Comment on recent paper "Global fishery prospects under contrasting management regimes" by Christopher Costello, Daniel Ovando, Tyler Clavelle, C. Kent Strauss, Ray Hilborn, Michael C. Melnychuk, Trevor A. Branch, Steven D. Gaines, Cody S. Szuwalski, Reniel B. Cabral, Douglas N. Rader, and Amanda Leland which appeared online in the Proceedings of the National Academy of Sciences, March 28, 2016.

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Summary:

This paper shows that there is a triple bottom line, that abundance, catch and profit can all be increased by reforming fisheries management in places where it has not been reformed. It provides the most comprehensive estimates of the status of global fisheries and shows that the large fish stocks of the world that provide 95% of global catch on average are at about the abundance that would produce long term maximum yield, and fishing pressure, on average is below traditional targets. Less than 20% of fish stocks appear to be overfished by U.S. standards.

Main Text

The paper by Costello and others 'Global fishery prospects under contrasting management regimes" that appeared March 28 in PNAS provides the most comprehensive assessment of the status and potential of global fisheries. Its key result is that when stocks are overfished, most can recover within 10 years if appropriate management measures are taken, and, that globally, we could have more catch, more fish in the ocean and more profit. Most of the potential for this "triple bottom line" comes from Asia where fisheries are both large and at present mostly unmanaged. We must distinguish between fisheries that are reformed and those that are poorly regulated and remain in a race to fish.

Diving deeper into the estimated current status of fish stocks, we find it depends greatly on the size of the stock. Although the paper examined the status of 4,324 individual stocks, only 719 of them provide 96% of the catch. These stocks have a potential yield of over 10,000 tons of catch per year, whereas 3500 very small fish stocks account for only 4% of the catch. From the perspective of catch, profitability and fish in the ocean, it is the 719 that are critical and feed us.

We find a very close relationship between the status of fish stocks and their size. One measure of stock status is their average size relative to their abundance that would produce long term maximum yield. Small stocks with potential yield of less than 1,000 T are at 76% of the level that would produce long term yield. The largest stocks (> 500,000 T potential yield) on the other hand, are at 1.34 times this target level. Small stocks are fished harder than large stocks.

Status of Global Fisheries

Potential Yield (1000 MT)	Number of stocks	Total potential yield of this group (1000 MT)	% of all potential yield	Abundance	Fishing pressure	% overfished
0 – 1	2449	539	0.6%	0.76	1.04	19%
1-10	1184	4,303	4.9%	0.83	0.86	19%

10 – 100	553	18,094	20.6%	1.00	0.79	15%
100-500	134	29,354	33.4%	1.09	0.74	17%
> 500	32	35,577	40.5%	1.34	0.60	19%

The large stocks with potential catch > 10,000 MT are on average above the biomass target and below the fishing mortality rate target – that is, they are generally in good shape. Certainly, within each group there are stocks that are overfished (15-19%) and many that are fished harder than good management would dictate.

Why are big stocks in better shape than small stocks? One major reason is that governments, industry and NGOs devote more management effort to large stocks. A second possible reason is that the data available on small stocks are less reliable than for large stocks. We used the catch data provided to the Food and Agriculture organization of the United Nations by individual countries. FAO staff recommended not using stocks with less than 3,000 MT catch, which would eliminate a little over 3000 of the stocks in the analysis.

If we look at U.S. fish stocks, the status is even better. Again large stocks are generally in better shape than small stocks, but abundance is higher, fishing pressure is lower, and the percent overfished lower. Again stocks with a potential yield of more than 10,000 tons constitute 96% of potential yield.

Of particular importance is the low fishing pressure for the larger stocks, so low that the U.S. as a country is giving up considerable potential yield by fishing so conservatively. This analysis suggests we could almost double U.S. harvest by fishing at a rate that would maximize long term yield.

