



ENVIRONMENTAL SURVEILLANCE AND IMAGE OF SEA FARMING  
BJÖRN HEMBRE – LAGARLÍF 8<sup>TH</sup> OCTOBER 2024

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Low climate footprint

Low impact on nature and biodiversity globally

Healthy food for humans

Sustainability – a double-edged sword

Local environmental impact

Impact on wild salmon

Animal welfare

# IMPORTANT FOR EVERYONE

## PROTEIN NEED

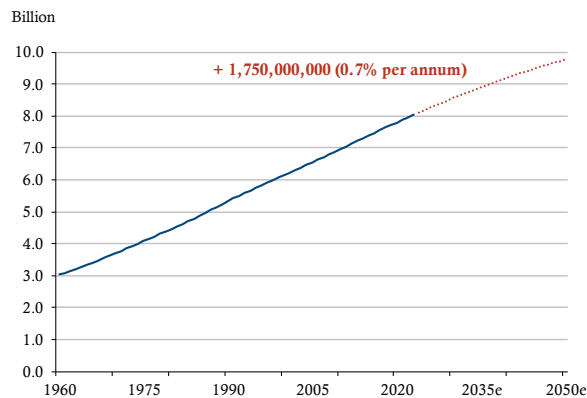


### AQUACULTURE IS A KEY PART OF THE SOLUTION – ATLANTIC SALMON IS STILL SMALL, BUT IN THE FOREFRONT OF THE AQUACULTURE REVOLUTION

- The world population is increasing and expected to be 10,000,000,000 in 2050
  - *This increase demand more protein production*
- The land that is suitable for agriculture is decreasing
- Earth is >70% ocean
  - *We need to utilize the BLUE acres*

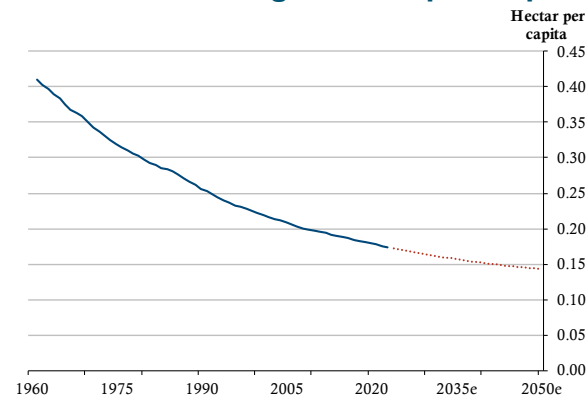
***“Ensuring the expansion of sustainable aquaculture is of fundamental importance for consumers,” – Food and Agriculture Organization of the United Nations (FAO).***

#### World Population

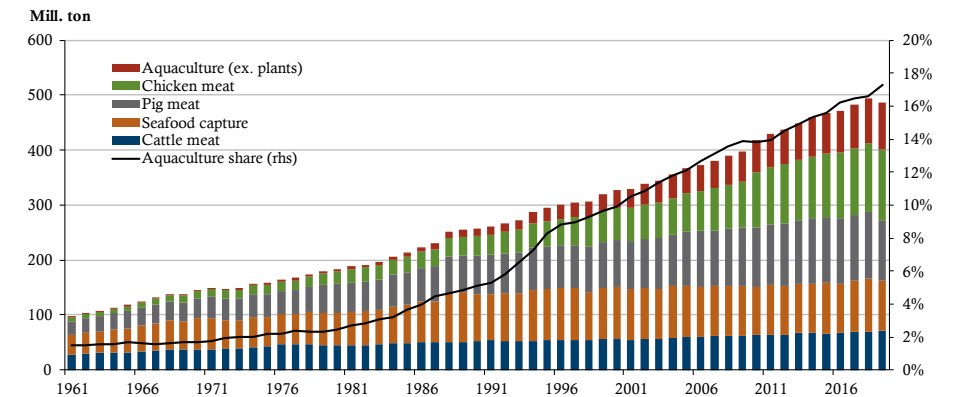


Source: FAO, Kverva

#### Land suitable for agriculture per Capita\*



#### Global Animal Protein Production and Share of Aquaculture



# THE GREEN SIDE OF THE SWORD

## CO2 AND HEALTHY FOOD



### Carbon Footprint

A carbon footprint measures the total greenhouse gas emissions caused directly and indirectly by the production of a product. Carbon footprint is measured in grams of carbon dioxide equivalent (g CO<sub>2</sub>eq) per typical serving (40 g) of edible protein of the product. Data are median values.



