Monterey Bay Aquarium
Seafood Watch®

FOUR- REGION SUMMARY DOCUMENT

Atlantic salmon, coho salmon

Salmo salar, Oncorhynchus kisutch

Norway, Chile, Scotland, British Columbia

Net pens

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Criteria Scores and Final Seafood Recommendations

Atlantic salmon* final scores

Criterion	Norway		Chile		Scotland		British Columbia	
C1 Data	6.7	GREEN	6.1	YELLOW	8.1	GREEN	7.5	GREEN
C2 Effluent	4.0	YELLOW	2.0	RED	5.0	YELLOW	5.0	YELLOW
C3 Habitat	6.0	YELLOW	3.9	YELLOW	6.8	GREEN	6.1	YELLOW
C4 Chemicals	1.0	RED	CRITICAL	CRITICAL	1.0	RED	2.0	RED
C5 Feed	5.2	YELLOW	4.2	YELLOW	5.9	YELLOW	5.8	YELLOW
C6 Escapes	2.0	RED	4.0	YELLOW	2.0	RED	4.0	YELLOW
C7 Disease	0.0	RED	4.0	YELLOW	0.0	RED	2.0	RED
C8 Source	10.00	GREEN	10.0	GREEN	10.0	GREEN	10.0	GREEN
C9X Wildlife mortalities	-6.0	YELLOW	-4.0	YELLOW	-5.0	YELLOW	-4.0	YELLOW
C10X Introduced species escape	0.0	GREEN	-0.4	GREEN	-1.0	GREEN	-4.0	YELLOW
Final score / Rank	**3.6**	RED	**3.7**	RED	**4.1**	RED	**4.3**	RED

Scoring note –scores range from 0 to 10 where 0 indicates very poor performance and 10 indicates the aquaculture operations have no significant impact. Color ranks: red = 0 to 3.33, yellow = 3.34 to 6.66, green = 6.66 to 10. Criteria 9X and 10X are exceptional criteria, where 0 indicates no impact and a deduction of -10 reflects very poor performance.

* Note Chile also has significant Coho salmon production which has a third red criteria for escapes and a final numerical score of 3.61.

Executive Summary

This report is a short summary of four country/region-specific Seafood Watch assessments for farmed salmon in Norway, Chile, Scotland and British Columbia (BC). The report is intended primarily to provide a convenient way of comparing the results across the four production regions, and also to explain the reasons behind any key differences in intermediate and final scores. The four region-specific reports (available online – see links below) contain more detailed background information, references to data sources and scientific literature, and further explanation of the calculations and scores.

Many aspects of net pen salmon farming have improved over the last decade; there has been a well-documented improvement in feed efficiency and reduction in the use of wild fish in salmon feeds, antibiotic use has declined in most regions (except Chile); sea lice numbers have been reduced during important outmigration periods for wild salmon, escapes have reduced, mortalities of seals and sea lions have dramatically decreased, and regulatory control of siting, monitoring and management of biomass with respect to benthic impacts has also improved. Data availability has also improved and while key data gaps remain in all regions, salmon farming can be considered to be an example for other aquaculture industries worldwide.

There are clear inherent differences between the different region; for example Atlantic salmon are native in Norway and Scotland verses non-native in BC and Chile; salmon farms in Norway and Scotland interact with wild Atlantic salmon populations, whereas BC is the only region where Atlantic salmon farms interact with wild Pacific salmon species. In contrast, there are no native wild salmon populations in Chile. The production system is similar in all regions (freshwater hatcheries and smolt production and coastal ongrowing in net pens) but the scale of production in Norway is almost fifteen times that of BC. Despite the improvements noted above, and the differences between the regions the final recommendation for all regions is a red "Avoid" for the following (highly summarized) reasons:

Norway – the final recommendation for farmed salmon from Norway is "Avoid" due to the use of antibiotics listed as critically-important to human health by the World health Organisation and high use of sea lice pesticides, documented evidence (and official acknowledgement) of the impacts of escaping farmed salmon on wild salmon populations, and documented evidence (and official acknowledgement) of the impacts of parasitic sea lice on wild salmon and particularly sea trout.

Chile - the final recommendation for farmed salmon from Chile is "Avoid" due to the risks of cumulative effluent impacts from the intensity of production and the southward expansion of the industry into pristine environments of very high ecological value, and the extremely high use of antibiotics and pesticides. The use of antibiotics in Chile (including those listed as highly-important to human health by the World Health Organisation) is over 500 times the combined totals of Norway, Scotland and BC.

Scotland - the final recommendation for farmed salmon from Scotland is "Avoid" due to the high use of sea lice pesticides (in 2013, there were 107 coordinated sea lice treatments involving multiple sites and 392 targeted single-site sea lice treatments in Scotland), documented genetic impacts of escaping farmed salmon on wild salmon, and a high risk of impact from sea lice on wild salmon and particularly sea trout.

British Columbia - the final recommendation for farmed salmon from BC is "Avoid" due to the substantial use of antibiotics listed as highly-important to human health by the World Health Organisation, and the ongoing uncertainty and therefore high concern with respect to potential impacts of pathogens on highly important wild Pacific salmon populations for which the salmon farming industry occupies critical migratory habitats for wild juveniles.

Chemical use is a concern in all four regions, and there are no regulations in place to limit antibiotic use in any region should a disease outbreak occur. These four regions represent the large majority of global farmed salmon production, and the assessments represent a snapshot of current practices in each region. The publication of new data is a continuous process; unless otherwise specified, the data used in this four-region summary are from 2012 or 2013 and represent the latest available at the time of writing. Due to inevitable annual variations in production data, the values presented in this report must be considered as approximate, but Seafood Watch considers them representative of current production and comparable between regions.

For further information and detailed analysis, the four region-specific reports are available online here:
Norway – http://www.seafoodwatch.org/cr/cr_seafoodwatch/content/media/MBA SeafoodWatch FarmedNorwaySalmon Report.pdf
Chile – http://www.seafoodwatch.org/cr/cr_seafoodwatch/content/media/MBA SeafoodWatch FarmedChileSalmon Report.pdf
Scotland – http://www.seafoodwatch.org/cr/cr_seafoodwatch/content/media/MBA SeafoodWatch FarmedScotlandSalmon Report.pdf
BC - http://www.seafoodwatch.org/cr/cr_seafoodwatch/content/media/MBA SeafoodWatch FarmedBCSalmon Report.pdf

The Seafood Watch Aquaculture Criteria are also available online here:
http://www.seafoodwatch.org/cr/cr_seafoodwatch/sfw_aboutsfw.aspx

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Scope of the analysis and ensuing recommendation

Species Assessed

Norway	Chile	Scotland	BC
Atlantic salmon	Atlantic salmon Coho salmon	Atlantic salmon	Atlantic salmon

Production Methods.

Norway	Chile	Scotland	BC
Net pens	Net pens	Net pens	Net pens

Approximate scale of annual production (metric tons, using the latest available year of data)

Norway	Chile	Scotland	BC
1,240,000 mt	Atlantic 490,300 mt Coho 148,100 mt	152,000 mt	83,490 mt

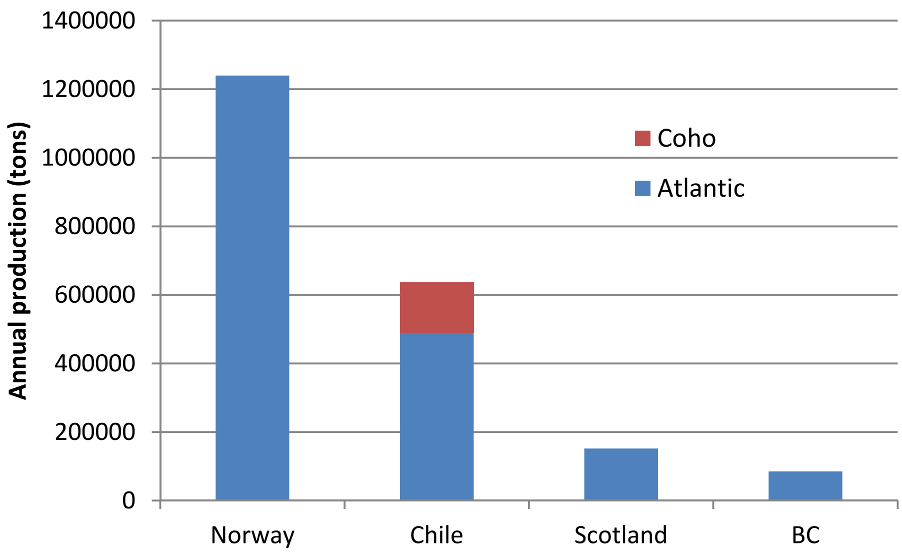

Figure 1. Approximate annual farmed salmon production (data from 2012 or 2013).

