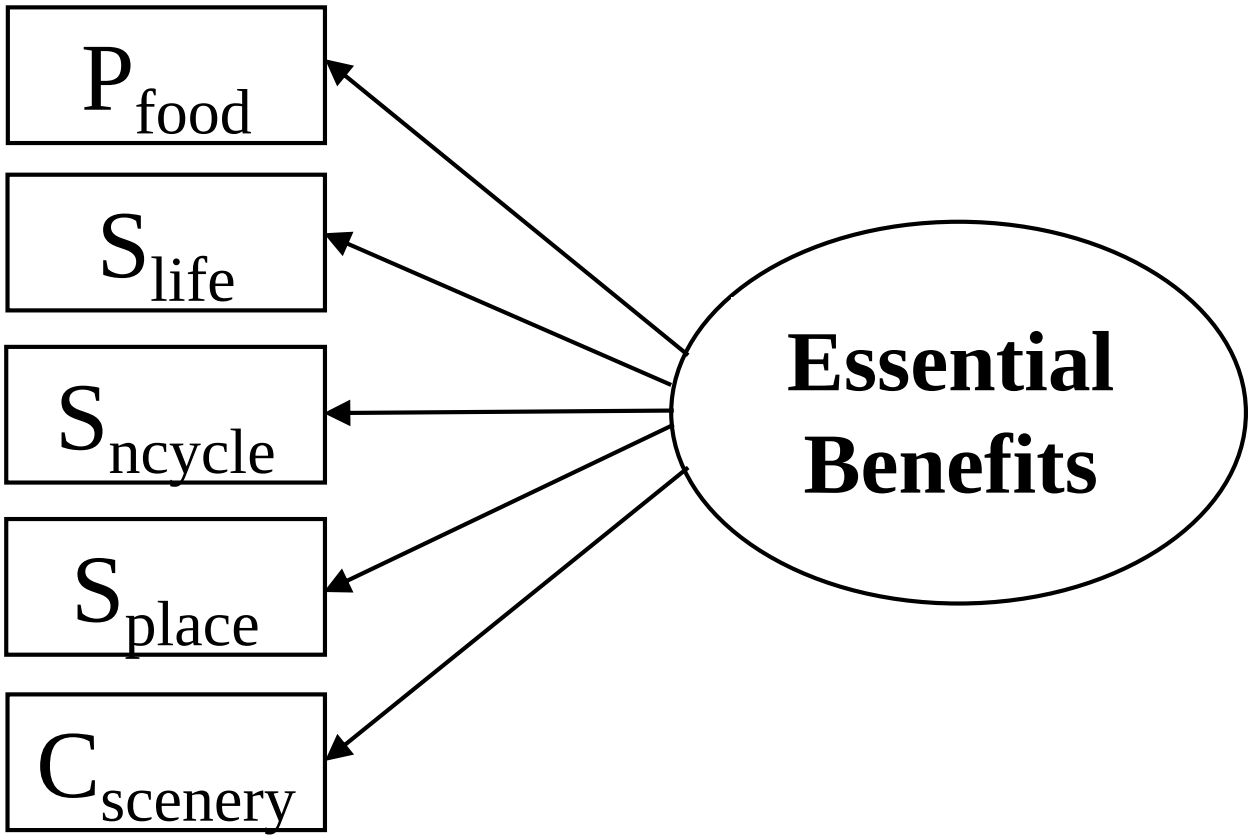


Results of factor analysis

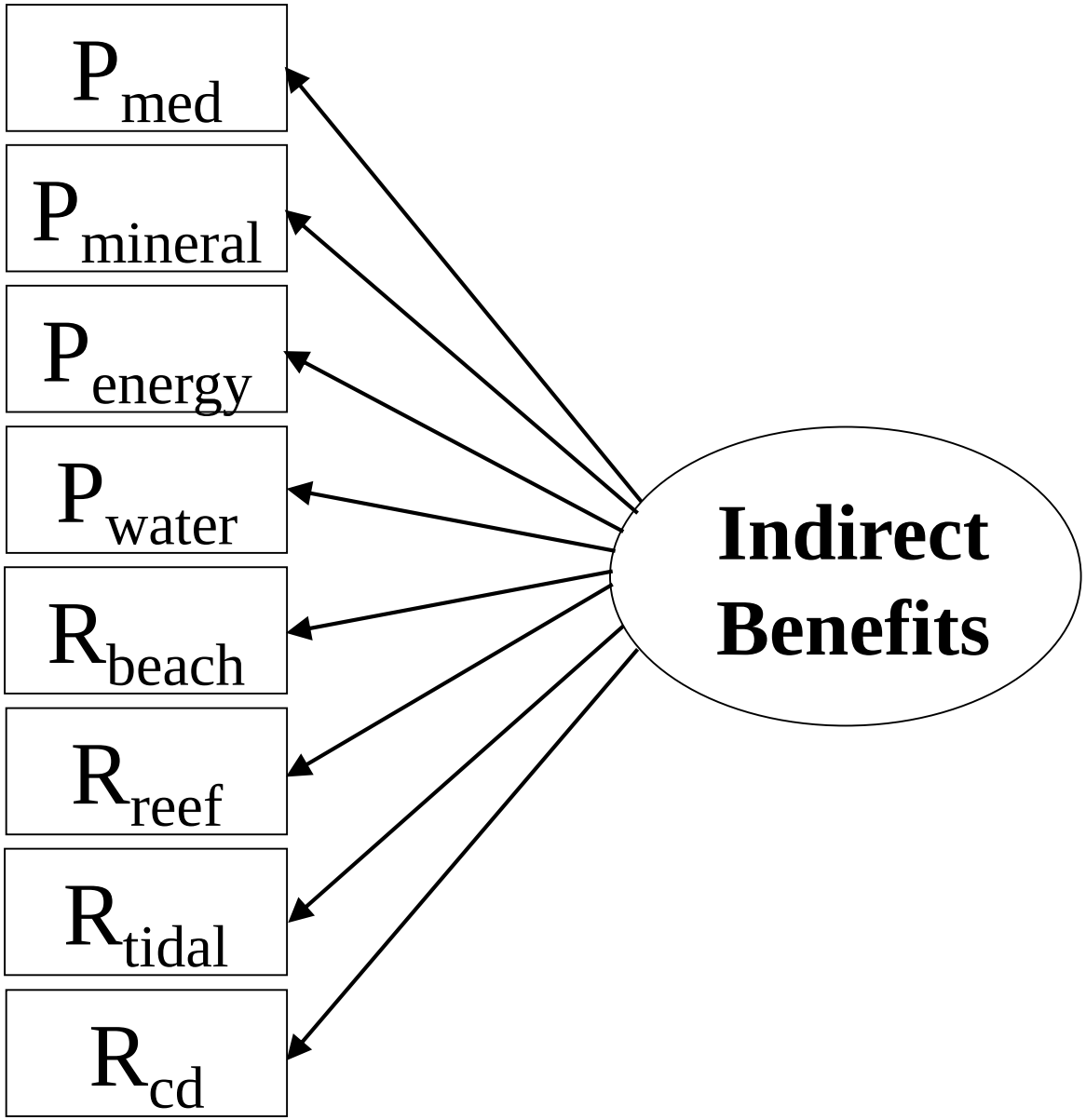
Variable	Factor 1	Factor 2	Factor 3
	Explained variance		
	7.44	46.25	5.46
	Rotated loadings		
P_{food}	**0.52**	0.33	-0.12
P_{med}	-0.14	**0.80**	0.13
$P_{mineral}$	0.00	**0.82**	-0.06
P_{energy}	0.10	**0.75**	-0.10
P_{water}	-0.09	**0.72**	0.10
R_{beach}	0.13	**0.64**	0.05
R_{reef}	0.18	**0.59**	0.08
R_{tidal}	0.37	**0.47**	-0.01
R_{cd}	0.21	**0.52**	0.07
$C_{religion}$	-0.12	0.26	**0.60**
C_{rec}	-0.08	0.01	**0.68**
C_{health}	-0.16	0.02	**0.80**
$C_{culture}$	0.32	-0.11	**0.66**
$C_{scenery}$	**0.46**	-0.07	**0.48**
S_{life}	**0.90**	-0.07	0.00
S_{ncycle}	**0.81**	0.03	0.04
S_{place}	**0.90**	0.04	-0.16

* Rotated factor loadings above 0.4 retained.