**0.60**

Farmed Salmon



**0.88**

Chicken



**1.30**

Pork



**5.92**

Beef

Source: Global Salmon Initiative



Everyone loves salmon, but it seems that people dislikes the farmer...

Why?

# ENVIRONMENTAL SURVEILLANCE

## WHAT CAN SEAFARMING AFFECT IN THE SURROUNDING ENVIRONMENT?

### WILD STOCKS OF SALMONIDS

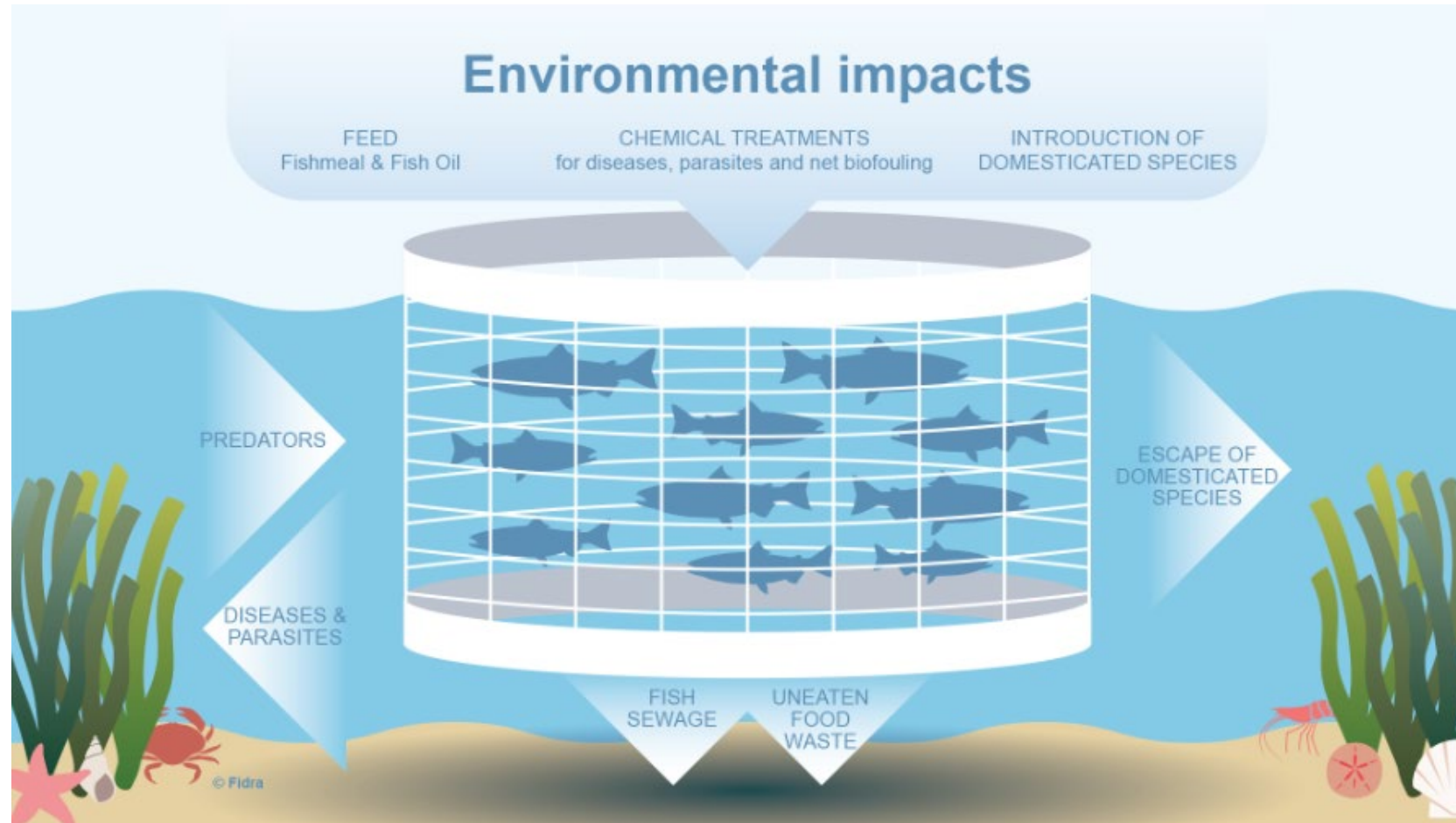
- Escapes
- Lice
- Diseases

### THE SEABED

- Organic load
- Copper

### BIODIVERSITY

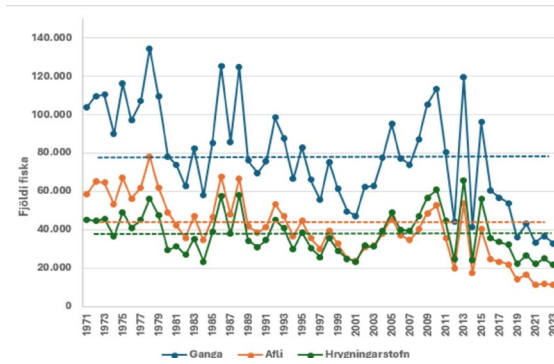
- Delicing medicines
- Organic load



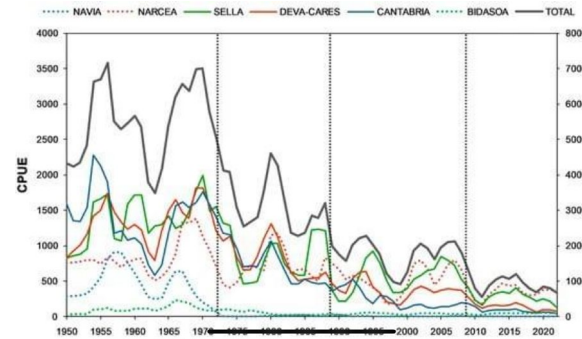
# DEVELOPMENT OF WILD STOCKS OF SALMONIDS

## IS SALMON FARMING TO BLAME?

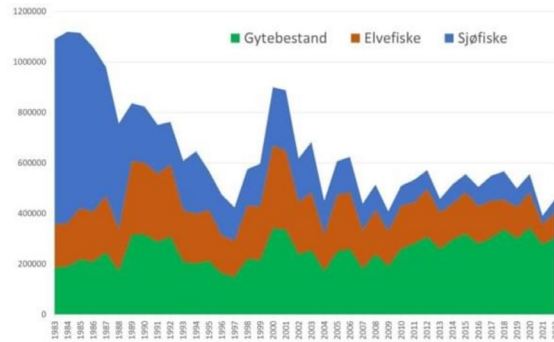
