

Information available to the Province for assessing the threat of salmon farm diseases

By Gary D. Marty



Spawning Chinook salmon jumping up a waterfall
Betsie Richardson Studio (pinterest.com)

Lesson #1:
**Diseases and
parasites are
natural and common
in wild salmon**

Evidence:

Wild BC Chinook Salmon Study^a

- Sample size = 82 fish
- # of microparasite species (all fish) = 20
- # microparasites per fish; median = 7 – 8

^aBass, Hinch, Teffer, Patterson, and Miller.
2017. Journal of Fish Diseases.

Assessing the Threat of Salmon Farm Diseases

Themes:

- **Clarification of a Cohen Commission Statement**
- **A medical perspective on disease transfer**
- **Provide confidence that:**

BC salmon farms pose **no more than a minimal risk of serious harm** to the health of migrating wild salmon populations

Cohen Commission Final Report

October 31, 2012

“In summary, I have concluded that net-pen salmon farming in the Discovery Islands poses **a risk of serious harm** to Fraser River sockeye through the transfer of diseases and pathogens.”

Cohen Commission Final Report

October 31, 2012

A medical perspective:

Lesson #2: The biology of disease transfer operates in a similar manner for salmon as it does for people

Demonstration:

1. Disease is more likely to transfer when the infected person/fish is closer to an uninfected person/fish.
2. Disease is more likely to transfer when the infected person/fish is exposed longer to an uninfected person/fish.

Cohen Commission Final Report

October 31, 2012

[*air travel*]

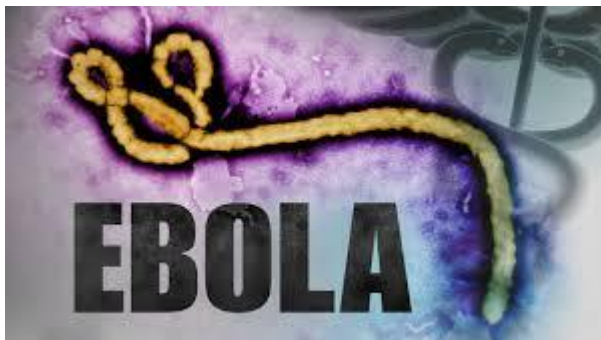
“In summary, I have concluded that **net-pen salmon farming**

[*to Vancouver International Airport*]

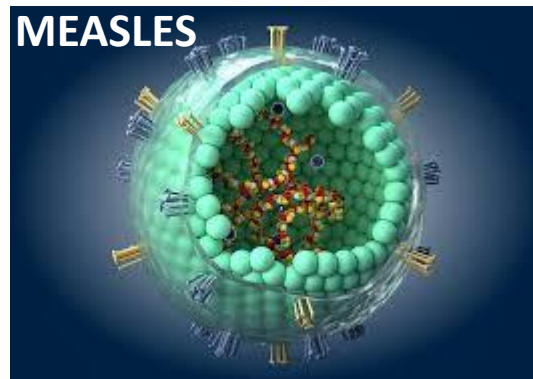
in the Discovery Islands poses a risk of serious harm to

[*British Columbians*]

Fraser River sockeye through the transfer of diseases and pathogens.”



news.poolandspa.com



fineartamerica.com



www.idsociety.org

Threat of Salmon Farm Diseases?

Minimal or Great? **Cannot quantify** [Vol. 3, p. 21, column 1]

Fish Disease Data Quality and Quantity? **Impressive** [Vol. 3, p. 18, column 2]

Trend in diseases from 2003 – 2010? **Declining** [Vol. 2, p. 164, last full paragraph]

IHN outbreaks: 2001 – 2003, 22 months/36 farms → 2012, 3 months/3 farms

Wastes, chemicals, and escapes? **Population-level effect unlikely**
[Vol. 2, p. 114, columns 1-2]

Conclusion about farm effect? **No significant negative impact**
[Vol. 3, p. 24, column 2]

What was the cause of the 2009 decline?

