food&water watch

Fact Sheet

Hungry Halibut

Offshore Aquaculture's Appetite for Wild Fish Stocks

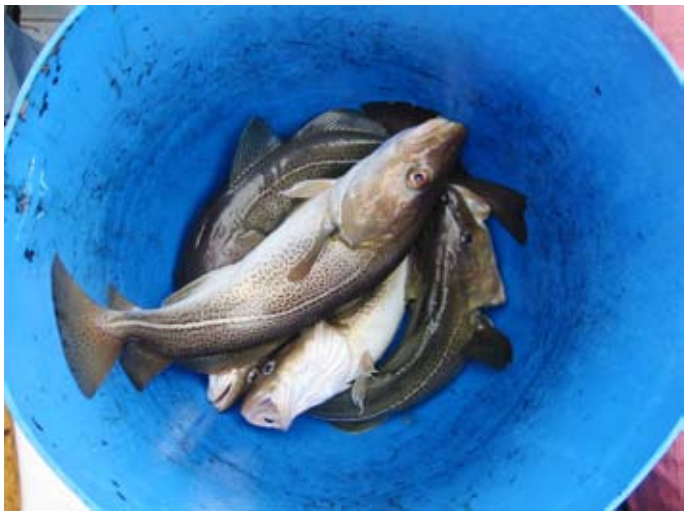
In March 2007, the Bush administration, hoping to reduce the U.S. trade deficit in seafood, urged Congress to reintroduce legislation that would permit raising fish in cages in the open ocean.[1] However, if the United States moves forward with such intensive fish farming, we could soon have a much more serious seafood deficit.

Disappearing Anchovies and Other Small Fish

Industrial fishing fleets take fish from the ocean faster than the fish reproduce.

More than 75 percent of the ocean fisheries have already been fished to capacity or over-fished, and climate change and pollution further stress wild fish.[2] A 2006 article in *Science* predicts that commercial fish stocks will collapse by 2048 if current fishing trends continue.[3] Open ocean fish farming would add to the problem because it relies on small wild fish to feed the fish grown in cages.

The fishmeal industry grinds anchovies, whiting, herring, pilchard, menhaden and other small wild fish, caught in mass quantities off the Pacific coast of North and South America and the Northeast Atlantic, into meal. Removing these fish from the ocean to fatten farmed fish denies food to penguins, whales, and other ocean mammals, and to larger predatory fish. Some of those, including wild cod, bass and grouper, are themselves over-fished or facing extinction.[4]



The Wild Fish to Farmed Fish Conversion[10]
(Under laboratory conditions, with fishmeal as the source of protein in feed)

Fish	Pounds of wild fish used to produce one pound of farmed fish
Cobia[11]	3.27-6.72
Red porgy[12]	4.64
Red drum[13]	3.71-5.56
Atlantic halibut[14]	2.74-3.17
Atlantic cod[15]	2.81-3.07

One-third of the global fish catch ends up as fishmeal or fish oil. Fish farms use about half of the fishmeal and more than 80 percent of the fish oil.[5] In 2003 alone, fish farms consumed about 18 million tons of fish (equivalent to more than 160 billion herring) in the form of fishmeal and oil.[6] For example, from 1988-2003, over-fishing eliminated 99 percent of the South American pilchard, commonly turned into fishmeal.[7]

Fish to Pellets to Fish Again

After turning the small wild fish into meal, fish feed processors mix in vitamins, minerals, cellulose, lipids, and other ingredients, and mold the mixture into pellets. Later, the aquaculture operators feed the pellets to the farmed finfish.

How many pounds of wild fish does it take to get one pound of farmed fish? About five pounds of small fish produce one pound of dry fishmeal or fish oil, which in turn makes up about 40 percent of the feed for marine

Experiments in Replacing Fishmeal with Alternative Proteins[22]
(Maximum replacement without reduced growth, under laboratory conditions)

Fish	Protein Source	Pounds of wild fish used to produce one pound of farmed fish
Halibut[23]	20% wheat gluten	2.10
Halibut[24]	45% soy protein concentrate, w/ methionine supplement	2.39
Cod[25]	25% soybean meal	2.77
Cod[26]	15% crab by-product meal	2.79
Cobia[27]	10% soybean meal	3.04
Cobia[28]	40% soybean isolate	3.66
Cobia[29]	40% soybean meal	3.75
Cobia[30]	40% hemp seed meal	3.80
Cobia[31]	40% yeast protein	3.93
Red drum[32]	40% soybean meal	4.59

finfish.[8] The fish, on average, gain one pound for every two pounds of pellets that they eat, until they reach market size and become food for humans.[9] Thus, every two to six pounds of fish caught in the wild yield one pound of fish raised in a cage.

Vegetarian Carnivores?

Recognizing the irreconcilable tension between declining fish stocks and aquaculture's projected demand for fishmeal, scientists have tried to replace the fishmeal in feed with proteins such as soybeans, canola, wheat gluten, and peas. Scientists have had some success with omnivorous freshwater fish such as catfish and tilapia, but not with the carnivorous fish the aquaculture industry would raise in offshore cages.

