

**Appendix D9: Using Non-Market Valuation to Value Protected  
Marine Species: A Review of the Literature**



## Using Non-Market Valuation to Value Protected Marine Species: A Review of the Literature \*

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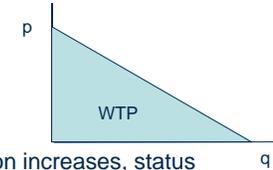
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## What Economic Values Are Measured?



- Willingness to pay (WTP)
  - For preservation of the species
  - For enhancement of the species (population increases, status improvements, reductions in extinction risk, etc.)
  - For conservation programs
    - Often with ill-defined or ambiguous effects on species
- Most commonly, the measured WTP is an estimate of the Total economic value (TEV)
  - TEV = use + nonuse value
  - For most T&E species, TEV is primarily or exclusively non-consumptive value (includes nonuse and non-consumptive use values)

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## Stated Preference (SP) Valuation Methods

- Use carefully constructed survey questions to elicit information about preferences
  - Hypothetical market situations
  - Contingent valuation (e.g., open-ended, payment card, referendum)
  - Choice experiments (focus on attributes)
- SP is capable of measuring nonuse or “passive use” values (i.e., value separate from use values, like existence value)
- General problem: In most cases, there is no corroborative evidence

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## Stated Preference-Related Controversies

- Hypothetical bias, “warm glow” and scope effects
- Critics argue that people do not answer CVM questions consistently with their actual behavior (e.g., Hausman [1993, 2012])
- Recent evaluation by Kling, Phaneuf, and Zhao (2012)

Table 2  
Summary of Authors' Assessment

| Validity concept | Assessment        | Comments  |
|------------------|-------------------|---|
| Criterion        | Some Yes, Some No | <ul style="list-style-type: none"> <li>• Persistence of hypothetical bias in homegrown value experiments implies invalidity.</li> <li>• Emerging consequentiality paradigm suggests potential for validity.</li> <li>• Difficult to conclude purely in favor of validity, but also difficult to outright reject validity.</li> </ul>                                    |
| Convergent       | Likely Yes        | <ul style="list-style-type: none"> <li>• Formal tests often accept revealed and stated preference equality. Even when statistically different estimates occur, they appear to illustrate common economic phenomena.</li> <li>• Practice has migrated towards using revealed and stated preference data as complements rather than substitutes.</li> </ul>               |
| Construct        | Strongly Yes      | <ul style="list-style-type: none"> <li>• Further development of standard theory suggests a wider range of outcomes can still be considered neoclassically rational.</li> <li>• New behavioral theories suggest alternative paradigms might be needed to assess validity.</li> <li>• Definitive construct validity tests are now more difficult to formulate.</li> </ul> |
| Content          | Variable          | <ul style="list-style-type: none"> <li>• Content validity is a study-specific concept, but the stock of accumulated wisdom suggests adherence to best practice is now a stronger validity concept than in the past.</li> </ul>  |



## Types of Species Valuation Studies

- Aggregate species valuation studies
  - Value one or more *groups* of species that include threatened and endangered (T&E) species
  - Species-specific values cannot be estimated
- Disaggregate species valuation studies
  - Enable estimation of species-specific values



## Aggregate Species Valuation Studies

- Studies
  - Berrens et al. (2000) – 11 T&E fish species
  - Farr et al. (2014) – broad groups of species in GBR in Australia
  - Jin et al. (2010) – general “marine turtle conservation” in Asia
  - Lyssenko and Martinez-Espineira (2006) – 17 species of whale in Canada
  - Ressurreicao et al. (2011, 2012) – programs to avoid reducing marine species richness in Europe (in terms of numbers of species in large taxa)
- Limited ability to use in benefits transfer (no individual species values)



## Disaggregate Species Valuation Studies

- Over 30 T&E marine species valuation studies to date
  - Many valuing charismatic megafauna
    - Cetaceans (5 studies)
    - Pinnipeds (11 studies)
  - Some valuing lesser known species
    - Striped shiner (Boyle and Bishop 1987)
    - Silvery minnow (Berrens et al. 2000)
    - Riverside fairy shrimp (Stanley 2005)
    - Short-nosed sturgeon (Aldrich et al. 2007)
- Many of these studies are included in one of three **meta-analyses** (Loomis and White 1996; Richardson and Loomis 2009; Martin-Lopez et al. 2008)