Early marine part of life cycle: [Vol. 3, p. 59, column 1]

1. poor food availability

2. harmful algae

References are to the Cohen Commission Final Report; available at:

http://epe.lac-bac.gc.ca/100/206/301/pco-bcp/commissions/cohen/cohen_commission/LOCALHOS/EN/INDEX.HTM

Threat of Disease Transfer

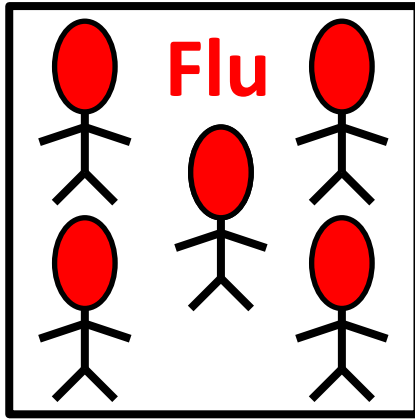
Illustration

Elevator

Football field

You

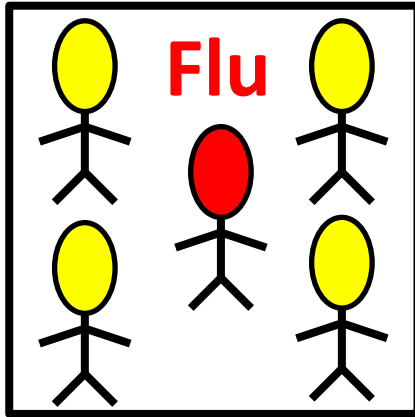
A



[Disease **does** spread from the four infected individuals]



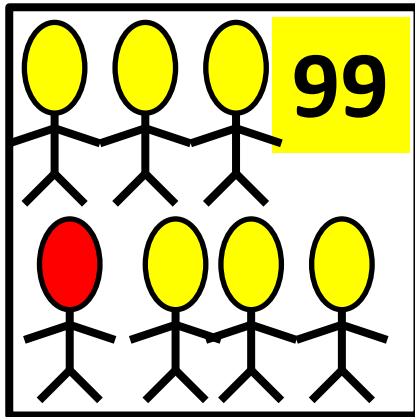
B



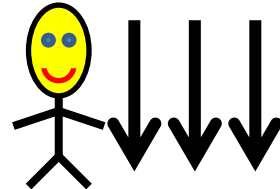
[Disease does **not** spread from the one infected individual]



C



[Disease does **not** spread, despite closer contact than in B]



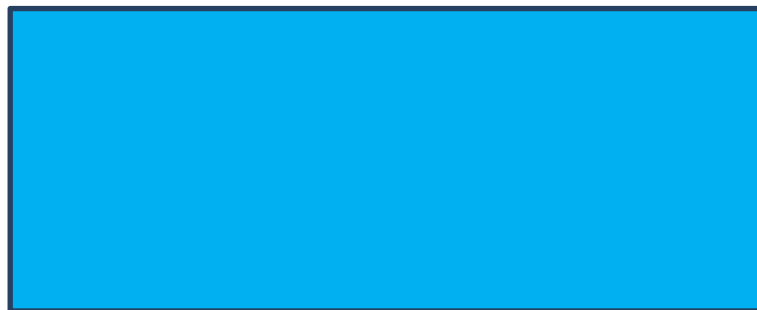
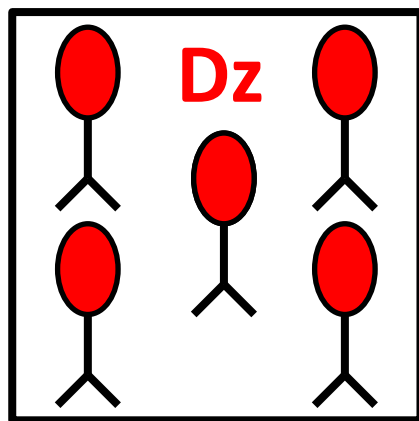
Fish Farm

