A Review of Global Data on Escapes from Open Net Cages Using Farmed Salmon as a Case Study

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pure salmon campaign
RAISING THE STANDARDS FOR FARM-RAISED FISH

Objective:

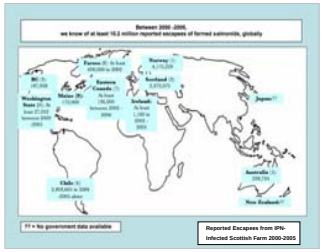
The findings are intended to aid the National Organic Standards Board (NOSB) in answering NOSB Question 3, and to consider:

- The rate of escapes from open net cage systems, by species and region
- The causes of escapes
- The potential of proposed organic standards to provide adequate controls of escapes from open net cage systems

Background & Methods:

Over the past year, the Pure Salmon Campaign has collected data to form an international inventory of reported escapes of salmon and other marine fish farmed in open net cages.

- Through Freedom of Information (FOI) requests in Scotland, Norway, Chile, Maine and Australia
- The North Atlantic Salmon Conservation Organization (NASCO) has also provided access to data



Results: Scientific Literature Review

30 Papers Globally

- Significant ecological and genetic impacts on native wild fish populations
- Risk of increased disease outbreak and decreased immunity of wild fish to disease
- Link of open net cage salmon farms with sea lice infestations of wild fish populations
- Escapes from other species grown in open net cages such as cod, halibut, sea trout, kingfish, and bream are an emerging international issue

A Conservative Estimate

- Incomplete data set for most regions
- Self-reported data
- Possible underreporting
- Doesn't include "leakages"
- Mostly includes only farmed salmonids
- Does not include 2007 data

NOSB Question Answered:

Rate of Escapes

Region	Year	Production (tonnes, wfe)	Reported Escapees	Escape Ratio	Average Escape Ratio
Norway (1)	2001	506,883	368,000	1:459	1:331
	2002	546,054	730,000	1:249	
	2003	578,475	550,000	1:350	
	2004	627,315	563,000	1:371	
	2005	645,387	722,000	1:298	
	2006	689,089	882,229	1:260	
Scotland (2)	2001	138,519	89,996	1:513	1:304
	2002	144,589	312,655	1:154	
	2003	169,736	151,853	1:373	
	2004	158,099	90,594	1:581	
	2005	129,588	1,002,883	1:43	
	2006	137,018	287,753	1:159	
Chile (3)	1995	98,287	315,133	1:104	1:626
	1996	144,315	111,706	1:431	
	2002	476,349	90,000	1:1,764	
	2004	569,500	2,023,365	1:94	
	2005	619,900	280,240	1:737	
British Columbia (4)	2001	68,000	55,167	1:411	1:195,158
	2002	84,200	20,455	1:1,372	
	2003	72,700	40	1:605,833	
	2004	61,800	43,985	1:468	
	2005	70,600	64	1:367,708	

*Figure 2 is modeled on "Table 1" of a paper titled *Ecological and Economic Impact Assessment of Salbelish Aquaculture in British Columbia*. Sumaila et al (2005) calculated the "escape ratio" of farmed salmon in British Columbia, which enables a comparison of rates of escapees in major producing regions. According to the paper: Sumaila, U.R., Volpe, J.P. and Liu, Y. 2005. Ecological and economic impact assessment of salbelish aquaculture in British Columbia. FCRR 13 (3). University of British Columbia Fisheries Center, Vancouver.
Escape ratio is calculated by dividing estimated annual number of salmon in production by the reported number of escapees (e.g. 1 in 252 farmed salmon escaped in Norway in 2006). Number of fish in production is conservatively estimated by dividing annual production (tonnes) by 3 kilograms – this representing a mean size class of the O+, 1+ and 2+ sea winter fish in marine net-pens during a given year. The actual figure would vary as market-ready adults (~4 kg) are harvested and replaced by a greater number of smolts (~70 g). A 3 kg average is a conservative net-pen standing stock estimator, resulting in a conservative estimate of proportional escapes.