These farmed fish need high quality fish protein in their diet. In various experiments, fish had difficulty digesting vegetable ingredients and often ate less of the feed.[16] In one study, all of the cobia fed diets without fishmeal died within five weeks.[17] Almost every fish had reduced growth when an alternative protein replaced more than 40 percent of the fishmeal.[18] Soy protein concentrate, wheat gluten, and other relatively successful substitutes for fishmeal are also quite expensive, which limits their potential for use in commercial fish farming.[19] However, even these ingredients have not pushed the ratio of wild fish to farmed fish below 2:1, which is still a significant net loss.

Fish oil has proved even more difficult to replace in the diets of carnivorous fish than fishmeal. In diets where some fishmeal is replaced, the fish oil content is actually increased to help meet dietary requirements. This is troubling because it takes about 16.7 pounds of wild fish to produce one pound of fish oil.[20] Fish that are fed vegetable oil, such as soybean oil, canola oil, and olive oil, have less of the healthy omega-3 fat and more of the unhealthy omega-6 fat than fish fed diets with fish oil.[21]

Conclusion

At a time when the ocean's wild fish are already overstressed and depleted, it is reckless and unacceptable to promote offshore fish farming. At this point, the practice is not sustainable: two to six pounds of wild fish are required to produce one pound of farmed fish. Members of Congress must stand up for the future of our oceans by opposing H.R. 2010, the 2007 National Offshore Aquaculture Act.

Endnotes

[1] "Commerce Secretary Gutierrez Announces Bush Administration Bill to Boost Offshore Aquaculture." National Oceanic & Atmospheric Administration, Department of Commerce, March 12, 2007, www.aquaculture.noaa.gov.
[2] Tacon, Albert et al. "Use of Fishery Resources as Feed Inputs to Aquaculture Development: Trends and Policy Implications." FAO Fisheries Circular No. 1018, Food and Agriculture Organization of the United Nations, Rome, 2006.
[3] Worm, Boris et al. "Impacts of Biodiversity Loss on Ocean Ecosystem Services." *Science*, 314(5800): 787-790, November 2006.
[4] "Hold the anchovies – Magellanic Penguins need them." BirdLife International, August 1, 2007, www.birdlife.org; "Peru's marine life losing out to fish farms." *World Birdwatch,* 28(3): 7, 2006; Ryan, John C. "The wonders of aqua-Alchemy." *World Watch*, September/October 2003.
[5] Ryan, 2003; Tacon, 2006.
[6] Tacon, 2006. Author estimated that 1 herring = 100g.
[7] Ryan, 2003.
[8] Tacon, 2006.
[9] Ibid.
[10] Calculations conducted by Food & Water Watch based on data drawn from the cited studies. For more information, please contact Lisa Reinhalter at (202) 797-6550, lreinhalter@fwwatch.org.
[11] Lunger, Angela N. et al. "The effects of organic protein supplementation upon growth, feed conversion and texture quality parameters of juvenile cobia (*Rachycentron canadum*)." *Aquaculture*, 264: 342-352, 2007; Chou, R.L. et al. "Substituting fish meal with soybean meal in diets of juvenile cobia *Rachycentron canadum*," *Aquaculture*. 229, 2004.
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[15] Refstie, Ståle et al. "Feed intake, growth, and utilisation of macronutrients and amino acids by 1- and 2-year old Atlantic cod (*Gadus morhua*) fed standard or bioprocessed soybean meal." A*quaculture*, 255(1-4): 279-291 May 2006; Toppe, Jogeir et al. "Inclusion of fish bone and crab by-products in diets for Atlantic cod, *Gadus morhua*." *Aquaculture,* 253 (1-4) :636-645, March 2006.
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[17] Lunger, 2007.
[18] Lunger, 2007; Chou, 2004; Albrektsen, Sissel et al. "Growth, feed efficiency, digestibility and nutrient distribution in Atlantic cod *(Gadus morhua*) fed two different fish meal qualities at three dietary levels of vegetable protein sources." *Aquaculture*, 261(2):626-640, November 2006; Førde-Skjærvik, Oddhild, et al. "Digestibility of diets containing different soybean meals in Atlantic cod (*Gadus morhua*); comparison of collection methods and mapping of digestibility in different sections of the gastrointestinal tract." *Aquaculture*, 261(1): 241-258, November 2006; Refstie, 2006; Lilleeng, Einar et al. "Comparison of intestinal gene expression in Atlantic cod (*Gadus morhua*) fed standard fish meal or soybean meal by means of suppression subtractive hybridization and real-time PCR." *Aquaculture*, In Press, Accepted Manuscript, Available online: February 7, 2007; Kim, Jeong-Dae et al. "Effect of the incorporation level of dehulled soybean meal into test diet on apparent digestibility coefficients for protein and energy by juvenile haddock, *Melanogrammus aeglefinus*." *Aquaculture*, In Press, Accepted Manuscript, Available online March 7, 2007; Berge, G. M. et al. "Soy protein concentrate in diets for Atlantic halibut (*Hippoglossus hippoglossus*)." *Aquaculture*, 178(1-2):139-148, July 1999; Helland, 2006.
[19] Tibbetts, 2006.
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[22] Calculations conducted by Food & Water Watch based on data drawn from the cited studies. For more information, please contact Lisa Reinhalter at (202) 797-6550, lreinhalter@fwwatch.org.
[23] Helland, 2006.
[24] Berge, 1999.
[25] Refstie, 2006.
[26] Toppe, 2006.
[27] Chou, 2004.
[28] Lunger, 2007.
[29] Ibid.
[30] Ibid.
[31] Ibid.
[32] Reigh, 1992.

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