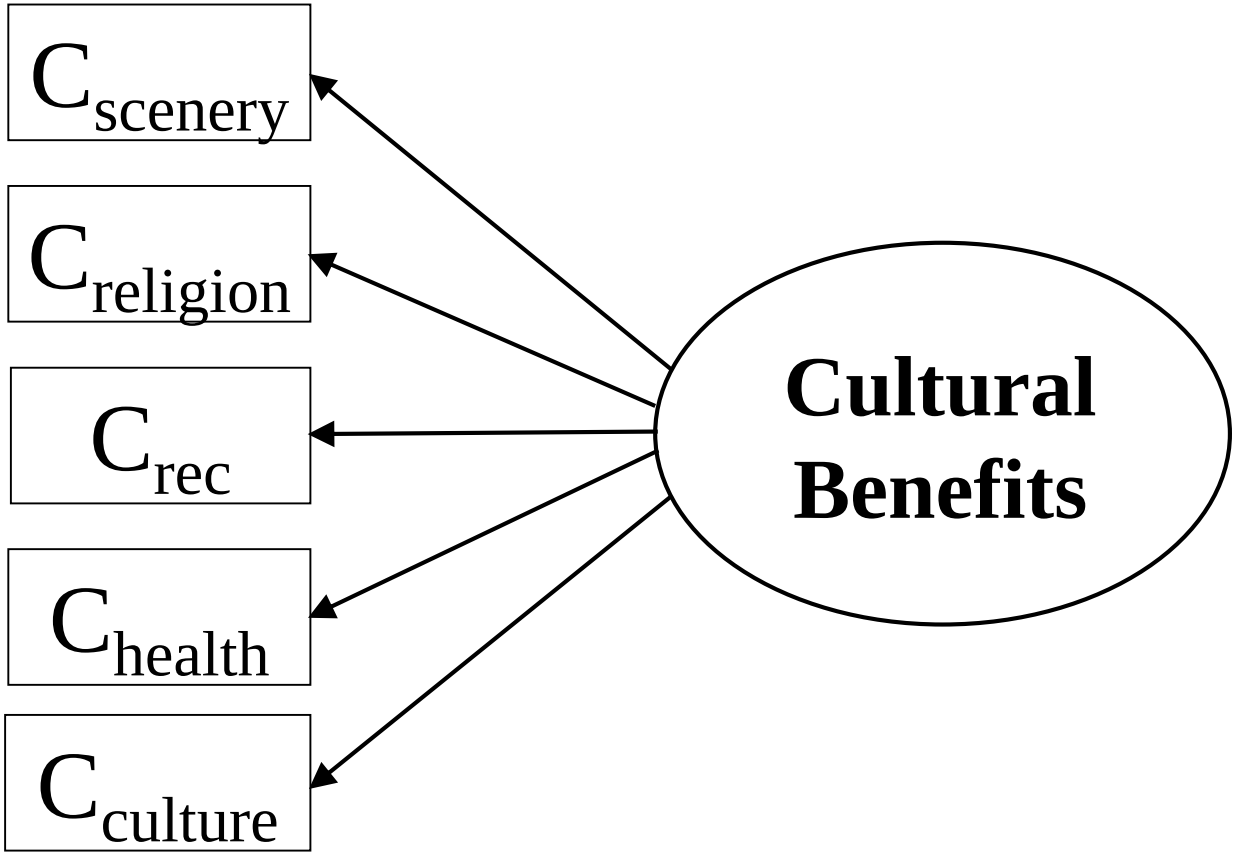
Hidden Factor & Naming Latent Constructs



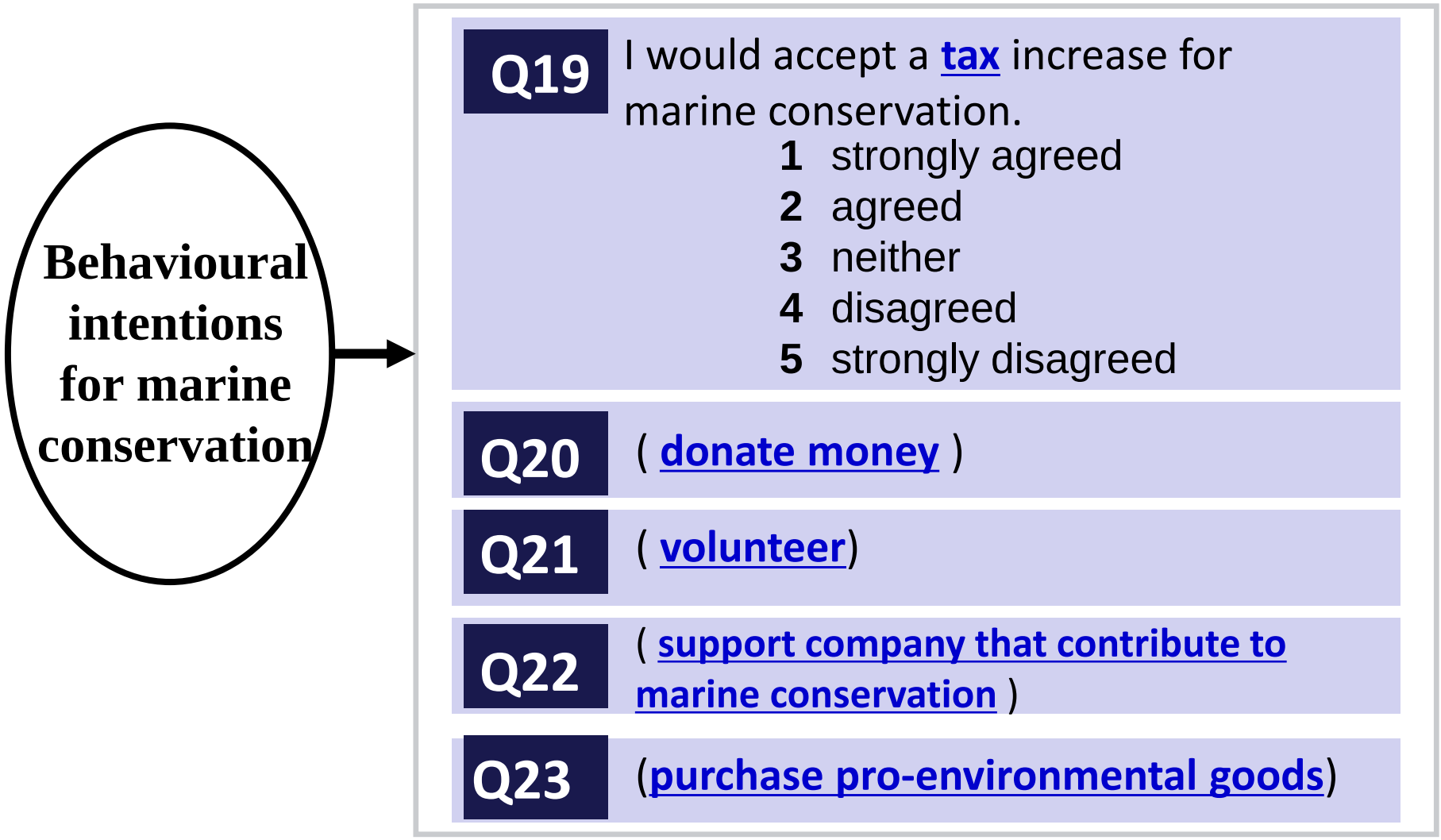
Hidden Factor & Naming Latent Constructs



