Memorandum

To: Norman Meade, Assessment and Restoration Division, NOAA

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Subject: Incentive Compatibility of Coral Reef Conjoint Survey

This memorandum addresses the question of incentive compatibility (sometimes also referred to as demand revelation) of the Coral Reef conjoint survey instrument. For purposes of this memorandum, we use the term "incentive compatibility" to mean truthful revelation of one's preferred choice of the conjoint questions presented in the survey.[1]

We first present a brief summary of incentive compatibility criteria as presented in Carson and Groves (2007) and then discuss applications to conjoint studies. We conclude with a specific evaluation of the incentive compatibility properties of the Coral Reef survey.

Summary of Incentive Compatibility Criteria

Carson and Groves (2007) used the mechanism design literature to identify three main conditions for incentive compatibility, willingness-to-pay (WTP) elicitation formats: (1) whether respondents care about how the outcome might be influenced by the answers they provided (consequentiality), (2) whether the aspects of the scenario described are plausible (plausibility), and (3) how the survey results are likely to be used. For a question to be consequential, a respondent must believe that his/her response may influence some action and he/she must care about possible outcomes. As stated in Carson and Groves (2007) "As long as the economic agents (hereafter, *agents*) being surveyed believe that their responses might influence the actions taken by businesses or governments (hereafter, *agency*), the standard economic model suggests that agents should respond to the survey in such a way as to maximize their expected welfare."

Incentive compatibility of conjoint type survey formats mainly focus on choice, rather than ranking, question formats, but the results are generally transferable. For example, Bateman et al. (2004), Ding et al. (2005), Ding (2007), and Collins and Vossler (2009) find that if researchers use provision mechanisms that require participants to "live with" then the design is incentive compatible. Carson and Groves (2007) also find that choices should be consequential and that respondents should believe payments would be enforceable in order to be incentive compatible. In other words, if respondents feel their answers are consequential, then they should truthfully reveal their preferences.

1. Truthful demand revelation and incentive compatibility are used interchangeably in the literature.

An additional issue is whether or not respondents fully understand the task presented to them. Bateman et al. (2004) looked at the issue of respondent's comprehension of the possible choice set in evaluating performance. They found that "When a stepwise disclosure procedure is adopted, the observed scope sensitivity is substantially and significantly affected by the order in which goods are presented but such procedural variance is not observed within advance disclosure designs." Thus, respondents understanding of the full choice set to be evaluated improve reliability. Finally, Collins and Vossler (2009) looked at the issue of two versus three choices and found that in fact the trichotomous choice performs marginally better than a dichotomous format on a number of indicators.

Application to the Coral Reef Survey

Below we provide a brief description of the Coral Reef survey then describe how the survey design addresses each of the identified criteria for incentive compatibility.

The introduction of the Coral Reef survey presented respondents with an incentive to complete for the survey in a truthful manner. We tell respondents that the government is deciding whether to undertake some actions to further protect Hawaiian coral reefs and that it wants the public's input in the decision. In this manner the survey is an "advisory referendum." The survey provided multiple statements about the consequences of respondent's choices (e.g., the government is making a decision; the government wants input from citizens to make its decision; this decision will have monetary impacts on individuals and individual's choices will affect the quality of coral reefs in Hawaii). The survey used a multinomial choice conjoint format to elicit WTP for two distinct mechanisms that would provide two different levels of reef protection and one option that combined the two individual options. Along with a status quo option, the four choices presented to respondents were:

- The status quo of no additional reef protection and no additional annual taxes
- Increased protection from overfishing through the increase in size of no-fishing zones around the reef and an increase in annual taxes
- Repair of coral reefs damaged from ship strikes and an increase in annual taxes
- A combined program of both protection for overfishing and reef repair with increased annual taxes.

Before respondents were asked to make a decision, they were reminded of their budget constraints. All four choices are presented to respondents at the same time, and they are instructed to indicate their preferred choice. Their preferred choice is removed from the set and then respondents are provided with the three remaining choices and again instructed to select

their preferred choice. Finally, the remaining pair of choices is provided to respondents. In this manner, a full ranking of respondents preferences is obtained.

Evaluation of Incentive Compatibility Conditions

Consequentiality: Respondents are informed that their responses to the survey will help the government make a decision about what more, if anything, should be done to protect the coral reefs around Hawaii. Respondents are also told that their annual federal taxes may increase as a result of their decision.

Plausibility: The protection and repair mechanisms are both types of actions that have occurred in the past. Examples are provided of where these types of actions have worked before to protect and restore coral reefs. Through focus groups, we verified that respondents believed and accepted the scenarios as plausible.

Use of survey results: Respondents are explicitly told that the results of the survey will inform government decisions on whether or not they should to do more to protect coral reefs around the main Hawaiian island. The respondents were told that their responses would influence the actions taken by the government, which is equivalent to an "advisory referendum."

Task comprehension: Respondents understanding of the specific task they are being asked to complete is important. Extensive pretesting through focus groups and cognitive interviews confirmed that individuals understood how to accurately complete the task. In addition, a warm-up question was used to ensure that respondents understood how to make the tradeoff between two programs before they saw the main choice options. The Coral Reef survey used an "advance disclosure design" by showing the full choice set that individuals would face at the beginning of the task and kept attribute levels constant for each specific respondent.

Credibility: Problems can also occur when a respondent is given inconsistent information at various points in a survey. Examples include providing two different cost numbers in a double-bounded dichotomous-choice elicitation format, or asking respondents about the provision of two different levels of the same public good at different points in a survey without corresponding changes in other information to justify those different levels.

In particular, this can be an issue with double bounded contingent valuation questions when respondents do not know the full set of choices being provided to them (the bid amounts changed in the second round) and respondents may feel "gamed" such that they may not truthfully reveal their preferences in the second round. The Coral Reef survey enhanced credibility and task understanding by providing the full choice set in the initial presentation and keeping attribute levels between choice sets constant for a given respondent.

The above criteria are successfully met in the overall design of the Coral Reef survey and led to the conclusion that the survey design does not violate incentive compatibility conditions and elicits truthful demand revelation.

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