BC also has minor but significant production of King (Chinook) salmon and coho salmon, but they have not been assessed at this time.

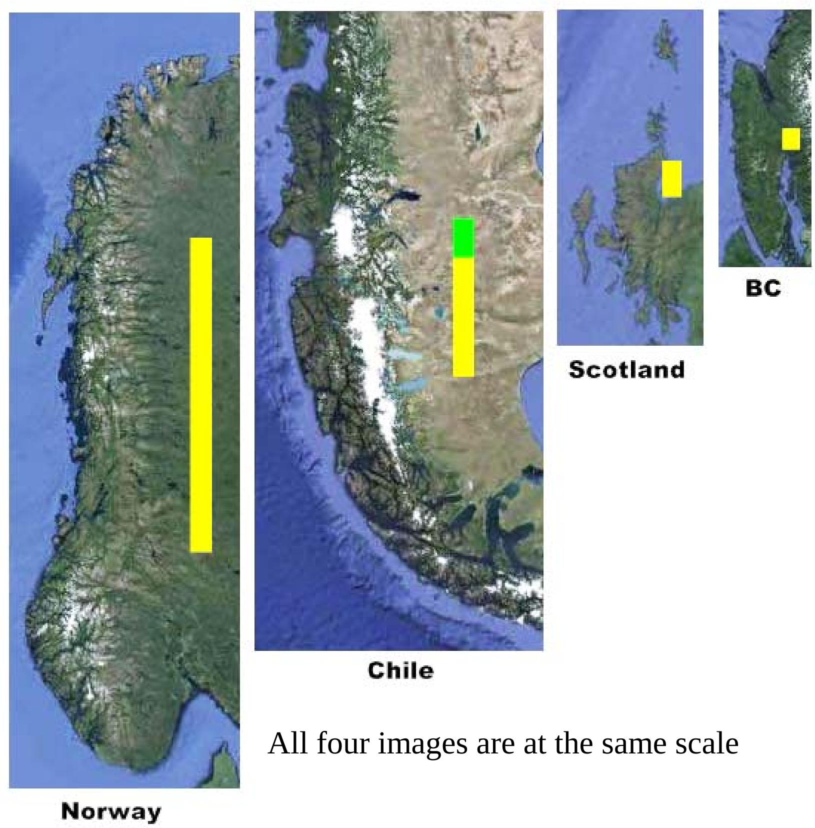

Figure 2. Relative region size and annual farmed salmon production. Maps are the same scale (rotated for convenient alignment); yellow/green bars represent annual salmon production from Figure 1 above (yellow = Atlantic salmon, green = coho salmon in Chile). Note Chile's production is heavily concentrated in the top third of the image. Images from Google Earth.

Norway's farmed salmon production is approximately fifteen times that of BC; Norway's largest fjord, the Hardangerfjord, produces approximately 70,000 to 80,000 tons which is comparable to the entire industry of BC (83,490 tons).

Criterion 1: Data Quality and Availability

Norway	Chile	Scotland	BC
6.7	6.1	8.1	7.5

Compared to the majority of aquaculture industries, data quality is good across all four salmon farming country/regions assessed. Although data are often self-reported by industry, and key knowledge gaps remain in all regions (e.g. a lack of public escape reports in Chile), a combination of industry and government data along with substantial academic research provides a high level of information. Data availability in Chile has improved dramatically after new management measures and new regulations were established after the country's production collapse in 2008-2011.

The data scores for Norway, Scotland and BC are all good, while Chile is considered moderate-good.

Criterion 2: Effluents

The Effluent Criterion assesses impacts of nutrient wastes beyond the immediate area of the farm (in contrast to the Habitat Criterion below which assesses impacts within the immediate farm area)

Final Score

Norway	Chile	Scotland	BC
4.0	2.0	5.0	5.0

Assessment type

Norway	Chile	Scotland	BC
Evidence-based	Evidence-based	Evidence-based	Risk-based

The risk-based assessment was used in BC on request from the SeaChoice group[1].

Results of regulatory benthic monitoring at the edge of the farm area (approximate results)

Norway	Chile	Scotland	BC
90% in condition 1or 2	74% compliant	85% compliant	80% compliant

Despite the substantial release of nutrient wastes from salmon farms, academic study of both soluble and particulate effluents from salmon farms in all regions conclude that significant impacts beyond the immediate farm areas, or cumulatively at the waterbody- or regional-level, are unlikely except in densely farmed areas with poor water circulation and flushing. To date, these studies have largely focused on changes in the phytoplankton community.

Monitoring of soluble nutrients in the water column beyond the farm does not occur in any of the four regions due to the limited ability to detect significant increases in nutrient levels beyond the net pens, but academic studies indicate there may be poorly-studied impacts on microbial (bacterial) and macroalgal (seaweed) communities (as opposed to the better-studied phytoplankton community) beyond the immediate farm area and therefore cumulatively in densely farmed areas. This uncertainty contributes to the "yellow" moderate concerns in the final scores for Norway, Scotland and BC.

Benthic (seabed) monitoring at the edge of the farm areas that is required in all regions as part of regulatory process shows that significant changes to species abundance or diversity at the edge of farm boundaries occur in approximately 20% of sites or samples, indicating that significant seabed impacts beyond the farm boundaries are likely to be occasional, temporary,

[1] The score using the evidence-based assessment was 4 out of 10.

or minor. These occasional, temporary, or minor impacts also contribute to the "yellow" moderate concerns in the final scores for Norway, Scotland and BC.

Chile is considered to be different from the more mature industries in the three other regions; the industry expanded rapidly with very dense production and was considered to exceed the carrying capacity in many locations and regions (which associated with other factors, contributed to a collapse in production from 2008-2011). Although now operating under a new regulatory structure, the Chilean industry continues to expand and also to move further south into pristine locations with extremely high ecological value. Academic studies consider it is likely that the Chilean industry contributes to harmful algal blooms and larger scale regional impacts in the densely farmed areas due to increased nutrient loads and also due to changes in the region's natural nutrient ratios associated with increased primary productivity. Despite the dense scale of production, the carrying capacity of the region is still largely unknown, including in the pristine areas into which the industry continues to expand.

Final Effluent Criterion Scores

With some ongoing uncertainty regarding the potential for poorly studied cumulative impacts in areas with clusters of farms, Norway, Scotland and BC have moderate scores of 4 to 5 out of 10 (Norway is slightly lower due to the very large scale of the industry), but Chile is considered to a be high concern due to the ongoing potential for larger scale cumulative local or regional impacts and a score of 2 out of 10.

Criterion 3: Habitat

The Habitat Criterion assesses impacts of nutrient wastes within the immediate farm area (in contrast to the Effluent Criterion above which assesses impacts beyond the immediate area of the farm.

