An Analysis of the Impact of IUU Imports on U.S. Fishermen

Executive Summary
June 16, 2016

While global illegal, unreported and unregulated fishing (IUU) annually costs the global economy an estimated $10 to $23.5 billion dollars, there has been very little research conducted to estimate the costs imposed on legitimate producers stemming from these illegal practices. To fill that knowledge gap, World Wildlife Fund (WWF) worked with Gentner Consulting Group, LLC to develop an economic snapshot of the impact of IUU imports on U.S. fishermen.

Primary Finding

The analysis focuses on the immediate economic impact on U.S. fishermen from curtailing unacceptably high levels of IUU imports, finding that **U.S. fishermen could be losing $1 billion dollars in revenue a year.**

If the federal government successfully stops IUU seafood from getting through our borders, **U.S. fishermen could see the equivalent of about a 20 percent raise**, as illegal products in the U.S. market create unfair competition between law-abiding and illegal fishermen, lowering prices that legitimate fishermen can obtain for their products.

Prices are reduced not only by the volume of illegal imports, but also because illegal products come to market without meeting the safety, labor and environmental standards that legitimate fishermen abide by.

The study finds that **U.S. fishermen will be better off economically** when legal product replaces illegal seafood in the U.S. market.

Why it Matters

- Illegal imports put U.S. fishermen at an economic disadvantage
- When illegal seafood products cross our borders and compete in our markets, illegal actors are taking money away from honest American fishermen.
- Stopping the flow of illegal seafood into the U.S. will help both U.S. fishermen and the health of our oceans.

Key WWF Recommendation

In February 2016, the Obama administration released a proposed rule to curb imports of IUU seafood in the U.S. However, the proposed rule only addresses traceability in a limited number of species labeled as “at risk,” rather than all species of fish. If the rule is to keep IUU out of the U.S., all species must be included.

For More Information

The full report, “An Analysis of the Impact of IUU Imports on U.S. Fishermen,” is available at https://www.worldwildlife.org/publications/an-analysis-of-the-impact-of-iuu-imports-on-u-s-fishermen

Contact

Michele Kuruc, vice president for oceans policy, Michele.Kuruc@wwfus.org

---

An Analysis of the Impact of IUU Imports on U.S. Fishermen

June 16, 2016

The document was financed by Oceans 5.

The opinions, findings and conclusions stated herein are those of the author(s) and do not necessarily reflect those of the donor.

Acknowledgements

The economic analysis in this report was conducted by Gentner Consulting Group, LLC.

Table of Contents

Introduction

The global harvest and trade in the products of illegal, unreported and unregulated (IUU) fishing reduces the economic viability of legitimate U.S. fishing operations by undercutting prices in domestic and global markets. This analysis finds that imports of illegally caught seafood into the United States may cost U.S. fishermen $1 billion, or 19% of total revenues from their catch, as a result of price suppression alone. The additional costs to fishermen from the market distortion caused by unfairly traded IUU products are far greater. A longer term impact on U.S. fishermen arises from the depletion of global fish stocks as a result of widespread IUU fishing, valued at $10 to $23.5 billion a year. [i]

Domestic consumers have become increasingly reliant on foreign imports to satisfy a growing demand for seafood. Between 1980 and 2014, consumption of seafood in the U.S. has increased over 60%, with the share of consumption taken by imports rising to over 90%.[ii] The United States vies with Japan for global seafood import dominance with both nations importing 13-14% of global seafood production.[iii]

High U.S. imports reflect the fact that the market for seafood is global. But that market can unfairly disadvantage U.S. fishermen when foreign producers are able to operate under lax environmental controls, lax enforcement of fisheries, safety and environmental laws, and lax or non-existent labor laws. Illegal activities impose social costs globally, lead directly to overexploitation of the resource and impact U.S. industries directly, reducing the price domestic harvesters are able to receive for their product and hurting U.S. fishing communities.

Economics of IUU Fishing

The Effects of IUU Fishing

Due to the clandestine nature of IUU fishing, it is difficult to estimate the total IUU catch and the economic impact of that catch as it moves through the processing, wholesaling, distribution and retail markets. Overall, there has been little work on estimates of the costs imposed on legitimate producers stemming from IUU fishing.[iv] The work that is available has centered on impacts to the biological stock, the economic and social impacts of IUU fishing, the determinants of fishermen's participation in IUU activities, and the methods for deterring IUU fishing.

