



An economic approach to understanding the international transfer of bycatch from unilateral bycatch reduction policies



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ABSTRACT

This paper contributes to an interdisciplinary discussion on the role of unilaterally imposed bycatch reduction policies vis-à-vis multilateral bycatch reduction agreements in an open economy. Through international trade, unilaterally imposed bycatch reduction policies can lead to a transfer of bycatch related environmental damage to foreign countries. The magnitude of this *transfer* or *spillover* effect depends on many economic factors. The paper includes an analytical discussion of those supply and demand side factors, which can be used to explain the differences in empirical findings of the transfer effect in various contexts. From a policy perspective, the discussion serves to define the extent of government intervention needed to mitigate the spillover effect in any given context. It also helps to identify the scope of regional multilateral bycatch reduction agreements as a way of coordinating efforts among countries that participate in bycatch related fish trade.

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1. Introduction

In an open economy, unilateral environmental policies that are designed to correct local production externalities may provide a basis for a shift in production to the country's trading partners. Depending upon the particular nature of the environmental problem, a shift in production could result in transferring some or all of the environmental damage to foreign production locations.

There are two fundamental questions of interest in this context. First, what is the magnitude of this trade induced leakage of environmental damage? This is essentially an empirical question and depends on the availability of international data on all relevant variables. Second, what are the underlying market related factors that determine the *magnitude* of this *transfer effect* or *spillover effect*? From an environment perspective, this trade induced transfer effect is of importance if the policy imposing country's welfare is a function of global environmental damage. In that event, the trade leakage from unilaterally imposed environmental policies may reduce the benefits from domestic environmental policies if the reduction in environmental damage in the domestic environment is offset by an increase in environmental damage in the foreign location where production is transferred. From a trade perspective, there is the concern about domestic

industries, which are required to comply with environmental regulations, losing competitiveness to foreign firms that do not face similar regulatory requirements.

This paper provides a discussion related to both questions listed above within the context of unilaterally imposed marine policies and multilateral environmental agreements designed to protect global marine resources. The focus is on understanding the market related factors that affect the magnitude of the transfer effect associated with unilaterally imposed bycatch reduction policies. The motivation for this paper primarily stems from bycatch of non-marketable species such as sea turtles, sea lions and dolphins though the proposed framework is equally useful for assessing the impact of international trade on bycatch species with market value.

The paper is structured as follows. In the following section, we provide the context and the policy background that motivates this discussion. In [Section 3](#), we use a simple analytical framework to analyze a set of supply side factors that affect both the domestic bycatch level and the trade induced transfer of bycatch. [Section 4](#) extends the model to consider the impact of consumer preferences on global bycatch level. The final section provides a few concluding remarks.

2. Context

To the best of my knowledge, only four recent studies, Refs. [\[20,17,2,9\]](#) have investigated the spillover effect of a unilaterally imposed U.S. bycatch policy. All four studies focus on the

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2001 shutdown of the Hawaiian swordfish industry. In an attempt to allow the target species to grow and to reduce sea turtle bycatch from swordfish fishing, the Hawaiian swordfish industry was closed from 2001 to 2004. Before the industry was closed, it supplied about 74 percent for annual swordfish produced in the country between 1991 and 2000 [9]. This rather drastic policy decision allowed for a natural experiment to identify a market transfer effect of sea turtle bycatch to the foreign regions where swordfish is harvested to be exported to the United States. Refs. [20,2] did not quantify the transfer effect in terms of relative changes in the number of sea turtle interactions. Ref. [20] showed that imports from Ecuador and Panama increased significantly when the Hawaiian swordfish fishery was closed. Ref. [2] compared bycatch-to-harvest ratio (the bycatch rate) for different fisheries and showed that the ratio fell comparatively for the Hawaiian industry after the fishery was reopened and management measures were implemented. Ref. [17] was the first to quantify the transfer effect in terms of number of sea turtle interactions. They found that the Hawaiian swordfish fishery shut down led to an additional 2882 sea turtle interactions in other parts of the world. For all non-U.S. fisheries in their sample, they used the same bycatch rate calculated based on average bycatch rates from previous studies. Ref. [9] advances the [17] study in two ways. They focus on a longer time frame and use estimates of country and fleet specific bycatch rates to provide a more accurate estimate for the additional sea turtle interactions in foreign locations.