Final Score

Norway	Chile	Scotland	BC
6.0	3.9	6.8	6.1

Intermediate scores

	Norway	Chile	Scotland	BC
Habitat conversion	7	5	7	7
Content of Regulations	3.25	2	4	3.25
Enforcement of Regulations	3.25	2.25	4	3.25
Regulatory or Management Effectiveness	4.22	1.8	6.4	4.22
Final Score	6.08	3.93	6.8	6.08

The floating net pens used in salmon farming have relatively little direct habitat impacts, but the benthic (seabed) habitat impacts from settling particulate wastes within their allowable zones of effect and particularly directly under the cages may still be profound. Academic studies indicate that in the large majority of sites, the impacts are reversible, and in fact relatively rapidly reversible. The total area of all farm sites in any one region represents a small proportion of the total coastal resource, but large farms or aggregations of multiple sites in one area can still affect a significant proportion of local habitats.

In Norway, Scotland and BC, the lack of irreversibility and the relatively rapid reversibility of site level impacts mean that the ecosystem services provided by the habitats overall are considered to remain functional. The habitat conversion score for these regions is 7 out of 10. Chile has a lower compliance with benthic monitoring requirements at the site level (with a decreasing trend), and there is a greater concern with the ongoing southward expansion into pristine habitats classified amongst those with the highest global conservation priority worldwide. The habitat conversion score for Chile is 5 out of 10.

Regulatory control in all regions accepts that the impacts under the net pens and within the allowable zone of effect will be significant, and is based on similar benthic impact models that result in permit restrictions on maximum farm size. Norway and BC have limited requirements related to cumulative impacts of the industry, or in areas with aggregations of sites and the regulatory process is considered to be only moderately effective at the cumulative level. Scotland categorizes water bodies based on their combined nutrient enhancement and benthic impact indices and the Scottish industry is considered to have a more effective regulatory system with respect to cumulative impacts. Chile has had documented problems with ineffective management of cumulative impacts, but has recently established a new regulatory structure after the production collapse from 2008-2011. The capabilities of the new regulatory system are still somewhat untested and the industry's continued expansion into pristine habitats results in a lower management score.

Final Habitat Scores

Overall, the small proportion of coastal habitats directly impacted by salmon farms means that the scores for the Habitat Criterion are moderate to good for all regions. Chile has a lower final score (3.93 out of 10) and Scotland higher (6.8 out of 10).

Criterion 4: Evidence or Risk of Chemical Use

Final Score

Norway	Chile	Scotland	BC
1.0	CRITICAL	1.0	2.0

A variety of chemicals can enter the environment from salmon farms (e.g. antibiotics, pesticides, antifoulants (e.g. copper), other metals (e.g. zinc from feeds), disinfectants, anesthetics), but the primary drivers of the final scores in all regions are antibiotics used to control bacterial diseases and pesticides used to treat sea lice parasites. None of the regions have regulations in place to limit the total use of antibiotics should a disease outbreak occur.

Antibiotics

Note:
1 - Due to the differing dose rates between antibiotics, and different types of antibiotic used in each region, comparisons of total and relative antibiotic use between regions must be made with caution.
2 - Chile's figures are based on an estimate for 2013 based on the total use in the first half of the year. The estimated value follows a clear trend of increasing antibiotic use in confirmed figures from the previous three years.

Total Antibiotic Use (kg)

Norway	Chile	Scotland	BC
1,591 kg	343,600 kg	168 kg	3650 kg

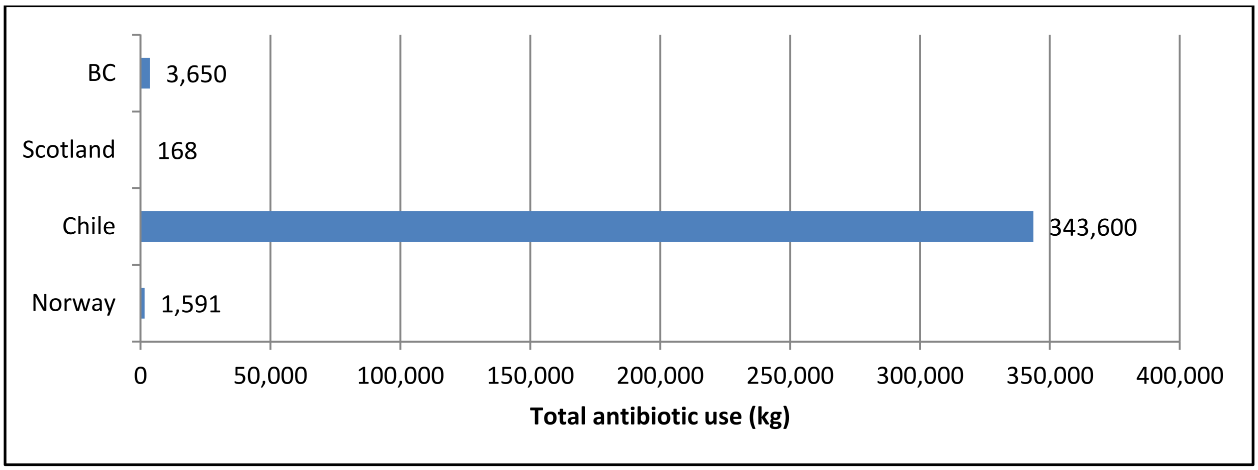

Figure 3. Total annual antibiotic use in kg.

Chile's (estimated) total for 2013 is currently more than 60 times the combined totals of the other three top global salmon producing regions of Norway, Scotland and British Columbia. The confirmed total for 2012 in Chile was still nearly forty times as much as the other three regions combined.

Relative antibiotic use in grams per ton of production

Norway	Chile	Scotland	BC
1.3 g/ton	700.8 g/ton	1.1 g/ton	43.7 g/ton

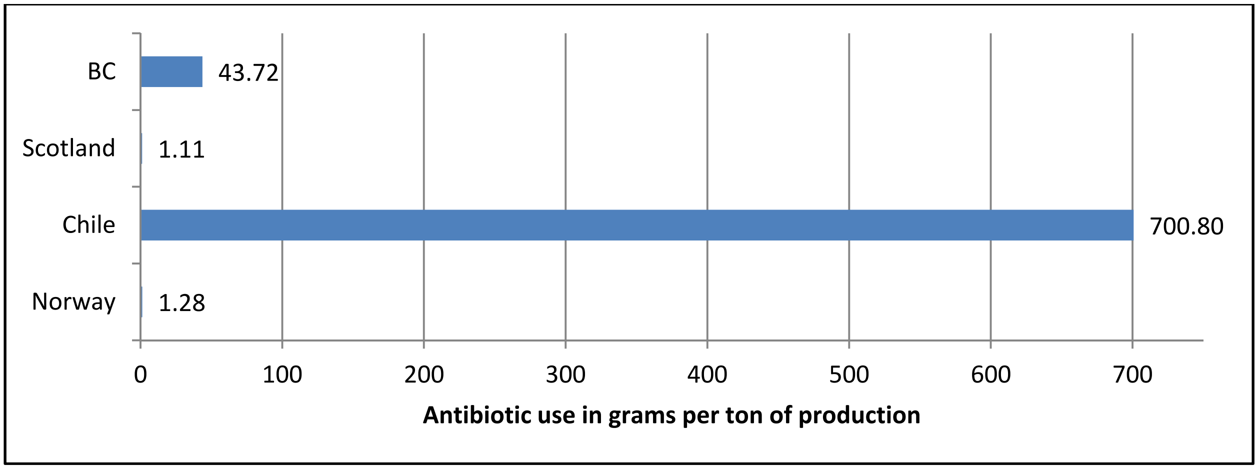

Figure 4. Relative antibiotic use in grams of antibiotic per ton of farmed salmon production.

In addition to the very high total use in Chile, the relative use of antibiotics (i.e. the amount used per ton of production) is also extremely high compared to other regions. Figure 4 shows that Chilean salmon famers on average use more than 500 times (546x) as much antibiotics per ton of salmon as Norwegian salmon farmers, and more than 600 times (634x) that of Scottish farmers. The relative use in British Columbia is also much higher than both Norway and Scotland (34x and 39x respectively), but the dominance of different antibiotics with different dose rates in each region (e.g. oxytetracycline in BC and Scotland[2] verses oxolinic acid in Norway) is an important factor in these calculations.