Global estimates of illegal and unreported fishing range from 13-31% of catch.[v] Additionally, in some fisheries, actual catch may be three times or more of the allowed harvest. A recent report on the Russian snow and king crab fishery, found that the level of overharvest due to illegal harvesting was two to four times the legal limit over the past decade.[vi]

This global IUU catch is finding its way to the U.S. market. An analysis of seafood imported to the United States estimated that between $1.3 and $2.1 billion, or 20-32% of U.S. wild-caught marine seafood imports in 2011, was illegally caught or the catch was not reported.[vii]

In addition to IUU harvest of targeted species, IUU activity has a huge impact on other species such as seabirds, turtles and marine mammals. As IUU fishers operate outside the law, many do not use technologies or techniques that reduce bycatch or harm to habitats. One estimate from 1998 stated that 50,000 – 89,000 seabirds were killed during IUU fishing for toothfish, in contrast to only 1,562 seabirds killed by the legal fleet.[viii] Additionally, high grading, where larger or better quality individuals or higher valued species are retained and smaller/lower quality individuals or lower value species are discarded, is more prevalent in IUU fishing in order to obtain a higher payoff. This has a direct and negative impact on the overall productivity of the resource and leads to reductions in legitimate fisher's revenues. Other studies have also found that IUU boats have much higher rates of seabird and cetacean bycatch.[ix]

IUU activity reduces the contribution of domestic and high seas fishing fleets to a nation's economic output while reducing government revenues and raising costs.[x] Illegal fishing:

- Reduces landing fees and taxes.
- Has ripple effects through local economies, reducing the economic activity across all other supporting shore side businesses, resulting in lower income tax revenues across those sectors.
- Greatly increases fisheries management and compliance monitoring costs while reducing the reliability of fishery science used to manage stocks.
- Reduces government revenues from negotiation of fisheries access agreements if IUU activity is pervasive.
- Depletes ocean fisheries in ways that increase risks of collapse, with implications for fishing incomes, the viability of communities and government revenues.

IUU fishing also creates negative social impacts. For developing countries in particular, IUU fishing can jeopardize food security, and IUU harvesters may often conflict with local artisanal fleets. Many IUU vessels are crewed from impoverished countries in order to reduce costs.[xi] Conditions that include slavery have been found on vessels, as well as the use of bonded labor, poor nourishment, widespread injuries and unhygienic conditions leading in many cases to illness. Violence towards workers, including restraining crew with chains or shackles, is also well-documented.[xii] Because IUU boats are outside the law, they ignore safety regulations and avoid inspections that increase costs. Furthermore, due to the risk of vessel forfeiture, many IUU boats are often old and decrepit, and with safety conditions on these boats routinely ignored there is a greater risk of injury and death for crew members.

IUU fishing leads to unsustainable harvest levels, undermining important fisheries management goals and resulting in a downward biological and economic spiral.[xiii] In the face of under-reporting of IUU harvest, fisheries management is forced to be cautious, leading to lower legal catch limits and reducing confidence in stock assessments.[xiv] Restricting catch limits to return the fishery to sustainable production can in some cases increase the level of IUU activity, leading to a downward spiral.

The results is that legitimate fishers are pushed out of the market and, because of their lower operating costs, IUU fishers gain an unjust economic advantage over legitimate fishers.[xv] Furthermore, the competition between legitimate and IUU fishers generates costs for legitimate fishers and fishing communities through smaller catches, lower incomes, and lower employment. Reinforcing the downward spiral, these impacts are compounding and will likely be worse in the future as stocks become

increasingly depleted. Ultimately, unchecked IUU fishing will push legitimate fishers out of business, an outcome particularly harmful to communities dependent on fishing.

