MARINE AQUACULTURE ISSUE PAPER #2

Seafood Trade
Production
Domestic and International Projects
Federal, State and Regional Actions

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Preface: This information is an update of Marine *Aquaculture Issue Paper - Seafood Demand, Production, Obstacles, Federal and State Actions and Opportunities* (Phillips 2005a). Please refer to that document for further information on marine aquaculture by going to http://www.aquaticnuisance.org/articles.php.

Credit: BC Salmon Farmers Association
http://www.salmonfarmers.org/

I. BACKGROUND

Freshwater and marine aquaculture production continues growing worldwide to meet increasing seafood demand. In 2004, total worldwide aquaculture production (excluding aquatic plants) was 45.5 million tons (up from 42.3 million in 2004[1]) (FAO 2006). Also, it is expected that landings of capture fisheries have peaked as most stocks are fully or over-exploited (Johnson 2004). Therefore, aquaculture products will be needed to meet much of the increased seafood demand of a growing global population. One recent and controversial study in the journal *Science*, argued that the world will run out of seafood (wild capture) by 2048 unless significant changes in harvest, habitat protection and other factors are made (Worm et al. 2006). The United Nations' Food and Agriculture Organization estimates that of the seven of the top ten species that account for 30 percent of the world total marine capture fisheries production are either fully exploited or over exploited (FAO 2005b).

The price per pound of Alaska Chinook salmon (See Table 1) continued to rise in 2005, due in part to greater demand for wild caught fish[2]. The price and demand for wild salmon have increased partly because of negative press regarding farmed salmon (e.g., PCB contamination), thus creating a niche market for wild caught fish (Wilhelm 2005).

[1] The 42.3 million ton figure (FAO 2005a) was updated from a preliminary estimate of 41.9 million tons (as reported in FAO 2004).
[2] The growth of the farmed Atlantic salmon industry in the past 20 years has severely impacted the West Coast salmon industry by driving down prices and shifting market share. Alaska's share of the world salmon market fell from 40 percent in 1980 to 20 percent in 2000 (Knapp 2003). The price of commercially caught Chinook salmon in Alaska fell from $2.69 a pound in 1988 to $1.30 in 2002.

Year	Alaska Ex-vessel Price per Pound (Chinook)
1984	$1.73
1985	$1.50
1986	$1.51
1987	$2.11
1988	$2.69
1989	$1.88
1990	$1.86
1991	$1.99
1992	$2.15
1993	$1.55
1994	$1.35
1995	$1.52
1996	$1.30
1997	$1.59
1998	$1.28
1999	$2.30
2000	$1.95
2001	$1.68
2002	$1.30
2003	$1.43
2004	$1.85
2005	$2.23
2006	$2.77 (preliminary)

Table 1: Ex-vessel price per pound of Alaskan wild caught Chinook salmon, 1984-2006 (ADFG 2006a, ADFG 2006b).

II. U.S. Seafood Trade and Aquaculture Production

The U.S. seafood trade deficit grew from $10.8 billion in 2004 to $11.6 billion in 2005 (See Table 2). Shrimp accounted for 30 percent of the value of total edible imports (NOAA Fisheries 2005).

Exports: In 2005, exports of nonedible fishery products were valued at $9.7 billion. The value of exports of edible fishery products was valued at $3.8 billion. The total value of edible and nonedible exports was $13.5 billion – $1.4 billion more than in 2004 (NOAA Fisheries 2005).

Imports: U.S. imports of edible fishery products in 2005 were valued at $12.1 billion – $768.0 million more than in 2004. Imports of nonedible fishery products were valued at $13.0 billion - $1.4 billion more than imported. Total value of edible and nonedible products was $25.1 billion in 2005 –$2.2 billion more than in 2004 (NOAA Fisheries 2005).

