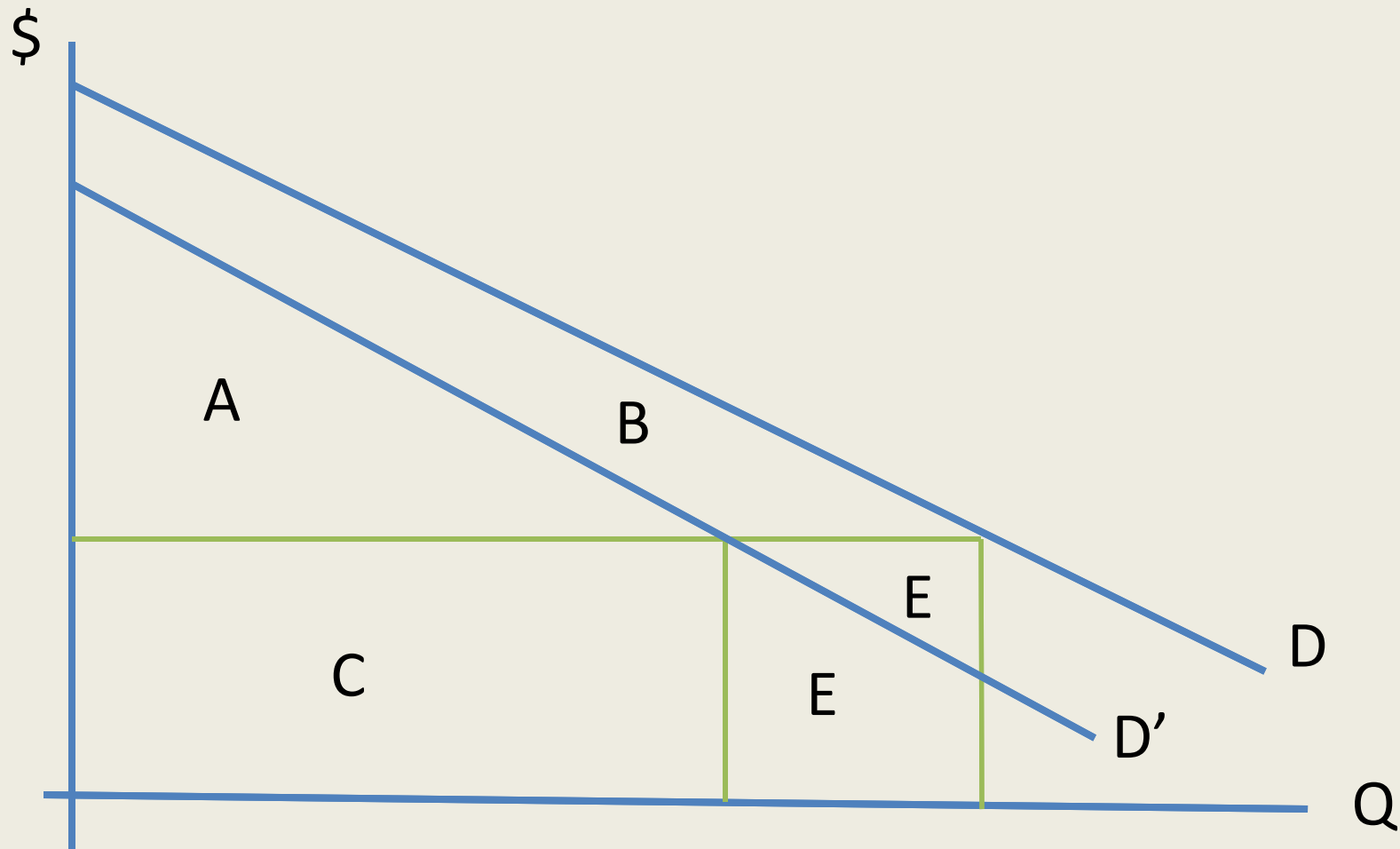


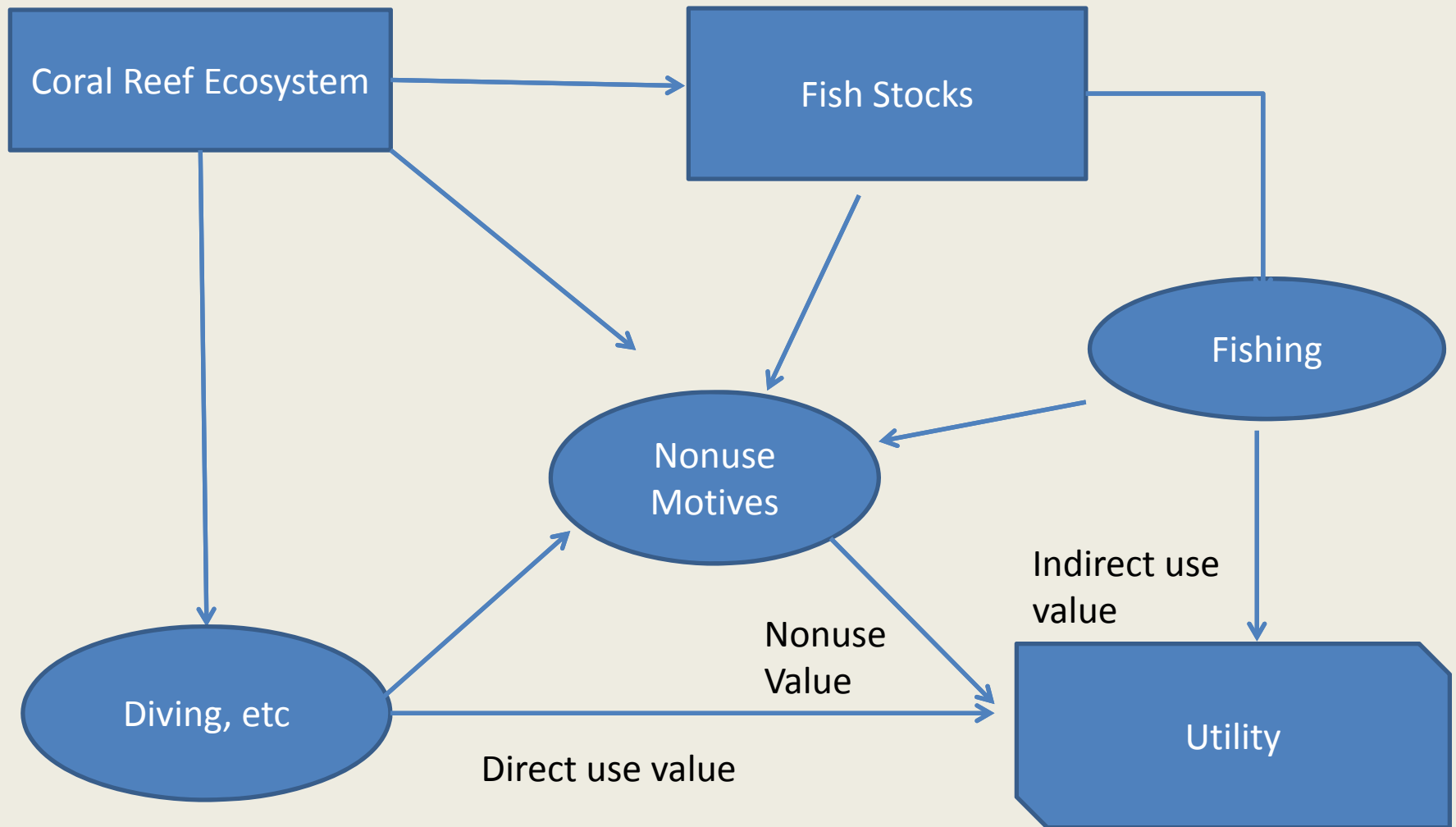
Nonmarket Valuation of Climate Change and Ocean Acidification Impacts to Marine Resources

John C. Whitehead
Department of Economics
Appalachian State University
Boone, NC

Nonmarket Values



Nonmarket Values for Coral Reefs



Use values

- Willingness to pay to avoid climate change to marine resources due to use of these resources on-site
- Direct use
 - Diving
 - Snorkeling
 - Viewing
- Indirect use
 - Fishing (coral reef habitat and nursery functions)