Status of U.S. Stocks

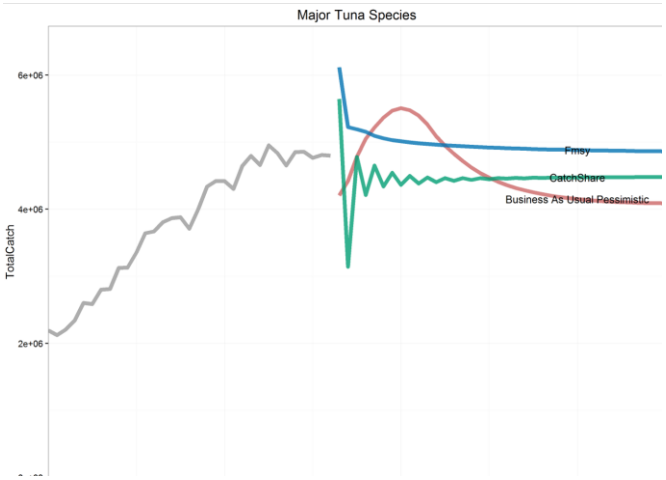
Potential Yield (1000 MT)	Number of stocks	Total potential yield of this group (1000 MT)	% of all potential yield	Abundance	Fishing pressure	% overfished
0 – 1	142	29	0.4%	0.82	1.15	23%
1-10	75	256	3.5%	1.00	0.55	31%
10 - 100	62	2,059	28.3%	1.22	0.58	15%
100-500	12	2,627	36.1%	1.37	0.44	8%
> 500	2	2,301	31.6%	1.26	0.76	0%

A significant limitation in the analysis is that we assume that all stocks are independent and each could be managed to produce its maximum benefits. Many of the problems with U.S. fisheries, and indeed fisheries around the world, occur in mixed stock fisheries. Most U.S. mixed stock fisheries are limited by weak stocks – catch of haddock and redfish in New England is limited by cod and yellowtail flounder. The catch of many species on the west coast of the U.S. is limited by yelloweye rockfish, and catch of

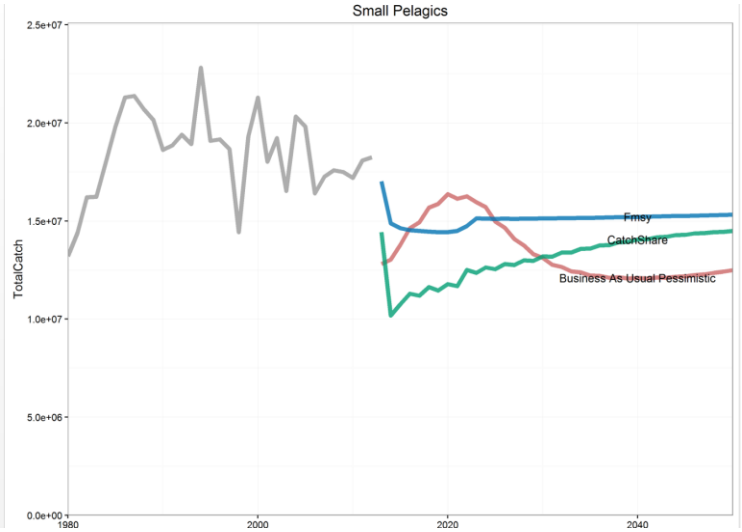
pollock and groundfish in Alaska is limited by bycatch of halibut and salmon. So long as the U.S. insists on trying to minimize the number of overfished stocks, we will have to keep exploitation rates on many species low.

The future potential of whitefish, tuna and small pelagics

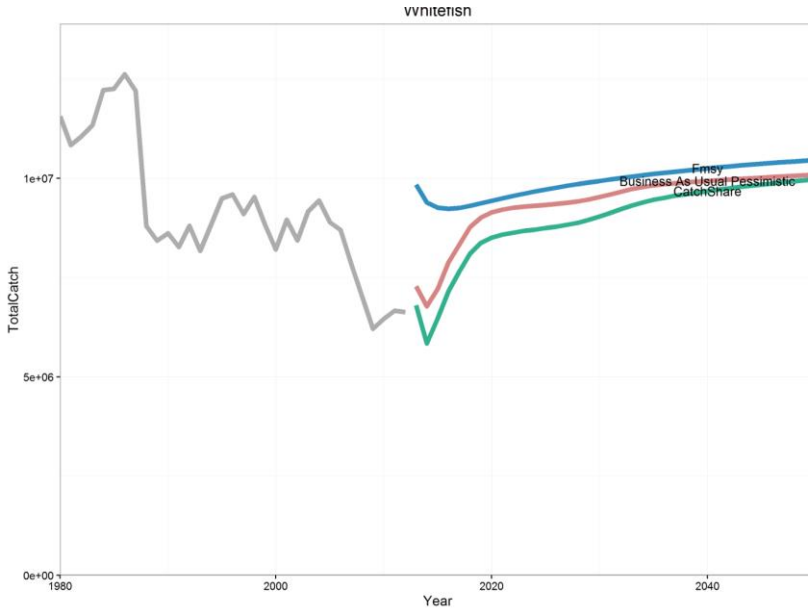
The Costello et al. paper looked at the future of fisheries under different management regimes. The three primary kinds of regimes explored were business as usual, fishing to maximum sustainable yield, and reforming fisheries to maximize economic yield and preventing the race-to-fish. We can look at the predictions under these three scenarios for three groups of fish, whitefish, tunas and small pelagic fisheries.



