UNITED NATIONS

CEPAL
ECLAC

World Bank Training
on Capabilities and Limitations of the Damage and Loss Assessment Methodology
September 26, 2007

EXERCISE TO ESTIMATE THE IMPACT OF AN EARTHQUAKE IN AYSEN, CHILE, ON THE SALMON EXPORT INDUSTRY

INTRODUCTION

Alter the 21 April 2007 earthquake that hit the southern part of Chile, causing the death and disappearance of workers of the Aysen fjord, which was severely affected. As a consequence of the event the Chilean central government and its President Ms. Bachelet, indicated that, given the causes of the tragedy, priority should be given to safeguard the lives and security of the workers.

This caused concern to the salmon industry entrepreneurs –namely those that carried out activities in the Aysen fjord-- who feared that workers would refuse to labor in the area and indicated the major loss to the industry was of its human capital. Workers and trade unions have emphasized the issues of security and the need to establish appropriate control mechanisms for the recovery process and not limit the actions to economical consequences.

Given the intermittent and varying intensity of seismic movements in the zone, both prior and alter the 21 April earthquake which caused landslides and a sea surge or minor tsunami, with major waves that destroyed salmon cultivation centers and killed laborers, the country's government has enforced the closure of those aquaculture enterprises that operated in high risk areas.

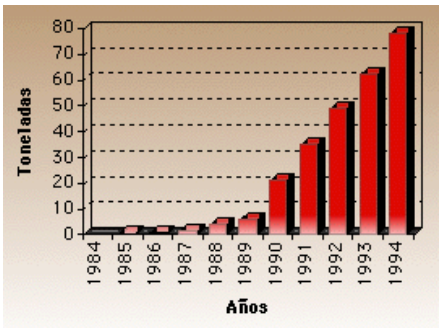
The salmon type known as "Coho" spends in its natural state almost a year in fresh water after birth. It is during this time it absorbs its egg sack and transforms into an alevin parr, able to swim. It is after spring, once it reaches its smolt state that salmon migrates back to the sea, where it will grow and develop for at least three years before returning to its birthplace, reaching in size between 43 and 91 cm. in length and a weight ranging from 600 grams to 14 kilos. Three types of salmon are cultivated in Chile: Coho, Atlantic salmon and rainbow trout (Salmo gairdnierri irideus). (See pictures)

The human impact of the measures taken by government after the earthquake, added to the assets destroyed and the loss of economic activity, as well as its consequences on livelihood of the workers in the area has been the subject of controversy. This exercise aims at quantifying the effects of the event in only one aspect: its consequences on salmon exports, and based on those, the potential loss of jobs. The other aspects, which may be commented on or discussed in the exercise, require a further analysis that exceeds the purpose of the exercise as presented.

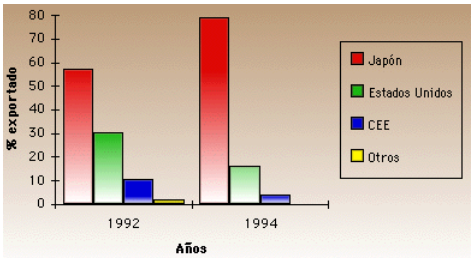
THE CASE

Chile has become very rapidly –in less than 15 years—the second world producer of salmon and the first producer of trout. Over the last ten years, since the nineties, the rate of growth has exceed an annual average of 22%. By 2006, the salmon and trout aquaculture represented 4% of the country's total exports and more than 50% of its fisheries' exports. It is because of this that salmon producing enterprises indicate that their activity is the fastest growing food sector export in the country, 70% of which have value added..

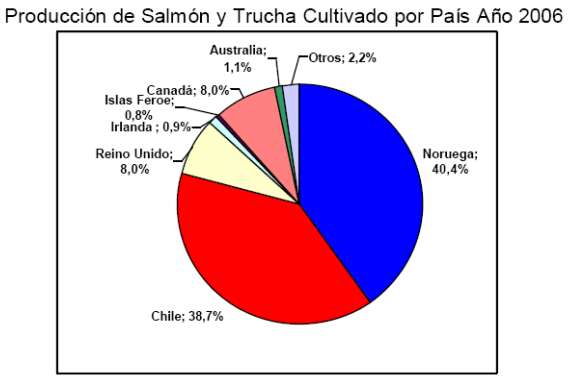
The graphs illustrate the weight of this activity in 2006: 38.7% of world production of salmon ant trout and exports in excess of 2,2 billion dollars.