### ICELAND



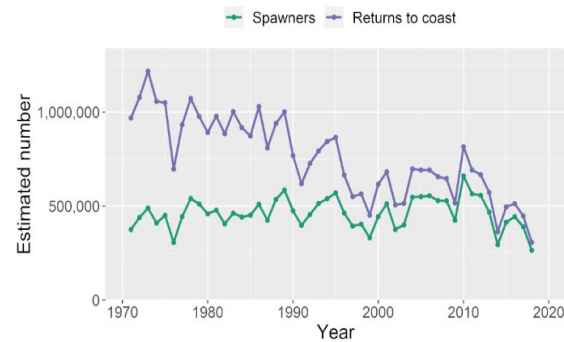
### SPAIN



### NORWAY



### SCOTLAND



**WILD SALMON STOCKS ARE UNDER STRONG PRESSURE**



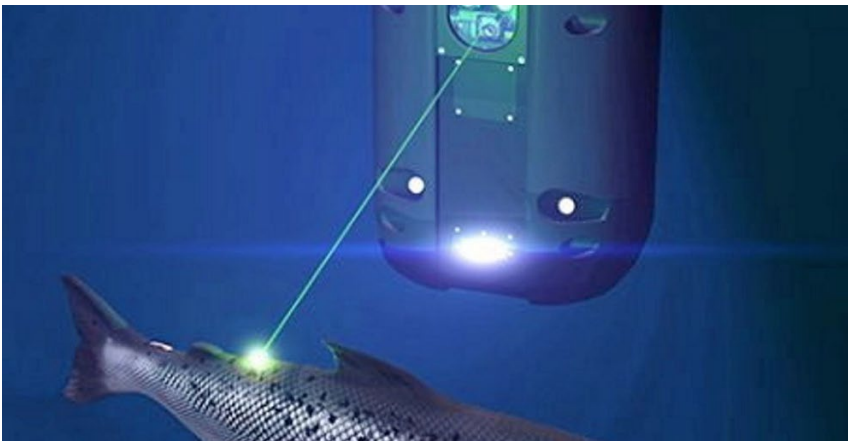
# WILD STOCKS OF SALMONIDS

## ESCAPES AND LICE

### ESCAPES, HOW TO PREVENT AND MITIGATE

- Control of smolt size
- Certified equipment in sea, NS-standard
- Inspections of nets:
  - *Every 30 days*
  - *Every time a new net has been put out, after operations and bad weather*
- Use lights during winter to prevent maturation
- If escape happen, re-catch with nets in sea.
  - *Fiskistofa organize recatch in rivers*

