



# **Salmon Piranha Style: Feed Conversion Efficiency in the Chilean Salmon Farming Industry**

*Study by the Terram Foundation*

English Language Summary, original study in Spanish available at [www.terram.cl](http://www.terram.cl)

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## **Introduction**

Aquaculture is the food producing sector that has grown the fastest during the last decades. This is confirmed through data published by FAO, which shows that while in 1970 the harvest of cultivated resources represented only 3.9% of the total world supply of fish, crustaceans and molluscs; in the year 2000 its importance grew widely, representing more than 27% of the total supply<sup>1</sup>.

The so called “blue revolution” has been catalogued as the great solution to diminish the pressure on intensely exploited capture fisheries, generated by the growing demand for protein of marine origin. Some researchers have stated that aquaculture not only can significantly contribute to the world’s food demands, but can also directly help in the conservation of aquatic resources and their genetic diversity (Neira & Díaz, 2005).

In this trend, salmon farming has played a significant role, being one of the main activities of fish farming, with a participation of the world’s total aquatic production that reached 12.1% in the year 2003<sup>2</sup>.

Nonetheless in aquaculture in general –and salmon farming in particular- along with the major production of hydro biological resources there is a growing menace. It began when

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<sup>1</sup> El Estado Mundial de la Pesca y Acuicultura (FAO; 2002)

<sup>2</sup> Includes fish and crustaceans (Tacon, 2005)

scientists calculated that to produce a farmed salmon, many kilos of wild fish were required, a situation that placed aquaculture in a vital contradiction, that the pressure on fishery resources is actually increasing and not decreasing as expected.

Currently Chile is the main producer of farmed salmon (along with Norway) and under such conditions it is pertinent and relevant to ask ourselves how many kilos of wild fish are needed to produce one kilo of farmed salmon in Chile.

This study addresses this question also with a brief analysis of the impacts associated to the feed conversion efficiency (FCE) (kg of pelagic fish : kg of farmed salmon) in Chile and its consequences.

### **Conclusions of the Study**

Currently the salmon farming industry is the primary source of demand for fish meal and fish oil in Chile, consuming one third of the domestic production of fish meal and 1.3 times the total production of fish oil. The demand increased as the salmon farming industry grew and it is expected to continue as it grows.

The production of one kilo of farmed salmon in Chile requires at least 8.5 kilos of pelagic fish and if the same conditions continue the FCE could reach 9.9 kilos in the medium term, equalling the depredatory rate of a wild specimen. This situation is of a very high ecological and social cost, because producing one fish from ten of a different species, that has similar nutritional value, is highly questionable from the world food security point of view. Moreover salmon is a product sold mainly to over-fed countries like Japan and the United States.

Salmon feed is composed of an important amount of fish meal and fish oil. During the last ten years these ingredients together have represented 70% of the feed although its proportion has varied. In effect, while the requirements of fish meal have decreased, fish oil has increased significantly. The latter is very complex, because the production of fish oil needs more pelagic resources than those required for the production of fish meal. According to data published by FAO, approximately 4-5 kilos of pelagic fish are required to produce one kilo of fish meal, while for the production of one kilo of fish oil, requires between 21 to 27 kilos.

According to the environmental evaluation of Chile carried out by the OECD (Organization of Economic Cooperation and Development) a rise in farmed salmon production could contribute to the excessive exploitation of capture fisheries. Salmon farming production projections indicate that by 2013 Chilean production will double. If the composition of the feed does not change, this sector will inevitably put huge pressure on pelagic fishery resources that are already depleted.

The OECD also suggested that the pressure on fisheries could be reduced if excess feeding is avoided and the proportion of soy, wheat and lupin flour in the feed are raised. Nevertheless, physical limits exist for this substitution. Research in this area have shown that only upto 25% of the fish's dietary protein can be substituted without significantly affecting its growth.

These facts allow us to infer that under present conditions and those projected, the salmon farming industry is not only unsustainable, but signifies a serious threat to the sustainability of capture fisheries in the South Pacific. Urgent measures are needed to guarantee the protection of capture fisheries.

The full study is available in Spanish at [www.terram.cl](http://www.terram.cl).

**Estimated FCE for the Chilean salmon farming industry (2004)**

Item	Year
	2004
Salmonid production (thousand tons. round)	600.50
Feed used (thousand tons.)	850.0
Feed/salmon conversion ratio (FCR)	1.42
Percentage of fish meal in feed	40
Percentage of fish oil in feed	30
Total FM required for feed (thousand tons.)	340.00
Total FO required for feed (thousand tons.)	255.00
Pelagic resources needed to produce FM in feed (thousand tons.)	1,307.69
% conversion fish/FM	0.26
% conversion fish/FO	0.05
FO produced as sub-product of FM (thousand tons)	62.96
Additional FO needed (thousand tons)	192.04
Pelagic resources needed to produce additional FO in feed (thousand tons.)	3,840.74
Total pelagic resources needed (thousand tons.)	5,100.00
<b>Total feed conversion efficiency</b>	<b>8.5</b>

**Estimated FCE for the Chilean salmon farming industry (2013)**

Item	Year
	2013
Salmonid production (thousand tons. round)	1,283.00
Feed used (thousand tons.)	1,816.07
Feed/salmon conversion ratio (FCR)	1.42
Percentage of fish meal in feed	35
Percentage of fish oil in feed	35
Total FM required for feed (thousand tons.)	635.62
Total FO required for feed (thousand tons.)	635.62
Pelagic resources needed to produce FM in feed (thousand tons.)	2,354.16
% conversion fish/FM	0.26
% conversion fish/FO	0.05
FO produced as sub-product of FM (thousand tons)	117.71
Additional FO needed (thousand tons)	517.92
Pelagic resources needed to produce additional FO in feed (thousand tons.)	10,358.32
Total pelagic resources needed (thousand tons.)	12,712.49
<b>Total feed conversion efficiency</b>	<b>9.9</b>

Source: Elaborated by Terram Foundation based on information from Anuario Estadístico de Pesca SERNAPESCA (2004), SalmonChile and Larraín et al (2005).