USE AND ABUSE OF ANTIBIOTICS IN SALMON FARMING

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SALMON FARMING CAMPAIGN

In the past few years Oceana South America and Antarctica, located in Santiago, Chile, has made continuous efforts on a national and international scale to denounce the salmon farming industrys' lack of sustainability in the south of Chile.

Nevertheless, there remain segments within Chile's government that have yet to assume their political responsibility in this issue, underestimating the scientific evidence that corroborates the real impact salmon farming activities have on our ecosystem.

Our salmon farming campaign is aiming at demanding the moratorium of the salmon industry's expansion for a period of 10 years, which would allow for scientific research as well as for the Chilean authorities to obtain enough resources to effectively regulate the salmon industry. The research would be based on environmental, sanitary, social and institutional arguments.
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PRESENTATION

Based on the article "Residues of tetracycline and quinolones in wild fish living around a salmon aquaculture center in Chile" published in Revista Chilena de Infectología (Rev. Chil. Infect. 2007; 24(1):8-12).

The salmon farming industry had an explosive growth in the past few years, which has made it into one of the most profitable businesses in Chile. This situation has been based on unique and "favorable conditions," which have made Chile the second largest producer of this sought after dish.

These conditions are related to the low labor costs and free use of the water resources. To this we add the pressure that the industry effects on the marine ecosystem, a situation that could have a direct link to the increase, frequency and intensity of red tide.

Added to this are the sanitary problems of salmon farming, mostly the intensive use of a wide range of antibiotics in the production of farmed fish. This practice does not only affect the farmed fish, but also the wildlife that inhabit the surrounding areas of the cages and the human population which ultimately consumes these substances.

This document brings to light a study which analyzes the presence of antibiotics and antiparasite residues in an aquiculture site in Cochamó, in the 10th region of Chile. The results show that the use of antibiotics in salmon aquiculture - as it has been shown in other countries - has environmental effects that go beyond the areas of aquiculture.

Due to the risks of the intense use of antibiotics, it is necessary to determine through wider and more detailed research the importance of the findings that we present, both for human and animal health, as well for the environment.

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1. INTRODUCTION

The development of aquiculture in Chile has been characterized by the use of antibiotics (Bravo et al., 2005). An example of this is the use of Flumequin, a Fluoroquinolone used exclusively for aquiculture purposes, which increased in use from 30 to 100 tons between 1998 and 2002 (Bravo et al., 2005 and Cabello, 2004).

This increase coincides with the increase in salmon production during the same period, from 258 thousand to 494 thousand tons (Bravo et al., 2005), situating Chile as the second largest salmon farming nation in the world, after Norway (Soto et al., 2004).

In this context, the existence of bacterial diseases with financial implications on the industry, have required the use antibiotics for the prevention and treatment of these diseases (Bravo et al., 2005, Cabello 2004, Cabello 2003). As seen around the world, the excessive use of antibiotics in aquiculture has had negative effects on human and animal health, (Cabello 2004, Bjorlundm 1990, Wolf, 2004 and Grave et al., 1999), not to mention damage to the environment (Cabello, 2006, Buschmann et al., 2006, Hektoen et al., 1995 and Samuelsen et al., 1992).

In Norway the wide spread use of antibiotics for the prevention of diseases in aquiculture was completely eliminated, with the purpose of minimizing the harmful effects of the antibiotics and dramatically restricting the amount of these substances, while completely eliminated the use of antibiotics such as quinalones, that have a negative effect on people's health (Buschmann et al., 2006).

Along with these measures, the regulations also control the use of antibioticsfor treatment of diseased fish, through epidemiological control enforced by governmental institutions such as, public health and wildlife agencies (Wolf, 2004, Grave et al., 1999 and Sorum, 2006).

In Chile, as in other parts of the world, the fish farms and cages are surrounded by a wide range of marine ecosystems,

Fish caught during our research.

where artisanal fishermen live and work, gathering shellfish and fishing wild fish for human consumption (Buschmann et al., 2006). Some of these wild species feed from on the leftover pellets and feces of the farmed fish, which gather at the bottom of the cages(Soto and Norambuena, 2004, Sorum, 2006, Coyne et al., 1997 and Kerry et al., 1996).

In this way, a variety of wildlife is involuntarily being exposed to the antibiotics potentially present in the food as well as the feces. For this reason, the flesh of the fishcan be contaminated by residue of antibiotics, with the possibility of passing into the human consumers' digestive tracts. (Bjorlund, 1990, Samuelsen et al., 1992 and Coyne et al., 1997).

Due to the potential harm to human and animal health that the presence of antibiotic residue in marine wildlife can cause, and because this phenomenon has been frequently described (Bjorlund, 1990 and Samuelsen et al., 1992), we decided to perform initial research to reveal whether the wild fish surrounding the fish farming areas contain noticeable quanitities of antibiotics in their flesh.

2. FISH FROM THE SAMPLE

In the month of November 2005, in Cochamo, next to Reloncavi, 60 Kilometers south of Port Montt, Chile, 13 autoctonous fish native to the area were caught next to an Atlantic Salmon (*Salmo Salar*) fish farm (Figure 1A).