For major tuna stocks we see no big differences in future yield, under business as usual we anticipate an increase in fishing pressure and catch in the short term, but a decline of catch to levels lower than today as the major tuna fisheries decline in abundance and profits disappear. Reformed fisheries would keep yields about where they are now, and fishing to maximize yield would increase yields slighty.

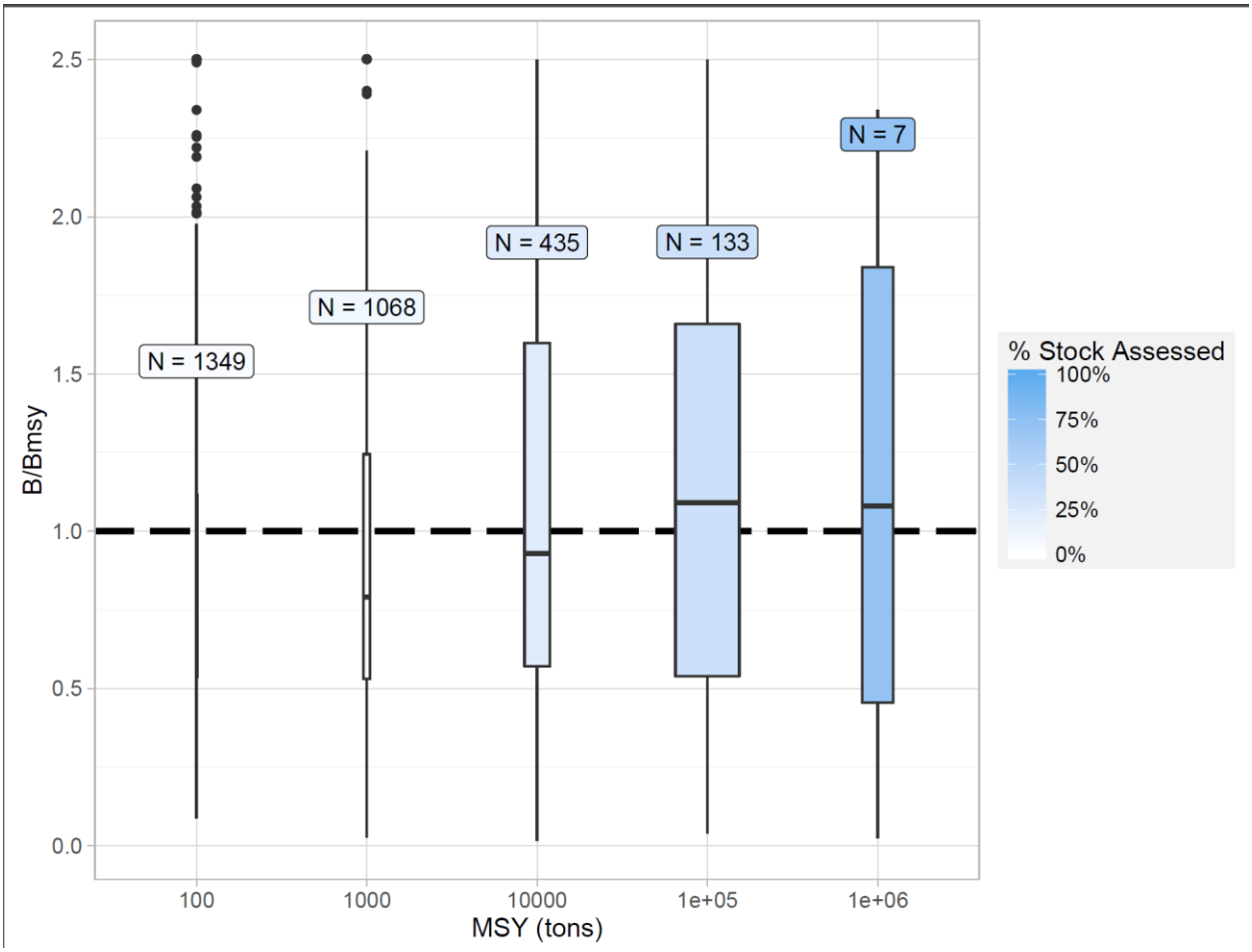


Small pelagics show an anticipated slight decrease in catch under each scenario, with maximization of catch again providing the highest long term catch, and business as usual the lowest.