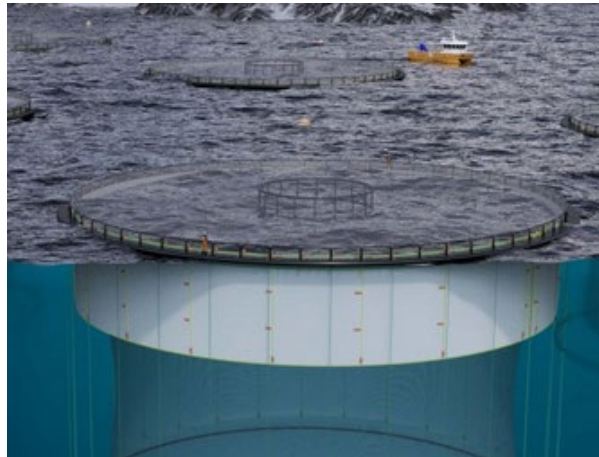
Lazer in use



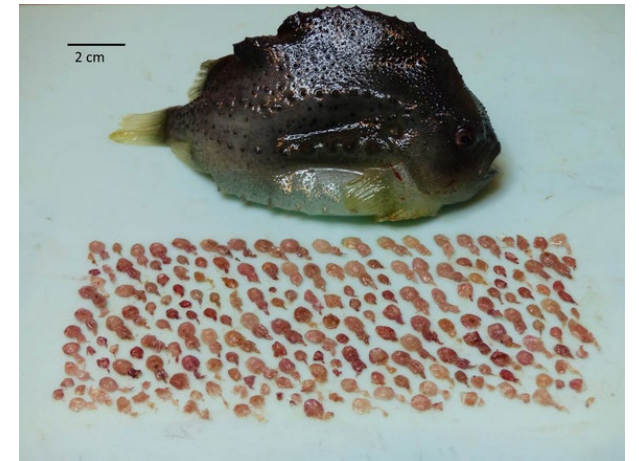
### LICE, HOW TO CONTROL

- Lice counting every week
- Regional cooperation of monitoring lice situation
- Preventive measures:
  - *Lice tarps*
  - *Lumpfish*
  - *Lazer*
- Treatments:
  - *Non-medical treatment*
  - *Medical treatment*
- Improved cooperation with authorities

Lice-tarp in use



Lumpfish who had approx. 200 Lice in its stomach



# WILD STOCKS OF SALMONIDS








## DISEASES



### A pure farming region

- Fewer diseases in Iceland compared to the rest of the salmon producing regions.
  - There are 3 diseases that cause significant loss in other salmon producing regions that are not found in Iceland. That is Pancreas Disease (PD), Cardiomyopathy Syndrome (CMS) and Salmonid Rickettsial Septicaemia (SRS).
  - Antibiotics has never been used in sea cages since the start of Arnarlax
  - All our sites on Fresh Water and Sea Water have regular visits from Veterinarians to monitor for diseases.



	Health risks <sup>1</sup>							
Viral diseases	Pancreas Disease ("PD")		✓	✓	✓	✓	✓	✓
	Infectious Salmon Anaemia ("ISA")	✓	✓	✓		✓		✓
	Heart- and skeleton muscle infection (HSMI)	✓	✓	✓	✓	✓		✓
	Cardiomyopathy Syndrome ("CMS")		✓	✓	✓	✓	✓	✓
Bacterial diseases	Bacterial Kidney Disease ("BKD")	✓	✓			✓		✓
	Salmonid Rickettsial Septicaemia ("SRS")				✓	✓	✓	✓
Parasites	Parvicapsula	✓	✓	✓	✓	?	?	✓