U.S. seafood trade deficit (NOAA Fisheries 2005)	2004 - $10.8 billion 2005 - $11.6 billion
2005 U.S. Atlantic salmon imports (Harvey 2005 & 2006a)	~ $1 billion; up over 16 percent from the 2004 total of $871 million
2004 tilapia imports (frozen whole and fresh frozen/fillet) (Johnson 2005)	~ 494 million pounds; up 30 percent from 2003, and eight times higher than in 1996
2004 U.S. and Canada combined percentage of world aquaculture production (FAO 2006)	1.3 percent
2005 value of U.S. aquaculture production (USDA 2005)	over $ 1 billion (see Figure 1)
2005 percentage of U.S. finfish aquaculture production represented by catfish (*Ictalurus punctatus*) (Johnson 2005)	80 percent
2005 value of British Columbia salmon aquaculture production (DFO 2006a)	$318,634,000 (Canadian)
Quantity of tilapia imports to the United States for 2001 and during the first half of 2006 (Harvey 2006b)	2001 - 57 million pounds 2006 - 163.1 million pounds
2005 farmed cod worldwide production (Cherry 2006)	12,000 metric tons
2015 projected farmed cod worldwide production (Cherry 2006)	300,000 – 500,000 metric tons

Table 2: U.S. and international seafood - aquaculture facts

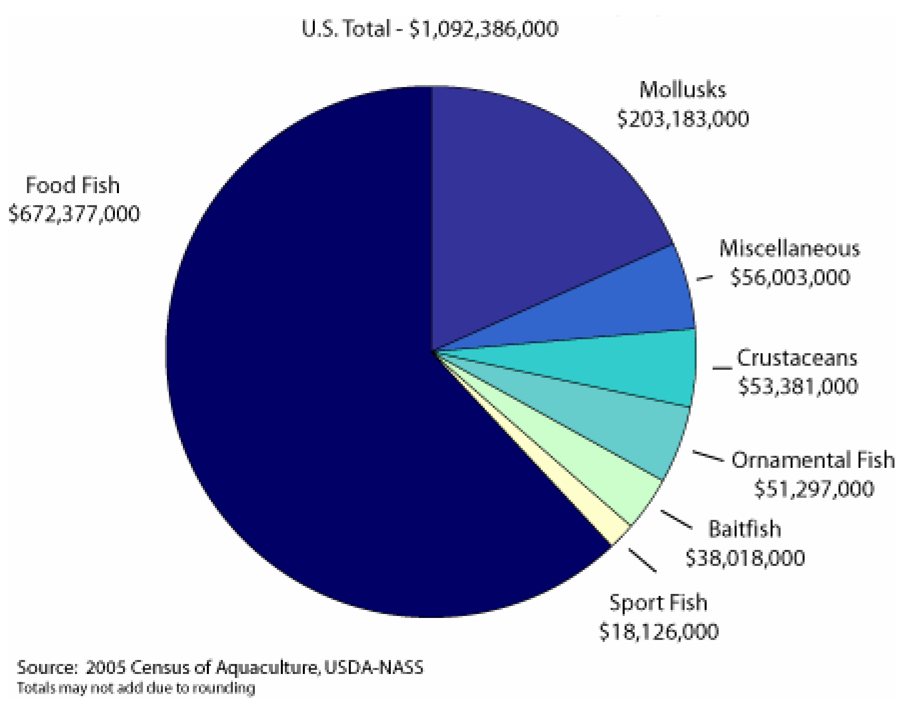


Figure 1: Value of aquaculture products sold by type 2005 (USDA 2005).

III. U.S., Canadian, and International Aquaculture Projects of Note[3]

UNITED STATES AND PUERTO RICO

Gilthead Sea Bream (*Sparus aurata):* Researchers at the University of Maryland Biotechnology Institute (UMBI) Columbus Center are raising gilthead sea bream, a Mediterranean species, in land-based, closed containment systems. UMBI envisions a facility that is 55,000 – 60,000 square feet which will produce 400,000 pounds of sea bream annually. An estimated $3 million investment is needed for such a facility (O'Brien 2006).

Hawaiian Yellowtail (A.K.A. Kahala) (*Seriola rivoliana*)**:** Kona Blue Water Farms in Hawaii is currently producing 5,000 pounds a week of Kahala (under the trade name Kona Kampiche) (Chou 2006). The price for fillets is currently $17.00 per pound and can be purchased online.

