Biosecurity in Aquaculture

Workshop on enhancing aquatic animal health and biosecurity

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Organisation mondiale de la santé animale
Organización Mundial de Sanidad Animal

وزارة البيئة والمياه والزراعة
Ministry of Environment Water & Agriculture
Kingdom of Saudi Arabia المملكة العربية السعودية

THE NORWEGIAN VETERINARY INSTITUTE (NVI)

Veterinærinstituttet
Norwegian Veterinary Institute

NVI is the **WOAH Reference Laboratory** for:

- *Infection with infectious salmon anaemia virus*
- *Infection with Gyrodactylus salaris*
- *Infection with salmonid alphavirus*
- *Chronic Wasting Disease*

and the **WOAH Collaborative Center** for

- *Epidemiology and Risk Assessment of Aquatic Animal Diseases*
- *The Economics of Animal Health*

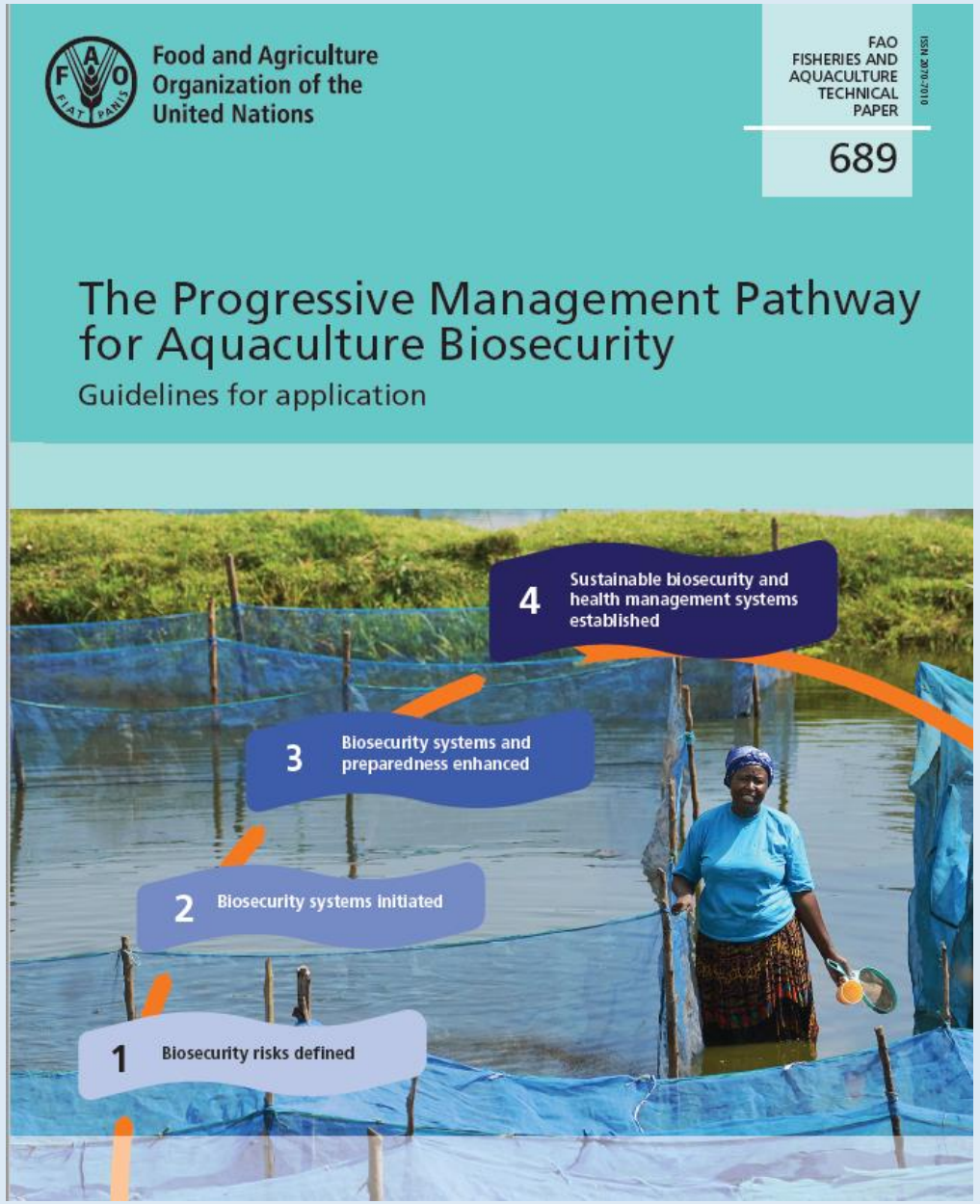
OUTLINES

DEFINITIONS OF BIOSECURITY
CATEGORIES OF PRODUCTION SYSTEMS
EPIDEMIOLOGICAL UNIT IN AQUACULTURE SYSTEMS
COMPARTMENTALIZATION
TRANSMISSION PATHWAYS
SURVEILLANCE, MONITORING AND VACCINATION
EQUIPMENT, DISINFECTION AND MANAGEMENT
BIOSECURITY PLAN
SOME EXAMPLES FROM NORWAY
SUMMARY

Source: COLOURBOX

BIOSECURITY IN AQUACULTURE (FAO)

"Cost-effective management of risks posed by pathogens to aquaculture through a strategic approach at the enterprise, local-sector, national and international levels with shared public-private responsibilities."



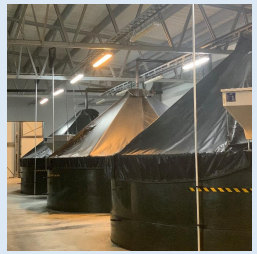
BIOSECURITY IN AQUACULTURE (WOAH)

"A set of management and physical measures designed to reduce the risk of introduction, establishment and spread of diseases, infections, or infestations to, from and within an aquatic animal population."

- Biosecurity for Aquaculture Establishments – ***Section. 4/ Chapter 4.1***
  - ❑ General principles – ***Chapter 4.1 /Article 4.1.4***