Open Ocean

Wild
salmon

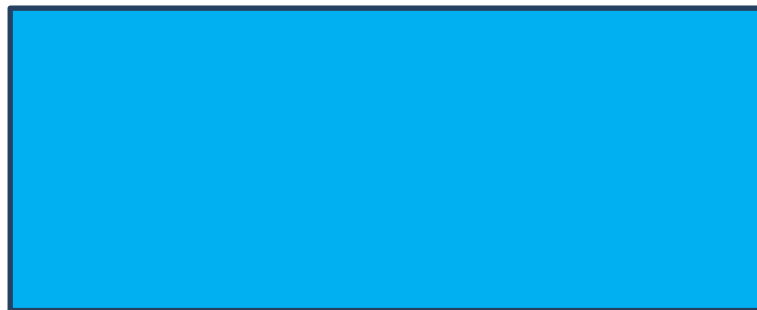
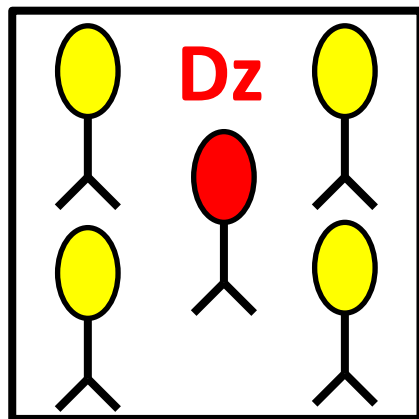
A

?

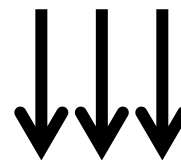
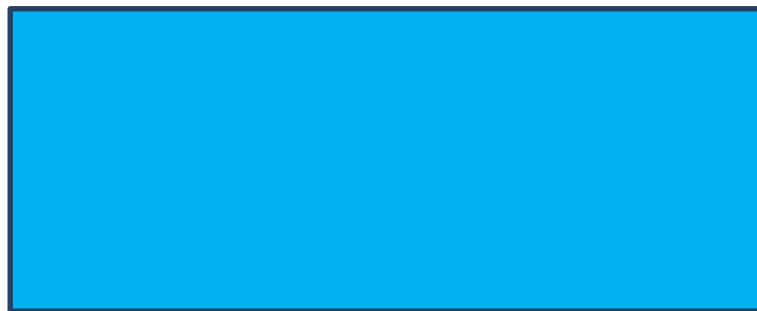
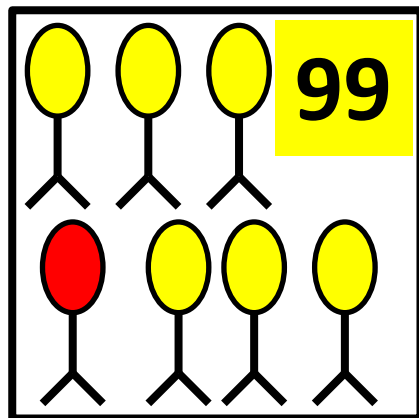


B

?



C



Monthly Salmon Farm Mortality

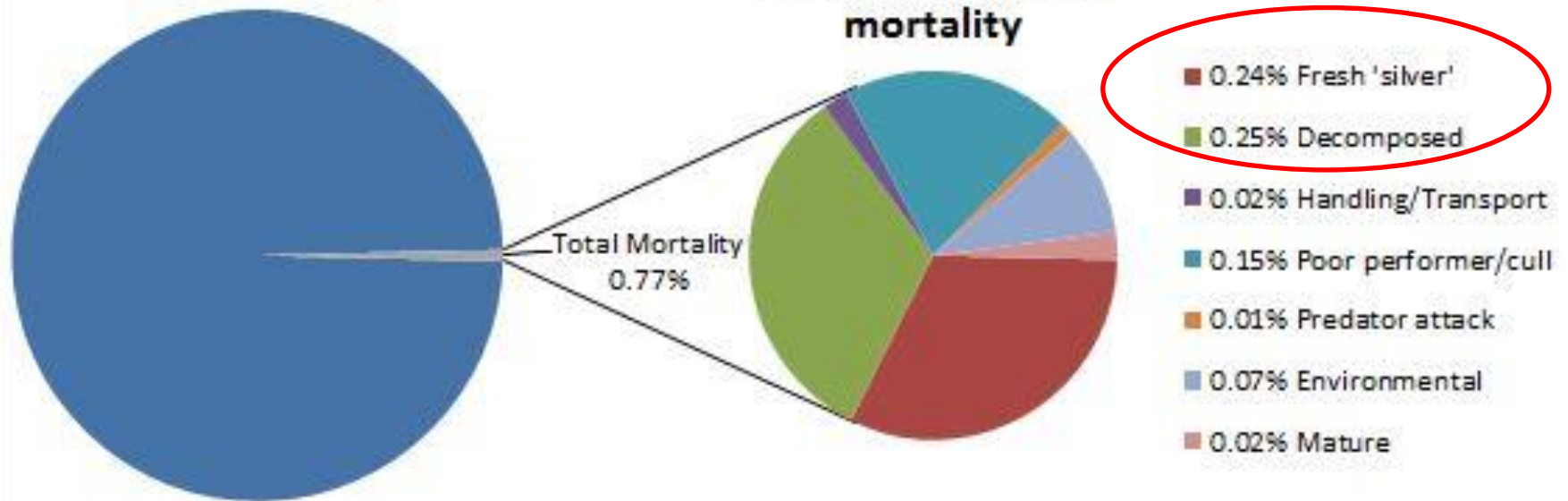
[Supports scenario C]