Economic Drivers of Illegal Activity

As with all enterprises, the profit motive drives IUU fishing.[xvi] Economic theory says that criminals maximize their utility by balancing the costs of being caught with the benefits of stealing fish.[xvii] [xviii] On the benefits side for illegal fishermen, global demand for seafood is increasing while the supply of wild-caught fish is fixed or decreasing due to management constraints. This has the effect of pushing seafood prices up and increasing the incentives for IUU fishing on the most valuable species.[xix] And because the costs of IUU operators are much lower than those of legitimate fishermen, profits are higher for IUU fishing even on lower value species. IUU fishers face lower operating costs since IUU vessels do not typically pay for observers, licenses, access fees, data collection, or monitoring, nor do they necessarily comply with safety rules, bycatch rules, labor rules or other rules that legitimate operators face that increase costs. IUU fishers may also be able to obtain fuel and other supplies on the black market, further reducing their operating costs and increasing the benefits they receive from cheating.

On the costs side of their cost-benefit analysis, illegal fishermen will calculate the downside of being caught: 1) detection likelihood; 2) penalty costs and avoidance costs; and, 3) moral and social costs. If any of these costs rise, the likelihood of participation in IUU fishing decreases.[xx] Detection likelihood is driven by the effectiveness and efficiency of enforcement, social acceptance of cheating, awareness of regulations, and level of private or NGO detection activities. Penalties increase costs directly and can include fines, forfeiture of boat, forfeiture of catch, and exclusion from the fishery. IUU fishers spend resources to avoid detection, such as paying bribes to falsify documents, tampering with their vessel monitoring systems (VMS), using transshipment vessels that effectively obscure the identity of the source fishing vessel, and other activities. Finally, moral and social standing in the community can impact participation. In many communities, the true social cost of cheating is not understood by the community, thereby reducing the moral or social cost of participating.[xxi] When communities and legal fishers understand the competitive disadvantage they face, the moral and social cost of IUU fishing for neighboring operators is greater.[xxii]

One final factor, global overcapacity, remains as a potential driver of IUU fishing.[xxiii] Legitimate fishers owning more capacity than they need to catch their quota may be induced to participate in IUU activities to keep that capacity employed.

Impact of IUU Imports on the U.S. Industry

U.S. fishermen harvested 9.5 billion pounds of seafood domestically in 2014, worth $5.4 billion.[xxiv] Of this total, over 7.8 billion pounds worth $5.3 billion was edible fish and shellfish. U.S. seafood imports totaled $19 billion in 2015, representing over 90% of U.S. consumption of seafood. As noted previously, 20-32% of wild-caught U.S. seafood imports are estimated to be the products of illegal and unreported fishing.[xxv]

This flow of illegal imports increases the volume of seafood in the U.S. market, suppressing prices for domestic harvest. It also undercuts the price received by domestic harvesters because of lower production costs for illegal harvesters. And given its global scope, illegal fishing also affects the price that U.S. fishermen can obtain in their export markets. This analysis quantifies only the first factor, the impact from domestic price suppression from the sheer volume of imported IUU product, although the losses caused by price undercutting by IUU products are likely to be much greater.

Reducing the flow of IUU caught fish into the US market would allow domestic fishermen to receive a fair price for their product, resulting in more income and spending. This infusion of revenues would come from seafood consumers across the U.S. and elsewhere paying a fair price for the seafood they buy, rather than supporting illegal fishing.

Price Suppression

Quantifying how prices respond to the flow of illegal product is at the heart of determining the cost that illegal seafood products have on the domestic industry. This analysis looks only at the downward effect on seafood prices from the sheer volume of illegally caught imports and not the potentially much greater cost from the uncompetitive pricing of illegal products.

The extent of price suppression can be estimated using the economic concept of *price flexibility*, or the percentage change in price associated with a 1 per cent change in quantity, all other factors remaining constant.[xxvi] In the case of imports, we are looking at the cross-price flexibility of imported seafood for domestic seafood, or the impact that a change in the quantity of imports has on the price of seafood in the United States.