Long term trends in antibiotic use (time-frame > 10 years)

Norway	Chile	Scotland	BC
Large decrease	High	No data	Large decrease

Middle term trends in antibiotic use (time-frame 10 years)

Norway	Chile	Scotland	BC
Stable (low)	Fluctuating (high)	Large decrease	Large decrease

Short term trend (timeframe <3 years)

Norway	Chile	Scotland	BC
Increase in 2013	Large increase 2010-2013	Stable	Stable

The large increases in Chilean antibiotic use covers both the total antibiotic use and also the relative use in grams antibiotic per ton of production; that is, the increase in antibiotic use is not simply related to the increasing farmed salmon production in Chile; salmon farmers in Chile are also using an increasing amount of antibiotic per ton of production

[2] Due to differences in dose rates, treatments with oxytetracycline require larger quantities of antibiotic than (for example) oxolinic acid.

Current use of antibiotics listed as highly-important to human health by the WHO

Norway	Chile	Scotland	BC
Yes	Yes	Yes	Yes

Current use of antibiotics listed as critically-important to human health by the WHO

Norway	Chile	Scotland	BC
Yes	Yes	No	No

The dominant antibiotics in all regions are listed as either highly- or critically-important to human health by the World Health Organisation. In net pen aquaculture, the large majority of antibiotics are discharged directly into the environment. While the direct environmental impacts are poorly studied, the global concerns relating to antibiotic resistance in human health are severe and undisputed. Antibiotic use in aquaculture (along with human and veterinary medicine, agriculture and horticulture) is considered a factor, and the pathways for the transfer of mobile components of antibiotic resistance from aquatic to terrestrial pathogens are clear. None of the regions have regulations in place to limit the total use of antibiotics should a disease outbreak occur.

The extremely high use of antibiotics in Chile results in a “critical” score for the Chemical Use criterion, and the substantial use of 3.65 tons of highly-important antibiotics in BC results in a high concern (score of 2 out of 10). The recent increase in Norway (total antibiotic use tripled from 2011 to 2012) to 1.5 tons primarily of antibiotics listed as critically important to human health also (along with pesticide concerns below) contributes to a high concern.

Pesticides

Note that due to the differing toxicities and application methods between treatments, and different types of treatments used in each region, comparisons across regions must be made with caution. Hydrogen peroxide has not been included in these figures.

The term “pesticide” is used below in the general context of a substance used for destroying organisms harmful to cultivated plants or animals (the term “therapeutant” or “drug”, or “medication” is also commonly used and may be specifically used in the registration of some “pesticide” compounds). The primary target for pesticide use in salmon farming is the parasitic sea louse, considered to be the most economically important ectoparasites affecting Atlantic salmon culture worldwide. While the use of pesticides to control sea lice can have a beneficial reduction in sea lice on wild salmon and sea trout, their use in open production systems that are open to both infections from wild fish and to the discharge of active pesticides ingredients is an ongoing concern.

Total pesticide use in kg

Norway	Chile	Scotland	BC
6,500	13,690[3]	507	10

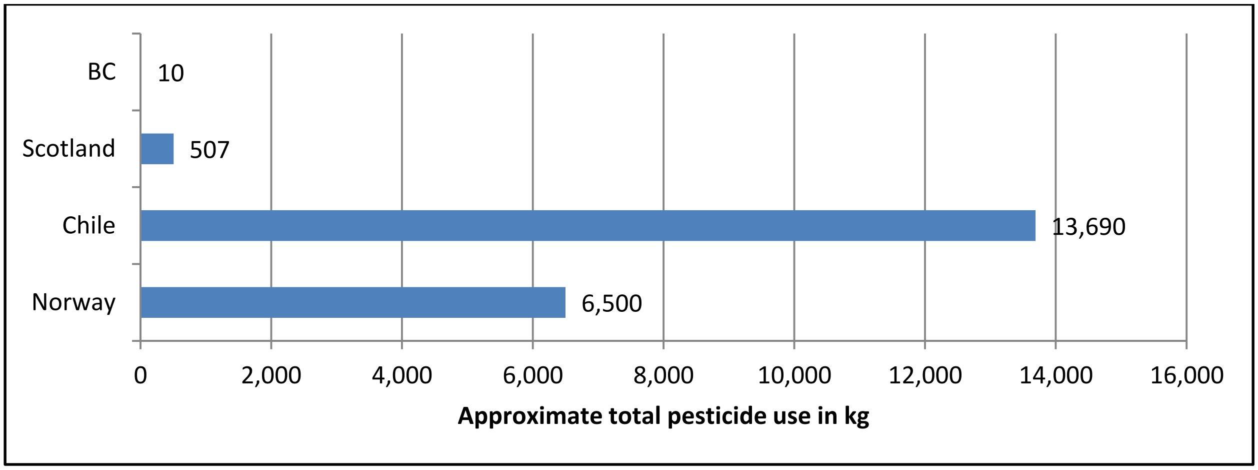

Figure 5. Total annual pesticide use.

Total pesticide use in Chile and Norway is very high (13.6 tons and 6.5 tons respectively). The use in Scotland is lower (0.5 tons), and very low in British Columbia (10 kg or 0.001 tons). These figures do not include the use of include hydrogen peroxide which although considered somewhat environmentally benign (it breaks down rapidly and harmlessly in the environment) is massive in Norway, Chile and Scotland and further indication of the severe production problem that sea lice represent. As hydrogen peroxide is much less effective than other pesticides, its use is indicative of the loss of effectiveness of other (previously more effective) treatments due to the development of resistance is sea lice populations. Hydrogen peroxide has recently been approved for use in BC, but is not yet considered to be indicative of resistance development there (see resistance section below).

Relative pesticide use in grams per ton of production

Norway	Chile	Scotland	BC
5.24	27.92	3.34	0.12

[3] Chile pesticide data is from 2011

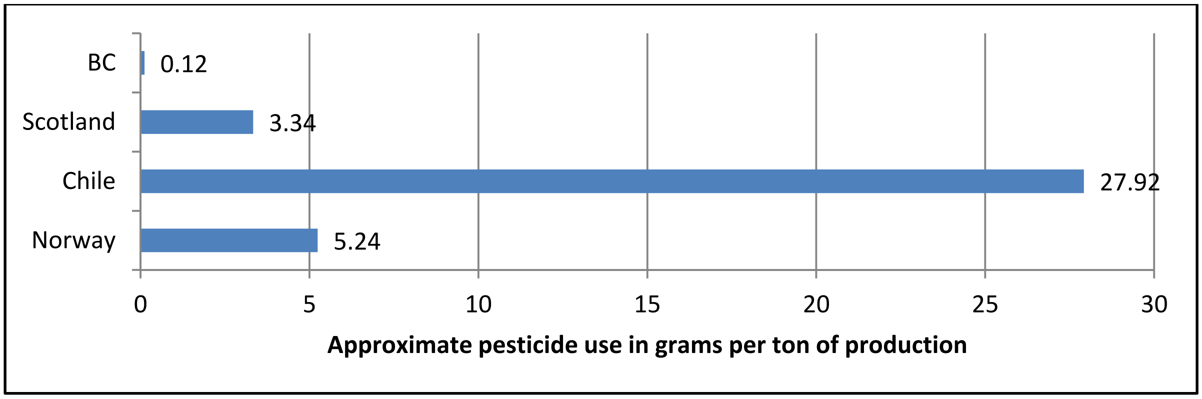

Figure 6. Relative pesticide use in grams per ton of production.

Due to the high toxicity of the pesticides, the dosage rates are very low. Therefore the total quantities used represent a large number of treatments. For example in Scotland in 2013, there were 107 coordinated treatments (each involving multiple sites in one area treating at the same time) and 392 targeted (single site) sea lice treatments.