Nonuse (aka, passive use) values

- Willingness to pay to avoid climate change to marine resources without the intent to use these resources on-site
- Motives
 - Altruism (WTP today for Δq today)
 - Ecological ethic (WTP today for Δq today)
 - Bequests (WTP today for Δq in the future)

Measurement of Total Economic Value

Types of Value

Valuation Methods

Use

Nonuse

Revealed Preference

Yes

No

Stated Preference

Yes

Yes

Revealed Preference Methods

- Types
 - Hedonic price method
 - Property values
 - Averting behavior method
 - Health values
 - Travel cost method
 - Recreation values
 - Single site TCM
 - Multiple site RUM
 - NFI, PF, GR (generally not appropriate)

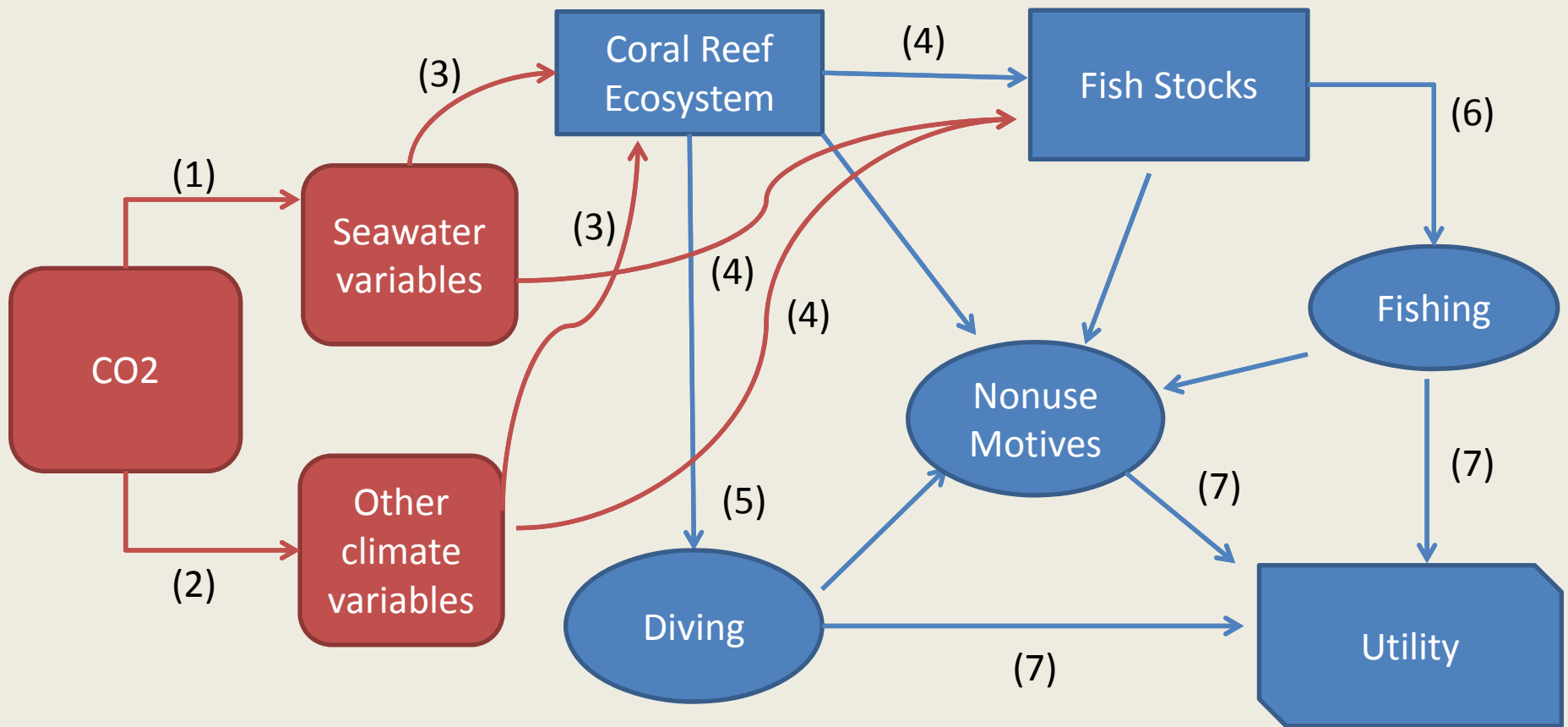
Stated Preference Methods

- Types
 - Contingent valuation
 - Used to estimate UV, NUV and TEV
 - difficult to avoid double counting in the case of climate change
 - WTP to climate change policy = bequest values
 - Choice experiments
 - Similar values as CVM Use to estimate UV, NUV and TEV
 - can be used to separate marine values from total values of climate change policy
 - Contingent behavior
 - Used to estimate recreation and other UVs