The Sample included five Patagonian blennie (*Eleginops maclovinus*), five False jacopever (*Sebastes capensis*) (Figure 1B) and three rainbow trouts (*Oncorhynchus mykiss*) (Table 1). The fishing occurred 30 meters from the farming cages, using an inch long hook, and using as bait food pellets without antibiotics which are used to feed salmons.

The fish were immediately sacrificed once on board. They were measured and later were examined for their stomach content, verifying the presence of food pellets used to feed salmons (Figure 1C).

Immediately after these procedures, the fish were kept in ice and taken to the SGS Aquatic Health's analyzing labs located in Puerto Varas, within a 6 hour time period. In the labs, samples were taken by High Performance Liquid Chromatography (HPLC), able to detect the presence of Oxitetraciclina, Emamectin, Ivermectine and Quinolones in the fish's tissue, substances that make up the antibiotics and antiparasites typically used in Chile's aquiculture industry.

Figure 2
A- Cochamo surroundings near the rafts cage of the study.
B- Cabrilla just captured.
C- Stomach content of a robalo with pellets for salmon..

3. RESULTS

The results (Table 1) indicate that 9 of the 13 sample fish caught in the area of the salmon farms contained salmon feeding pellets in their stomachs.

None of the samples detected any presence of the antiparasites Emamectin or Ivermectine. Table 1 indicates that the meat of the False jacopever which contained pellets had 2 parts per billion of Quinolone Oxolinic acid. In the same way, a Patagonian blennie which also had these farmed salmon food pellets in its stomach had 4 parts per billion of the same substance.

The analysis also found 87 parts per billion of Oxitetraciclina in a False jacopever, which did not contain any pellets used to feed salmons in its intestine.

Pellets used to catch the species used for research purposes.

Table 1. Stomach content and amounts of antibiotics (ppb) in filets of the sample fish, which were located near salmon farming cages in Cochamo, Reloncaivi,10th Region, Chile.

Species	N°	Food in stomach*	Oxitetraciclina (ppb)	Quinolonas (ppb)
False jacopever (*Sebastes capensis*)	1	pellet	ND	ND
	2	seaweed	ND	ND
	3	seaweed	ND	ND
	4	pellet	ND	2
	5	seaweed	87	ND
Patagonian blennie (*Eleginops maclovinus*)	1	seaweed	ND	ND
	2	pellet	ND	ND
	3	pellet	ND	4
	4	pellet	ND	ND
	5	pellet	ND	ND
Rainbow trouts (*Oncorhynchus mykiss*)	1	pellet	ND	T
	2	pellet	ND	ND
	3	pellet	ND	ND

ND: Not detected, Oxitetraciclina <30 ppb y Quinolones <1 ppb) T: amounts between 1 y 2 ppb * All the fish were caught with pellets used to feed salmon.