These flexibility estimates are generally calculated as inputs to larger models. In a model prepared for NOAA in 2008 to analyze international fishery trade measures, economists estimated that on average for all seafood species, U.S. dock prices are reduced by 1.27% for every 1% increase in the volume of imports.[xxvii] For some species the impact from changes in the volume of imports are greater. For example, the price of salmon will fall 5.5% for every 1% increase in import volumes, while the price of other seafood products, such as tuna, are less responsive than average to changes in imports.[xxviii]

The volume of IUU imports for the purposes of this analysis are estimated to be 10% and 15% of total seafood imports (corresponding to 20%, and 30% of wild caught imports, given that about half of total seafood imports are farmed). This is supported by research published in *Marine Policy* that indicates that 20%-32% of imports of wild caught seafood to the United States are illegally caught or unreported.[xxix]

Applying the price flexibility factors to estimates of the volume of illegal seafood imports in 2014, we find that U.S. fishermen may have lost from $675 million to $1 billion in revenues as a result of price suppression from illegal seafood imports.

Table 1 summarizes the price and revenue suppression occurring if 10% or 15% of all U.S. seafood imports are from illegal sources. If 10% of all U.S. seafood imports are IUU product, average U.S. landed

seafood prices are being suppressed by 9 cents per pound from their 2014 average of nearly 68 cents a pound, decreasing revenues to fishermen by $675 million, or 13%. If the U.S. import supply chain contains 15% IUU product, prices are being suppressed by 13 cents a pound and $1 billion in dockside revenue is being lost, or over 19% of total seafood revenues for U.S. fishermen.

Table 1 Price and Revenue Suppression for U.S. Harvesters from IUU Imports: 2014

Percent IUU in U.S. Seafood Imports	Price Suppression* ($/lb.)	Revenue Loss** ($ millions)	Revenue Loss*** (% of total)
10%	$0.09	$675	12.7%
15%	$0.13	$1,012	19.1%

* Cross-price flexibility coefficient of 1.27 applied to percent IUU and average U.S. landed price for edible fish and shellfish of $.675/lb.
**Based on 2014 U.S. commercial landings of 7.8 billion pounds of edible fish and shellfish in the 50 states.
*** Total U.S. landings revenues for edible fish and shellfish in 2014 were $5.3 billion.

Undercutting U.S. Prices

The above approach focuses on the lower prices that U.S. fishermen receive at dockside as a result of the huge volume of illegal fish entering the U.S. market, but it assumes that those imports are at the market price. It does not take into account the extent to which illegally caught products can unfairly undercut the prices of legal products simply because IUU producers have lower costs and are able to offer seafood at far lower prices than domestic producers or imported products that are harvested legally. As a result, the price suppression and economic impacts estimated in this analysis can be seen as the lower bound on the actual costs to harvesters.

Given the opaque nature of the seafood supply chain and the difficulty of identifying IUU product in the absence of required traceability, data on the price discounts that IUU suppliers are able to offer are not widely available. However, one example provides a clear indication. The Inter-Cooperative Exchange, an organization of Alaska crab fishermen, estimates that imports of illegally caught crab from Russia reduce Alaska domestic king/snow crab prices by as much as 25%.[xxx] Even with the huge volumes of illegal Russian crab imported into the U.S. market[xxxi] this is clearly a much greater price drop than that suggested by the price flexibility estimates for crab seen in the literature,[xxxii] and would result in significantly greater losses in revenues than would be estimated under the methodology used in this analysis.

U.S. fishermen must also contend with price pressures from falsely labelled seafood. This problem appears to be widespread[xxxiii] and numerous cases have been prosecuted, including the sales of farm-raised Asian catfish and Lake Victoria perch as grouper, sole or snapper.[xxxiv] In one case, a huge volume of falsely- labelled catfish (about 300,000 pounds) was distributed to supermarkets and restaurants from Panama City through the Gulf coast, deflating the price of grouper in the entire region.

Impact on Stocks

Large scale long term imports of illegally caught seafood have had an impact on U.S. markets and fishermen and in some cases on the health of shared stocks. In the McNab case,[xxxv] high volumes of illegally harvested spiny (rock) lobster from Honduras, with wholesale value of $17 million or more, were imported into the United States for over 10 years before being detected. The volumes of illegal spiny lobster imported by McNab were so great that they exceeded the total output of Florida and seven other states. Following the successful prosecution of the perpetrators, U.S. imports of spiny lobster plummeted 75%.[xxxvi] While the criminals enriched themselves at the expense of lobster fishermen in the U.S. Gulf states, the harvest of undersized and egg-bearing lobsters significantly undermined the sustainability of the Honduran lobster fishery. Furthermore, the illegal fishing of undersized and egg bearing spiny lobsters in the Caribbean reduced the volume of larva that was available to seed U.S. stocks, reducing long term harvest potential in the U.S. fishery.[xxxvii] [xxxviii]