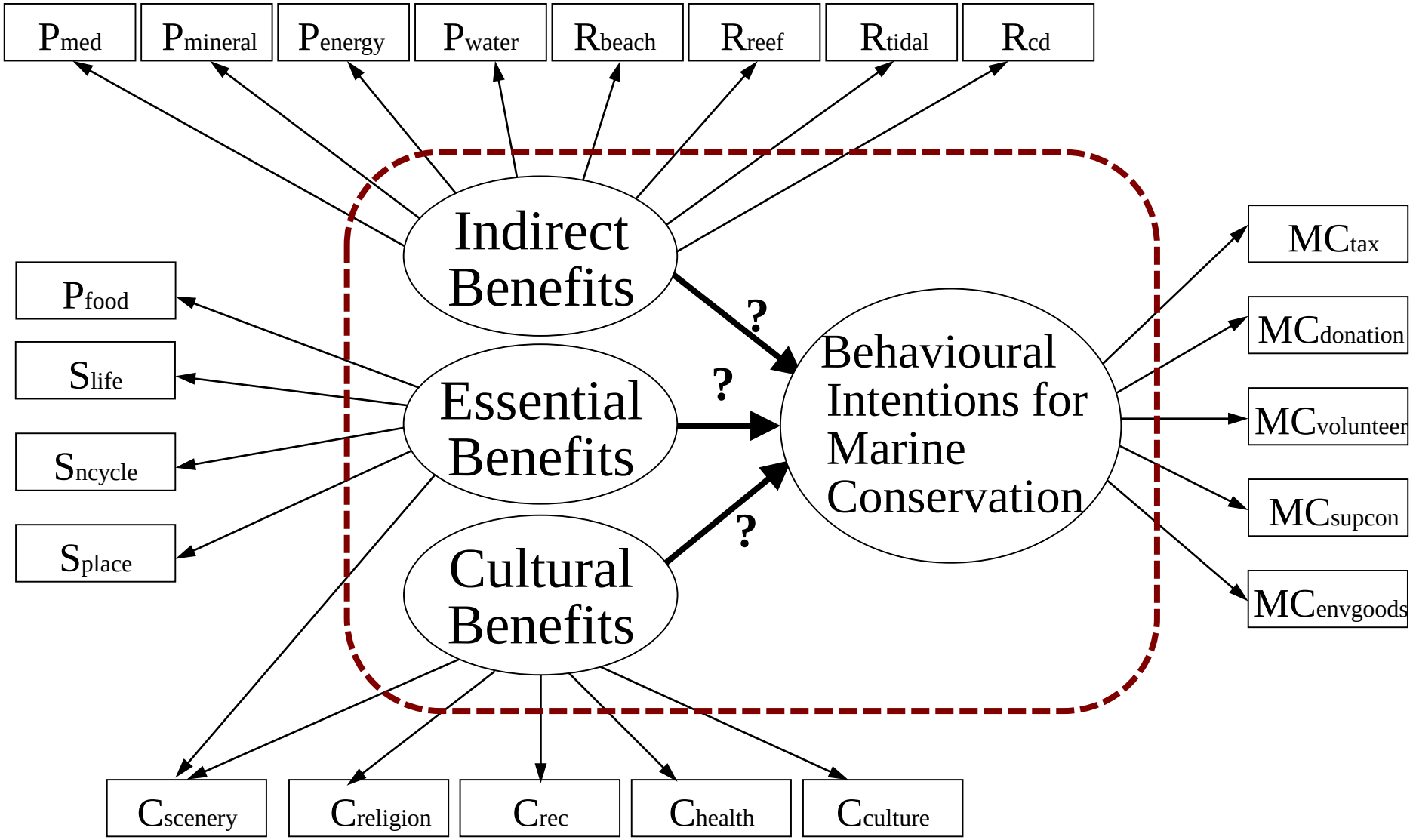
Hidden Factor & Naming Latent Constructs



- **5 questionnaire items on behavioral intentions for marine conservation developed ← based on a review of existing literature**

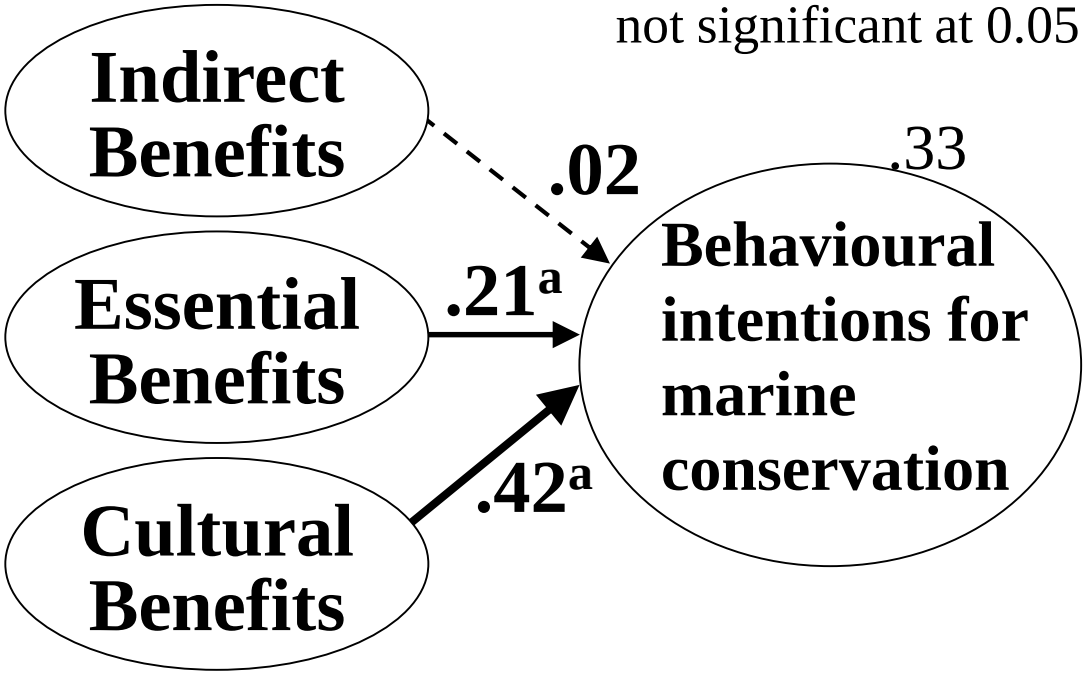


Latent variables and behavioral intentions in our hypothetical model (structural equation model)



Standardized estimated hypothetical model

* “a” indicates significance at the 0.001 level. Dashed line indicates path that is not significant at 0.05 or better.



GFI=0.846

AGFI=0.807

RMSEA=0.089

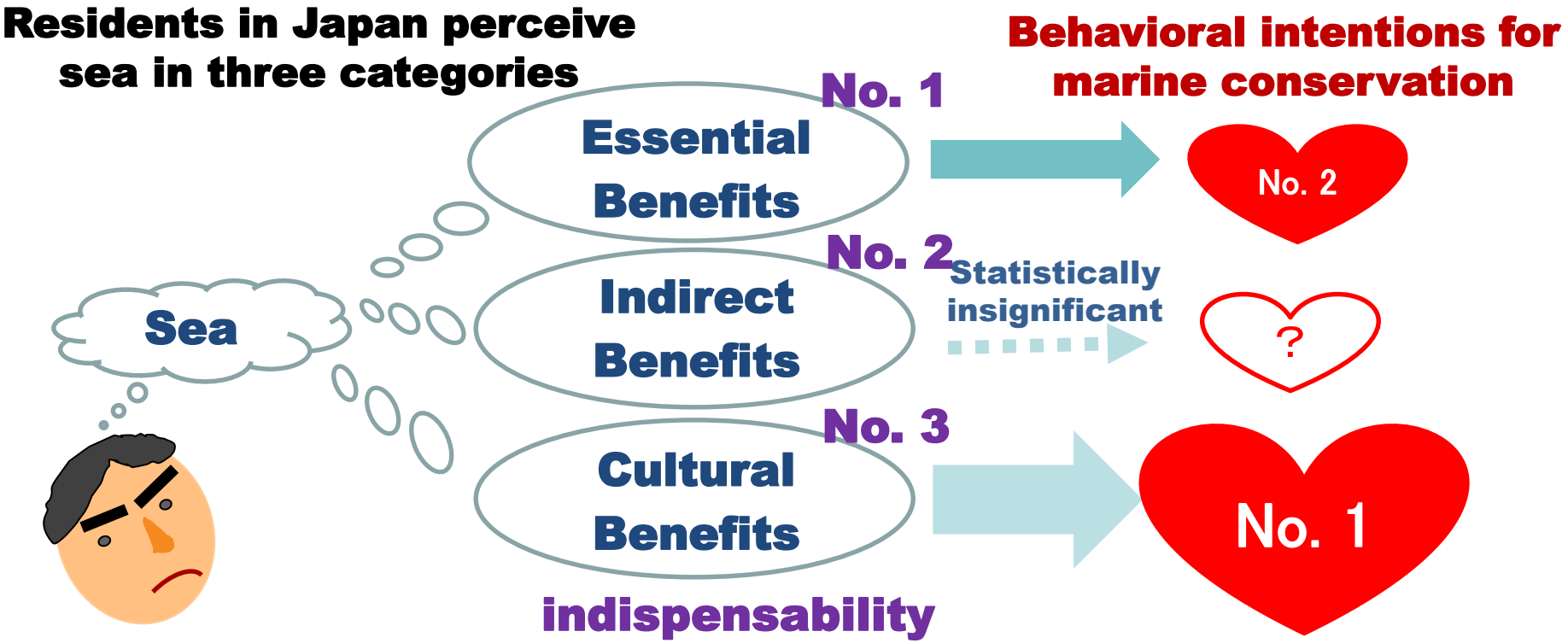
Behavioural intentions are most positively driven by “Cultural Benefits”.