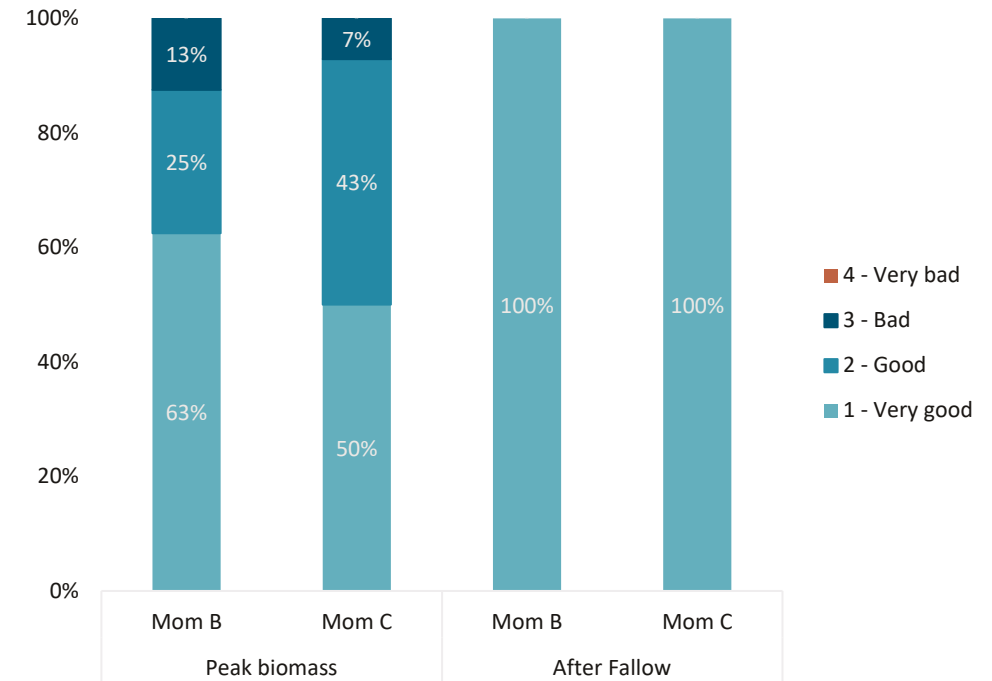
# THE SEABED

## RESULTS



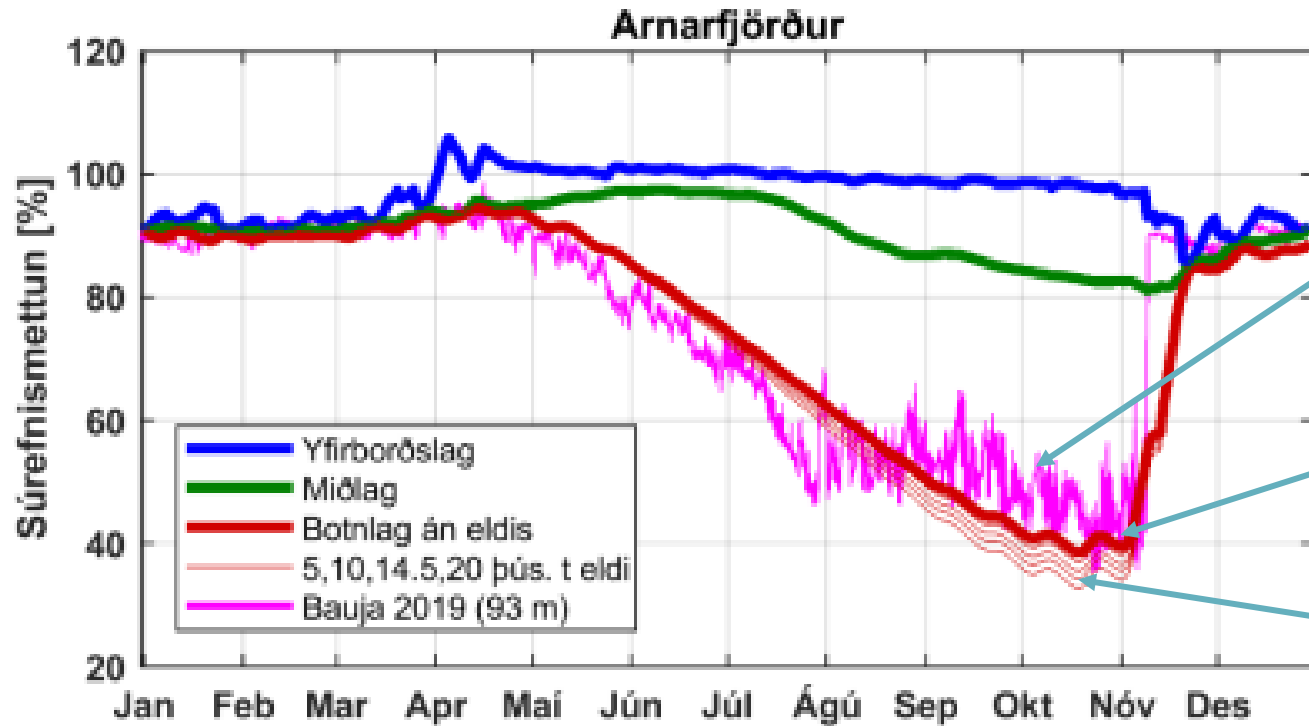
### BOTTOM SAMPLING

- According to regulation we need to do bottom sampling at peak biomass and after resting period (Fallow) before next generation output
- *We see that during peak biomass in the production cycle that there is impact on the sites with feces and probably some left over feed*