  - ❑ Transmission pathways and mitigation measures – ***Chapter 4.1 /Article 4.1.7***
  - ❑ Biosecurity plan development – ***Chapter 4.1 /Article 4.1.9***
  - ❑ Risk analysis – ***Chapter 4.1 /Article 4.1.8***
- Disinfection – ***Section. 4/ Chapter 4.4***
- Contingency plan – ***Section. 4/ Chapter 4.6***
- Handling, disposal and treatment of aquatic animal waste – ***Section. 4/ Chapter 4.8***

- Biosecurity and surveillance system requirements – ***Section. 1/Chapter 1.4/Article 1.4.5***

CATEGORIES OF PRODUCTION SYSTEMS



Closed system

- There is sufficient control over water entering and exiting the system to exclude *aquatic animals*, *vectors* and *pathogenic agents*.
- Environmental conditions can also be controlled.
- Examples of closed *aquaculture* systems include recirculating *aquaculture* production systems, production systems with a safe water supply free from *pathogenic agents* or *aquatic animals* (e.g. ground water), or those with high levels of treatment (and redundancy) of water entering and exiting the system.

Semi-closed system

- There is some control over the water entering and exiting the system and over the environmental conditions.
- *Aquatic animals* and *vectors* can be prevented from entering and exiting the system; however, there is limited control to prevent the entry or exit of *pathogenic agents*.
- Examples of semi-closed *aquaculture* production systems are ponds, raceways, floating enclosures, and flow through tanks.

Semi-open system

- It is not possible to have control over the water entering or exiting the system, or over the environmental conditions.
- Some *aquatic animals* and *vectors* may also enter and exit the system.
- Examples of semi-open *aquaculture* production systems are net pens or cages for finfish and suspended baskets or rope systems for molluscs in natural water bodies.