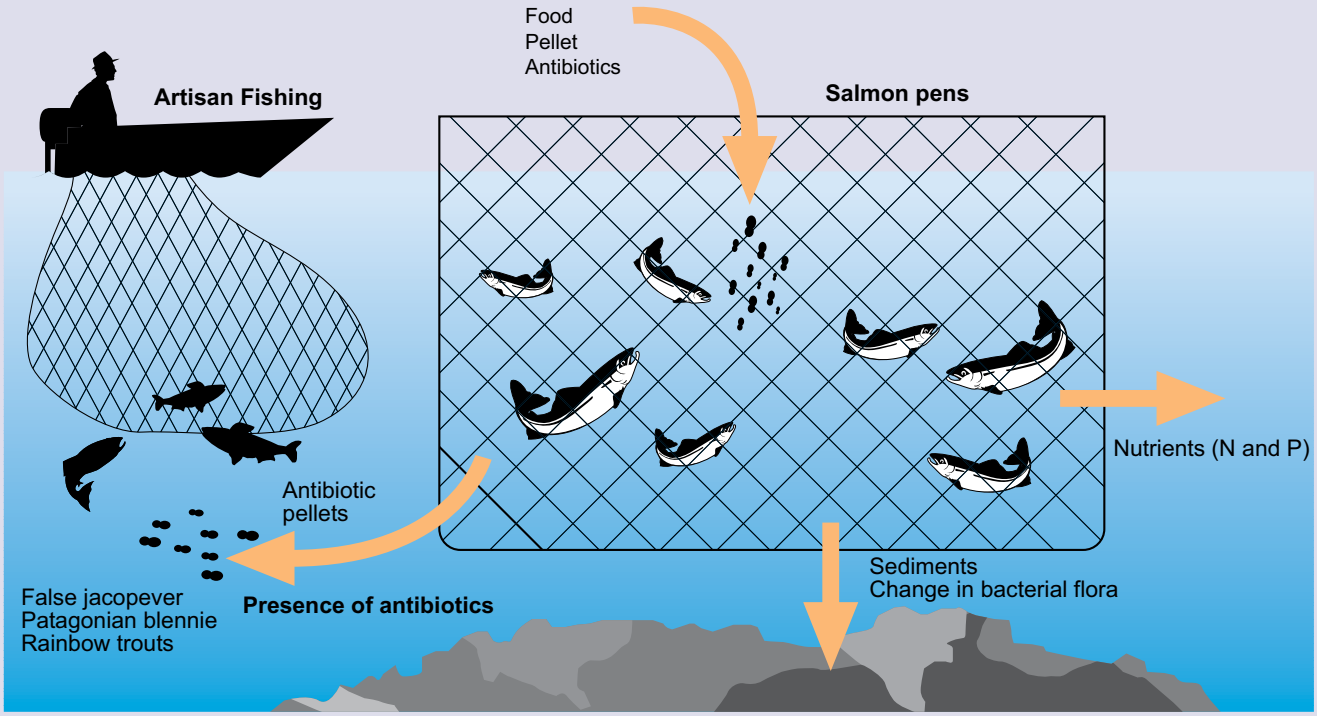
4. DISCUSSION

The results of this study confirm that wild fish that inhabit the surrounding of these aquaculture areas and are consumed by people, ingest the pellets prepared for salmons. The pellets are medicated with antibiotics and other drugs, which then pass to the flesh of the fish, and stay in them in significant quantities (Figure 2) (Bjorlun et al., 1990 and Samuelsen et al., 1992).

Similar results have been found in other regions of the world, where salmon farming is an industry (Degroodt et al., 1994 and Samuelsen et al., 1992). Although this preliminary study shows that the amounts of Tetracycline and Quinolone detected in the marine wildlife are lower than the maximum tolerated by the Codex Alimentarius (200 ppb for Tetracycline and 500 for Flumequin) (Codex Alimentarius, 2006), as well as by Chile's fishing authority Sernapesca (100 ppb for Tetracycline and 600 for Flumequin) (Sernapesca, 2005), the study clearly indicates that the wildlife surrounding these farms is being contaminated with antibiotics (Bjorlun et al., 1990, Samuelsen et al., 1992 and Forum, 2006).

The biggest concern regarding public health is the detectable amounts of Quinolones, an antibiotic which has been outlawed in aquiculture in other countries, due to its negative effect on people's immune system (Wolf, 2004 and Grave et al., 1999).
These findings show that this contamination needs to be monitored, due to its negative effects on humans, animals and the environment, considering that the antibiotic residue in these fish might surpass the amount allowed by national and international regulatory bodies (Wolf, 2004, Grave et al., 1999, Codex Alimentarius, 2006 and Sernapesca, 2005).

Figure 2. The following illustration depicts how salmons are fed with pellets which contain antibiotics. Some of these are not consumed by the salmon, which causes sediments at the bottom of the sea, as well as the ingestion of these antibiotics by fish that are outside of the pens. We can also notice how the boats emit Phosphorous and Nitrogen into the marine atmosphere.



The ingestion of antibiotic contaminated fish meat has the potential of altering the human digestive organs, thus favoring infections such as Salmonella (Cabello, 2003 and 2006), it can also allow for antibiotics that are resistant to the normal flora. There is also the risk of triggering toxic and allergic phenomenon's which can be difficult to diagnose due to the lack of research on the ingestion of these antibiotics (Cabello, 2003 and 2006).

The residue of these antibiotics can also alter the normal flora of the sea wildlife and could infect the farmed fish as well as the aquaculture zones, with bacterial pathogens resistant to the antibiotics (Cabello, 2006, Sorum, 2006 and Husevåg et al., 1991).

The presence of this residue -which contains Tetracycline and Oxolinic acid- in salmon that is exported as well as the ones consumed in Chile, has been the other deleterious consequence which may have financial repercussions on the aquaculture industry in Chile (Ecoceanos, 2006).

The excessive use of antibiotics also has the potential of harming the financial welfare of the industry due to the increase of bacterial pathogens in the fish in addition to the development of new bacteria in the farmed fish and the loss of prestige in the export of products that contain antibiotic residue (Ecoceanos, 2006).

The growth of the national aquiculture industry suggests that the presence of these sanitary problems is increasing in Chile, unless the dialogue between the industry, the consumers and government agencies in charge of protecting human and animal health can agree on measures that regulate the excessive use of antibiotics in the industry (Cabello, 2006, Buschmann et al., 2006a and Herktoen et al., 1995).

The environmental regulations of aquiculture in Chile (RAMA) do not include a regulation on the use of antibiotics in aquiculture, and are mainly limited to the effect of aquiculture on the ocean floor (Buschmann et al., 2006b).

Nevertheless, these preliminary results suggest that effects of aquiculture as we know it, goes far beyond its geographic location, proving that the dispersal of antibiotic residue detected in marine wildlife could reach the human population if these contaminated fish are consumed (Buschmann et al., 2006b).

With this in mind, our findings suggest the need for an ecosystemic approach intended to control the environmental effects, as well as the consequences this activity has on human and animal health (Buschmann et al., 2006b and Hunter-Cervera et al., 2005).

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