- *So far, all our sites (15 generations) have been restored to condition **1 - Very good** after the resting period*



# THE SEABED

## WHAT IS THE THEORETICAL IMPACT OF FARMING ON A THRESHOLD FJORD?



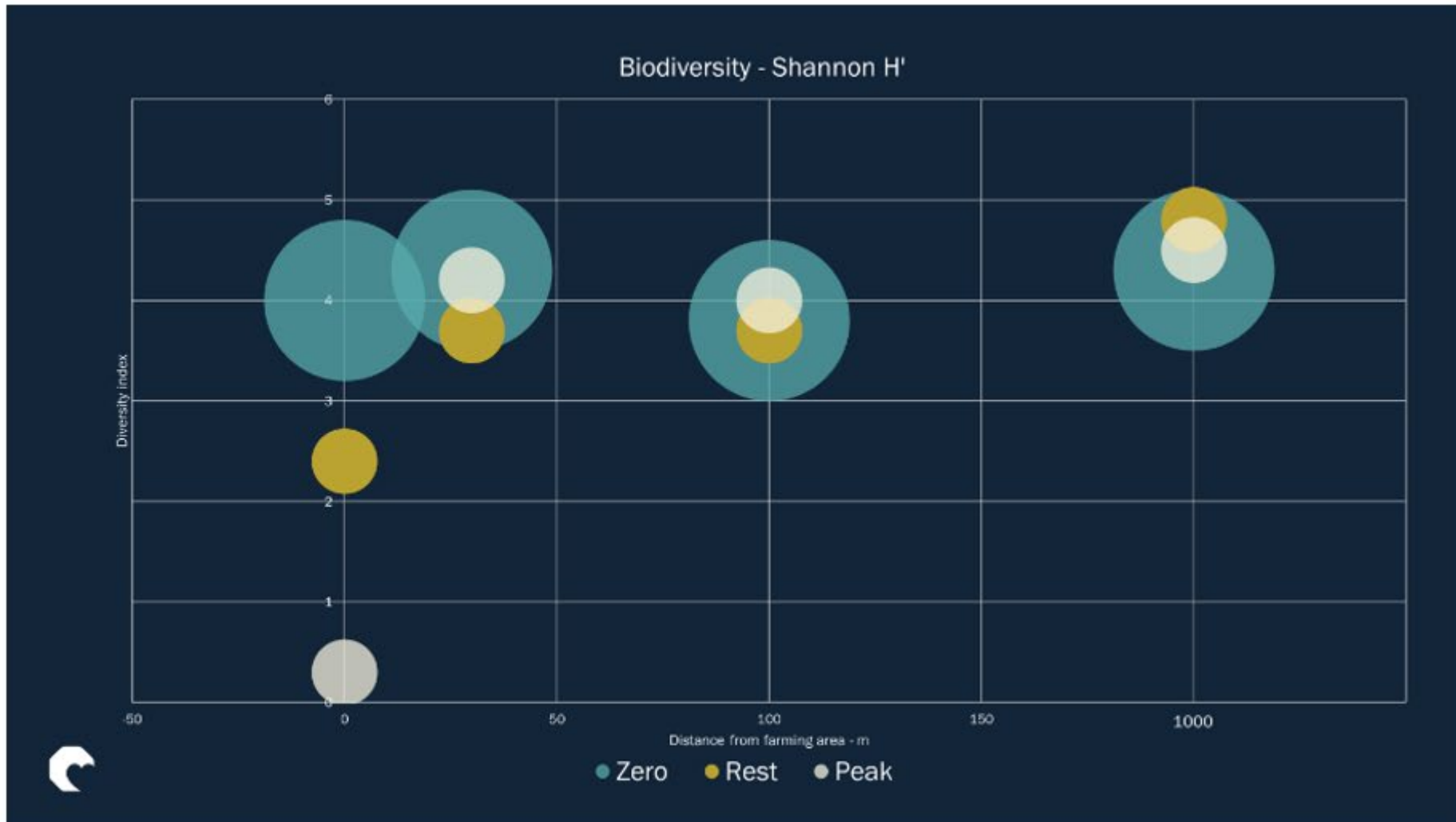
Actual oxygen saturation in 2019  
(Actual average biomass trough the year was 7.000 tonn)