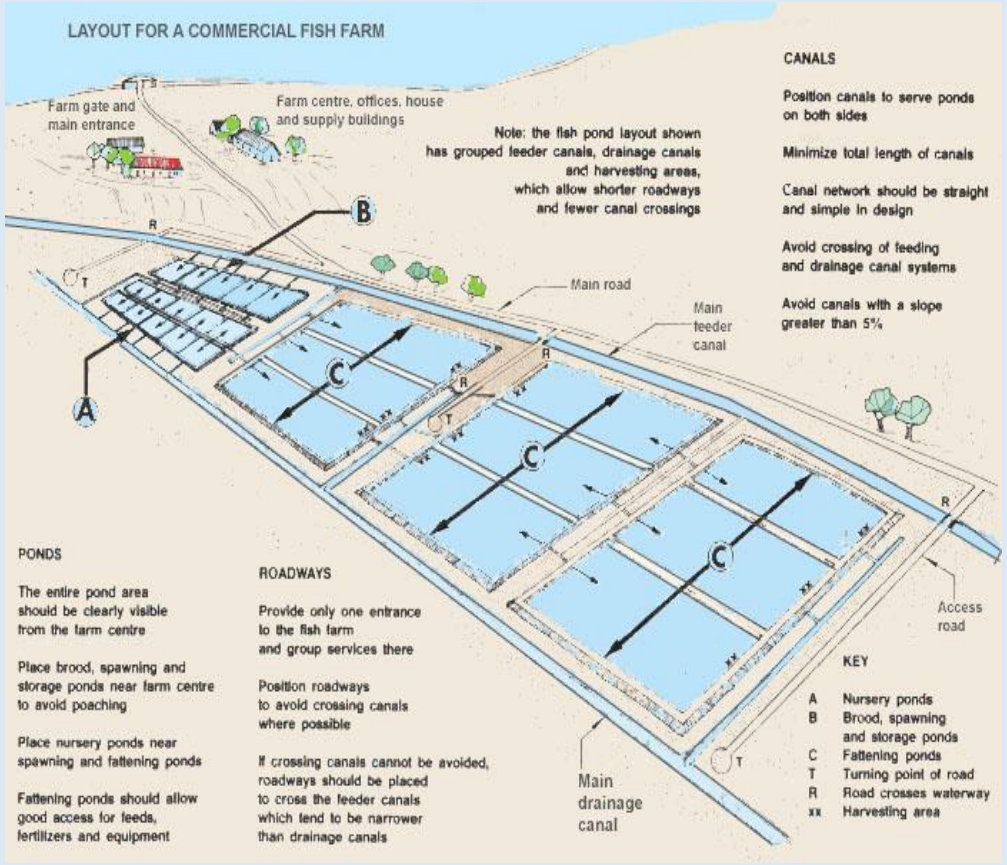
EPIDEMIOLOGICAL UNIT IN AQUACULTURE SYSTEMS

WOAH Aquatic Code, Glossary

A group of animals that share approximately the same *risk* of exposure to a *pathogenic agent* with a defined location (e.g. fish in a pond, caged fish in a lake)

or

Animals sharing the same management practices make it likely that a *pathogenic agent* in one group of animals would quickly spread to other animals (e.g. all the ponds on a farm, all the ponds in a village system).