Atlantic species, Zones 3.1 & 3.2

April through June, 2016

Mortality as a proportion
of inventory

Proportion of total
mortality



Annual Salmon Farm Mortality

[Area 3.1+3.2] Quarter	Monthly Mortality (%)	
	Total	“Fresh silver” + Decomposed
2015Q4	0.93	0.45
2016Q1	0.56	0.23
2016Q2	0.77	0.49
2016Q3	2.01	0.84
Total (Annual)	12.81	6.03

[These are the most likely to have an infectious disease that threatens wild salmon.]

c/w wild fish 3%/day

More info?

DFO Fish Health Auditing and Surveillance Program

- Scientifically based representative sampling
- 30 salmon farm audits per quarter
- 2016: 772 Atlantic salmon, 73 Pacific salmon
 - Sampled fish – moribund or recently dead
- Histopathology: all fish, 9 organs/fish
- Bacteriology: all fish, kidney
- PCR tests: pooled samples from all fish
 - Viruses – VHSV, IHNV, IPNV, ISAV, SAV
 - Bacteria – *Piscirickettsia salmonis*

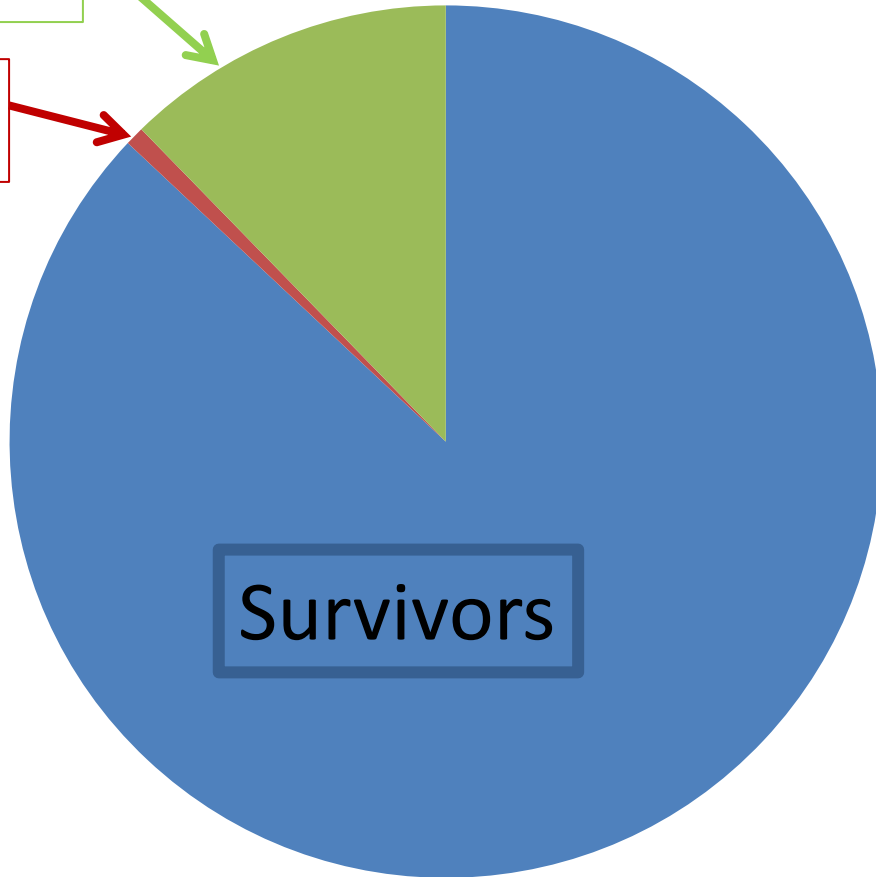
Support for Scenario C: **691** Reasons

691 fish

Source: DFO Farm Salmon Fish Health Audit Program – 2016 data

Sample size: 772 Atlantic salmon

81 fish



Fish Farm Mortality Data:

■ Survive (87%)

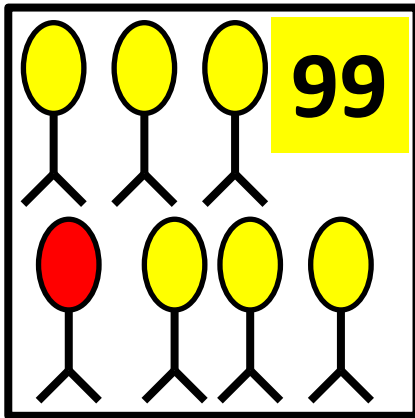
DFO Audit Program Data:

■ Death from infectious disease of concern (0.7%)

■ Death from something else (12.3%)

In 2016, 99.3% of the farm salmon were continuously exposed to diseases of concern, but none of the 99.3% died of those diseases.

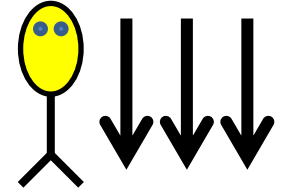
Fish Farm



Open Ocean



Wild
salmon