Calculated natural oxygen saturation,  
due to natural production in the fjord  
(down to 38% oxygen saturation)

Calculated oxygen saturation with  
20.000 tonn of biomass in the  
fjord at any given time  
(down to 32% oxygen saturation)

# BIODIVERSITY

## IMPACT ON THE SEABED



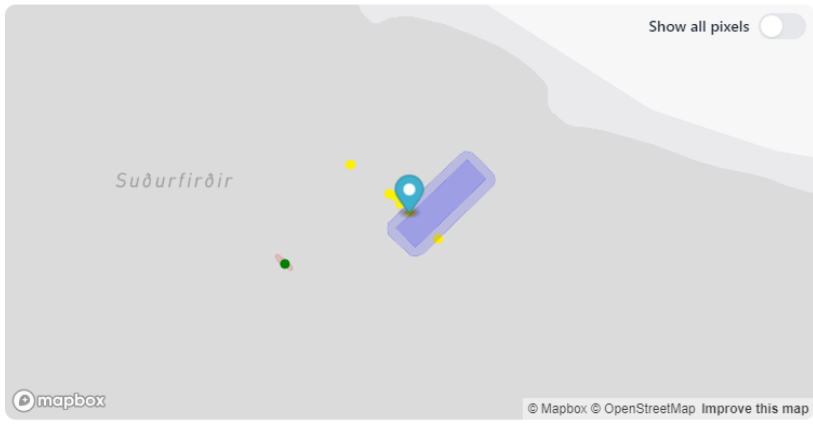
- The Shannon H is an an diversity index that measure the biodiversity of the benthic fauna on the seabed. Normal level of this index in Icelandic fjords, without influence from surroundings, is between 3 to 5.
- The impact is mainly directly under the sites
- As seen on the graph 100m away the impact is not recognizable, even under peak biomass.

← ↻ 🔒 https://botndyr.is/data/sample/76541455-6816-447b-8e56-626f2406f1c8

## RORUM

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### Dashboard



Show all pixels

Suðurfirðir

© Mapbox © OpenStreetMap Improve this map

Station	Depth m	Pileou'	Shannon'	Type R'
C1	85	0.63	2.89	29

Fjord:  Area:  Date:

Distance or Station:

A 25m
A 110m
A 170m
A 220m
A 500m
B 65m

**Diversity index**

Pileou J'
Shannon H'
Type R'

○ 2017-06-27 + 2018-09-25 × 2020-06-20 △ 2022-02-09 ★ 2023-06-27

1 Modulus

**Types**

Sequence

Affinity / Alphabetical order

Log

NIS



Capitate capital-  
 Mediomastus fragilis-  
 Chaetozone sp(p)-  
 Tyasira Sarsi-  
 Parougia nigridentata-  
 The Long/Long-  
 Prionospio steenstrupi-  
 Thyasiridae-  
 Ennucula tenuis-  
 Limestone macoma-  
 Cistenides hyperborea-  
 Pholoe inornata-  
 Yoldia hyperborea-  
 Mytilus edulis-  
 Nemertea-  
 Galathowenia oculata-  
 Nuculana pernula-  
 Spy-  
 Open Crisp-  
 Asteroid-  
 Caprellidae-  
 Lysianassidae-  
 Melinna cristata-  
 Nephtys ciliata-  
 Ophelina acuminata-  
 Ophiuroidea-  
 Polynoidae-  
 Scalibregma inflatum-  
 Syllis sp(p)-  
 Ampharete borealis-  
 Ampharetidae-  
 Slovenian Ceratocephale-  
 Cossura longocirrata-  
 Euchone papillosa-  
 Euchone sp(p)-  
 Lophelia boeckii-