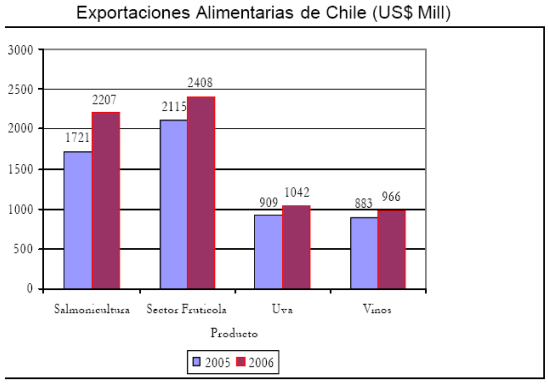


Producción de Salmón en Chile.



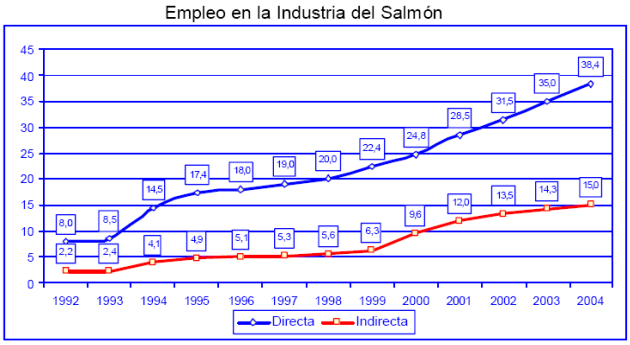
Destino de las exportaciones de salmón en 1992 y 1994.





In terms of employment, the salmon industry in Chile provides jobs to over 53.000 people, some 38.000 are direct posts. Between 2002 and 2006 some 80 thousand workers were trained for the industry. In 2004 the industry invested $436,4 million US dollars in training (Sence). According to ProChile, salmon aquaculture is the Chilean export activity that generates the most jobs

directly. For each US$1 MM of export it is estimated that 17 new jobs are created (as compared to 3,8 jobs for the same amount of copper exports, according to ProChile 2006). The graph illustrates employment evolution in the salmon aquaculture sector.



Indirect employments generated by salmon aquaculture are associated with activities such as research and development, other ancillary support activities. In fact this industry has generated a productive growth cluster in the southernmost part of Chile that includes more than 1.200 suppliers associated with the salmon aquaculture (INE). In 2006 500 enterprises were established based on salmon aquaculture, 100 of which provide inputs and 400 are service related.

Due to this favorable evolution the Xth and XI regions (Los Lagos and Aysen) grew 39 and 41 percent respectively (in nominal terms) during the last six years, well above the national average of 28%. Larger economic growth and employment generation in the area have caused an important internal migration towards the "salmon communities". Between 1992 and 2002 population growth reached an average of almost 11%, headed by Quellón (24%) and Castro (12,9%). (2002 Census).

DAMAGE AND LOSSES: MAGNITUDE AND LOCALIZATION OF EARTHQUAKE IMPACT

Salmon production in Chile is concentrated in the Southernost part of the country. Specifically in the Tenth region are located 95% of the enterprises and about 4% in the XIth region. Main aquaculture points are illustrated in the map. The Aysen based ones represent 4% of the total
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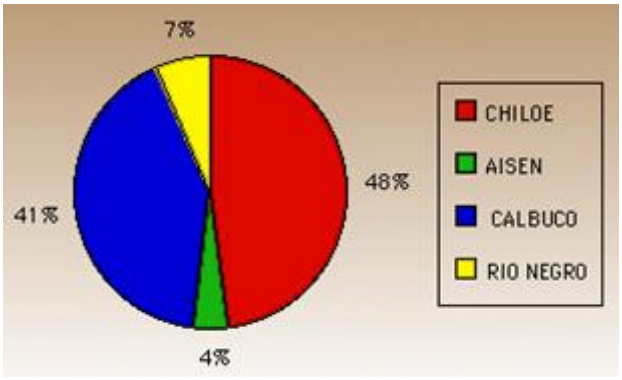
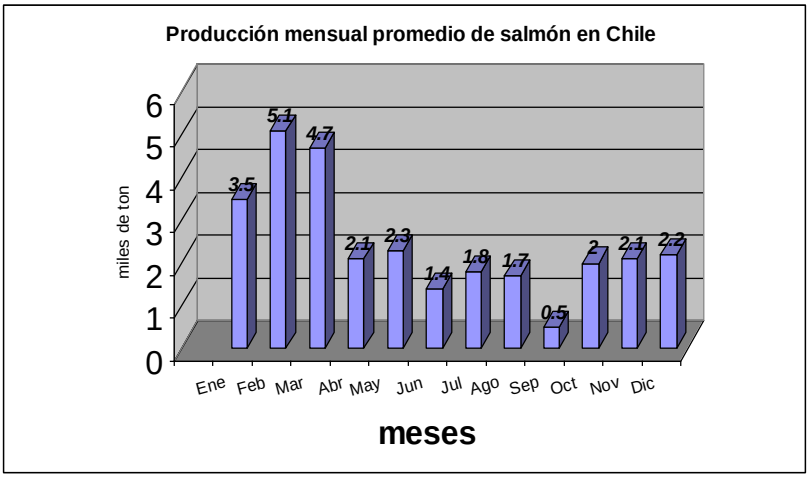
Location of the main aquaculture ponds in Chile's Tenth region