Cobia

- At the University of Miami, Dr. Dan Benetti is leading a research team that is attempting to induce cobia (*Rachycentron canadum*) breeding with temperature and light changes to trick the fish into believing it is their spawning season. If this experiment is successful, it could result in year-round breeding. According to Benetti, "It's not a 99 percent chance that cobia will be sold in Costco in five years. It's more like 99.999 percent". (Schonwald 2006).

- By early 2007 Snapperfarm, Inc. a cobia fish farm located in Culebra, Puerto Rico plans to install additional cages and increase production to provide a year-round supply of cobia to markets in Puerto Rico and the U.S.

- In October 2006, MariCal, Inc. and Blue Ridge Aquaculture, Inc. formed Virginia Cobia Farms LLC. This venture will utilize a combined water treatment and specialty feed process that will allow the commercial rearing of cobia in inland freshwater facilities in the U.S. Thirty million dollars will be invested to develop the new technology and method for farm-raising cobia.

- Gulf Marine Institute of Technology (GMIT) continues its efforts to develop a finfish farming (cobia) facility using a decommissioned offshore oil platform complex in the Gulf of Mexico (Texas). Working with the University of Texas, Texas A&M and other sponsors, GMIT hopes to convert this oil and gas platform complex into the U.S.'s largest offshore cage system mariculture production and research project. Legal concerns have slowed the project, including a lawsuit from the State of Texas to shut down the operation (GMIT, no date). Most recently, in December 2005, there was a state court ruling in Texas that allowed GMIT to proceed with its proposed project.

[3] The projects listed here represent a few of the countless aquaculture projects worldwide. Cod, cobia and sablefish farming are highlighted in this document because of their potential to compete in the market place with wild capture fish. Also, cod and cobia farming are in a boom phase (whereas, sablefish is not). For information on Atlantic salmon and other species, see: *Marine Aquaculture Issue Paper (Seafood Demand, Production, Obstacles, Federal and State Actions, and Opportunities*) (Phillips 2005a).

INTERNATIONAL

Categories of finfish farming include hatchery-based rearing from egg to adult (aka "closed cycle aquaculture" or "true aquaculture") and capture-based aquaculture (CBA), which involves capturing "seed" material from the wild, then growing it to marketable size in captivity, using aquaculture techniques. Table 3 shows some production figures for worldwide capture-based aquaculture. The transfer of finfish seed to CBA farms is often characterized by high mortality rates (and thus waste of resources) and has caused conflicts with other resource users (e.g., the obstruction of waterways as cages containing bluefin tuna are towed) (FAO 2004). Concerns about overfishing of wild tuna stocks for CBA grow-out operations have also been raised (Phillips 2005b).

Hatchery-rearing technology is being researched and developed for CBA species. Provided that these technologies prove economically viable, hatchery-reared fry will ultimately replace wild-caught fry (Sophia 2004). Bluefin tuna, a very high value fish, is an example where research is closing in on commercially viable captive breeding technology. The South Australian company Clean Seas Tuna Ltd, recently said they could produce 5,000 metric tons of tuna within a decade (ABC 2006).

Species Group	**Estimated Production** ***(Thousand Tons)***
Eel	**288**
Grouper	**15**
Bluefin Tuna	**10**
Yellowtail	**136**

Table 3: Estimates for capture-based worldwide aquaculture production of eel, grouper, bluefin tuna and yellowtail in 2000 (FAO 2004).

Bluefin Tuna:

- As indicated above, the Australian company, Clean Seas Tuna (Ltd), is nearing its goal of closing the lifecycle on the valuable Southern bluefin tuna. The company says they have already successfully achieved this with yellowtail kingfish (*Seriola lalandi)* and mulloway (*Argyrosomus japonicu*s) as both are in significant commercial production. The Australian government recently provided a grant of $4.1 million to assist in the commercialisation of Southern bluefin tuna breeding.

- With more than eight permitted farms, Mexico produced 3,800 metric tons of bluefin in 2004-2005 (Smart and Sylvia 2006).

Grouper: In Israel, Ardag Red Sea Mariculture, Ltd. continued research on the production of new marine species including white grouper (*Epinephelus aeneus*) and spangled emperor (*Lethrinus nebulosus*) (Wray 2005).

Cobia: Cobia projects are already underway in Thailand, Taiwan, Japan, China, Vietnam, Brazil, Mexico, Belize and the Bahamas.