## Meta-Analyses of U.S. T&E Species Values

- |   |   |
|---|---|
| <p><b><u>Loomis and White (1996)</u></b></p> <ul style="list-style-type: none"> <li>• 20 CV studies conducted between 1983 and 1994</li> <li>• Annual WTP ranged between \$11 and \$153 (2013 dollars)</li> <li>• 7 studies valuing T&amp;E marine species</li> <li>• Marine species valued: whales, salmon, steelhead, sea otters, loggerhead sea turtles</li> </ul> | <p><b><u>Richardson and Loomis (2009)</u></b></p> <ul style="list-style-type: none"> <li>• 11 additional studies conducted through 2005 (all CV except 1 CE unpublished study)</li> <li>• Annual WTP ranged from \$12 to \$404 (2013 dollars)</li> <li>• An additional 5 studies valuing T&amp;E marine species</li> <li>• Additional marine species valued were other migratory fish, fairy shrimp, and Steller sea lions</li> </ul> |
|---|---|



## Martin-Lopez et al. (2008)

- Not just U.S. studies
- 60 studies total, but only 20 value aquatic species
- Of the 20, there are 4 non-U.S. studies, several gray literature papers, a non-primary study, and a duplicate study

**Table 1. Threatened, endangered, and rare marine species values reported in meta-analyses**

| Marine Species   | Source Study  | Country         |
|--|---|-----------------|
| <i>Martin-Lopez, Montes, and Benaya (2008, Conservation Biology)</i> |   |                 |
| Grey seals   | Bosetti and Pearce (2003)   | U.K.            |
| Hawaiian monk seal   | Samples and Hollyer (1990), Brown et al. (1994)   | United States   |
| Mediterranean monk seal  | Langford et al. (1998)  | Greece          |
| Northern elephant seal   | Hageman (1986)  | U.S.            |
| Steller sea lion   | Girard et al. (2002)  | U.S.            |
| Beluga whale   | Tkac (1998)   | U.S.            |
| Blue whale   | Hageman (1985, 1986), Bulte and Kooten (1999)   | U.S., Canada    |
| Bottlenose dolphin   | Hageman (1986)  | U.S.            |
| Gray whale   | Hageman (1985, 1986), Loomis and Larson (1994)  | U.S.            |
| Humpback whale   | Samples et al. (1986), Samples and Hollyer (1992), Brown et al. (1994), Wilson and Tisdell (2003) | U.S., Australia |
| Loggerhead sea turtle  | Whitehead (1992), Wilson and Tisdell (2003)   | U.S., Australia |
| Atlantic salmon  | Stevens et al. (1991), Bulte and Kooten (1999)  | U.S., Canada    |
| Arctic grayling  | Duffield and Patterson (1992)   | U.S.            |
| Chinook salmon   | Hanemann et al. (1991), Olsen et al. (1991)   | U.S.            |
| Cutthroat trout  | Duffield and Patterson (1992)   | U.S.            |
| Steelhead  | Olsen et al. (1991)   | U.S.            |
| Shortnose sturgeon   | Kotchen and Reiling (1998)  | U.S.            |
| Kelp bass  | Carson et al. (1994)  | U.S.            |
| White croaker  | Carson et al. (1994)  | U.S.            |
| Riverside fairy shrimp   | Stanley (2005)  | U.S.            |

9



## Recent Disaggregate Studies: SPCE Studies

- Rudd (2009) – Canada
  - **5 species:** Atlantic salmon, Atlantic whitefish, N. Atlantic right whale, porbeagle shark, and white sturgeon
  - Valued Canadian households' WTP for increasing populations
  - *SPCE design only allowed estimation of relative species values*
- Lew et al. (2010) – U.S.
  - **1 species:** Eastern and western stocks of Steller sea lion
  - Valued U.S. and Alaska households' WTP for increasing population sizes and improving ESA status
- Lew and Wallmo (2011), Wallmo and Lew (2011, 2012) – U.S.
  - **8 species:** N. Atlantic right whale, N. Pacific right whale, Puget Sound Chinook salmon, Upper Willamette River Chinook salmon, smalltooth sawfish, leatherback sea turtle, loggerhead sea turtle, and Hawaiian monk seal
  - Valued U.S. households' WTP for improving ESA status