In addition to the costs currently being imposed on the domestic industry from IUU imports, there is the loss to harvesters from the depletion of shared stocks that are subject to IUU fishing. Relieving this pressure could cause the stocks that U.S. harvesters share with other countries to recover more quickly, allowing greater domestic production and corresponding economic benefits. For instance, if a reduction in illegal fishing of bluefin tuna allowed the bluefin stock to recover, domestic producers would at some point be able to benefit from increased catch volumes. Over time, stock sizes may increase if IUU fishing is reduced, potentially increasing future harvest capacity globally and in U.S. waters.

Costs for Fishing Communities

The loss in revenues for U.S. harvesters from illegal seafood entering the market has broader costs for fishing communities. With the captain, crew and owners of legally fishing vessels receiving lower revenues from their catch, they have less to spend on retail, transportation, and housing, and the losses for labor and businesses supplying these goods percolate through the economy. These benefits are not estimated here but can often be several times the value of the initial revenue loss. This analysis also does not incorporate the even greater economy-wide costs from lost production if U.S. fishermen are forced by low prices to remain idle. Alternatively, price suppression can incentivize U.S. fishermen to fish illegally and overfish to replace lost revenues, leading to longer term losses as stocks are depleted.

Caveats

This limited static analysis cannot determine the final impact on prices and revenues arising from the dynamics of economic markets. Over time, foreign or domestic suppliers would likely increase their supply of legal seafood products to make up for the reduced availability of IUU products.[xxxix] U.S. fishermen will continue to be better off when legal product replaces illegally sourced seafood, because their prices would no longer be undercut by seafood products from illegal fishing vessels that do not meet labor or environmental or safety standards.[xl]

This analysis does not incorporate the income and employment losses to importers of IUU products if these products are curtailed. In addition, this analysis has only focused on lost revenue for U.S. harvesters. While U.S. importers and consumers may benefit in the near term from these suppressed prices, in the longer term they are bound to pay the cost as IUU fishing depletes fish stocks, reducing the availability of wild caught seafood on the market. Meanwhile, U.S. fishing businesses and support industries are going bankrupt, driving the decline of U.S. fishing communities.

Conclusion

Illegal fishing is an activity made lucrative through lower costs and ready demand for seafood in major markets. The complex and opaque seafood supply chain, combined with a lack of traceability and adequate regulation, allows IUU seafood to flow largely unchecked across the U.S. border and into supermarkets and restaurants. The cost to U.S. fishermen is high – up to $1 billion in lost revenues arising from price suppression from import volumes alone, with significant additional unquantified losses as seafood prices are undercut directly by unfair competition. Further costs are seen in the detrimental impacts on fishing communities, while the depletion of global stocks has long term implications for U.S. fishermen and seafood businesses alike. Addressing illegal fishing at its source and curtailing access for IUU seafood in the U.S. market whelp to relieve pressures on global fisheries and allow U.S. fishermen to earn a fair price for their catch.

References

Agnew, D.J. and C.T. Barnes. 2004. Economic Aspects and Drivers of IUU Fishing: Building a Framework. OECD. Fish Piracy. Combating Illegal, Unreported and Unregulated Fishing. OECD, Paris. Pp.19-49.

Agnew DJ, Pearce J, Pramod G, Peatman T, Watson R, et al. 2009. Estimating the Worldwide Extent of Illegal Fishing. PLoS ONE 4(2): e4570. doi:10.1371/journal.pone.0004570

Asche, F., T. Bjorndal, and D. V. Gordon. 2005. Demand Structure for Fish. SNF Working Paper No. 37/05. Institute for Research in Economics and Business. pp.44.

Bray, K. 2000. A Global Review of illegal, Unreported and Unregulated (IUU) Fishing. Document AUS: IUU/2000/6. 53 p.

Charles, A.T., R.L. Mazany, and M.L. Cross. 1999. The Economics of Illegal Fishing: A Behavioral Model. Marine Resource Economics. 17:95-110.