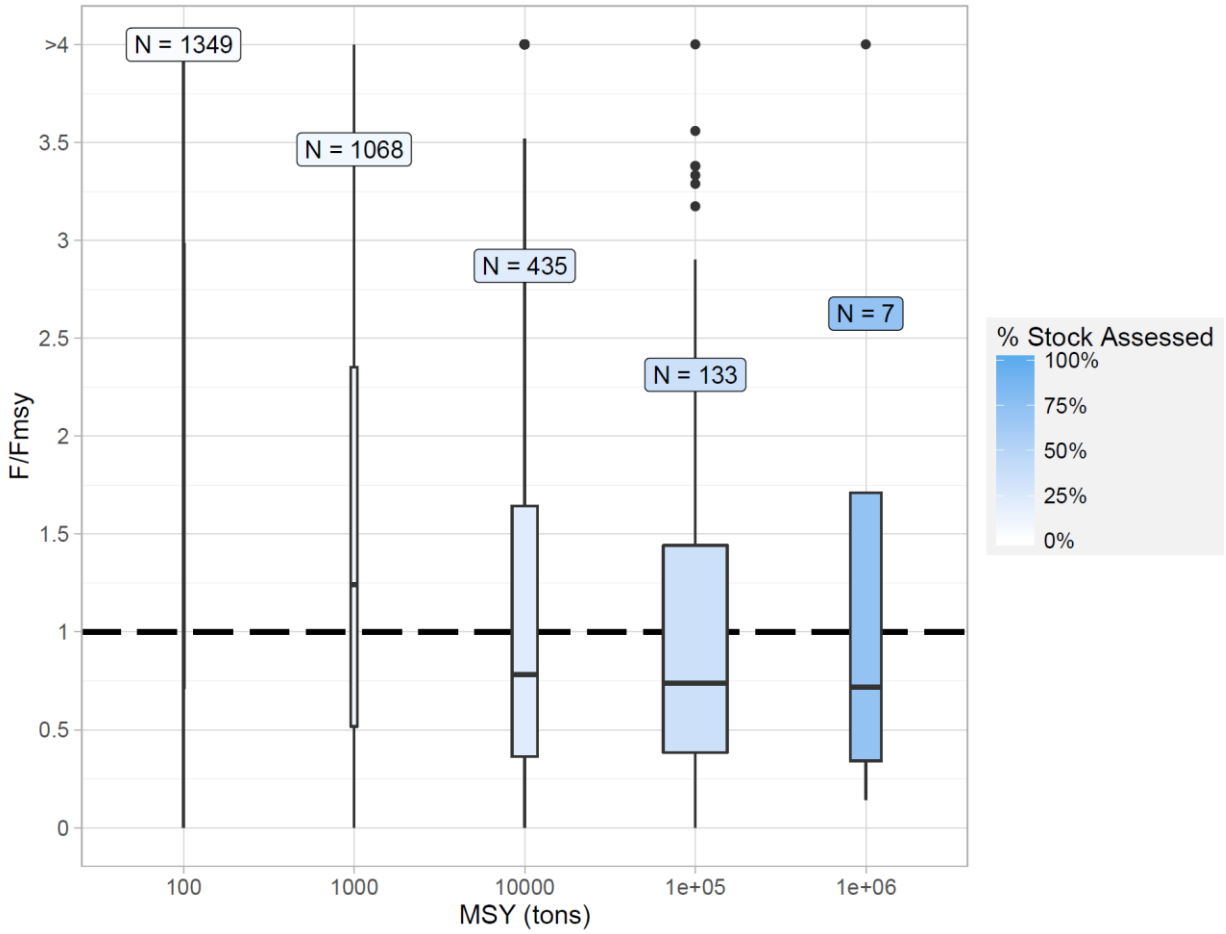


Whitefish show more potential for increase in catch primarily because so many of them are currently underexploited, and moving to maximization of catch would yield an immediate significant increase in yield. Whitefish show reasonably little difference in long term catch across the three scenarios.

Some additional graphics



This graph shows the average abundance B/BMSY compared across size of the stocks. The width of each bar is how much potential yield comes from stocks of that size. The number of stocks in the analysis is given at the top of each bar. The key point is that the larger stocks are on average at abundance that would produce long term maximum yield.



This graph shows F/FMSY, the fishing mortality compared to the fishing mortality that would produce long term maximum yield. The large stocks are on average fished at rates well below the rate that would produce maximum sustainable yield.