English

# THE SEABED

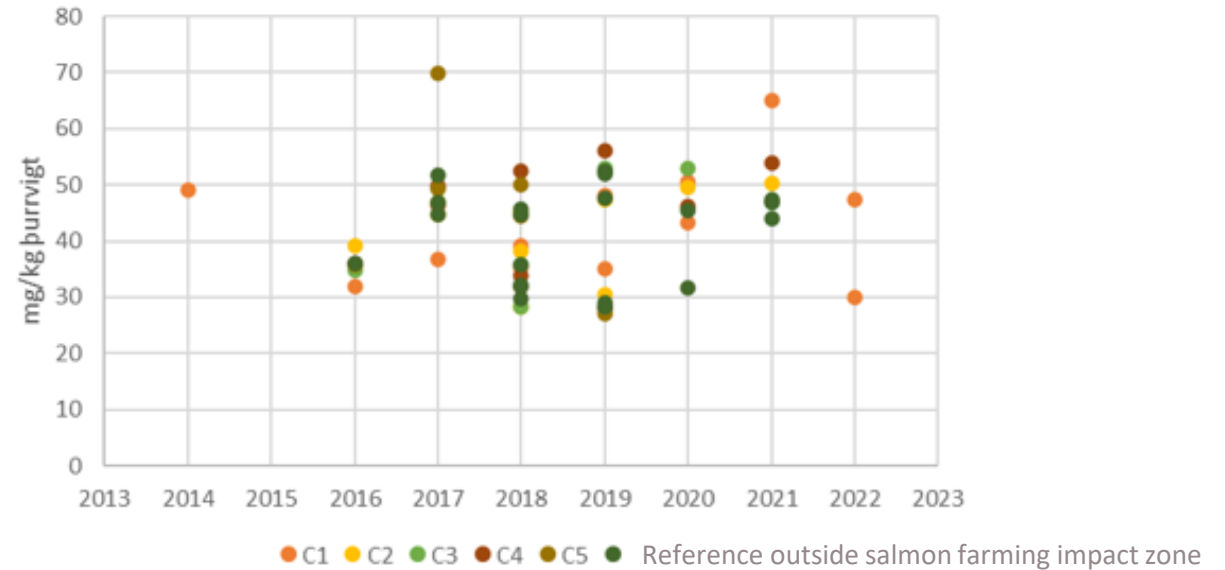
## COPPER



### NATURAL LEVELS OF COPPER IN ICELAND ARE HIGH

- In regulation nr. 796/1999 the limits for copper in sediments on the seabed is from very low to very high:
  - *Low levels 40-70 mg/kg*
  - *Upper limit for natural levels 70-250 mg/kg*
  - *High levels 260 - 1,300 mg/kg*
  - *Very high levels >1.300 mg/kg*

### HOWEVER, WE ARE MOVING AWAY FROM COPPER COATED NETS



Results of monitoring of copper concentrations (mg/kg dry weight) in sediment at the bottom of Arnarfjörður in the vicinity of Arnarlax's pens and at reference stations during the period 2014-2022. Throughout this period, dicopper oxide has been used in the company's farming nets in Arnarfjörður. Values are shown for reference samples (outside the affected area of farming) and all samples in the affected area of farming (stations: C1 to C5).

# SUMMARY

## OVERVIEW

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### THE IMAGE OF SEA FARMING

- Farmed salmon is one of the best protein production in the world
  - *Low feed conversion rate (FCR)*
  - *Low CO2 footprint*
  - *Low impact on the Seabed*
- Salmon farming is becoming significant in Icelandic export values from sea
  - *Next after Cod in export export value, and can in a few years pass by cod*
- Provides significant number of jobs, and a good life, in rural areas, East and Westfjords
- Why is the image still so negative on the producers and how can we change that?

### THE COMPANIES NEED TO DO THIS IN THE RIGHT WAY

- Keep on monitoring the environmental impact
- Educate and inform people
- Secure good fish welfare

### THE SALMON IS OUR STOCK AND THE FJORDS ARE OUR HOME

- The companies do everything they can to have the salmon in 1<sup>st</sup> place
  - Prevent escapes, mortality, and everything that threaten the fish health
    - *Every lost fish is a loss for the company*
  - We have to treat our sites well, and monitor them, to be able to continue using them for generations to come

**WE CARE!**



SUSTAINABILITY  
IT'S IN OUR NATURE

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