# Attribute Non-attendance in Choice Experiments of Marine Ecosystem Goods and Services: Special Issue Introduction

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## INTRODUCTION

This special issue of *Marine Resource Economics* focuses on attribute non-attendance (ANA) in stated preference research. ANA occurs when individuals ignore one or more attributes in stated preference choice experiment (CE) questions. If present but unaddressed, ANA can lead to biased model coefficients and welfare estimates. The ANA literature includes two primary approaches for identifying and accounting for ANA behavior in CE studies: the stated and inferred ANA approaches. In the stated ANA approach, survey respondents provide self-reported information about CE attributes that have been ignored or given less than full attention. In the inferred ANA approach, econometric models are used to probabilistically discern ANA behavior from the choice data. In the rest of this introduction, we conduct a systematic bibliometric analysis to characterize the ANA literature and a meta-analysis to examine the effect of ANA strategies on welfare estimates. We then briefly summarize the articles in this special issue and describe how they fit into the literature. Finally, we offer some suggestions for future research.

## BIBLIOMETRIC ANALYSIS

To conduct a systematic review of the empirical ANA literature, we employed the Web of Science (WOS) database (https://www.webofknowledge.com/) and searched for published articles using the key words "attribute non-attendance" and "attribute nonattendance." The final search was conducted on December 20, 2019. The first key word produced 159 articles, with 95 of these categorized by WOS as "economics." The other articles were categorized by WOS as "environmental studies" or "agricultural economics policy," among others. The second key word search produced an additional five articles. Two of these five studies were screened out as being primarily a health study (e.g., benefit-risk trade-off) and not a valuation study, leaving three additional articles. The resulting set of 162 articles was screened for content, with many mentioning ANA only in the introduction and/or conclusions. The final sample size for bibliometric analysis is therefore $n = 86$ empirical articles with a focus on ANA.

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In figure 1, we report the trends in publications and citations over the 2009–19 time period. Since 2013 the annual number of published articles has ranged from 6 to 15, with an average of 11. The number of citations to these articles has significantly increased, with an average annual change of 33 per year. Increases in citations but not published articles suggest that researchers are beginning to recognize ANA as a potential issue of concern but are not feeling the need to formally analyze it in their empirical analysis. This growth rate is similar to the 11-year period when papers containing the "stated preference" key word reached 300 citations in 2004, according to a search of WOS. There were more than 5,000 citations to 500 stated preference articles in 2019.

The ANA literature is international with applications in Europe (49% of all studies), Australia (16%), Asia (14%), North America (13%), and Africa (8%). The most common object of valuation is the environment (43% of all studies). Only one of the environmental applications focuses solely on the estimation of use values, with the remainder estimating total economic value. The next largest topical categories are food consumption (23%), transportation (15%), and health (10%). Sixty-eight percent of the ANA studies employ inferred ANA methods. Forty-nine percent employ stated ANA methods. The sum of the stated and inferred applications is greater than 100% as 12 articles, 14% of the total, compare the two approaches.

## META-ANALYSIS

The presence of ANA has implications for econometric model performance and welfare analysis. Almost all ANA articles report an improvement in econometric efficiency when comparing a baseline model that assumes full attribute attendance with a model that accounts for inferred or stated ANA. In nearly all studies, ANA affects the size of regression coefficients; ANA-adjusted coefficients are typically further away from zero, since ignoring the attribute is generally captured as a utility parameter equal to zero. Since willingness to pay (WTP) estimates are constructed from these coefficients, ANA directly affects welfare analysis.