Doulman, D.J. 2000. Illegal, Unreported and Unregulated Fishing: Mandate for an International Plan of Action. FAO. Document AUS: IUU/2000/4. 16p.

Evans, D.W. 2000. The Consequences of Illegal, Unreported and Unregulated Fishing for Fishery Data and Management. FAO. Document AUS:IUU/2000/12. 9p.

FAO. 2007. Combating Illegal, Unreported, and Unregulated Fishing Through Monitoring, Control and Surveillance, Port State Measures and Other Means. Twenty-seventh session of the Committee on Fisheries. COFI/2001/7. Rome, FAO.

Gentner, B. 2008. Economic Analysis of International Fishery Trade Measures. Report prepared for the National Marine Fisheries Service Office of International Affairs in support of the National Environmental Protection Act analysis of the trade provisions in the Magnuson-Stevens Reauthorization Act. October 2008. 160p. (unpublished)

Hatcher, A. 2004. Incentives for Investment in IUU Fishing Capacity. OECD. Paper presented at the IUU Workshop, April 19-20, 2004. AGR/FI/IUU(2004)4. 19p.

Herrmann, Mark and Joshua Greenberg. 2006. An international market model for red king (Paralithodes camtschaticus), blue king (P. platypus), golden king (Lithodesaequispinus), Tanner (Chinoecetes Bairdi) and snow (Chinoecetes opilio) Crab. North Pacific Research Board 423 and Alaska Department Fish and Game Final Report, 170 p.

Le Gallic, B. and A. Cox. 2006. An Economic Analysis of Illegal, Unreported and Unregulated (IUU) Fishing: Key Drivers and Possible Solutions. Marine Policy. 30(2006):689-695.

Le Gallic, B. (2007). The Use of Trade Measures Against Illicit Fishing" Economic and Legal Considerations. Ecological Economics, doi:10.106/j.ecolecon.2007.05.01.

Lopez, E and E. Pagoulatos. 2002. Estimates and Determinants of Armington Elasticities for the U.S. Food Industry. Journal of Industry, Competition and Trade. 2(3): 247-258.

National Marine Fisheries Service (NMFS). 2015. Fisheries of the United States 2014. Current Fishery Statistics No. 2013. Eds. Alan Lowther and Michael Liddel. Commerce Dept., NOAA, National Marine Fisheries Service, Office of Science and Technology, Fisheries Statistics Division. September 2015.

OECD. 2005. Why fish piracy persists: the economics of illegal, unreported and unregulated fishing. Paris: OECD.

Pauly D, Christensen V, Gue´nette S, Pitcher TJ, Sumaila UR, et al. 2002. Towards sustainability in world fisheries. Nature 418: 689–695.

Pramod, Ganapathiraju, K. Nakumura, T.J. Pitcher and L. Delagran. 2014. Estimates of illegal and unreported fish in seafood imports to the USA. Marine Policy. Issue 48. P.102-103.

Steinback SR, Thunberg EM. 2006. Northeast Regional Fishing Input-Output Model. NOAA Tech Memo NMFS NE 188; 54 p.

Sumaila, U.R., J. Alder, and H. Keith 2006. Global Scope and Economics of Illegal Fishing. Marine Policy. 30(2006) 696-703.

Van Mulekom, L., A. Axelsson, E.P. Batungbacal, D. Baxter, R. Siregar, I. de la Torre, and SEAFish for Justice. 2006. Trade and Export Orientation of Fisheries in Southeast Asia: Under-Priced Export at the Expense of Domestic Food Security and Local Economies. Ocean and Coastal Management. 49(2006):546-561.

Whitlow, J. 2004. The Social Dimension of IUU Fishing. Paper Submitted to the IUU Workshop April 19-20. OECD AGR/FI/IUU(2004)15. 9p.

World Wildlife Fund. 2014. Illegal Russian Crab: An Investigation of Trade Flow. 40p.

