

## Homework #3: Preventing Whale Strikes in the Santa Barbara Channel<sup>1</sup>

### ESM 204

Three endangered whale species (blue, fin, and humpback) migrate through the Santa Barbara Channel each year. Because the channel is bisected by a highly trafficked shipping lane, container ships sometimes come into fatal contact with surfacing whales. Marine biologists estimate that anywhere from 10-60 lethal whale strikes occur in the channel each year, but it is difficult to estimate this mortality because whale strikes most often go undetected. One component of the WhaleStrikes Group Project at the Bren School (2016) was to quantify the existence value of these endangered whale populations to better understand the total economic value that is lost every time a lethal ship strike occurs. To do this, contingent valuation surveys were administered online to over 2,000 respondents. After describing the conflict between shipping and whales in the channel, the respondents were presented with the following:

“A management program is being considered that is expected to reduce the risk of a whale strike being fatal by 20%. This is estimated to save at least 5 whales along the West Coast of the United States each year.

This management program would affect shipping vessels traveling through the Santa Barbara channel on their way to the Port of Los Angeles and Port of Long Beach, and it is expected to increase the costs associated with importing goods into the U.S. by sea. A tax on goods coming in through these ports is being considered to cover the costs of this program. Though these ports are located in California, their goods are distributed nationally so price increases can be expected around the country.

If you were asked to vote on this program, knowing that it would cost your household an extra \$20.00 each year in additional taxes, how would you vote? (Keep in mind your income and other annual expenses).

☐ I would vote in favor of this program.

☐ I would vote against this program.”

The underlined values were randomized among respondents. The survey also collected basic demographic information, and asked a series of questions to identify the respondents’ attitude toward the environment. Using the survey results, the WhaleStrikes Group estimated that the average U.S. household would be willing to pay about \$69 per year to prevent lethal whale strikes.

Now assume that the Santa Barbara County government (rather than the federal government) is interested in implementing a vessel speed reduction (VSR) program in the channel that would reduce the risk of whale strikes by 60%, and they would like to know if doing so is economically efficient for its constituents. A VSR program is expected to be the cheapest way to mitigate lethal whale strikes. The cost of implementation is \$7 million, and the benefits are derived only by Santa Barbara County residents. You have written and distributed a contingent valuation survey to 500 Santa Barbara County residents to determine the local demand for a VSR program. The data set from this survey is available as part of this assignment.<sup>2</sup> **Your job is to produce a 1 page memo, with appendices, that argues for, or**

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<sup>1</sup> Thanks to Kendall Mills for helping prepare this homework.

<sup>2</sup> Data columns are: (1) “risk”: level of risk reduction, (2) “bid”: annual payment for the household, (3) “vote”: 1 is yes, 0 is no, (4) “NEP” : measure of environmental concern (feel free to consult the WhaleStrikes Group Project

**against, the VSR program on economic grounds (where the only benefits you account for are to residents of Santa Barbara).** The following steps may help you prepare your case.

1. Create a linear probability model that predicts a respondent's probability of voting 'yes' on the ballot based on their age, income, NEP score, the risk reduction offered by the program, and the cost of the program to that respondent. Show the model and interpret the regression coefficients.
2. Based on this regression, what can you say about the value of a single prevented whale death? (Hint: Think about how risk reduction for all whales translates into the number of whale deaths avoided)
3. Pick three arbitrary respondents. For each of those respondents, estimate their WTP for a VSR program offering 60% risk reduction.
4. Now repeat this process and estimate the mean WTP for a VSR program offering 60% risk reduction among Santa Barbara County households.
5. If there are 150,000 households in Santa Barbara County, estimate the total benefit of a VSR program to these households.
6. Based only on these benefits, do the benefits of the VSR program outweigh the costs?

When a container ship reduces its speed, it not only reduces the risk of colliding with a whale but also emits less carbon per distance traveled. For this reason, the WhaleStrikes Group Project recommended enrolling container ships in voluntary carbon trading markets to mitigate fatal whale strikes. Assume that for any ship transiting the Santa Barbara Channel, a speed reduction (that results in a 60% risk reduction) will cost the shipper \$1,000, but will result in 20 fewer tons of CO<sub>2</sub> emitted per transit.

7. Suppose the price of a carbon credit is **\$Z per ton**, at what price  $Z^*$  will the shipping industry decide to adopt the VSR for purely self-interested reasons? (Note: if ships voluntarily reduce speed, then the \$7 million cost (noted above) of implementing the VSR would be avoided)
8. Now suppose the carbon credit price is exactly  $Z^*$ , so all ships voluntarily reduce speed to achieve the 60% risk reduction. Approximately how many whales would be saved by this? What would be the social value of allowing ships to enter the carbon trading market?

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report for more information), (5)"income": categorical variable for income level, (6)"age": categorical variable for age.