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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Background

Two Distinct Problems

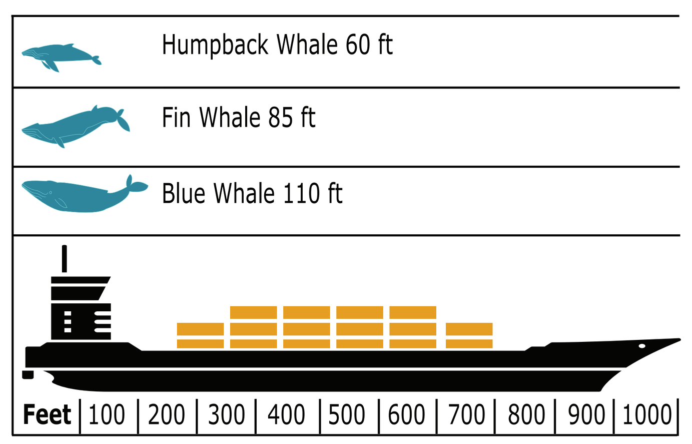
- **Whale strikes** are collisions between ships and whales that can be fatal and threaten endangered whale species.
- **Air pollution** from container ships is significant, impacting human health in coastal communities.

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 important region. It serves as a migratory pathway for three endangered whale species and includes a highly-trafficked marine shipping route in which roughly 2,700 transits occur annually.

Whale strikes can be fatal when ships are larger than 65 feet and travelling at 14 knots (~16 mph) or faster. These whale strikes pose a considerable threat to three endangered species, humpback, fin, and blue whales. Marine biologists estimate that 20 - 30 lethal whale strikes occur on the west coast of the United States each year[1].

Roughly 54% of Santa Barbara's total nitrogen oxides pollution is attributed to container ship emissions[2]. These emissions degrade coastal air quality and negatively impact the health of coastal residents in Santa Barbara and Ventura Counties.

Magnitude of the problem:



Why is shipping important?

- The industry is responsible for transporting approximately 90% of all consumer products.
- The global fleet of container ships transports about $13 trillion worth of goods annually.
- Maritime shipping is the most energy efficient way to distribute goods globally.

One Unique Solution

Vessel speed reduction (VSR) is the intentional slowing of ship speed. For this project, a VSR program would require ships to slow to 12 knots (~14 mph) — a speed at which air pollution emissions and the risk of a whale strike being fatal are both significantly reduced[3]. While VSR can be imposed upon the shipping industry through regulatory action, it can also be implemented as a voluntary, incentive-based program that simultaneously addresses these two seemingly distinct environmental problems. Because it is a comprehensive and cost-effective management strategy that appeals to multiple stakeholders, we focused solely on voluntary VSR as a solution for whale strikes and air pollution.

Objective

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

- Assessing the value of emissions reductions in existing pollution prevention programs
- Estimating the human health benefits that would result from an industry wide VSR program
- Determining how much people value whale conservation

Significance

- Whale strikes and air pollution are two persistent problems in the channel region that have not yet been resolved despite decades of work.
- VSR is a cost-effective management strategy that simultaneously addresses these two problems.
- Our comprehensive approach to environmental problem solving is a useful model that managers can adopt to develop more effective management strategies.

VSR Trial in the Santa Barbara Channel

During the summer of 2014, three local environmental groups conducted a successful, short-term VSR trial program in the channel. Shipping companies interested in participating were offered a payment of $2,500 per ship for each transit through the channel. Enrollment forms from eight companies were submitted for more than 80 transits, demonstrating industry interest in the program, but funding was only available for 27 transits. In total, 16 tons of nitrogen oxides and 500 metric tons of greenhouse gas (GHG) emissions* were reduced during this three-month trial period.

*Since the completion of our project, the trial results have been amended to show that nitrogen oxides and GHG emissions were reduced by 12.4 and 536 metric tons, respectively.