While an empirical analysis provides an estimate of the bycatch transferred through trade in a particular context covering a specific time period, a theoretical framework is needed to identify and understand the economic factors that can affect the magnitude of this estimate in any time period. This is particularly important in the context of bycatch because consistent time, zone, and industry specific global bycatch data are often not available for numerous reasons. For example, the stochastic nature of the externality, migratory nature of the bycatch species, limited information of the spatial and temporal distribution of the target and bycatch species, all make it difficult to accurately gauge the impact of any bycatch reduction policy on the stock, which is typically unknown. Another major impediment to the conservation effort is the challenges associated with monitoring marine resources and fishers' daily at-sea activities, given a limited budget. That makes it challenging to obtain accurate estimates of zone specific bycatch rates over time, which can be affected by unilaterally imposed bycatch reduction policies. These challenges partly explain the relatively small body of empirical literature on the impact of bycatch reduction policies.

The United States has made two major attempts to counteract the trade leakage that resulted from its bycatch policies. The first attempt was made in 1989 through Section 609 of US Public Law 101–102, commonly known as the Shrimp-Turtle Law. In 1987, the U.S imposed the TED regulation on the domestic shrimp industry with the aim to reduce sea turtle interactions and bycatch associated with that industry [15]. Following the passage of the TED regulation, in 1989, the United States initially imposed trade embargoes on fourteen Caribbean states that did not have comparable turtle bycatch reduction policies [21,3].¹ By 1996 the trade ban was extended to a large number of shrimp exporting countries all over the world.

The second attempt was made in August, 1990, when the U.S. imposed trade embargoes on tuna imports from Mexico because the harvest did not meet the criterion to be certified as “dolphin-safe”.

The embargoes also affected the intermediary countries that handled the tuna en route to the U.S. from Mexico. In February 1991, Mexico requested a panel to dispute the U.S. move to ban its exports. The panel reported to the GATT members in September 1991. Its key conclusions were, (i) the U.S. could not impose embargo on tuna imports from Mexico on the grounds that the Mexican regulations on its tuna harvesting methods did not satisfy U.S. regulations, and, (ii) GATT rules did not permit one country to take trade actions in an attempt to impose its domestic law on another sovereign country, even if the intention was to protect health or exhaustible natural resources in a foreign environment.

Both these moves were overruled by the WTO panel and the U.S. had to do away with the trade restrictions.² In the shrimp turtle case, the U.S. lost its case because it was found to discriminate among countries that were banned from exporting shrimp to the U.S. by providing financial and technical support to the Caribbean nations and a longer transition period for those fishers to adopt turtle friendly devices. Other countries such as the East Asian countries did not receive these benefits [21]. In the tuna import ban case, the U.S. and Mexico held bilateral consultations to reach an agreement outside GATT.

These two cases highlight the need to coordinate efforts among countries to reduce the trade induced transfer of environmental damage, which stem from unilaterally imposed bycatch reduction policies. A thorough understanding of the natural and economic factors that affect the size of the transfer effect can provide valuable region, country and industry specific information even when consistent, reliable data on fleet interactions with bycatch species are unavailable. Information on the variables that affect the volume of interactions might still be available, which can be used to forecast whether, in any given context, trade flow can be expected to result in significant transfer of bycatch related environmental damage. Also, it is a step toward understanding the effectiveness of unilateral bycatch policies in an open economy. The 1989 Shrimp Turtle law and the consequent events provide some justification for this argument.

The countries that faced the trade embargoes differ (in some cases, significantly) among each other on some or all of the factors analyzed below. For example, Thailand and India have consistently remained among the top ten shrimp exporters (in terms of volume) to the U.S. for the last two decades and they were among the countries that faced the trade ban. However, even in the early nineties more than 60 percent of Thai shrimp supply was aquaculture production (no bycatch). Currently, over 80 percent of total Thai shrimp is from aquaculture production. On the contrary, 70 to 80 percent of the Indian shrimp production is wild caught in a marine environment where various turtle species are found. This implies that almost 80 percent of Thai shrimp can be classified as “turtle-safe” because of the choice of technology, whereas for India this percentage is only around thirty.

Another comparison can be made between two countries that faced the trade ban and are located in different parts of the world, such as India and the country of Trinidad and Tobago. Both countries primarily supply wild caught shrimp, but fish in very different geographical locations. Thus, for any given change in fishing effort resulting from a U.S. bycatch policy, the net change in the bycatch level in both countries may be significantly different because of the difference in the joint distribution of the target and the bycatch species in the two different fishing environments. Neighboring countries India and Pakistan harvest shrimp in the same marine environment with similar technology (wild capture) and export shrimp to the U.S., but the relative size of their industries and domestic markets

¹ For more details on the Shrimp Turtle case, the following sources are suggested: http://www.wto.org/english/tratop_e/envir_e/edis08_e.htm, <http://ictsd.org/i/publications/3469/>.

² GATT Art.XX (b) permits use of trade measures to protect endangered species.

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