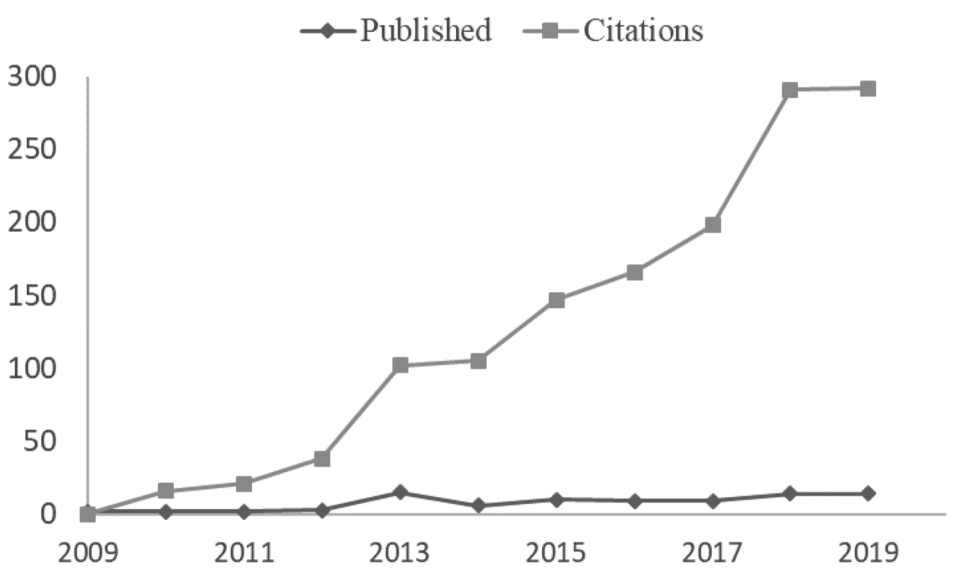


Figure 1. Trends in Attribute Non-attendance Scholarship

The manner in which welfare is impacted depends upon the pattern of ANA behavior. When ANA is solely considered for the cost attribute, WTP estimates fall in ANA models relative to standard econometric models since the cost parameter is the denominator in the calculation of WTP. If ANA is considered solely for an attribute coefficient, WTP adjusts upwards in ANA models relative to baseline models (assuming the attribute is considered an economic good, rather than an economic bad). When ANA effects are considered for both cost and attribute coefficients, the overall effect could be in either direction. To investigate the magnitude of these differences in the literature, we considered the subsamples of ANA papers in the fields of environmental and food consumption from the bibliometric analysis, since these are the topics of most interest to readers of *Marine Resource Economics*.

We restricted our comparison to articles that presented tables of WTP estimates with clean comparisons between baseline and ANA econometric models. We excluded articles that estimated willingness to accept ($n = 3$) and did not employ household samples ($n = 2$). We also dropped one of two articles that used the same dataset. We identified 14 articles that provide clean WTP comparisons with household samples. Ten of these articles are in the environmental field, and four consider food consumption applications. There are 75 comparisons of WTP estimates in the environmental articles and 26 in food consumption. Forty-one percent of the estimates result from face-to-face interviews, 27% are from internet surveys, 22% are from mail surveys, and 5% are from a lab experiment. We were unable to determine the survey method for 5% of the estimates. Of these 14, only one article containing 12 comparisons of WTP estimates are from models when ANA is solely considered for the cost attribute.

The dependent variable for this analysis is the ratio between the baseline WTP point estimate ($WTP^{base}$) and the WTP point estimate after ANA adjustment ($WTP^{ANA}$); that is, $WTP^{base}/WTP^{ANA}$. If $WTP^{ANA}$ estimates are lower than $WTP^{base}$, this ratio will be greater than one. All of the WTP ratios are unique; that is, each WTP ratio corresponds to a specific attribute in a specific model within a particular study. Considering the full data analyzed, the ratio is 2.08 and statistically different from 1 ($t = 2.95$, with clustering at the article level). This indicates that WTP is about 100% higher when respondents who do not fully consider choice attributes are included in the analysis. Five of the ratios are greater than 6. Dropping these as outliers, the mean of the trimmed ratio is 1.69, which is different from 1 ($t = 3.51$).

We next conduct an ordinary least squares regression analysis with WTP ratio as the dependent variable and clustered standard errors to account for multiple estimates per study. The independent variables are dummies for food consumption studies (relative to environmental), stated ANA methods (relative to inferred ANA), and internet survey methods (relative to all other methods). The food consumption studies ($t = -1.94$) and stated ANA methods ($t = -2.60$) have lower WTP ratios. Internet survey methods have no effect on the WTP ratio.

We next perform a similar analysis separately for the environmental and food consumption ratios. The food consumption WTP ratio is equal to 1.04, which is not statistically different from 1. The environmental WTP ratio is 1.93, which is statistically different from 1 ($t = 5.61$). Considering just the environmental ratios, the comparisons using stated ANA have lower WTP ratios ($t = -2.73$) according to a regression model. Internet survey methods have no effect.

This analysis, though preliminary and conducted with a small sample, provides some evidence that ignoring ANA in welfare analysis could lead to upwardly biased WTP estimates, particularly in environmental applications.

## THIS ISSUE

There are five articles in this special issue: a review article and four empirical articles. The empirical articles present applications spanning a range of marine ecosystem goods and services: from public preferences for coastal zone management (Ahi and Kipperberg 2020) and habitat restoration (Petrolia and Hwang 2020; Hindsley, Landry, and Morgan 2020), to consumer preferences for oyster varieties (Petrolia and Hwang 2020) and salmon ecolabeling certification (Zhang, Fang, and Gao 2020). These studies cover both of the primary ANA approaches—stated and inferred. Ahi and Kipperberg examine the effect of including a labor market attribute in a CE using an inferred ANA model. Zhang, Fang, and Gao compare stated and inferred approaches. Petrolia and Hwang conduct a replication study of three published studies using an inferred ANA approach. Hindsley, Landry, and Morgan consider stated ANA. In two of these articles (Ahi and Kipperberg 2020; Zhang, Fang, and Gao 2020), ANA has significant effects on WTP and negligible effects on the others. Nevertheless, in these latter two studies (Petrolia and Hwang 2020; Hindsley, Landry, and Morgan 2020) the WTP estimates are more precisely estimated when ANA is accounted for.