Diseases do transfer between wild and farm salmon

- <1% of farm fish die per year of significant disease
- **Diseases that do not spread inside the farm will spread even less outside the farm**
- Reasonable assumption: **farm-source disease kills <1% of wild salmon per year**
- Compare with **3% per day = normal death rate of wild juvenile salmon**

Evidence of the Reliability of Audit Program data

- **Histopathology** – slides have been examined by 8 different pathologists from 2001 – today
 - Consistent finding – low prevalence of infectious disease
- **PCR & Bacteriology** – BC Animal Health Centre accredited by two independent organizations
 - AAVLD
 - Standards Council of Canada (ISO17025)

Evidence that Pacific salmon are not more susceptible to Atlantic salmon diseases

- **Sea lice** (some juvenile Pacific salmon ARE more susceptible than farmed Atlantic salmon)
 - Effectively controlled by current adaptive management
- No evidence of others
 - Controlled laboratory studies – at least six over the past 25 years
 - Norway and Chile – long history of cohabiting Pacific salmonids with Atlantic salmon on the same farms

Summary

- **Lesson #1: Diseases and parasites are natural and common in wild salmon**
- **Lesson #2: The biology of disease transfer operates in a similar manner for salmon as it does for people**
- Scientific principles of disease transfer:
 - Salmon farm diseases pose no more than **minimal risk** of serious harm to migrating wild salmon populations