Indispensability of marine ecosystem

Latent constructs	Degree of agreement regarding the indispensability *					
	1	2	3	4	5	Total
Essential Benefits	**39.6%**	**40.2%**	17.6%	2.4%	0.3%	100%
Indirect Benefits	24.4%	42.7%	26.8%	5.1%	1.0%	100%
Cultural Benefits	11.9%	34.7%	36.8%	13.5%	3.1%	100%

* 1: strongly agreed, 2: agreed, 3: neither, 4: disagreed, 5: strongly disagreed

Summary and Discussion (1)

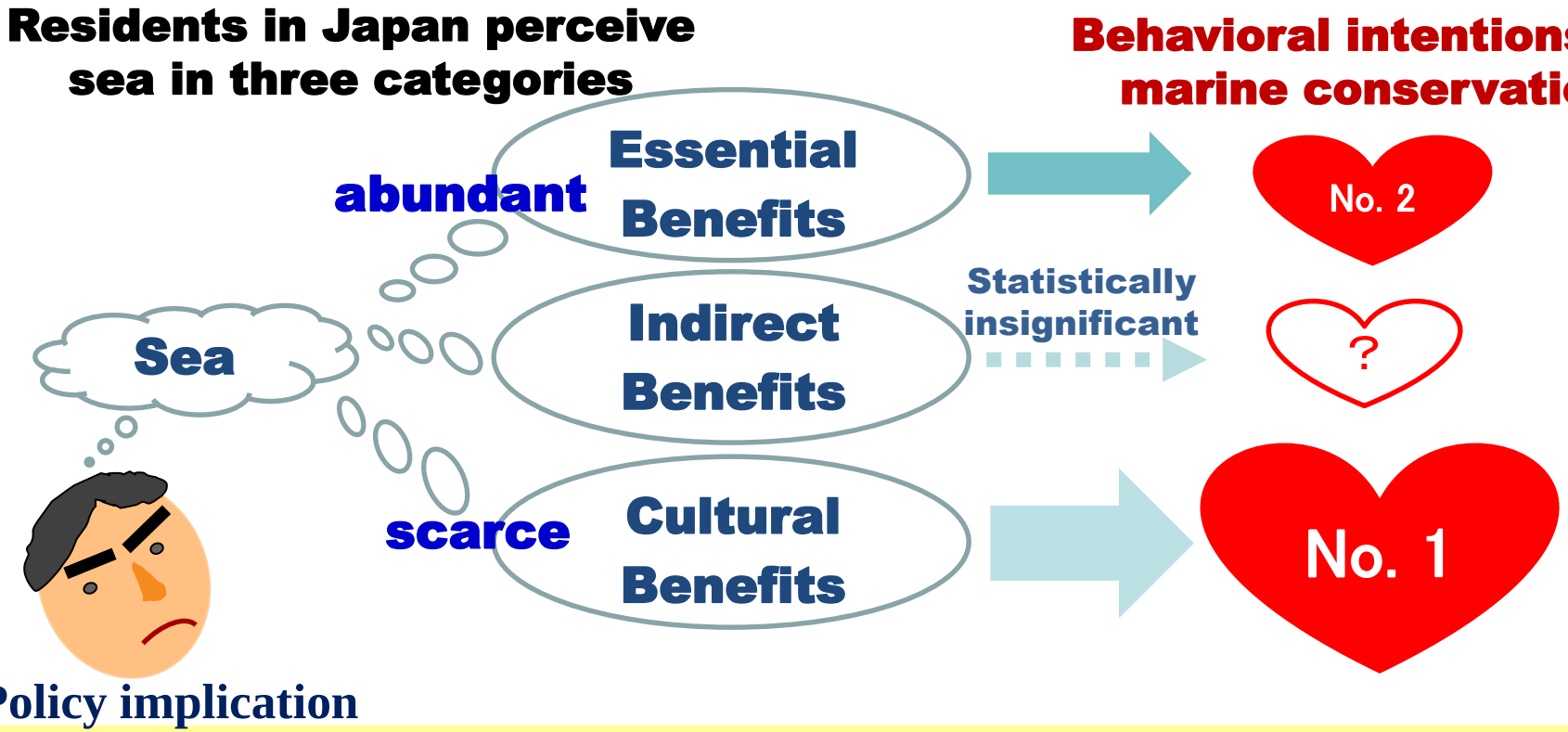


Discrepancies between the value of marine ecosystem services that respondents identified as the most **indispensable**, and how this **affects** their behavioural intentions for marine conservation

The hypothesis was rejected.

Summary and Discussion (2)

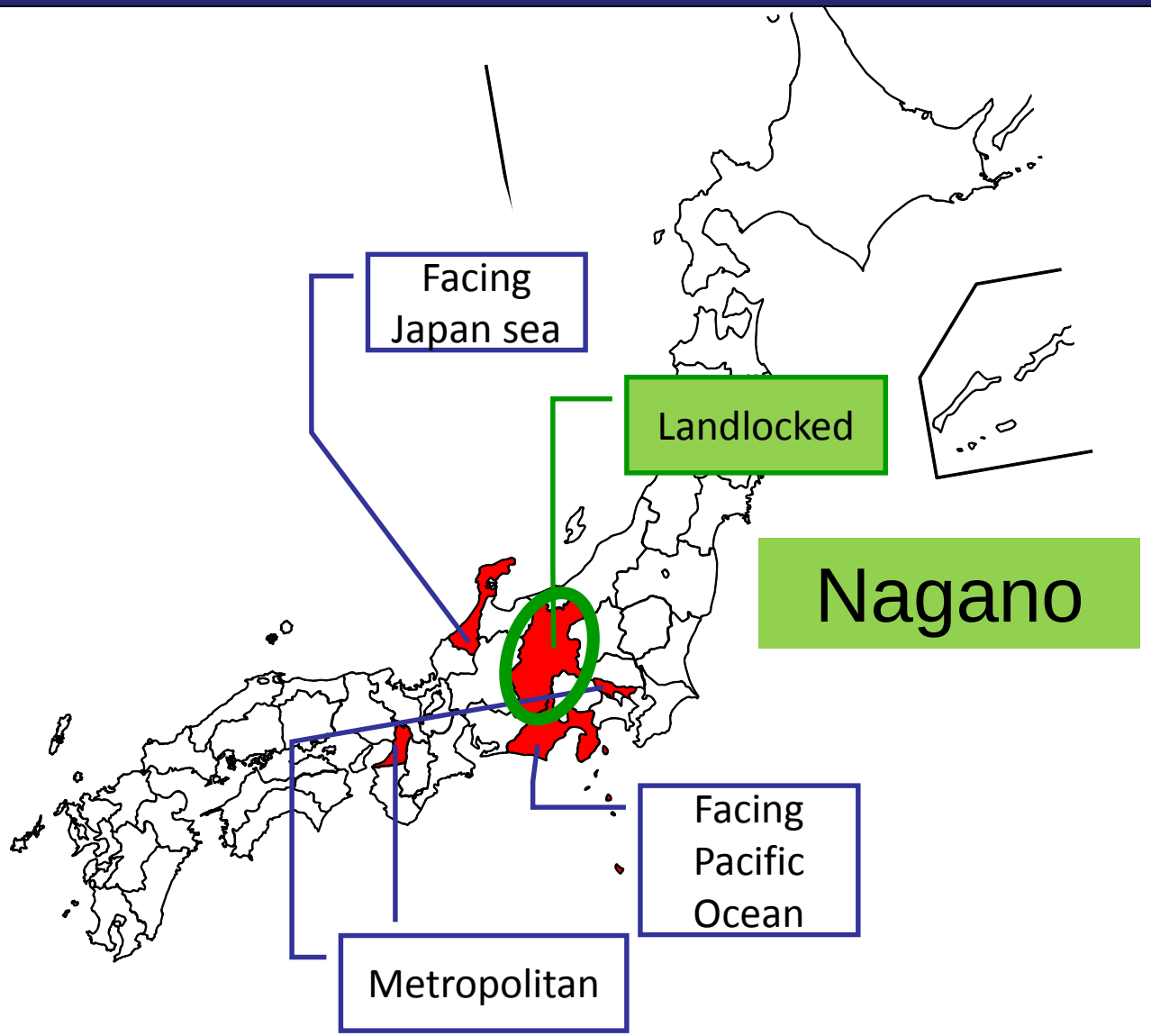
Applying **"scarcity principle"**, the discrepancies above might be caused because of their perceiving "Cultural Benefits" as scarce, while perceiving "Essential Benefits" as abundant and secured.