Barramundi *(Lates calcarifer*): Australia-based Cell Aqua shipped its first batch of fingerlings to the Netherlands as part of its international expansion plans. The company believes that there is the potential to grow 600 tons of barramundi in Europe within the next 10 years, plus there is the potential for other barramundi farms to be established in the U.S. (potentially California, Arizona and Nevada) (FFI 2006).

Dentex and Bream: Mediterranean fish farmers are growing several new species, including dentex (*Dentex dentex*) and several sea breams (sharp nosed sea bream {*Puntazzio puntazzio}*, brown meager {*Sciena umbra*}, white sea bream {*Diplodus sargus*}, red sea bream {*Pagellus bogaraveo*}, and red-banded sea bream {*Pagrus auriga*} (Mitrovich 2005).

Atlantic Halibut: Canadian Halibut Inc. is teaming up with the Canadian government and academic researchers on a $3.3 million research project to test the viability of raising Atlantic halibut (*Hippoglossus hippoglossus*) in an aquaculture environment. The project will be located in the Bay of Fundy where 50,000 juvenile halibut will be placed for performance trials (Intrafish 2006). As of 2006, five countries have reported some level of Atlantic halibut aquaculture production: Canada, Norway, UK, Iceland and Chile (DFO 2006b).

Sablefish:

- One sablefish (*Anoplopoma fimbria)* farm is operating in British Columbia, though more sites are planned (DiPietro 2005).

- Researchers at the University of British Columbia conducted an assessment of the potential ecological and economic effects of sablefish farming in British Columbia (Sumaila et al. 2005). They found that:

> Sablefish aquaculture development in BC is destined to proceed on a trial and error basis with coastal communities and BC’s marine environment exposed to undeterminable risk.
>
> From the experience of salmon farming in BC, it appears that sablefish farming is unlikely to add to (i) BC and Canada’s GDP, (ii) export earnings, and (iii) number of people employed in the sablefish sector of BC’s economy.

- Another sablefish aquaculture study, commissioned by the Department of Fisheries and Oceans Canada and conducted by the Centre for Coastal Health, found the following (Stephen and Fraser 2004):

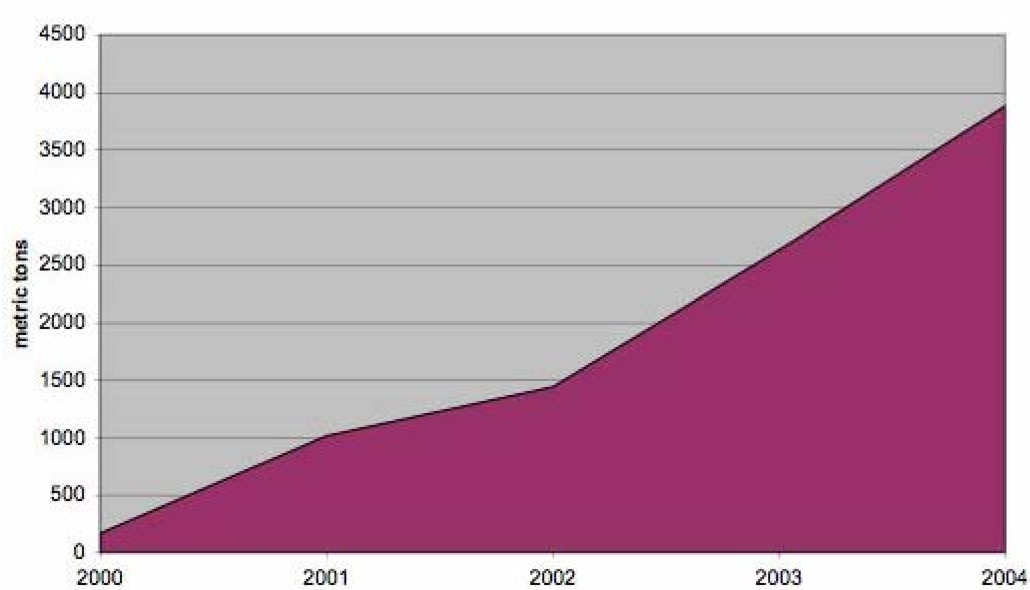
> We agree that sablefish farming will, as all coastal activities, leave an ecological footprint, thus having some environmental impacts. We further believe that the likelihood, magnitude and spatial scale of the impacts sablefish farming at its current and 4 year predicted levels of production will be less than what occurs for salmon farming primarily because the numbers of sablefish produced (and hence biomass) will be significantly less than the numbers of salmon commercially produced by aquaculture in BC. This, in turn, reduces the number of sablefish that might escape and encounter wild fishes or disseminate hazards. It also reduces the ecological footprint of sablefish farming in comparison to salmon farming, including waste discharges. When or if sablefish production levels increase significantly beyond the forecasts we were given, this conclusion must be re-assessed.