Results

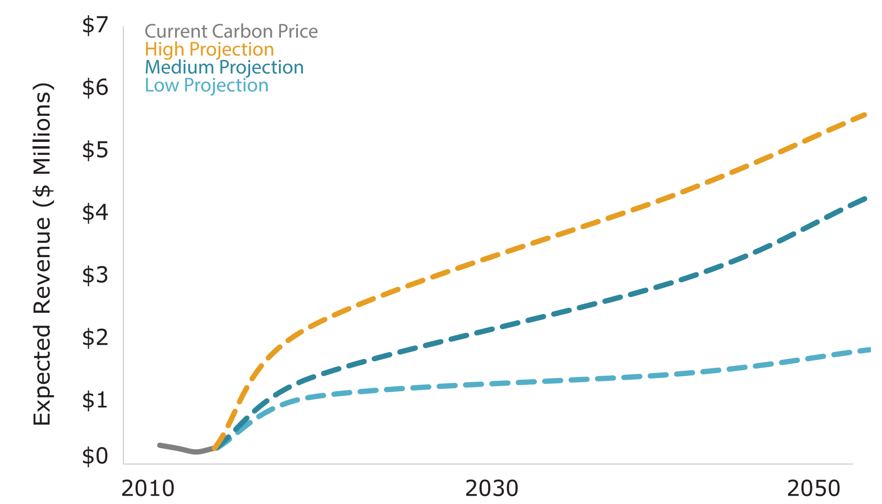
Pollution Prevention Programs

We conducted an extensive literature review and consulted with experts in the field to identify pollution prevention programs that could be modified to include emissions from container ships. The three most feasible options were:

The Greenhouse Gas Credit Exchange
The Voluntary Offsets Market
The Greenhouse Gas Reduction Fund

An **emission credit,** or one metric ton of avoided GHG emissions, is generated by polluters that take additional measures to reduce their carbon footprint. To participate in emission credit markets, ships would reduce their speeds, thereby reducing GHG emissions and generating emissions credits to sell for profit. Revenue is dependent on the price of these credits, and as carbon prices increase over time, revenue for participating ships will grow.

How will revenue generated in these markets change with increasing carbon prices?



Human Health Benefits

- We adapted the methodology of a similar public health study[4] and found that a VSR program would result in a 30% and 17% reduction in ozone in Santa Barbara and Ventura Counties, respectively.
- This level of reduction would generate a combined total of $5.8 million in human health benefits.
- Our estimate does not include non-hospital-related costs, such as inhalers or medications. Health benefits would be greater if these costs were taken into account.

Every year, approximately 52,000 people in Santa Barbara and Ventura Counties are admitted to the hospital for respiratory-related illnesses[5]. Implementing a VSR program in the channel would result in:

Santa Barbara County	Ventura County
1,081 avoided hospitalizations	**664** avoided hospitalizations
$3.4 million in human health benefits	**$2.4 million** in human health benefits

Value of Whale Conservation

$69 — The average American household is willing to pay $69 annually to fund whale conservation on the west coast.

7¢ — Every American household would only need to pay seven cents annually to cover the $7 million implementation cost of VSR.

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

We used this technique to survey more than 2,000 individuals across the country to estimate the monetary value of whale conservation on the west coast.

\+ + >> $7 Million

The economic, environmental, and human health benefits of VSR in the channel vastly exceed the cost of implementing this program. Slower shipping speeds generate benefits in the form of (1) revenue to the shipping industry through participation in pollution markets, (2) increased protection for whales in the Santa Barbara Channel, and (3) improved human health in coastal communities. Our estimates of the diverse benefits of VSR can be used as economic arguments in support of program implementation and mechanisms for capturing the benefits of reduced ship-generated pollution emissions.

Conclusions

Based on our analyses, there are multiple economic arguments that support the implementation of vessel speed reduction. 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 frameworks of three existing pollution prevention programs — the Greenhouse Gas Credit Exchange, Voluntary Carbon Offsets Market, and Greenhouse Gas Reduction Fund — could be modified to incorporate emissions generated by container ships transiting the channel. These modifications would give ships the opportunity to generate revenue by slowing down and reducing their emissions.

The combined health benefits of VSR for Santa Barbara and Ventura Counties are nearly equal to the implementation cost of this program. Reduced air pollution emissions from slower ship speeds would result in fewer hospitalizations for respiratory-related illnesses and fewer missed days of work and school.

Individuals across the country are interested and willing to pay for whale conservation on the west coast. Our results suggest that the average American household is willing to pay an amount far greater than what is needed to fully fund VSR.

Recommendations

We have quantified the diverse monetary benefits of vessel speed reduction, and they can be used to leverage support for VSR from relevant stakeholders. Furthermore, we have identified existing pollution prevention programs that could serve as funding sources for VSR. We recommend that our clients use our project's findings to develop and implement a voluntary and industry-wide VSR program in the channel. If successful, this program could be scaled and implemented along the coast of California where it will continue to produce benefits for whale populations and coastal communities.

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6. Painted Bren Logo by Allison Horst
7. Icon Credits: Khanh Mai (whales), Nicholas Menghini (house), Kelly Turgeon (man), Simon Child (air pollution), Curtis Free (price tag), David Scama (hospital), Icon Island (dollar sign), and Oliver Guin (ship).

Project Clients

Santa Barbara County Air Pollution Control District · NCCOS · National Marine Sanctuaries Channel Islands

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