Developed resistance to sea lice pesticide treatments

	Norway	Chile	Scotland	BC
Resistance developed	Yes	Yes	Yes	No
Resistance to multiple treatments	Yes	Yes	Yes	No

The overuse of pesticides leads to the development of resistance in sea lice populations (i.e. the sea lice become immune to the pesticides and the treatments are no longer always effective). Access to a variety of pesticides is beneficial to an integrated sea lice management strategy, and reduces the development of resistance, but continuing overuse of multiple treatments has led to multiple pesticide resistance in Norway, Chile and Scotland. BC is unique (among these four regions) in maintaining (to date) the efficacy of the most effective sea lice treatment (emamectin benzoate).

The extremely high use of pesticides in Norway and Chile and the development of multiple resistance in these countries as well as Scotland indicate a severe production problem. The available academic studies indicate direct environmental impacts of pesticide use should be limited to the immediate farm area, although more recent studies indicate some uncertainty with respect to the more toxic treatments (e.g. teflubenzuron) and concerns with large-scale multi-site coordinated treatments. Therefore the increasing total pesticide use and the increasing use of more toxic alternatives in addition to the large number of coordinated (i.e. multiple site) treatments maintains a high concern regarding potential cumulative impacts in Chile, Norway and Scotland.

Final Chemical Use scores

All four regions use substantial quantities of either antibiotics listed as highly- or critically-important to human health or sea lice pesticides. None of the regions have regulations in place to limit the total use of antibiotics should a disease outbreak occur. The use and subsequent discharge of substantial quantities of the chemicals in open net pen systems (that provide no barrier to infection from environmental pathogens and parasites that subsequently require treatment) remains a high concern in all regions, and a critical concern in Chile.

Criterion 5: Feed

Final Score

Norway	Chile	Scotland	BC
5.2	4.2	5.9	5.8

Feed information

- Economic Feed Conversion Ratio (eFCR) = the amount of (dry) feed provided divided by the tons of salmon (wet weight) harvested. Note a lot of the weight in harvested salmon is water in contrast to the dry feed.
- FI:FO = the number of tons of wild fish used to supply the fishmeal or fish oil needed to grow one ton of farmed salmon[4].

For a full explanation of the calculations, see the Seafood Watch Aquaculture Criteria document[5]. Also see individual country/region reports for more detailed data.

	Norway	Chile	Scotland	BC
Feed Conversion Ratio (eFCR)	1.2 – 1.3	1.3	1.25	1.15 - 1.24
$FI:FO_{fish\ oil}$	1.8	2.43	1.2	2.14
FI:FO range****	1.23 – 2.37	2.43	1.2	1.31 – 2.98
Fish oil yield %***	5, 10	5	10.0	5, 9.5
Source fishery sustainability**	-3	-6	-2	-6
Use of land animal proteins*	No	Yes (23%)	No	Yes (37%)
Edible protein IN	315.9	260.3	342.6	115.0
Edible protein OUT	169.0	169.0	169.0	169.0
Protein gain or loss (%)	-47.5	-35.1	-50.7	+47.7
Feed footprint (hectares)	11.2	11.67	11.05	8.84

**** FI:FO range (for fish oil) where more than one data source was available.
*** Fish oil yield strongly influences the FIFO value for farmed salmon. Specific data provided by the feed companies enabled a lower FI:FO value to be calculated. Separate figures are different data sources.
** Source fishery sustainability score range: 0 = sustainable, -10 is demonstrably unsustainable. A score of -6 indicates unknown sources where specific data was not available.
* The use of “non-edible” land animal by-product protein ingredients reduces the edible protein input in feeds (figures in brackets are % of total feed).

[4] Seafood Watch uses the “academic” calculation for FI:FO which produces a relevant result (i.e. the fundamental number of tons of wild fish that would need to be caught to produce one ton of farmed fish), but acknowledges that for “oily” fish like salmon, there will be significant “spare” fishmeal that could be used to produce other aquaculture species.
[5] http://www.montereybayaquarium.org/cr/cr_seafoodwatch/sfw_aboutsfw.aspx

Feed Scores

	Norway	Chile	Scotland	BC
$FI:FO_{fish\ oil}$	1.8	2.43	1.2	2.14
FI:FO score (0-10)	5.5	3.92	7.01	4.65
Source fishery sustainability**	-3	-6	-2	-6
Wild Fish Use score (0-10)	4.96	2.46	6.77	3.37
Protein gain or loss (%)	-47.5	-35.1	-50.7	+47.7
Protein gain or loss score (0-10)	5	6	5	10
Feed footprint (hectares)	11.2	11.67	11.05	8.84
Feed footprint score (0-10)	6	6	6	6.5
Final Feed Score	5.2	4.2	5.9	5.8

For a full explanation of the calculations, see the Seafood Watch Aquaculture Criteria document.

Fish In:Fish Out Ratio

The use of wild fish in salmon feeds (i.e. fishmeal and fish oil) has dropped substantially over the last decade, particularly fish oil, primarily due to the increasing cost of these ingredients but also due to sustainability concerns. Marine ingredients have increasingly been replaced by terrestrial crop and animal sources. When combined with improvements in Feed Conversion Ratio (due to improved understanding of salmon's nutritional requirements, improved feed formulation and manufacturing techniques and improved feeding techniques), the result has been an improvement in the Fish In:Fish Out ratio.

Salmon aquaculture still consumes a large share of global fish oil supplies, and the FI:FO ratios for Chile and BC are still over 2.0 but improved understanding of source fishery sustainability means where data is available (in this case specifically from Norway, Scotland and one feed company in BC) fishmeal and fish oil can be shown to be sourced from well-managed fisheries.

Two factors heavily influence the feed scores; the FCR and the fish oil yield value (i.e. the amount of oil extracted from wild fish). The FCR values are very similar across the four regions, and although industry reported and therefore potentially on the lower end of the true range, they are consistent with literature values. Detailed data on the species used to make fish oil available from some feed companies enables a higher yield value to be defined (9.5 - 10 %) compared to the default value in the Seafood Watch criteria (5%). The higher yield value data provided by feed companies in Norway, Scotland and one company in BC therefore contribute to their lower FI:FO value and a higher FI:FO scores. A key feed paper (Tacon and Metian (2008)[6] predicted (using data to 2006) that FI:FO values would drop from 4.0 in 2007 to 1.5 in 2020. Figure 7 shows this prediction with the 2013 data calculated in the Seafood Watch assessments. The calculated values show that Chile and BC are close to the prediction, whereas Norway and Scotland have exceeded the expectation (primarily because of the more specific data on fish oil yield).

[6] Tacon, A. G. J. and M. Metian. 2008. Global overview on the use of fish meal and fish oil in industrially compounded aquafeeds: Trends and future prospects. Aquaculture 285:146-158

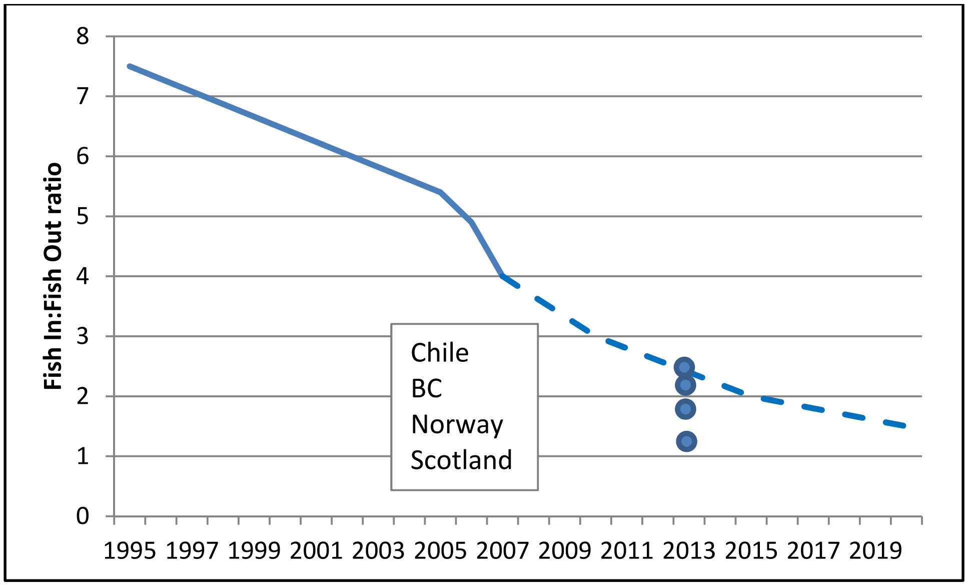

Figure 7. Plot of measured FI:FO (solid line) and predicted FI:FO (dashed line) for farmed salmon in Tacon & Metian (2008). Four dots represent FI:FO values for the four regions calculated by Seafood Watch.