Cod:

Global production of wild-capture cod (*Gadus morhua*) has been steadily declining for more than four decades. Capture production fell from a high of 4.1 million metric tons in 1968 to a total production of less than 1.3 million metric tons in 2004[4]. On the other hand, from 2000 to 2004 worldwide aquaculture production increased over 2000 percent (See Figure 2). Current (2005) worldwide cod aquaculture production is 12,000 metric tons. Some project that it could reach as much as 100,000 metric tons by 2010, escalating to between 300,000 and 500,000 metric tons by 2015 (Cherry 2006), with exponential growth occurring in Norway, the UK, and Canada (Sackton 2006).

It is estimated that Norway’s twelve largest cod farming companies have a total production capacity of 115,000 tons (Solsletten 2006). In March 2006 Cooke Seafood harvested its first farm-raised cod in Blacks Harbour, New Brunswick, Canada – a total of 50,000 market size fish (McGovern 2006).

[4] Pacific cod production has remained relatively stable.



Source: Alaska Seafood Marketing Institute

Figure 2: Worldwide harvest of farmed cod, 2000 – 2004 (metric tons) (Alaska Seafood Marketing Institute 2006).

IV. Legislation

National Offshore Aquaculture Act of 2005: In June 2005, Senators Stevens (R-AK) and Inouye (D-HI) introduced the National Offshore Aquaculture Act **(S. 1195).** The bill authorizes the Secretary of Commerce to establish and implement a regulatory system for offshore aquaculture in the U.S. EEZ. **STATUS:** Hearings on the bill were held in the Senate Commerce Committee's National Ocean Policy Study Subcommittee (04/06/06); and the Senate Commerce Committee's National Ocean Policy Study (06/08/06). **STATUS:** This bill was not acted upon in the 109^{th} Congress.

National Oceans Protection Act of 2005 (S. 1224): Introduced in June 2005 by Senators Boxer (D-CA) and Lautenberg (D-NJ), this bill has numerous sections on fisheries management, oceans research, marine mammals, aquaculture and aquatic nuisance species. **STATUS:** This bill was not acted upon in the 109^{th} Congress.

V. Federal, Regional, State and Other Policy Actions

NOAA: In November 2006, NOAA released its 10-Year Plan for the NOAA Aquaculture Program. The Plan addresses NOAA's involvement in marine aquaculture in the United States over the next decade, including program goals and strategies, budget and staffing requirements, outcomes, benefits, and challenges.

Gulf of Mexico Fishery Management Council: The Gulf Council is in the process of drafting an aquaculture amendment to the Reef Fish Fishery Management Plan. At its June 2006 meeting, the Council indicated that the draft amendment should be ready in January 2007.

Alaska: In May 2006, a bill (SB 25, “An Act relating to labeling and identification of genetically modified fish and fish products”) passed the Alaska legislature unanimously and was signed into law requiring labeling of any genetically modified seafood.

California: In May 2006, a bill (SB 201, the “Sustainable Oceans Act”) was signed into law further regulating California’s ocean finfish farming. The law requires regulation of finfish aquaculture locations based on various impacts to water quality, the marine ecosystem and wild fish. The California Department of Fish and Game will develop an environmental impact report for coastal marine finfish aquaculture projects. The report will provide a framework for managing marine finfish aquaculture in a sustainable manner that considers environmental impacts.

Credit: OceanSpar -- http://www.oceanspar.com/

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