Endnotes

[i] Agnew et al. (2009).
[ii] NMFS (2015).
[iii] FAO. International trade in fisheries commodities, 2012.
[iv] Charles et al. (1999), Le Gallic (2007), Le Gallic and Cox (2006).
[v] Agnew et al. (2009). Agnew et al. examined harvesting in 54 exclusive economic zones and 15 high seas regions focusing on 292 case studies in individual fisheries covering some 46% of total marine harvest globally. They used the anchor point and influence method to estimate IUU levels across broad species groups. Their estimates fall between the MRAG (2005) estimates of $9 billion in global IUU and Pauly et al.'s (2002) estimate of $25 billion.
[vi] World Wildlife Fund (2014).
[vii] Pramod et al. (2014). Starting with the $16.5 billion in edible U.S. seafood imports in 2011 (2.62 million tons) the authors excluded farmed and freshwater species to focus on wild-caught marine seafood imports. For each of the top 10 exporting countries the authors picked the top three exports by species group as a sample, accounting for 45% of U.S. imports of wild caught seafood. The fisheries of origin for these 30 export species groups were researched to assess the extent of IUU fishing in each.
[viii] Doulman (2000).
[ix] Agnew and Barnes (2004).
[x] Agnew and Barnes (2004) and OECD (2005).
[xi] Whitlow (2004).
[xii] AP Investigation: Are slaves catching the fish you buy? March 25, 2015. http://bigstory.ap.org/article/b9e0fc7155014ba78e07f1a022d90389/ap-investigation-are-slaves-catching-fish-you-buy
[xiii] Sumaila et al. (2006), Doulman (2000)
[xiv] Evans (2000)
[xv] OECD (2005). p.13.
[xvi] OECD (2005).
[xvii] Sumaila et al (2006).
[xviii] Bray (2000).
[xix] Hatcher (2004).
[xx] Sumaila et al. (2006).
[xxi] Washington Post, February 6, 2015. "Outcry over jail 'just for catching fish.'"
[xxii] Le Gallic (2007).
[xxiii] OECD (2005)
[xxiv] NMFS (2015).
[xxv] Pramod et al. (2014).
[xxvi] Price flexibility coefficients can be approximated by using the inverse of the own-price elasticity of demand. Ronald Schrimper, Economics of Agricultural Markets. p. 78-79. See also: Principles of Microeconomics, D.D. Tewani, 2003 p. 56.
[xxvii] Gentner (2008). The Econometric Appendix outlines the methodology used to estimate the elasticities/price flexibility coefficients.
[xxviii] Ibid.
[xxix] Pramod et al. (2014).
[xxx] Wall Street Journal. April 3, 2013.
[xxxi] World Wildlife Fund (2014).
[xxxii] A .07% decrease in price for every 1% increase in imports. Price elasticity for king/snow crab estimated by Herrmann and Greenberg (2006).
[xxxiii] Oceana. February 2013, National Seafood Fraud Report; October 2014, Misrepresentation of Shrimp; April 2015, Mislabeling of Chesapeake Blue Crab.
[xxxiv] NOAA "NOAA Investigations into Mislabeling Seafood Protects Consumers and Fishermen" February 4, 2011. http://www.noaanews.noaa.gov/stories2011/20110204_seafoodmislabeling.html Some of the fish tested positive for malachite green and Enrofloxin, both of which are banned from U.S. food products.
[xxxv] U.S. Department of Justice, U.S. Attorney for the Southern District of Alabama, News Release, August 8, 2001.
[xxxvi] Interviews with retired NOAA agents who investigated the McNab case.
[xxxvii] NOAA Office of Law Enforcement press release "Defendants Sentenced for Conspiracy to illegally Import $2.8 million of Undersized Lobster," December 12, 2003.
[xxxviii] Another case in 2003 found $2.8 million of undersized lobster from Nicaragua imported over a 5 year period, with 85 shipments totaling 190,000 pounds destined for a wholesaler in Virginia and other companies in the United States. NOAA Office

of Law Enforcement press release "Defendants Sentenced for Conspiracy to illegally Import $2.8 million of Undersized Lobster," December 12, 2003. Imports of illegally caught spiny lobsters have continued with prosecutions in 2006 (Jamaica) and 2010 (Bahamas).

[xxxix] If domestic producers could increase their harvests, price increases would be lower than estimated but overall income to domestic fishermen would most likely increase. However, with the exception of some tuna quotas which have not been met in recent years, the scope for increased production is limited by hard quotas in many U.S. fisheries.

[xl] However, price increases may be tempered if consumers substitute away from seafood.