Policy implication

- **Utility of marine ecosystem services would fluctuate in accordance with scarcity of the services in their places of residence.**

Delving into results of residents of Nagano, Landlocked Prefecture

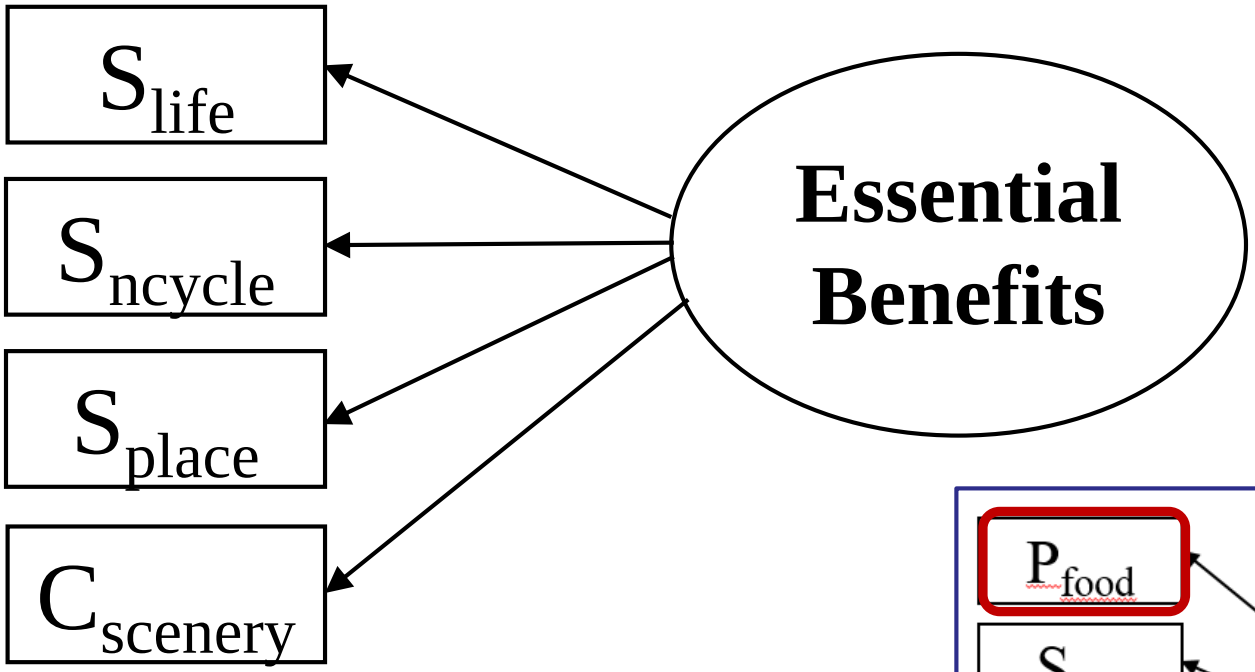


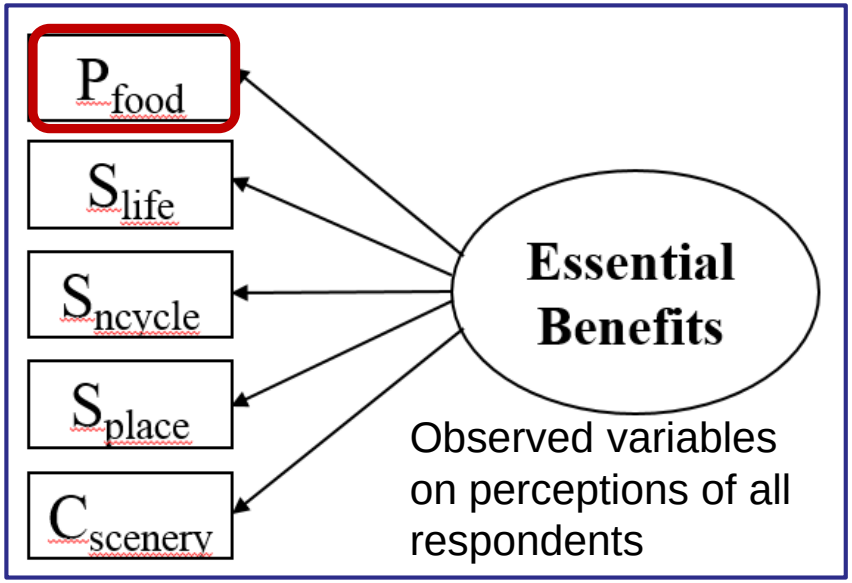
Results of factor analysis: Nagano residents

Variable	Factor 1	Factor 2	Factor 3
	Explained variance		
	40.64	8.95	6.74
	Rotated loadings		
$P_{ornament}$	-0.06	**0.40**	0.27
P_{med}	-0.16	**0.48**	0.06
$P_{mineral}$	0.09	-0.02	0.04
P_{energy}	0.11	-0.03	-0.04
P_{water}	-0.15	**0.56**	0.12
R_{beach}	0.14	**0.73**	0.02
R_{reef}	0.17	**0.75**	0.04
R_{tidal}	0.39	**0.50**	-0.09
R_{cd}	0.09	**0.83**	-0.12
$C_{religion}$	-0.13	0.26	**0.49**
C_{rec}	-0.07	-0.13	**0.69**
C_{health}	-0.16	0.28	**0.60**
$C_{culture}$	0.32	-0.14	**0.68**
$C_{scenery}$	**0.41**	-0.03	**0.55**
S_{life}	**0.80**	0.04	0.01
S_{ncycle}	**0.75**	0.16	0.04
S_{place}	**0.90**	-0.03	-0.09

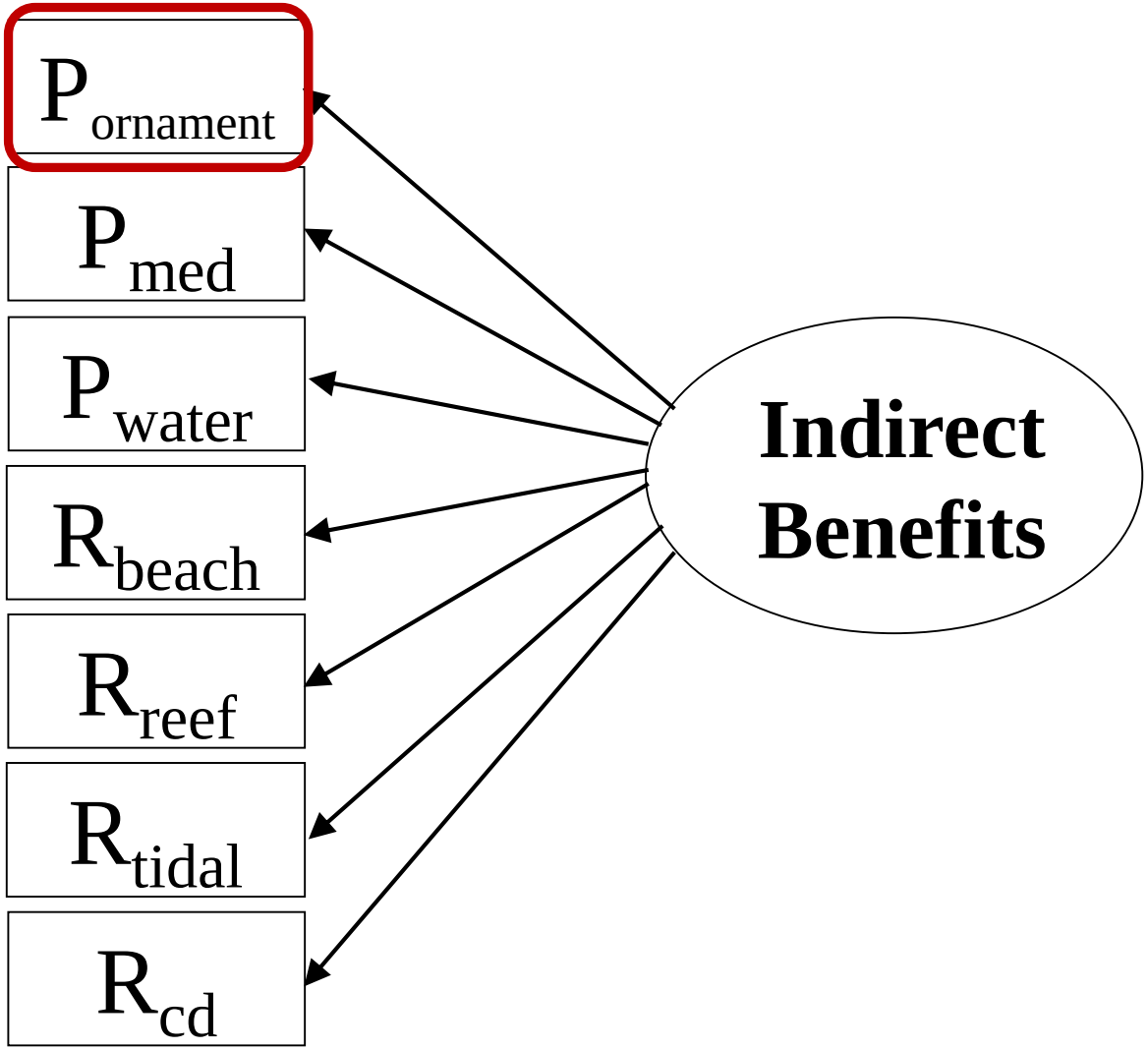
* Rotated factor loadings above 0.4 retained.