National distribution of salmon production

In Chile industrial production of salmon is made exclusively through intensive cultura, unlike in other major producters where capture in natural groth habitat is also made. Natonal production has a certain seasonality, since the Coho salmont represents almost 60% of the Chilean production, and is concentrated in the first three months of each year. The remainder of

production, composed of the Atlantic variety or "Salar" takes place during the whole year and represents the production achieved in the remaining months of the year (see graph)



The technical expert team coordinated by ONEMI (the national emergency management institution of Chile) after 22 January 2007 in the Aysen region indicated that the zone was affected by recurrent seismic phenomena, and established the seismic foci in a range extending from the Liquiñe-Ofqui fault, located in the Quitralco estuary, aligned with various volcanic cones. The fault's depth is less than 10 km. below water level, at the northern fron of the sector called Punta Esperanza, some 20 Kms. Northeast of Chacabuco. Chile's presidency has underlined its main concern is the physical integrity of the population and work force of Aysén, while maintaining the community's development, taking into account 25% of its population is linked directly or indirectly to the salmon sector.

A presidential legislative initiative (submitted on 12 June 2007) was made to face the consequences of the event which proposes remedies for the mandatory closing of salmon growing centers in the Aysen Fjord. This initative has been labeled by some as the "Ley Flash". This measure limits aquaculture activities in the Aysen Fjord, some of which dates back to the 1980s. As a consequence of the disaster aquaculture activities in the affected locations is impossible and the government's initiative restricts operations in the zone paralyzing an area that prior to the event was in full production. CORFO and SERCOTEC have implemented a special 400 million Chilean pesos (approximatedly 2 USD million) special program to support microenterprises in trade, industry and tourism in the area in order to overcome the emergency that temporary paralyzed their activities due to navigationrestrictions in the fjord causing losses in sales and other aspects. In May CORFO announced an additional $ 600 million peso operation for microenterprises in Aysen consisting of special subsidies to compensate the effects of the 21 April earthquake. Another area of CORFO (Innova Chile) destined 200 million pesos to study the socioeconomic and environmental impacts caused by the event on the Aysen fjord, and propose mitigating measures, eventual relocation of salmon activities and its connected ones (small fisheries, tourism, artisan capture and others). This relocation is estimated to take from eight to ten months. An additional Special Programme was developed by CORFO and SERCOTED including other institutions such as the Treasury, the Ministry of Labor, the State National Bank; all of which contribute to an integrated package of measures to favour affected enterprises in trade, industry and tourism. CORFO's Vice President announced finally that they Hill reinforce their existing program to attract investments to the area. All of this is intended to facilitate the development and implementarion of new projects and investments required to relocate and expand operations of existing projects..

For the purpose of this exercise it is assumed that activities were interrupted in the Aysen Fjord from January onward, reaching total closure the month of the earthquake. Reinitation of activities in the area is not made for the duration of the remaining of the year.

ESTIMATION OF LOSSES AND DAMAGES

With the provided information, the exercise requires to:

a) Estimate the amount of production losses of the Aysen fjord, month by month, considering a 30% drop from January to March, total interruption from the occurrence of the disaster for a six month period and a show recuperation –at a 5% rate from the seventh month onward and Hill the end of 2007,
b) Estimate the impact on exports associated with this drop in production, in terms of volume and value, for the whole year 2007, and
c) Estimate the number of jobs affected, supposing that the number of jobs in Aysen is proportional to the weight of Aysen in national salmon production. Beginning 2008, recuperation will progress to reach its pre-disaster levels supported by the CORFO and other entities programs..
d) Through an internet search obtain information in respect of the asset damages caused by the event and estimate recovery and reconstruction costs, including the investments announced by CORFO and other institutions mentioned in the text.

ANNEX

The following tables will provide useful information for the exercise.

SalmonChile
ASOCIACIÓN DE LA INDUSTRIA DEL SALMÓN DE CHILE A.G.