Net Protein Gain or Loss

Despite the improvements in marine ingredient use and FCR, salmon farming can still represent a large net loss of edible protein. “Edible” protein in feeds are considered to come from wild fish and crop ingredients used in feeds, but is also increasingly being replaced by non-edible by-products from wild fish already caught for human consumption, and in some regions (BC and Chile) by by-products of land animals. Harvested farmed salmon are separated into edible components (fillets etc.) and non-edible components (bones, viscera, fins etc.). Salmon farming now processes all of the non-edible by-products and returns them to other forms of food production therefore 100% of the harvested protein is considered to be utilized.

Due to a high level of land animal by-product ingredients and also fishmeal from fishery by-products, approximately 72% of the protein in BC salmon feeds comes from non-edible sources and results in a net gain in edible protein in contrast to the substantial net loss in the other regions. Chile also uses land animal by-products but has a lower inclusion level in the feed, and therefore still has a net loss of protein, although better than Norway and Scotland who did not use land anima; by-products at the time of assessment.

Feed Footprint

As marine ingredients continue to be replaced by terrestrial sources in salmon feeds, the environmental impact of producing these ingredients must also be considered. The Seafood Watch criteria have a simple assessment based on the area of marine and terrestrial habitats required to produce the marine, terrestrial-crop and terrestrial-land animal ingredients. Although the inclusion levels of these ingredients vary between regions, the differences are not sufficient to lead to different scores (Norway, Scotland and Chile all score 6 out of 10) with the exception of BC (score 6.5 out of 10) which has a slightly higher score due to the higher use of terrestrial (crop and animal) ingredients.

Final Feed Scores

The final feed scores are calculated by combining the scores for the three factors (wild fish use, protein gain or loss, and feed footprint) with a double weighting on the wild fish use as the most important factor. The final scores are all in the moderate "yellow" category and range from 4.9 (Chile) to 5.9 (Scotland).

Criterion 6: Escapes

Final Score

Norway	Chile	Scotland	BC
2.0	4.0	2.0	4.0
	3.0 (Coho)		

A key difference between the four regions is the native or non-native status of the salmon species being farmed. Although somewhat counter-intuitive, the final scores for Atlantic salmon are better in Chile and BC where the species is non-native, compared to Norway and Scotland where Atlantic salmon are a native species as discussed below.

Native/non-native status

	Norway	Chile	Scotland	BC
Atlantic salmon	Native	Non-native	Native	Non-native
Coho salmon		Non-native		

Although the design and operation of net pens has improved and reported escape numbers have generally declined over the last decade, large scale escape events continue to occur from net pen salmon farms (e.g. 154,000 escapes in Scotland in January 2014; 55,000 in Norway, January 2014), and along with potentially significant "trickle" losses these escapes continue to highlight the vulnerability of this production system and the ongoing high risk of escape.

Data on recaptures are sparse or non-existent and recapture efforts are also considered to be limited or non-existent in all regions. Although escapees have been reported at considerable distances from escapes sites in all regions, post-escape mortalities from predation and starvation are likely to be high. Robust data or estimates on mortalities are limited, therefore a precautionary Recapture and Mortality value of 13% has been used which acknowledges some likely mortality, but maintains the final escape risk score in the "red" high risk category to also acknowledge the ongoing high escape risk.

Escapes scoring information

	Norway	Chile	Scotland	BC
Initial Escape Risk score (0-10)	2	2	2	2
Recapture and Mortality %	13	13	13	13

Adjusted Escape Risk score (0-10)	3	3	3	3
Invasiveness – Atlantic (0-10)	1.5	6	2	6
Invasiveness – Coho (0-10)		4		
Final Score – Atlantic (0-10)	2.0	4.0	2.0	4.0
Final Score – coho (0-10)		3.0 (coho)		

Considering well-documented interactions between escaped farmed salmon and wild salmon populations in the North Atlantic (i.e. Scotland and Norway) and resulting concerns regarding reduced genetic fitness and/or loss of distinct genetic sub-populations in these countries, the invasiveness score for Atlantic salmon in Norway and Scotland is low. For example, the complete replacement of some wild Atlantic salmon populations in Norway with fish derived from farm escapees has been reported, and salmon farm escapees in Norway are considered to be one of the three major factors impacting wild salmon production (in addition to sea lice and hydroelectric power).

Numerous deliberate historic attempts to establish Atlantic salmon in the Pacific in both Chile and BC (to enhance commercial and sport fisheries) have not been successful. Other salmonid species (also deliberately introduced) have successfully established in both regions, and while various salmonid species have become established globally, Atlantic salmon has never become established beyond its native range. Large escapes of farmed Atlantic salmon have occurred over the last three decades in Chile and BC at different life stages (e.g. from juvenile to mature pre-spawning adults), in different locations, and at different times of year. Although juvenile salmon have been reported in a river in BC and also in Chile and assumed to be from local reproduction (in BC), there is no current evidence of their establishment in either region, and studies conclude that Atlantic salmon is a poor colonizer outside of its native range in the Pacific. Increasing domestication of farmed Atlantic salmon over multiple generations in the Pacific in BC and Chile can be considered to either lower the likelihood of success in the wild, or increase the adaptation to the Pacific and therefore increase the potential success in the wild. The current lack of evidence of the establishment of Atlantic salmon in the Pacific, supported by studies showing a high prevalence of empty stomachs in recaptured escapees, means that the assessments for Chile and BC consider Atlantic Salmon to be "*not established, and highly unlikely to establish viable populations*" according to the Seafood Watch criteria (the invasiveness score is 6 out of 10).

Coho salmon (a native of the North Pacific) have also been the subject of deliberate releases in the south Pacific in Chile, and there is evidence of coho populations in several rivers in Chile. This species is considered to be "*partly established with the potential to extend the species range"* according to the Seafood Watch criteria (the invasiveness score is 4 out of 10).

Final Escapes Scores

Combining the high escape risk score with the invasiveness score for Atlantic salmon in BC and Chile results in moderate final scores of 4 out of 10 which despite the limited evidence of impacts, acknowledges the ongoing concern regarding the potential for this species to become established in the future. The lower invasiveness score for coho salmon (i.e. evidence of impacts) combined with the same escape risk results in a "red" high concern score of 3 out of 10.

Criterion 7: Disease, Pathogen and Parasite Interactions

Final Score

Norway	Chile	Scotland	BC
0.0	4.0	0.0	2.0

Due to the complexity of the debate regarding pathogens and parasites, the following is a very brief summary of the issues and the assessments. Please refer to the individual reports for more detailed information.

Vaccinations and improvements to biosecurity have reduced the occurrence of fish health events on salmon farms, but the open nature of the net pens means the fish are readily infected by pathogens from the surrounding waterbody or wild fish, or from other natural infection routes. As a result, they can suffer from, host, amplify, and act as a temporally unnatural reservoir for a variety of pathogens and parasites that have the potential to impact native salmonid species (including sea trout particularly). The expansion of salmon aquaculture has therefore brought conservation concerns in regions where the areas occupied by salmon farms are important migratory corridors for wild salmonids. In Norway, the scale of production means that farmed salmon outnumber wild salmon by an estimated 250 to 700 times.