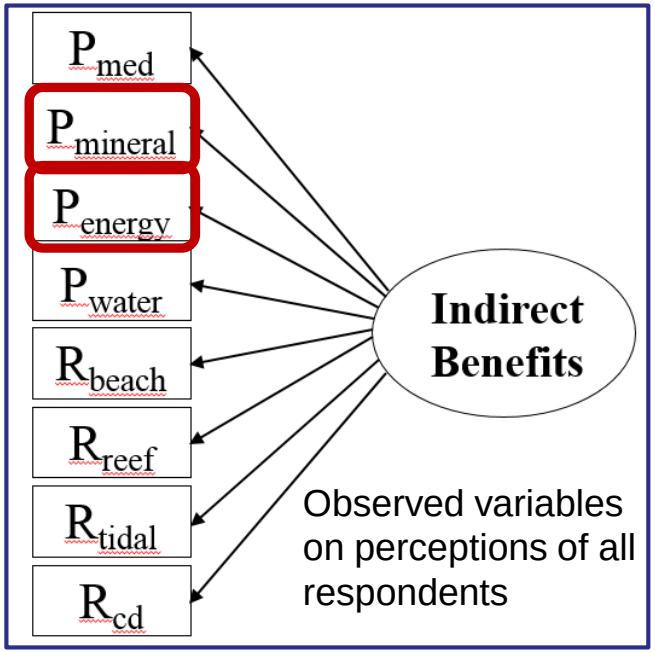
Latent Constructs and observed variables on perceptions of Nagano residents (1)



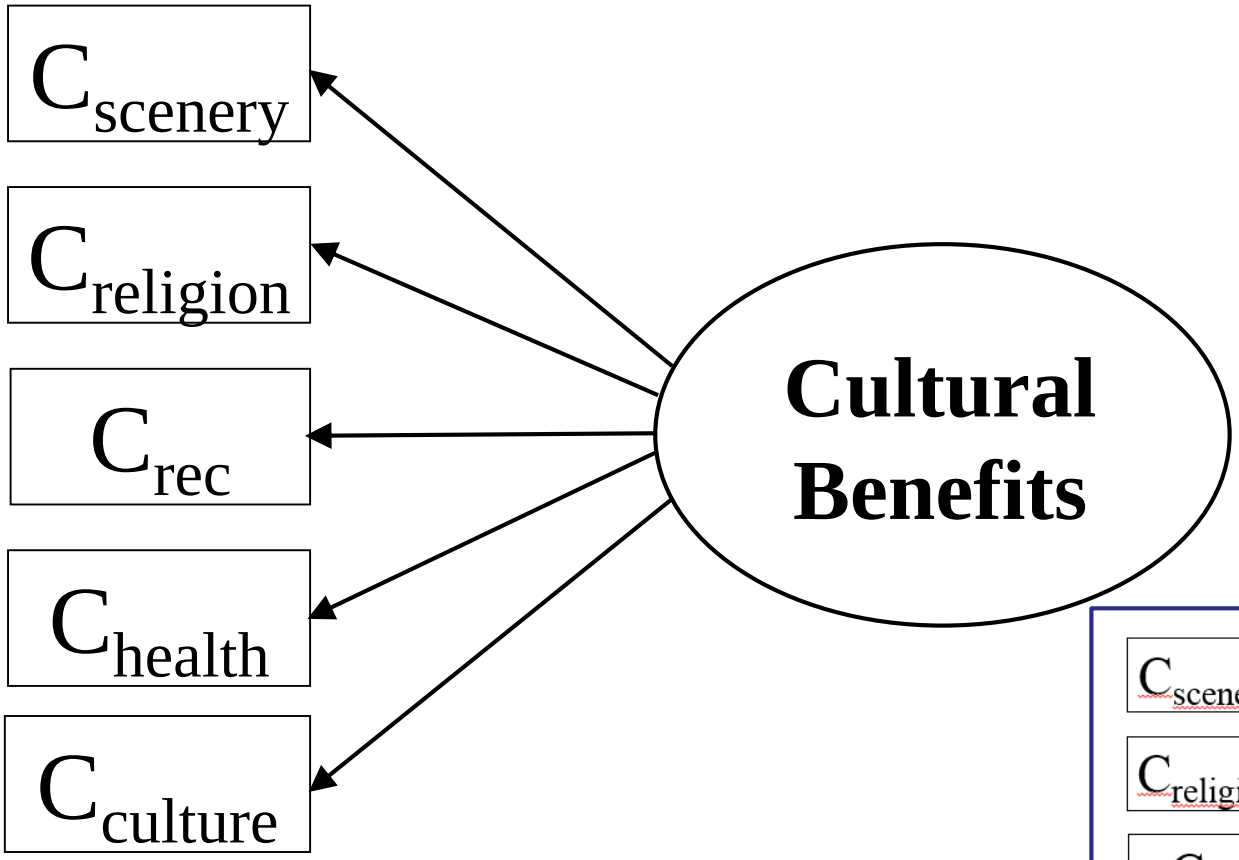


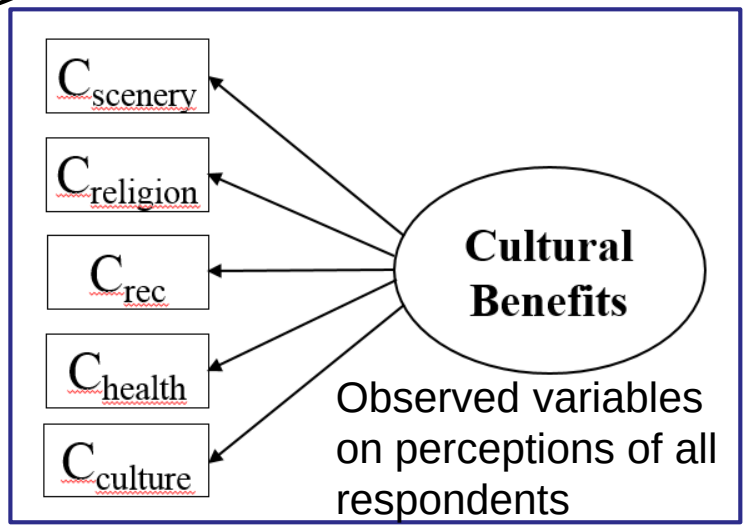
Latent Constructs and observed variables on perceptions of Nagano residents (2)