EVOLUCION DE LAS EXPORTACIONES DE VALOR AGREGADO
Millones de dólares FOB Chile

Producto	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	% 2006
Filete fresco	91	143	198	204	278	280	300	353	371	409	513	23%
Filete congelado	68	95	108	119	171	201	197	217	354	397	554	25%
Seco salado	24	41	18	18	19	15	15	18	20	16	10	0%
Ahumado	13	10	9	13	19	20	29	31	44	57	69	3%
Conservas	3	2	7	8	8	7	7	23	28	31	35	2%
Otros productos	8	23	30	29	54	54	72	129	180	251	339	15%
Total V.Agregado	208	314	370	390	550	578	621	770	996	1.161	1.520	69%
% V.Agregado	**39%**	**47%**	**52%**	**48%**	**56%**	**60%**	**64%**	**67%**	**69%**	**67%**	**69%**	
Total Exportado Chile	538	668	714	818	973	964	973	1.147	1.439	1.721	2.207	

EXPORTACIONES CHILENAS DE SALMON Y TRUCHA
Millones de dólares FOB Chile

MERCADO	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
JAPON	295	366	337	471	477	436	403	427	566	638	704
ESTADOS UNIDOS	177	214	270	259	358	364	414	544	575	606	792
UNION EUROPEA	31	37	45	34	57	77	62	58	118	236	308
LATINOAMERICA	26	37	47	39	53	51	47	56	79	88	156
OTROS MERCADOS	9	15	15	15	29	37	48	62	101	153	246
TOTAL	538	668	714	818	973	964	973	1.147	1.439	1.721	2.207

EXPORTACIONES CHILENAS DE SALMON Y TRUCHA

MILES DE TONELADAS NETAS

Pais	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	% 2006
Japón	80,5	93,3	104,6	91,8	110,6	157,4	161,6	119,1	154,3	150,7	148,7	38,4%
Estados Unidos	41,0	45,8	52,3	44,5	65,0	87,9	108,4	117,1	124,1	118,3	108,8	28,1%
Alemania	2,2	3,0	2,4	1,7	3,2	5,5	4,6	4,8	11,2	23,9	23,6	6,1%
Brasil	4,3	6,3	7,4	5,1	7,7	10,0	13,1	11,0	15,1	14,9	18,6	4,8%
Rusia						0,7	1,0	1,0	2,8	6,1	11,1	2,9%
Francia	1,7	1,5	3,2	2,1	3,8	5,7	5,5	4,1	5,8	8,4	10,3	2,7%
Rep. China		0,5	0,4	0,1	0,3	4,1	3,8	3,1	4,6	5,5	9,8	2,5%
Tailandia	0,5	1,2	0,6	0,4	0,7	5,0	4,8	5,5	7,9	10,6	9,2	2,4%
Corea del Sur	0,1	0,1	0,5	0,1	0,5	0,6	0,4	0,8	1,4	2,7	5,4	1,4%
México	0,3	0,7	1,0	0,9	1,7	1,9	2,3	3,1	3,7	3,8	4,2	1,1%
Canadá	0,1	0,2	0,7	1,0	1,6	2,1	3,2	3,4	3,0	3,0	3,8	1,0%
Bélgica	0,1	0,5	0,4	0,1	0,3	0,3	1,6	1,6	1,4	1,7	3,4	0,9%
Israel					0,4	0,3	0,6	0,4	3,3	4,0	3,3	0,9%
Argentina	0,7	1,2	1,7	1,8	2,2	2,8	0,9	1,2	1,8	2,4	2,8	0,7%
Dinamarca	0,5	1,4	1,0	0,2	0,1	3,6	1,3	0,2	0,7	5,1	2,3	0,6%
Reino Unido	0,7	0,6	1,3	1,5	1,9	2,5	2,4	1,1	1,0	1,9	2,0	0,5%
Venezuela	0,1	0,3	0,5	0,6	0,9	1,3	1,3	0,2	1,0	1,4	1,7	0,4%
Italia	0,4	0,4	0,8	0,6	0,5	1,2	1,5	0,9	1,2	1,3	1,6	0,4%
Taiwán	0,7	1,2	0,4	0,2	1,4	2,0	3,6	1,5	2,1	4,1	1,3	0,3%
Singapur	0,1	0,0	0,1	0,1	0,5	0,3	0,4	0,5	1,0	1,2	1,2	0,3%
Colombia	0,1	0,1	0,2	0,2	0,2	0,3	0,4	0,6	0,8	0,9	1,1	0,3%
España	0,3	0,3	0,3	0,1	0,1	1,6	1,4	0,6	0,5	1,0	0,9	0,2%
Suiza	0,1	0,2	0,3	0,3	0,2	0,1	0,3	0,3	0,5	0,0	0,6	0,1%
Australia	0,1	0,1	0,2	0,2	0,3	0,1	0,3	0,2	0,3	0,3	0,3	0,1%
Holanda	0,2	0,4	0,7	0,9	1,4	1,2	2,3	0,4	0,3	0,4	0,2	0,1%
Otros	0,5	0,7	0,9	0,6	1,4	2,9	5,9	4,4	4,7	10,1	11,1	2,9%
TOTAL	**135**	**160**	**182**	**155**	**207**	**301**	**333**	**287**	**354**	**384**	**387**	100%
% variación	38%	18%	13%	-15%	33%	46%	11%	-14%	23%	8%	1%	