Rate of Escapes

Organic Farms Report Escapes

A comparison of Soil-Association "Organic" Salmon Farm Sites to SEPA data 2002 -2006 suggests:

- 12 escape incidents
- 122,962 reported escapees
- About 1% recaptured
- No production data - Could not calculate escapes rate

Causes of Escapes

Region	Year	Major Causes of Escapes	% of Escapes
Norway	2001-2006	Plant Failure	53
		Collision	13
		Others	12
Scotland	2002-2006	Weather	28
		Predator	23
		Equipment Failure	20
Chile	2004 -2005	Net breakage	36
		Storm/Wind & Rain	29
Australia	2000-2007	Unknown	40
		Net tear/Hole	33
		Storm	20

What is the current rate of escape in the conventional aquaculture and developing organic aquaculture industry?

Our international inventory of escapes data indicates at least **10.2 million farmed fish escapes between 2000 and 2006** in **262** reported escape incidents. For Norway and Scotland the rate of escapes was 1 in every 300 fish in production

How can the issue of escape be better controlled in an organic system than in a conventional ocean-based system?

An organic system based on open net cages can never control escapes; therefore, open net cage systems should never be considered organic.

Are there any implications to containment farming of fish species not indigenous to that geographic area other than cross-breeding with native species?

- Escapees can compete with native and non-native wild salmon species for mates, space and prey.
- Escapes may have a detrimental impact on vulnerable wild salmon populations at a regional scale.
- Escapes present risks of increasing disease outbreaks, proliferating possible disease transmission routes in the environment, and decreasing the immunity of wild fish to disease.
- Repeated farm escapes can establish self-sustaining feral populations and escapees can have significant impacts on wild fish whether or not escapees reproduce.
- Risks include potential reductions in the genetic diversity (and resulting ability to adapt to environmental change), productivity, and fitness of wild fish, leading to possible extinctions as well as the loss of unique gene pools.

Concerning Trends in Escapes

Escapes of Chemically-treated Salmon

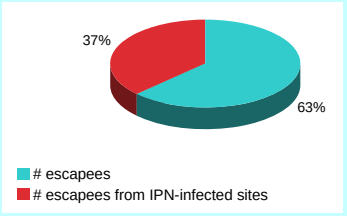
Chemically-Treated Escapes from Scottish Atlantic Salmon Farms

Year	# Escapees	# from site treated with Emamectin	# from site treated with Cypermethrin	# from site treated with Oxytetracycline
2002	312,655	8,647	0	0
2003	151,853	16,001	500	0
2004	90,594	15,946	0	0
2005	1,018,683	51,953	3,000	0
2006	287,753	24,318	0	1,950

Concerning Trends in Escapes

60% of Scottish Escapees from IPN-Infected Sites

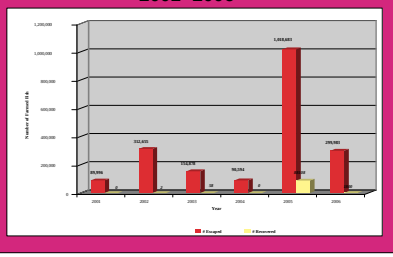
Reported Escapees from IPN-Infected Scottish Farm 2000-2005



Concerning Trends in Escapes

Successful Recapture is Virtually Impossible

Scottish Reported Escapes of Marine Finfish Versus Recovered 2001 -2006



Conclusion:

- Escapes continue to occur in every major producing region
- Norway reported 1.2 million escapes of farmed fish in 2006, despite a zero escapes policy
- Weather and failure of equipment are the leading causes of escapes
- Less than 2% of escapes are recapture, on average
- Escapes occur from diseased and chemically treated sites
- New species are escaping at a higher rate (Norwegian data)
- Escapes occur from UK organic sites, despite organic standards

For more information and a list of references see the full paper at www.puresalmon.org