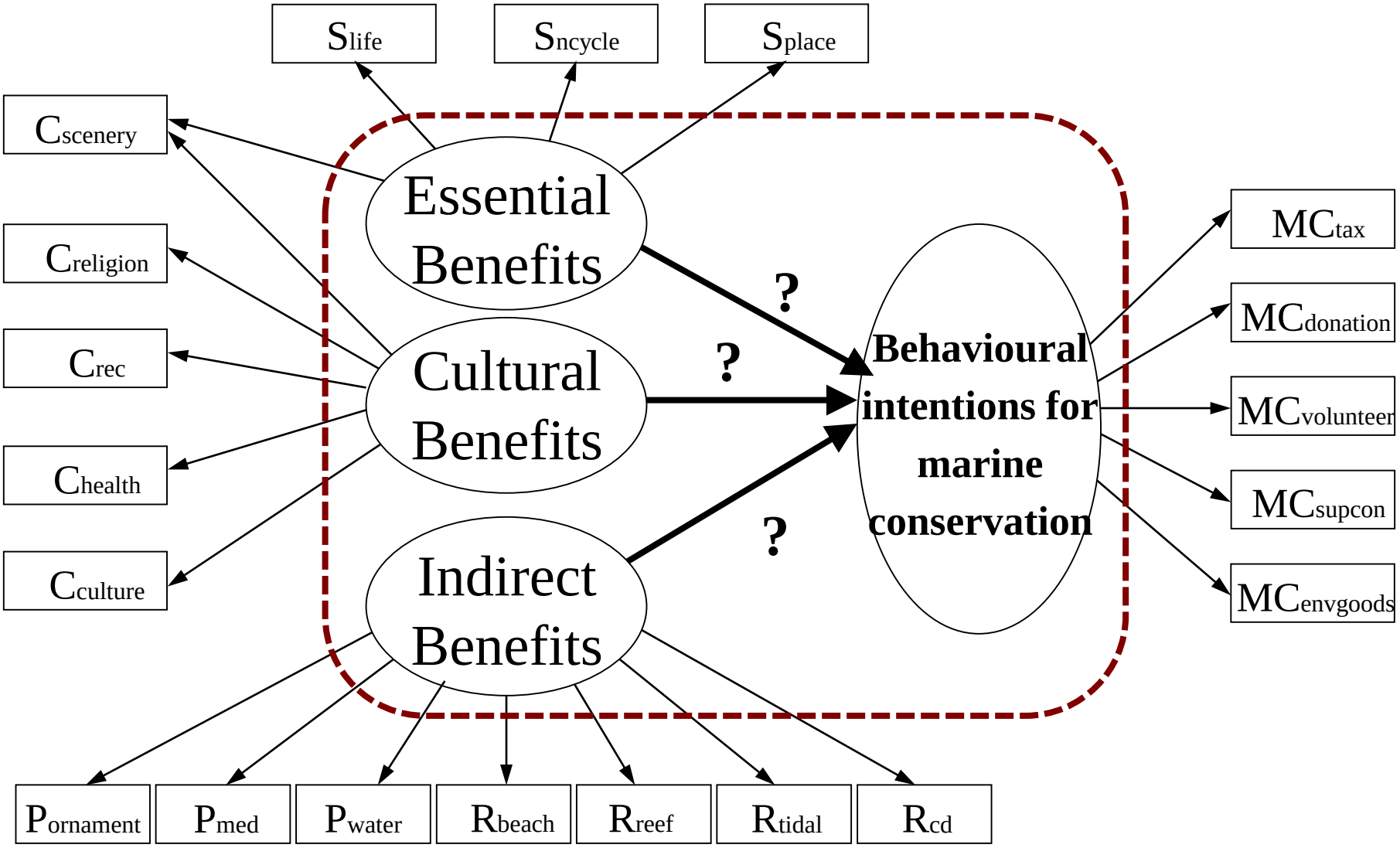


Latent Constructs and observed variables on perceptions of Nagano residents (3)





Latent variables and behavioral intentions: Nagano residents



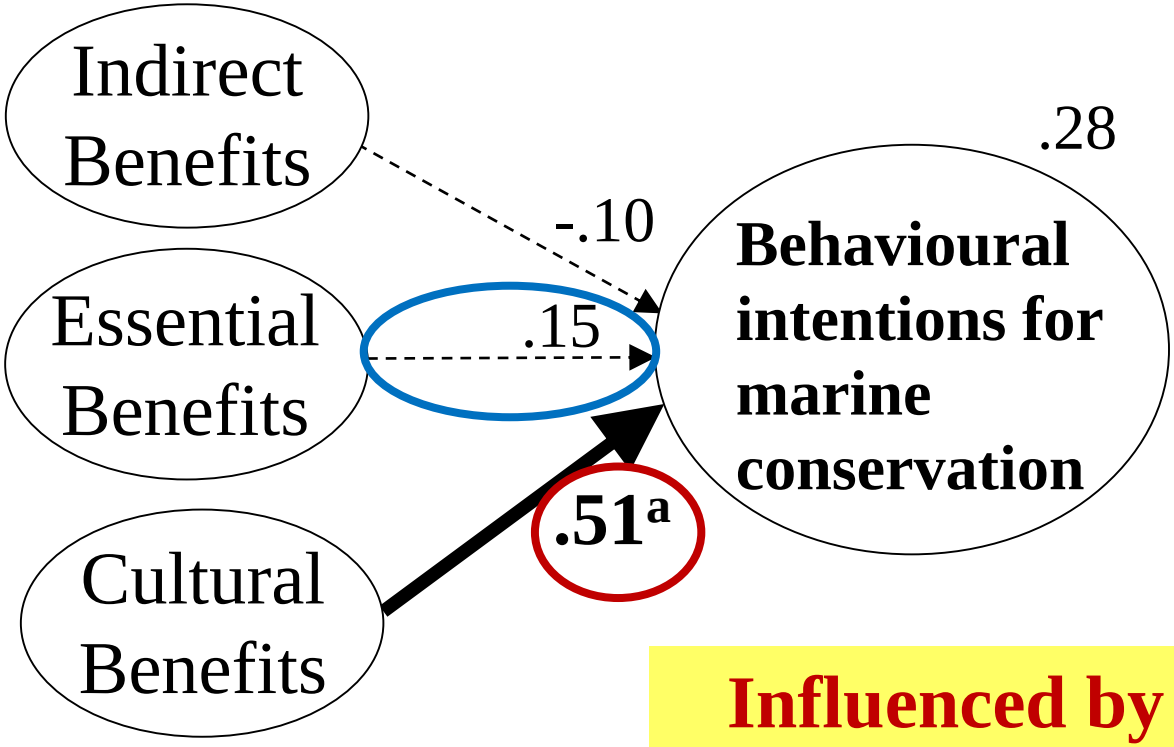
Latent variables and behavioral intentions: Nagano residents

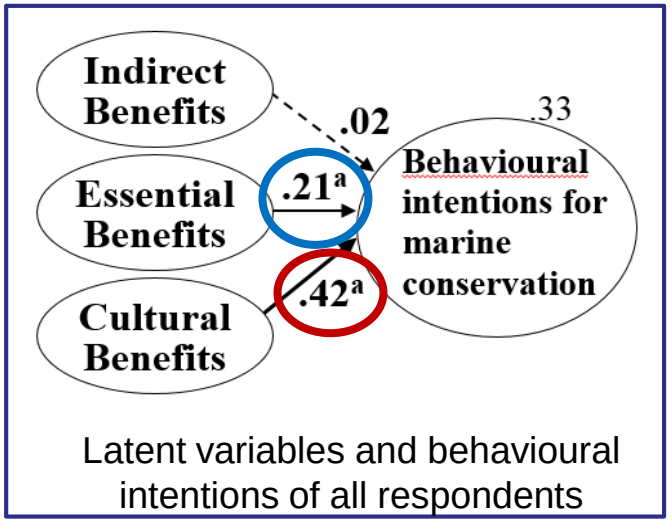
GFI=0.809

AGFI=0.754

RMSEA=0.095

* “a” indicates significance at the 0.001 level. Dashed line indicates path that is not significant at 0.05 or better.