RP-SP Methods

- Problems with both RP and SP Methods
- Joint estimation of RP-SP data can mitigate some of these problems
- TCM/RUM with SP methods is used to estimate use and nonuse values

Climate Change and Nonmarket Values



Literature

- RP: Spatial variation in climate variables
 - Mendelsohn and Markowski, 1999
 - Loomis and Crespi, 1999
 - Ahn, et al., 2000
 - Pendleton and Mendelsohn, 1998
- RP: Temporal variation in climate variables
 - Englin and Moeltner, 2004
 - Carter and Letson, 2009
- SP: Richardson and Loomis, 2004

A reduced form damage function

- Data
 - NSRE (1990, 2000)
 - NSFHWAR (every 5 years)
- Recreation Days = $f(X; \text{temp, precip, etc})$

Saltwater Fishing Participation

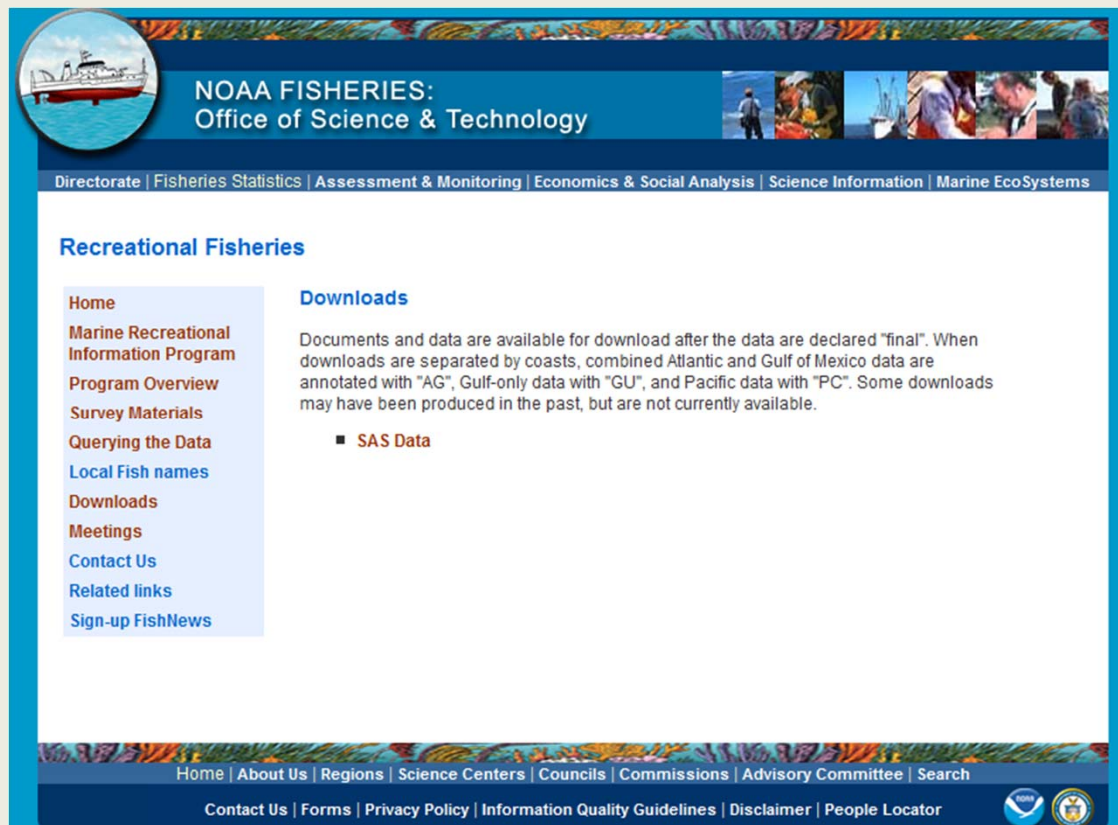
Linear probability model				
Variable	Estimate	t-value	3F	7F
Intercept	1.9467	27.42		
income	-0.0009	-9.45		
white	-0.0379	-4.20		
male	-0.1035	-15.42		
age	0.0013	5.56		
educ	0.0046	3.11		
hhnum	-0.0087	-3.13		
under6	-0.0002	-0.03		
metro	-0.0315	-3.82		
jantemp	-0.0022	-5.90	-0.00666	-0.01554
jultemp	0.0017	1.76	0.00504	0.01176
janpcp	-0.0063	-3.16		
julpcp	-0.0194	-7.62		
			-0.00162	-0.00378