EXPORTACIONES CHILENAS DE SALMON Y TRUCHA MILLONES DE DOLARES FOB CHILE												
PAIS	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	% 2006
Estados Unidos	177,3	214,2	270,0	258,6	357,8	363,6	413,7	543,7	575,1	605,7	792,2	35,9%
Japón	295,2	365,7	337,3	471,2	476,9	435,3	403,0	427,1	566,5	638,4	703,8	31,9%
Alemania	11,8	12,9	10,1	7,8	15,4	23,9	14,4	20,7	58,5	120,7	161,7	7,3%
Brasil	18,5	24,3	29,2	20,4	27,4	25,6	27,4	32,4	45,5	47,7	89,3	4,0%
Francia	8,6	7,5	15,0	8,9	17,6	20,5	16,2	16,6	28,8	44,1	66,0	3,0%
Rusia						0,3	1,6	2,1	6,7	17,3	45,9	2,1%
Rep. China		1,6	0,8	0,6	1,1	8,3	7,0	8,2	14,0	18,4	40,9	1,9%
Thailandia	3,2	4,3	2,2	2,4	2,5	9,9	11,2	17,2	25,6	37,9	39,0	1,8%
Mexico	1,5	3,6	5,1	5,0	9,7	9,0	10,0	14,6	18,0	19,1	30,6	1,4%
Corea del Sur	0,5	0,6	1,3	0,5	2,2	1,5	0,8	2,9	4,6	9,8	26,4	1,2%
Bélgica	0,4	2,5	2,3	0,5	1,2	1,1	5,7	7,2	7,8	9,5	24,4	1,1%
Canadá	0,4	1,0	3,2	5,4	7,5	7,3	11,7	17,1	16,5	15,8	24,4	1,1%
Reino Unido	2,8	2,2	5,1	7,5	10,2	9,2	6,7	4,4	4,3	10,2	15,1	0,7%
Israel					1,6	0,9	1,1	1,4	10,0	13,4	14,7	0,7%
Argentina	3,7	5,5	7,1	7,4	8,4	8,0	2,2	3,4	5,5	7,7	13,1	0,6%
Dinamarca	3,1	7,5	4,9	0,9	0,6	9,6	3,4	0,9	2,7	24,7	13,0	0,6%
Italia	1,7	2,0	3,2	2,9	2,6	3,8	4,2	3,8	5,7	6,1	10,8	0,5%
Venezuela	0,6	1,5	2,1	2,7	4,2	4,8	4,0	0,9	4,0	5,8	10,2	0,5%
Singapur	0,5	0,2	0,2	0,4	2,3	1,1	1,2	2,0	4,3	5,0	6,8	0,3%
Taiwán	2,3	3,3	1,4	0,6	5,6	4,6	6,2	4,5	6,5	13,1	5,9	0,3%
Colombia	0,5	0,9	1,2	1,1	1,3	1,2	1,7	2,3	2,7	3,5	5,9	0,3%
España	1,2	0,9	0,9	0,5	0,2	2,8	2,8	2,4	2,5	4,8	5,3	0,2%
Suiza	0,5	1,2	2,0	2,4	1,0	0,3	1,3	1,2	2,7	0,1	5,3	0,2%
Australia	0,4	0,9	1,9	1,6	2,5	1,0	1,2	1,1	1,6	1,7	1,6	0,1%
Holanda	1,2	1,0	3,0	5,3	8,9	5,6	7,3	1,4	1,5	2,6	1,5	0,1%
Otros	2,3	3,4	4,0	3,2	4,7	5,0	7,4	7,9	17,4	38,1	52,5	2,4%
TOTAL	**538**	**668**	**714**	**818**	**973**	**964**	**973**	**1.147**	**1.439**	**1.721**	**2.207**	**100%**
% variación	10%	24%	7%	15%	19%	-1%	1%	18%	25%	20%	28%	