The ANA review by Lew and Whitehead (2020) considers the origins and motivations for the study of ANA in the CE literature. Their discussion illustrates that ANA is a logical extension of behavioral research examining bounded rationality. Next, they describe the variety of approaches that have developed in the context of econometric modeling techniques. They describe stated ANA models like the commonly used attribute elimination model (Hensher, Rose, and Greene 2005) and ANA validation model (Hess and Hensher 2010), as well as inferred ANA models like the equality-constrained latent class (ECLC) model (Scarpa et al. 2009) and endogenous attribute attendance model (Hole 2011). Moreover, they discuss recently developed approaches using eye movement data, which are referred to as visual ANA approaches (e.g., Balcombe, Fraser, and McSorley 2015). Throughout, they highlight key issues in the literature associated with these methods and note some challenges in welfare estimation common to all ANA approaches. Their article concludes by discussing several promising directions for future research.

Ahi and Kipperberg (2020) conduct a CE with a split-sample treatment, where one sample is presented with an additional labor market attribute. Their application is to coastal protection in Norway. The authors estimate a random parameters ECLC inferred ANA model and compare these results with the standard random parameters logit model. They find that the ECLC models have improved econometric performance and six of seven WTP estimates decrease, some substantially. Inclusion of the labor market attribute has mixed effects.

Zhang, Fang, and Gao (2020) estimate the factors that affect imported salmon consumption at restaurants in China. They compare stated and inferred approaches and the effects of asking the stated ANA questions halfway through the series of CE questions and after the last one. The authors estimate both a random parameters logit baseline model and a stated ANA model and find that econometric performance improves with the stated ANA model. The WTP estimates decrease in each of the nine comparisons, with a mean WTP ratio—defined as in the previous section—of 2.69. The inferred latent class ANA model produces a mean WTP ratio of a more modest 1.34.

Petrolia and Hwang (2020) conduct a replication study of three previously published CE articles with inferred ANA methods. Two of these studies consider environmental topics—coastal protection in Louisiana—and the third considers seafood consumption. Considering comparisons between only the econometric models used in the original study and their ANA equivalent,

the authors find improvements in econometric efficiency when ANA is considered but mixed effects on WTP, mostly because changes in coefficients (which are substantial) on the cost and quality attributes largely offset one another. They find that WTP estimates are estimated more precisely when accounting for ANA.

Hindsley, Landry, and Morgan (2020) consider the effects of stated ANA in conjunction with hypothetical bias mitigation in a study of the quality improvements for the Sarasota Bay estuary. They examine eight different models, each with a different interpretation of ANA (cost only versus all attributes), stated ANA (taking account of respondents who ignore attributes and also those who do not fully consider attributes), and interactions with a hypothetical bias certainty correction. The authors find only limited effects from ANA. For example, the mean WTP ratio comparing the base and a stated ANA model is 1.07 over the five attributes. Similar to Petrolia and Hwang (2020), the authors find that the primary benefit of the ANA models is more narrow WTP confidence intervals.

These studies are illustrative of the impacts that ANA can have on stated preference research. Future research could pursue several directions. As this issue illustrates, there are numerous ways to account for ANA behavior. More studies comparing alternative ANA approaches (stated versus inferred, alternative inferred approaches, alternative stated approaches, etc.) are needed. There is a number of stated preference articles addressing marine ecosystem goods and services. Similar to Petrolia and Hwang (2020), more replication studies that reexamine older, published studies with ANA methods are needed to corroborate the expected gains from employing these methods across a wider range of applications and to further evaluate the implications of ignoring ANA behavior on welfare. Similarly, meta-analyses of the ANA literature and benefit transfer studies are needed in order to gain an understanding of the policy implications. More fundamentally, studies exploring the theoretical and empirical bases of ANA behavior and factors affecting ANA are also needed. Our opinion is that CE studies that do not account for ANA run the risk of producing biased estimates. However, this is an unresolved question and one that is ripe for further investigation.

The editors of *Marine Resource Economics* welcome submissions in these and other areas that inform the discussion on ANA in stated preference research for marine ecosystem goods and services.

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