Saltwater Fishing Days

Negative Binomial Intensity Model				
Variable	Estimate	t-value	3F	7F
Intercept	2.4058	3.83		
income	0.0002	0.22		
white	-0.0609	-0.71		
male	0.24	3.93		
age	0.0031	1.35		
educ	-0.0686	-4.94		
hhnum	-0.068	-3.00		
under6	0.0419	0.83		
metro	0.0358	0.47		
jantemp	-0.0044	-1.22	-0.0132	-0.0308
jultemp	0.0128	1.47	0.0384	0.0896
janpcp	-0.0265	-1.46		
julpcp	0.117	5.74		
			0.0252	0.0588

A more structural damage function

- MRFSS data
 - temporal variation
 - Spatial variation
- Climate change would affect species composition and potential fishing days



The screenshot shows the NOAA Fisheries Office of Science & Technology website. The header includes the NOAA logo and the text "NOAA FISHERIES: Office of Science & Technology". Below the header is a navigation bar with links: Directorate | Fisheries Statistics | Assessment & Monitoring | Economics & Social Analysis | Science Information | Marine EcoSystems. The main content area is titled "Recreational Fisheries" and features a sidebar with links: Home, Marine Recreational Information Program, Program Overview, Survey Materials, Querying the Data, Local Fish names, Downloads, Meetings, Contact Us, Related links, and Sign-up FishNews. The main content area has a "Downloads" section with the text: "Documents and data are available for download after the data are declared 'final'. When downloads are separated by coasts, combined Atlantic and Gulf of Mexico data are annotated with 'AG', Gulf-only data with 'GU', and Pacific data with 'PC'. Some downloads may have been produced in the past, but are not currently available." Below this text is a sub-section for "SAS Data". The footer includes links: Home | About Us | Regions | Science Centers | Councils | Commissions | Advisory Committee | Search, and Contact Us | Forms | Privacy Policy | Information Quality Guidelines | Disclaimer | People Locator. There are also logos for NOAA and the Department of Commerce.

Marine recreational fishing and climate change

- Household production model
 - $HCKR = f(X; cs, ts)$
 - Changes in season length
 - Changes in species composition
- Participation / Site selection model
 - $Y = f(TC, HCKR; cs, ts)$
- Estimate WTP with simulated changes of climate change

Conclusions

- No study to date explicitly addresses nonmarket valuation of climate change and marine resources
 - WTP review finds no mention of marine values
 - Is it insignificant or missing?
- Meta-analyses could be used in a benefit transfer study
 - Coral reef recreation values
 - Outdoor recreation values
 - Recreational catch values
- But, behavioral response to climate change is missing

Future Research

- All sorts of studies are needed: RP, SP; TEV, UV, NUV
- Most promising with existing RP data
 - Reduced form
 - More structural
- New studies
 - SP data
 - CVM – difficult to avoid double counting
 - CE – can differentiate between marine and other values
 - CB – behavioral response to climate change
 - RP-SP joint estimation
 - Can differentiate between UV and NUV