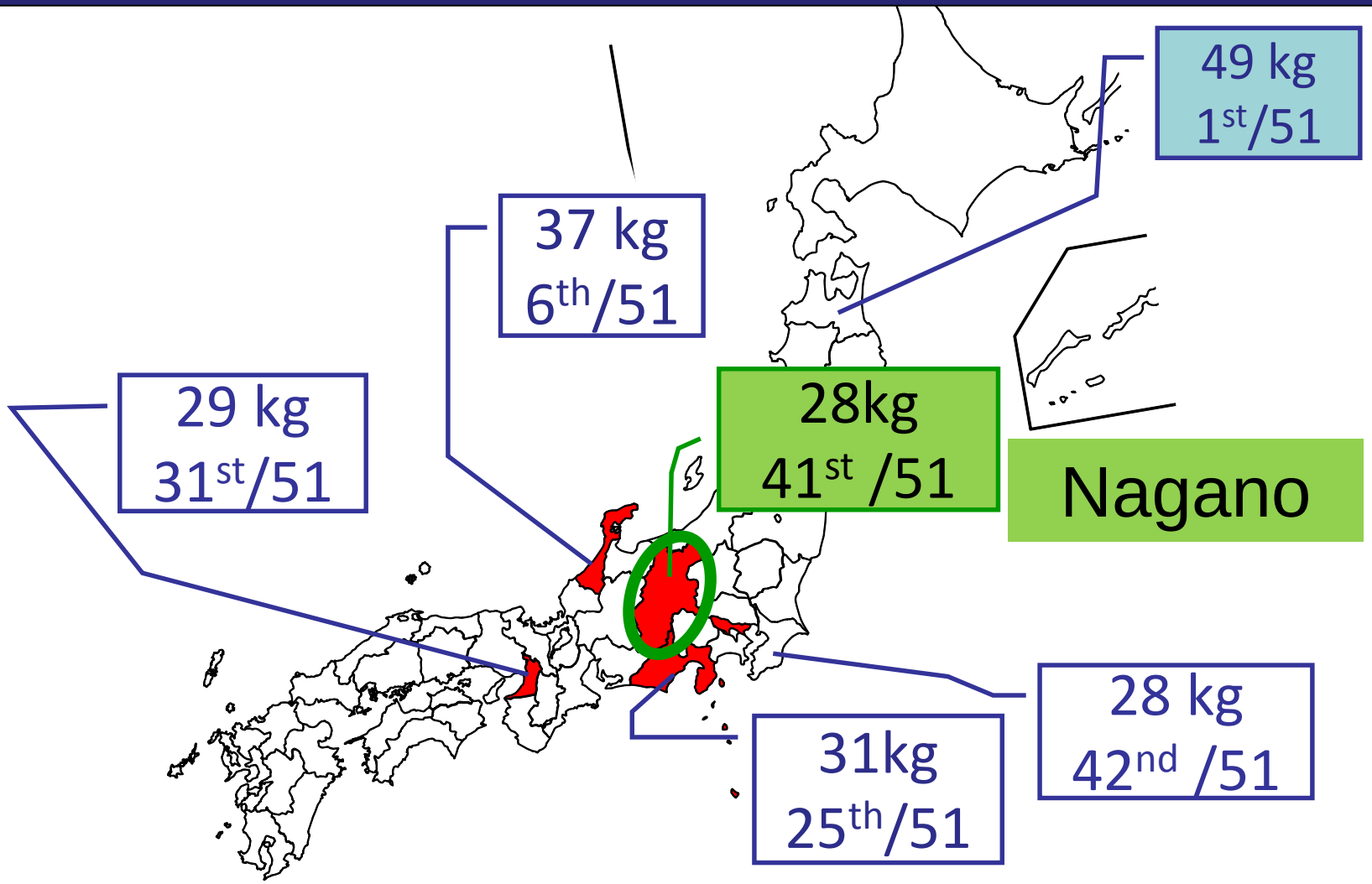




Latent variables and behavioural intentions of all respondents

Influenced by scarcity principle?

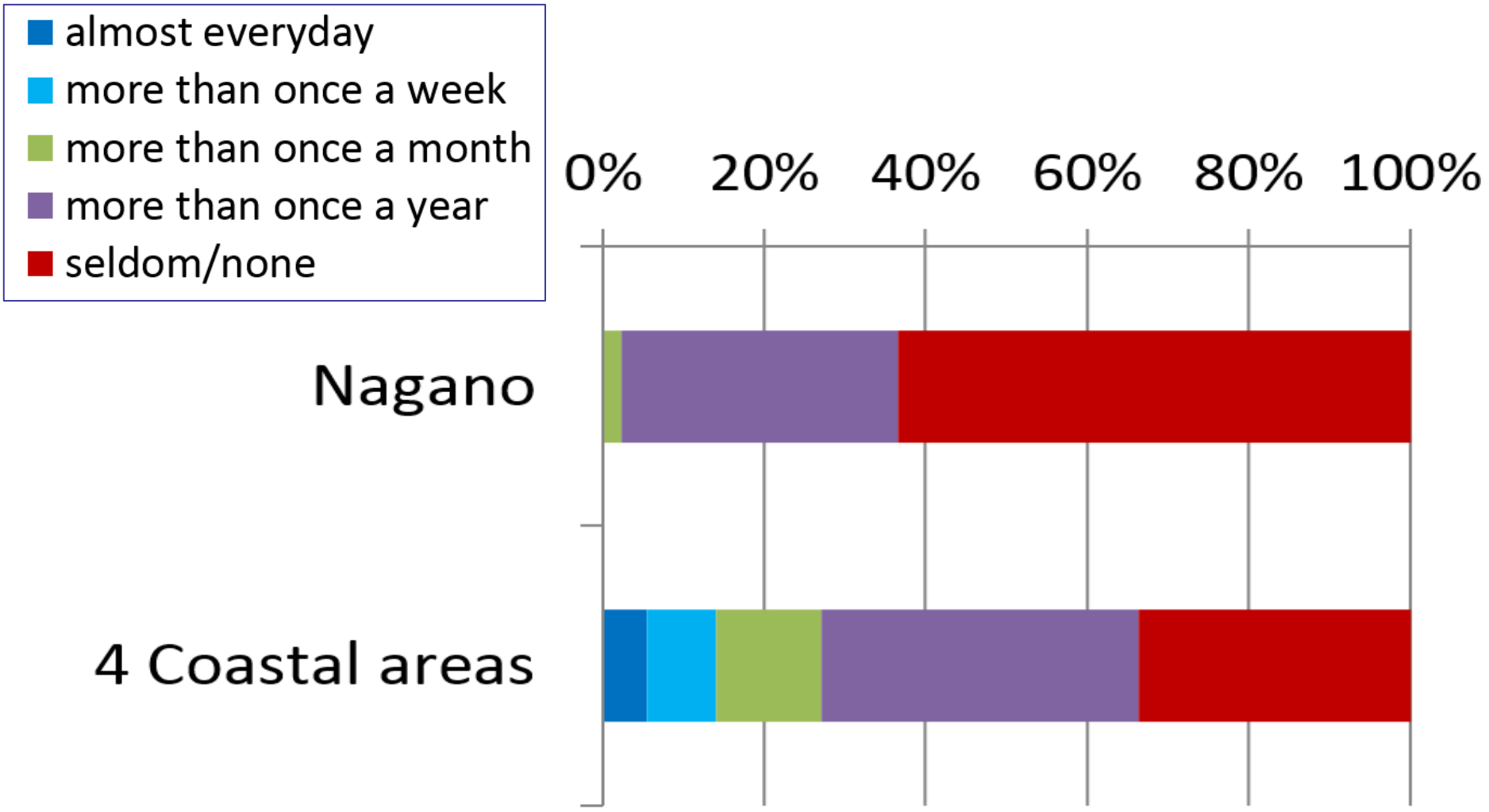
Why "P_{food}" excluded?



Annual consumption of fish and shellfish

※Average of annual consumption of fish and shellfish from 2011 - 2013

Consideration on scarcity principle



Q. “How often do you see the sea?”

Summary and Discussion (3)

- More attention is needed for cultural aspects of marine ecosystem services if we want to obtain better support from citizens.

- Perception of marine ecosystem could vary reflecting scarcity of the services in their place of residents, i.e., proximity/relationships with the sea and cultural background.

- Marine policy needs to be tailored in line with cultural context of respective places.

Acknowledgement

This work was supported by the **JSPS KAKENHI** (Grant number 4403) **“New Ocean Paradigm on its Biogeochemistry, Ecosystem and Sustainable Use (NEOPS) ”.** This is a five year project from 2012 aiming at advancing our understanding of ocean biogeochemistry and ecosystem dynamics in the Pacific Ocean for the sustainable use of ecosystem services, with particular attention to the high seas.

NEOPS
New Ocean Paradigm
on Its Biogeochemistry, Ecosysytem and Sustainable Use

http://ocean.fs.a.u-tokyo.ac.jp/research-e.html

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Human utility of marine ecosystem services and behavioural intentions for marine conservation in Japan

Kazumi Wakita [a,*], Zhonghua Shen [b], Taro Oishi [c], Nobuyuki Yagi [b], Hisashi Kurokura [b], Ken Furuya [b]

[a] Ocean Policy Research Foundation, 3-4-10, Toranomon, M
[b] Graduate School of Agricultural and Life Sciences, The Un pan.
[c] Faculty of Socio-Environmental Studies, Fukuoka Institute 11-0295, Japan

Thank you.

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ABSTRACT

This study explores the utility of marine ecosystem services to Japanese residents and how this influen their behavioural intentions for marine conservation. In exploring this, the indispensability of mari ecosystem services is used as a key concept. Building on a presumption that the higher the perceiv indispensability, the greater the utility, a hypothesis has been developed that the greater the indispensabil