Presence of vulnerable wild salmonid populations

Norway	Chile	Scotland	BC
Yes	No	Yes	Yes

Farmed salmon outnumber wild salmon

Norway	Chile	Scotland	BC
Yes	No	Yes	No

While diseases and parasites have caused, and continue to cause, significant production problems in all regions, with respect to potential impacts on wild salmonids there are two main areas of concern; these are firstly bacterial and viral pathogens, and secondly parasites of which sea lice are the focus. These topics, particularly sea lice, have been the subject of intense debate in the scientific literature with predicted impacts ranging from population extinction to no-net-effect.

With respect to bacterial and viral diseases, despite the potential for these pathogens to cause major production problems, there is little evidence of impacts on wild salmonids or other wild fish species. For example, although the Infectious Salmon Anemia virus caused the collapse of the Chilean Atlantic salmon farming industry between 2008 – 2011, sampling of wild fish and other marine life in Chile did not detect the virus in over 500 samples (with the exception of one escaped Atlantic salmon). Globally, there have not been any documented mortalities in salmon outside of farms as a result of ISA. Nevertheless, the difficulty of detecting mortalities in wild fish is clear, and a variety of bacterial and viral diseases of high pathogenicity to wild salmon are present on farms in all regions. In addition, the movement of salmon eggs from Europe to Chile and British Columbia is responsible for the introduction of pathogens such as ISA and Piscine Reovirus (associated with the Heart and Skeletal Muscle Inflammation) (the presence of ISA in BC is highly disputed), and movements of infected fish (e.g. from hatcheries to coastal net pens) within these regions has made them widespread, but as above, the impacts are as-yet uncertain.

The potential for impacts are clear; for example Atlantic salmon have been shown to act as a source of “spillback to sympatric wild fishes” (in this case, with respect to viral hemorrhagic septicemia virus, VHSV) and salmon farms have also been shown to be a source of more virulent strains of pathogens. Therefore despite the lack of evidence of impacts, the direct overlap of farming areas and critical migration corridors for juvenile salmon continues to be a high concern in Norway, Scotland and BC. Chile is the only country that does not have native wild salmon populations, and there is no evidence of salmon farm pathogens (bacterial or viral) impacting non-salmonid species in Chile. Therefore the concern with respect to impacts on native species is lower in Chile than the other regions.

With respect to sea lice, it is clear that salmon farms represent the dominant source of lice infection on wild juvenile salmon and sea trout in Norway, Scotland and BC:

- In Norway, large review studies and meta-analyses conclude that sea lice have a moderate population regulating effect on wild salmon. Along with escapes and hydroelectric power, sea lice are considered to be one of the three major factors affecting wild salmon production in Norway. Impacts on sea trout are a greater concern; Norway’s Auditor General stated: “*The prevalence of lice remains at a high level along large parts of the coast and this has a negative impact on wild fish, sea trout in particular”.*
- In Chile, sea lice from farms have been shown to infect other non-salmonid species but are considered unlikely to have a significant population level impact. Nevertheless, the expansion of the industry and the location of pathogen and parasite reservoirs in pristine regions further south continue to be a concern.
- In Scotland, lice levels are being controlled during the important outmigration period for wild salmon (from February to June), but lice levels at other times of year remain a high concern, particularly for wild sea trout.
- In BC, the issue of sea lice has been the cause of intense debate, particularly on more vulnerable pink and chum salmon which migrate past salmon farms at a very small size. Numerous studies indicate a large drop in sea lice numbers from approximately 2004-2007 (compared to previous “epizootics” events), and although wild salmon continue to be

infected by sea lice, the infection levels are not considered to result in significant population declines.

Final Disease Scores
Salmon farms continue to act as reservoirs for highly virulent pathogens of wild fish. The potential for significant impacts on wild fish resulting from bacterial or viral pathogens on salmon farms remains in all regions although to date, evidence of impacts is scarce. Due to the overlap of salmon farms and critical habitats for highly important wild salmon migrations, this represents a high concern in Norway Scotland and BC and a score of 2 of 10. In addition, the documented impacts on salmon and sea trout resulting from sea lice infections in Norway and Scotland result in a reduced score of 0 out of 10. There is only minor evidence of potential impacts in Chile, but an ongoing concern remains regarding the expansion of pathogen reservoirs into more southerly locations; the score for Chile is a moderate 4 out of 10.

Criterion 8: Source of Stock – Independence from Wild Fisheries

Final Score

Norway	Chile	Scotland	BC
10.0	10.0	10.0	10.0

Due to the industry-wide use of domesticated broodstocks, salmon farming in all regions is considered to be independent of wild salmon fisheries for the supply of adult or juvenile fish. Therefore the score for the Source of Stock Criterion is 10 out of 10.

Criterion 9X: Wildlife and Predator Mortalities

Final Score

Norway	Chile	Scotland	BC
-6.0	-4.0	-5.0	-4.0

Criterion 9X is an exceptional criterion which results in a penalty score of 0 (no impact) to -10 (evidence of significant impacts) where relevant to the assessment.

The main concerns with respect to predator and wildlife mortality are marine mammals and to a lesser extent birds due to deliberate lethal control, and accidental entanglement. Lethal control of pinnipeds (seals and sea lions) is permitted in Scotland and BC, is illegal in Chile, and is unclear in Norway. Mortality data is published in Scotland and BC.

The total number of seals and sea lions killed in BC (primarily from deliberate shooting) has dropped from a high of over 600 per year in the 1990s to approximately 10 per year in 2013 (although there was a spike in sea lion numbers to over 200 in 2011); numbers in Scotland are not differentiated from wild fishery controls, but the total mortality in 2013 was 237 harbor and grey seals. In Chile, some mortalities may occur due to entanglement or unreported shooting in remote location, but no data is available from Norway, the regulatory oversight of lethal control is not clear, and therefore the level of mortality in Norway is unknown.

Final Wildlife and Predator Mortality Scores

Although distasteful from an anthropomorphic perspective, the mortality numbers of pinnipeds and of bird entanglements are not likely to have a significant population level effect on any of the species. Therefore there is a moderate concern for all regions with a lower (worse) score for Norway due to the lack of transparency.

Criterion 10X: Escape of Unintentionally Introduced Species

Final Score

Norway	Chile	Scotland	BC
0.0	-0.4	-1.0	-4.0

Criterion 10X is an exceptional criterion which results in a penalty score of 0 (no impact) to -10 (evidence of significant impacts) where relevant to the assessment.

This criterion is a measure of the escape risk (introduction to the wild) of alien species other than the principle farmed species unintentionally transported during live animal shipments. The movement of live fish and particularly eggs has been an essential component of the establishment of salmon farming in all regions. As the Norwegian industry was the first to become established, it was the source of many live fish movements, and has since been shown to be the origin of introduced pathogens such as European (North Atlantic) strains of ISA virus into Chile and PRV into both Chile and BC.

Previous introduction of non-native species resulting from salmon farming

Norway	Chile	Scotland	BC
No	Yes	No	Yes

Ongoing imports of salmon eggs (and percent of total egg production)

Norway	Chile	Scotland	BC
Yes (<1%)	Yes (<1%)	Yes (53%)	No

The international movement of live salmon is now principally of eggs. Movements of eggs between Norway and Scotland continue, but while over half of Scotland's egg production relied on imports (in 2012), only 1% of Norway's eggs were of foreign origin. As Scotland and Norway are both in the NE Atlantic, the risk of introducing pathogens from movements between these countries is generally low. An exception is the parasite *Gyrodactylus salaris* which continues to represent a serious risk of impact if introduced into Scotland; however with effective regulatory and biosecurity measures in place, the risk of introduction of introduction due to the movement of salmon eggs is considered to be low. Egg imports into Chile continue (as of 2013), but represent a small component of total eggs produced as the country is now largely self-sufficient with its own broodstocks.

BC has not imported eggs since 2009 and the ongoing risk of introducing further non-native species is considered to be low while this situation continues, however the movements of live fish (smolts) from hatcheries to coastal net pens remains an essential component of the salmon farming production model (in all regions). Therefore the apparently recent introduction of PRV from Europe into BC in addition to the uncertain links between this virus and Heart and Skeletal Muscle Inflammation (HSMI) means although these movements now occur within health management zones the risk of spreading PRV within BC remains a moderate concern with respect to the importance of the wild salmon populations. PRV and ISA have also been spread throughout Chile, but without natural wild salmon populations, these movements are of a lower environmental concern.