10



## Recent Disaggregate Studies: CV Studies

- New data
  - Solomon et al. (2004): WTP for protection program for manatees from a survey of a Florida county's residents
  - Ojea and Loureiro (2010): WTP for preservation and for increase in population above MVP for European hake and Norwegian lobster (Galician households in Spain)
  - Stithou and Scarpa (2012): WTP for programs involving setting up MPAs which contribute to protection of Mediterranean monk seal and loggerhead sea turtle (very small sample of tourists of Greek island)
- Old data, new models
  - Giraud and Valcic (2004), Larson et al. (2004), Aldrich et al. (2007), and Kontogianni et al. (2012)
- Hybrid CV/CE: Boxall et al. (2012)

11



## Recent Disaggregate Studies by T&E Marine Species

**Table 2. Recent Disaggregate Threatened, Endangered, and Rare Marine Species Valuation Studies**

| Species                               | Reference                 | Valuation Method | Mean/Median WTP Range        | Frequency of payment | Units | Survey Year | Good Valued          | Country |
|---------------------------------------|---------------------------|------------------|------------------------------|----------------------|-------|-------------|----------------------|---------|
| Short-nosed sturgeon                  | Aldrich et al. (2007)     | CV               | \$6.46-40.57                 | One-time             | I     | 1997        | Recovery program     | U.S.    |
| Harbor seal                           | Boxall et al. (2012)      | Hybrid CV/CE     | \$77.37 – 197.85             | Annual               | H     | 2006        | Improved status      | Canada  |
| Beluga whale                          | Boxall et al. (2012)      | Hybrid CV/CE     | \$111.46 – 349.10            | Annual               | H     | 2006        | Improved status      | Canada  |
| Steller sea lion                      | Giraud and Valcic (2004)  | CV               | \$88.43 – 88.18              | Annual               | H     | 2000        | Recovery program     | U.S.    |
|                                       | Lew et al. (2010)         | CE               | \$34.94 – 204.24             | Annual               | H     | 2007        | Improved status      | U.S.    |
| Mediterranean monk seal               | Kontogianni et al. (2012) | CV               | 50 – 87.1 euros              | Unknown <sup>a</sup> | H     | 2009        | Population increase  | Greece  |
|                                       | Stithou and Scarpa (2012) | CV               | 15.20 – 20.94 euros          | One-time             | I     | 2003        | Protection program   | Greece  |
|                                       |                           | CV               | 12.40 – 14.27                | Per visit            | I     | 2003        | Protection program   | Greece  |
| Gray whales                           | Larson et al. (2004)      | CV               | \$22.51 – 33.94 <sup>b</sup> | Annual               | I     | 1991        | Population increases | U.S.    |
| Hawaiian monk seal                    | Lew and Wallmo (2011)     | CE               | \$43.72 – 85.66              | Annual               | H     | 2008        | Improved status      | U.S.    |
|                                       | Wallmo and Lew (2011)     | CE               | \$43.72 – 68.12              | Annual               | H     | 2008        | Improved status      | U.S.    |
|                                       | Wallmo and Lew (2012)     | CE               | \$36.26 – 66.31              | Annual               | H     | 2009        | Improved status      | U.S.    |
| Puget Sound Chinook salmon            | Wallmo and Lew (2011)     | CE               | \$46.95                      | Annual               | H     | 2008        | Improved status      | U.S.    |
|                                       | Wallmo and Lew (2012)     | CE               | \$40.49                      | Annual               | H     | 2009        | Improved status      | U.S.    |
| Smalltooth sawfish                    | Lew and Wallmo (2011)     | CE               | \$33.96 – 64.50              | Annual               | H     | 2008        | Improved status      | U.S.    |
|                                       | Wallmo and Lew (2011)     | CE               | \$33.96 – 53.39              | Annual               | H     | 2008        | Improved status      | U.S.    |
|                                       | Wallmo and Lew (2012)     | CE               | \$32.45 – 51.89              | Annual               | H     | 2009        | Improved status      | U.S.    |
| Norwegian lobster                     | Ojea and Loureiro (2010)  | CV               | 15.83 euros                  | One-time             | H     | 2006        | Protection program   | Spain   |
| Hake                                  | Ojea and Loureiro (2010)  | CV               | 24.57 euros                  | One-time             | H     | 2006        | Protection program   | Spain   |
| Manatee                               | Solomon et al. (2004)     | CV               | 10.25 – 21.44                | Annual               | H     | 2001        | Protection program   | U.S.    |
| Loggerhead sea turtle                 | Stithou and Scarpa (2012) | CV               | 15.70 – 22.52 euros          | One-time             | I     | 2003        | Protection program   | Greece  |
|                                       |                           | CV               | 12.04 – 13.64 euros          | Per visit            | I     | 2003        | Protection program   | Greece  |
| Upper Willamette River Chinook salmon | Wallmo and Lew (2012)     | CE               | \$43.72                      | Annual               | H     | 2009        | Improved status      | U.S.    |
|                                       | Wallmo and Lew (2012)     | CE               | \$40.65                      | Annual               | H     | 2009        | Improved status      | U.S.    |
| North Pacific right whale             | Wallmo and Lew (2012)     | CE               | \$41.72 – 73.16              | Annual               | H     | 2009        | Improved status      | U.S.    |
| North Atlantic right whale            | Wallmo and Lew (2012)     | CE               | \$38.79 – 71.62              | Annual               | H     | 2009        | Improved status      | U.S.    |
| Leatherback sea turtle                | Wallmo and Lew (2012)     | CE               | \$37.96 – 67.97              | Annual               | H     | 2009        | Improved status      | U.S.    |

