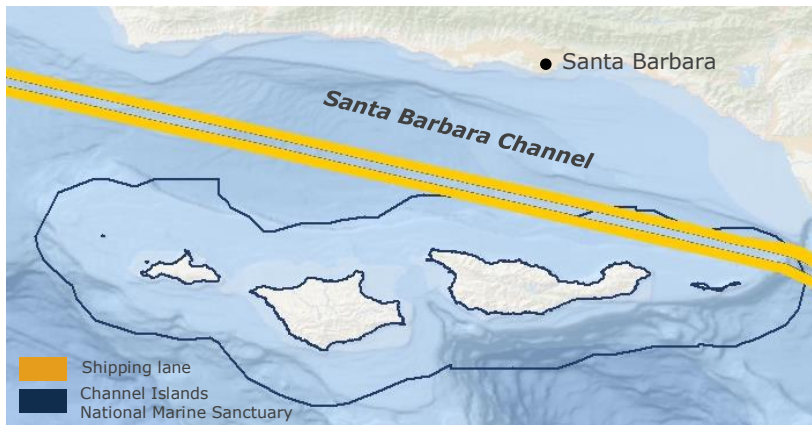


The Value of Non-Market Goods: Whale Conservation and Human Health Benefits from Vessel Speed Reduction in the Santa Barbara Channel

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The **Santa Barbara Channel** is a stretch of the Pacific Ocean that separates Southern California from the four northern Channel Islands. The channel is an ecologically and economically valuable region that serves as a migratory pathway for endangered whale species and contains a highly-trafficked maritime shipping route.

Two Distinct Problems

Shipping in the channel is associated with two distinct environmental problems:



Whale strikes are collisions between ships and whales that can be fatal and threaten endangered whale species.



Air pollution from container ships is significant, impacting human health in coastal communities.

Project Objective

To explore the economic benefits of a voluntary VSR program and compare them to the \$7 million implementation cost by:



Determining how much people value whale conservation

Estimating the human health benefits of reduced pollution

Assessing the value of emission reductions in existing pollution prevention programs

One Unique Solution



Vessel speed reduction (VSR), or the intentional slowing of ship speed, is a unique strategy that simultaneously reduces shipping emissions and the frequency of lethal whale strikes. We estimate the cost of industry-wide implementation in the channel to be approximately \$7 million annually.

Significance

Maritime traffic threatens three endangered whale species – blue, fin, and humpback – and negatively impacts the health of coastal residents. Our group's novel approach compared the human health and conservation benefits generated from VSR to the program's implementation cost.

Value of Whale Conservation



Purpose

We conducted a contingent valuation study to estimate how much people in the United States value varying levels of whale conservation along the west coast.

Contingent valuation is a survey-based instrument commonly used by economists to estimate the value of an environmental good or service that has no market value.

Survey Process



We interviewed experts and reviewed literature to develop our survey methodology.



We designed survey questions based on this research.



We surveyed over 2,000 individuals across the United States.



We calculated the amount that the average American household is willing to pay for whale conservation.

Results

Individuals across the country are interested and willing to pay for whale conservation on the west coast. We offered survey respondents two different ways to fund conservation, and our results suggest that both would generate more money than is necessary to implement a VSR program.

Consumer Tax

If conservation funds were secured using a consumer tax, the average American household would be willing to pay

\$ \$69 per year

Tax Reallocation

If conservation funds were secured using tax reallocation, the average American household would be willing to reallocate up to

\$ \$0.62 per year

Program Cost

Based on our estimation of the program's cost, every American household would only need to pay seven cents to fully fund VSR.

\$ \$0.07 per year

Human Health Assessment

Purpose

We estimated the human health benefits that could be generated in Santa Barbara and Ventura Counties from a VSR program in the channel.

Shipping and Health

Shipping emissions account for about 54% and 30% of nitrogen oxides (NOx) pollution in Santa Barbara and Ventura Counties¹, respectively. Under certain environmental conditions, NOx is converted into ozone, which is harmful to human health and can increase the rate of respiratory-related illnesses. VSR could reduce ship-generated NOx emissions significantly, thereby reducing human health risks associated with ozone².

Results

An industry-wide VSR program would reduce ozone concentrations by approximately 30% and 17% for Santa Barbara and Ventura Counties, respectively. This would result in:

Santa Barbara County



1,081 avoided hospitalizations



\$3.4 million health benefits

Ventura County



664 avoided hospitalizations



\$2.4 million health benefits

Pollution Prevention Program Analysis

Purpose

We evaluated several existing pollution prevention programs to determine the potential revenues that the shipping industry could generate if its emissions were included within these frameworks. These programs would need to be modified to incorporate emissions from container ships.



Clean Air Canada

Results

Greenhouse Gas Reduction Fund

This \$2 billion fund supports programs in California that reduce greenhouse gas (GHG) emissions. Allocating \$7 million to VSR would cover the program's implementation costs.

Greenhouse Credit Gas Exchange

This program allows polluters to voluntarily reduce GHG emissions and create credits that can be purchased. VSR would produce credits that could be sold for profit.

Voluntary Offsets Market

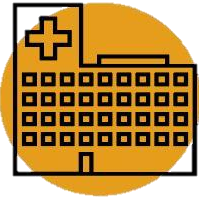
Similar to the GHG Exchange, ships can voluntarily sell credits to other entities through a carbon registry, such as the American Carbon Registry.

Conclusions

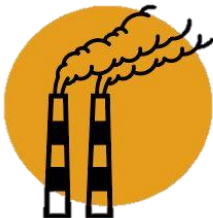
Based on our analyses, there are multiple economic arguments that support the implementation of VSR. Furthermore, there are viable funding sources that could be used independently or collectively to generate the funds necessary to sustain a long-term, industry-wide VSR program in the channel.



The average American household is willing to pay approximately \$69 per year to fund whale conservation. This estimate is orders of magnitude greater than the mere 7 cents that each household would need to pay to cover the cost of VSR.



The human health benefits generated from an industry-wide VSR program are nearly equal to the estimated \$7 million cost of this program. Combined benefits for Santa Barbara and Ventura Counties total \$5.8 million, but this estimate does not account for non-hospital-related costs (e.g. inhalers, medications) that would also be avoided as a result of improved air quality.



Three existing pollution prevention programs– Greenhouse Gas Reduction Fund, Greenhouse Gas Credit Exchange, and Voluntary Carbon Offsets Market – could allow the shipping industry to generate revenue while reducing its emissions. Expected revenues are currently small, but projected to grow as the price of carbon increases over time.

Acknowledgments

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References: [1] Santa Barbara County Air Pollution Control District. (2015). Protecting blue whales and blue skies: Report on the 2014 vessel speed reduction incentive trial in the Santa Barbara Channel. [2] Khan et al. (2012). Greenhouse gas and criteria emissions benefits through reduction of vessel speed at sea. *Environ. Sci. Technol.*, 12600-2607. Icon credits: Khanh Mai (whales), Kelly Turgeon (man), Simon Child (air pollution), David Scama (hospital), Icon Island (dollar sign), Oliver Guin (ship), Michael Thompson (survey), Michela Tannoia (calculator), Sergi Delgado (meeting), and Jon Testa (book).