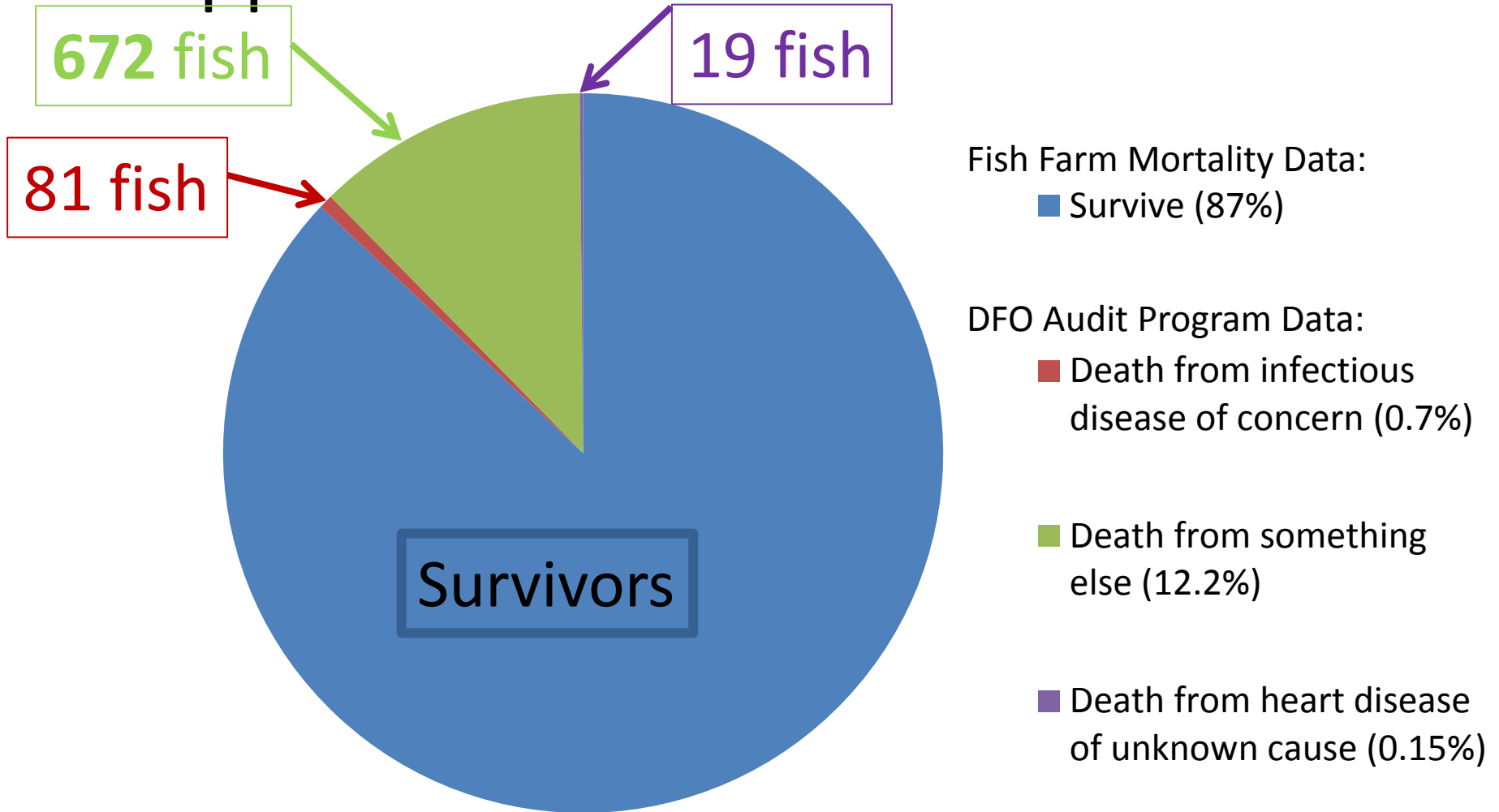
Cause of Death in 2016 - Diseases of Concern

# of fish	Type of infectious agent (772 fish sampled)
78	Bacteria:
	<i>Piscirickettsia salmonis</i> (n = 56)
	<i>Renibacterium salmoninarum</i> (n = 11)
	<i>Aeromonas salmonicida</i> (n = 5)
	Unidentified bacteria (n = 4)
	<i>Yersinia ruckeri</i> (n = 2)
2	Virus:
	VHSV (n = 2)
1	Parasite:
	<i>Paramoeba</i> sp. (n = 1)
81	Total (= 11% of all samples during 2016)

Audit fish represent ~6% of all fish on farms in 2016

11% of 6% = 0.7% (< 10 fish per thousand)

Support for Minimal Risk: **672** Reasons



In 2016, 99.1% of the farm salmon were continuously exposed to diseases of concern & heart disease, but none of the 99.1% died of those diseases.