Final scores for Escape of Unintentionally Introduced Species

With very low egg imports, the risk in Norway is considered negligible (score 0 out of 10). Chile is similar, but represents a small risk of further introductions and associated environmental impacts on wild species (score -0.4 out of -10). Scotland has significant egg imports, but a low risk of introducing further non-native pathogens (score -1 out of -10). Current evidence of a recent introduction of PRV virus into BC and the ongoing movement of infected fish within the region despite no current evidence of impacts is a moderate concern (score -4 out of -10).

Final Seafood Recommendations

With two or more red criteria scores for all country/regions, the final recommendation for farmed salmon in Norway, Chile, Scotland and British Columbia is "Avoid".

Atlantic salmon final scores

Criterion	Norway		Chile		Scotland		BC	
C1 Data	6.7	GREEN	6.1	YELLOW	8.1	GREEN	7.5	GREEN
C2 Effluent	4.0	YELLOW	2.0	RED	5.0	YELLOW	5.0	YELLOW
C3 Habitat	6.0	YELLOW	3.9	YELLOW	6.8	GREEN	6.1	YELLOW
C4 Chemicals	1.0	RED	CRITICAL	CRITICAL	1.0	RED	2.0	RED
C5 Feed	5.2	YELLOW	4.2	YELLOW	5.9	YELLOW	5.8	YELLOW
C6 Escapes	2.0	RED	4.0	YELLOW	2.0	RED	4.0	YELLOW
C7 Disease	0.0	RED	4.0	YELLOW	0.0	RED	2.0	RED
C8 Source	10.00	GREEN	10.0	GREEN	10.0	GREEN	10.0	GREEN
C9X Wildlife mortalities	-6.0	YELLOW	-4.0	YELLOW	-5.0	YELLOW	-4.0	YELLOW
C10X Introduced species escape	0.0	GREEN	-0.4	GREEN	-1.0	GREEN	-4.0	YELLOW
Final score / Rank	**3.6**	RED	**3.7**	RED	**4.1**	RED	**4.3**	RED

Scoring note –scores range from 0 to 10 where 0 indicates very poor performance and 10 indicates the aquaculture operations have no significant impact. Color ranks: red = 0 to 3.33, yellow = 3.34 to 6.66, green = 6.66 to 10. Criteria 9X and 10X are exceptional criteria, where 0 indicates no impact and a deduction of -10 reflects very poor performance.

Coho salmon final scores

Criterion	Norway		Chile		Scotland		BC	
C1 Data			6.1	YELLOW				
C2 Effluent			2.0	RED				
C3 Habitat			3.9	YELLOW				
C4 Chemicals			CRITICAL	CRITICAL				
C5 Feed			4.2	YELLOW				
C6 Escapes			3.0	RED				
C7 Disease			4.0	YELLOW				
C8 Source			10.0	GREEN				
C9X Wildlife mortalities			-4.0	YELLOW				
C10X Introduced species escape			-0.4	GREEN				
Final score / Rank			**3.6**	RED				

About Seafood Watch®

Monterey Bay Aquarium's Seafood Watch® program evaluates the ecological sustainability of wild-caught and farmed seafood commonly found in the North American marketplace. Seafood Watch® defines sustainable seafood as originating from sources, whether wild-caught or farmed, which can maintain or increase production in the long-term without jeopardizing the structure or function of affected ecosystems. Seafood Watch® makes its science-based recommendations available to the public on www.seafoodwatch.org. The program's goals are to raise awareness of important ocean conservation issues and empower seafood consumers and businesses to make choices for healthy oceans.

Each sustainability recommendation is supported by a Seafood Report. Each report synthesizes and analyzes the most current ecological, fisheries and ecosystem science on a species, then evaluates this information against the program's conservation ethic to arrive at a recommendation of "Best Choices," "Good Alternatives," or "Avoid." The detailed evaluation methodology is available on our website. In producing the Seafood Reports, Seafood Watch seeks out research published in academic, peer-reviewed journals whenever possible. Other sources of information include government technical publications, fishery management plans and supporting documents, and other scientific reviews of ecological sustainability. Seafood Watch Research Analysts also communicate regularly with ecologists, fisheries and aquaculture scientists, and members of industry and conservation organizations when evaluating fisheries and aquaculture practices. Capture fisheries and aquaculture practices are highly dynamic; as the scientific information on each species changes, Seafood Watch's sustainability recommendations and the underlying Seafood Reports will be updated to reflect these changes.

Parties interested in capture fisheries, aquaculture practices and the sustainability of ocean ecosystems are welcome to use Seafood Reports in any way they find useful. For more information about Seafood Watch and Seafood Reports, please contact the Seafood Watch program at Monterey Bay Aquarium by calling 1-877-229-9990.

Disclaimer
Seafood Watch® strives to ensure all our Seafood Reports and the recommendations contained therein are accurate and reflect the most up-to-date evidence available at time of publication. All our reports are peer reviewed for accuracy and completeness by external scientists with expertise in ecology, fisheries science or aquaculture. Scientific review, however, does not constitute an endorsement of the Seafood Watch program or its recommendations on the part of the reviewing scientists. Seafood Watch is solely responsible for the conclusions reached in this report. We always welcome additional or updated data that can be used for the next revision. Seafood Watch and Seafood Reports are made possible through a grant from the David and Lucile Packard Foundation.

Guiding Principles

Seafood Watch® defines sustainable seafood as originating from sources, whether fished[7] or farmed, that can maintain or increase production in the long-term without jeopardizing the structure or function of affected ecosystems.

The following **guiding principles** illustrate the qualities that aquaculture must possess to be considered sustainable by the Seafood Watch program:

Seafood Watch will:

- Support data transparency and therefore aquaculture producers or industries that make information and data on production practices and their impacts available to relevant stakeholders
- Promote aquaculture production that minimizes or avoids the discharge of wastes at the farm level in combination with an effective management or regulatory system to control the location, scale and cumulative impacts of the industry's waste discharges beyond the immediate vicinity of the farm
- Promote aquaculture production at locations, scales and intensities that cumulatively maintain the functionality of ecologically valuable habitats without unreasonably penalizing historic habitat damage
- Promote aquaculture production that by design, management or regulation avoids the use and discharge of chemicals toxic to aquatic life, and/or effectively controls the frequency, risk of environmental impact and risk to human health of their use
- Within the typically limited data availability, use understandable quantitative and relative indicators to recognize the global impacts of feed production and the efficiency of conversion of feed ingredients to farmed seafood
- Promote aquaculture operations that pose no substantial risk of deleterious effects to wild fish or shellfish populations through competition, habitat damage, genetic introgression, hybridization, spawning disruption, changes in trophic structure or other impacts associated with the escape of farmed fish or other unintentionally introduced species
- Promote aquaculture operations that pose no substantial risk of deleterious effects to wild populations through the amplification and retransmission of pathogens or parasites
- Promote the use of eggs, larvae, or juvenile fish produced in hatcheries using domesticated broodstocks thereby avoiding the need for wild capture
- Recognize that energy use varies greatly among different production systems and can be a major impact category for some aquaculture operations, and also recognize that improving

7 "Fish" is used throughout this document to refer to finfish, shellfish and other invertebrates.

practices for some criteria may lead to more energy intensive production systems (e.g., promoting more energy-intensive closed recirculation systems)

Once a score and rank has been assigned to each criterion, an overall seafood recommendation is developed on additional evaluation guidelines. Criteria ranks and the overall recommendation are color-coded to correspond to the categories on the Seafood Watch pocket guide:

Best Choices/Green: Are well managed and caught or farmed in environmentally friendly ways.

Good Alternatives/Yellow: Buy, but be aware there are concerns with how they're caught or farmed.

Avoid/Red: Take a pass on these. These items are overfished or caught or farmed in ways that harm other marine life or the environment.