Units refer to the value's unit measurement in terms of household (H) or individual (I)

<sup>a</sup>The payment vehicle was a contribution made on the water bill, but the frequency of billing was not mentioned.

<sup>b</sup>Also presents estimated WTP in non-monetary terms (hours donated).

12



## Recent Disaggregate Studies: Some Observations

- WTP values range from -\$120 to \$438 (2013 dollars)
  - Negative values for SSL recovery program (Giraud and Valcic 2004) and shortnose sturgeon protection program (Aldrich et al. 2007) in CV studies
  - Largest values were from Boxall et al. (2012) for valuing beluga whales in St. Lawrence estuary
- Survey methodologies: numerous web-based surveys (primarily SPCE studies)
- Expansion of species covered, but still many holes
- Geographic coverage worldwide remains concentrated (U.S., Canada, Australia, Europe)
- Increasing number of WTP estimates that are “policy flexible”
  - Value of increasing population, reducing risk, or improving status
  - Mainly due to switch to SPCE methods

13



## Discussion: Some Observations

- Gray literature contains additional studies, but have not been peer reviewed
- Many earlier studies and some newer ones use less than state-of-the-art methods, are based on small sample sizes, use simple estimation models, or survey limited populations
- Embedding remains a problem
  - E.g., valuing a broad program instead of specific policy instruments, or effects on species
- A note about corals
  - Numerous recreation-based valuation studies in coral reef ecosystems (Londoño and Johnston 2007); not tied to individual species generally

14



## Discussion: Are We There Yet?

- Answer: No, but progress is being made
- Policy relevant WTP estimates are increasing in number and quality, but more are needed
- Need more studies on lesser-known species (biological, ecological, and economic information)
- Need values for MMPA species that are not ESA-listed
- More research on relationship between regulations, conservation, and other management measures on species
- Big questions still remain in valuation generally (e.g., Is there a cap on WTP for all T&E species?)
- Benefits transfer methods are advancing but many challenges remain given limitations in the set of available estimates
- Integrating economic values into policy analyses and related models (e.g., bioeconomic models)

15