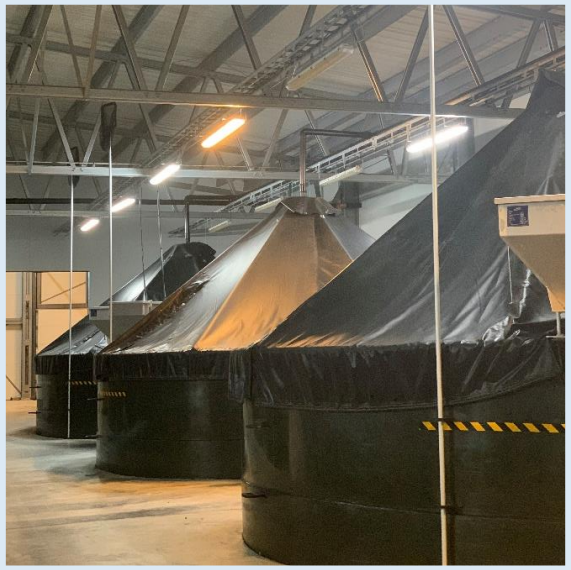
CLOSED SYSTEM: Broodstock Facility with High Biosecurity

Biosecurity control measures:

- Seawater sourced from ≥30m depth, then recirculated
- Water treatment using UV, ozone, and biofiltration
- Strict disinfection protocols and one-way fish movement
- Continuous water quality monitoring and pathogen detection systems

Facility layout and structure:

- Complete separation of freshwater and seawater systems
- Physical separation of buildings, personnel, and equipment



Discussion Point:

•Should this facility be considered a **single epidemiological unit** or **multiple units**?

SEMI-CLOSED SYSTEM: Tilapia and Catfish Farm

Includes a **hatchery**, **pre-growing area**, and **earthen ponds**

Varying levels of biosecurity across components

Discussion Point

Can each pond be considered a **separate epidemiological unit**?

- Possible if:
  - No direct water exchange
  - No shared equipment or personnel
- Otherwise, may be grouped as one or more units

SEMI-OPEN SYSTEM: Sea Cages

Each cage can hold **hundreds of thousands of fish**
Cages spaced 20–50 meters apart within a farm
Farm sites separated by 2–5 kilometers
Connectivity varies based on:

- **Water flow**
- **Shared personnel/equipment**
- **Local biosecurity practices**

Key Question: What defines the epidemiological unit?

- A **single cage**, given the physical boundaries and individual management?
- A **group of cages within one farm**, due to shared personnel and equipment?
- The **entire farm**? Or **multiple farms within a production cluster**, especially if they share water currents or service vessels?

COMPARTMENTALIZATION

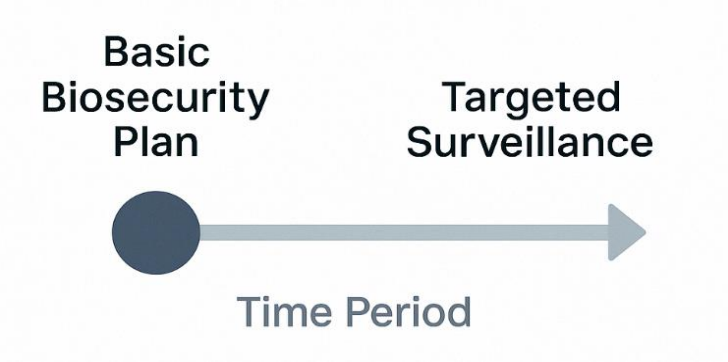
Aquatic Code: Section. 4/Chapter 4.3

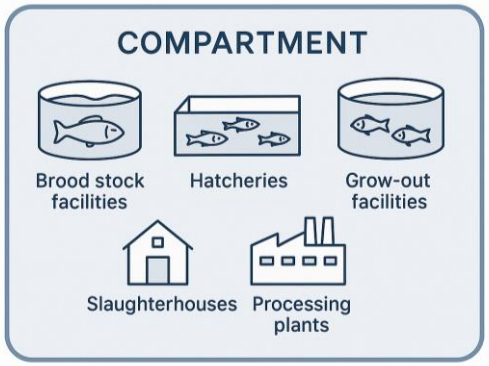
Compartmentalisation provides an opportunity to trade disease-free aquatic animal commodities from zones or countries that are not declared free from the diseases of concern

Compartment means *one or more aquaculture establishments* under *a common biosecurity management system* containing an aquatic animal population with a distinct health status with respect to a specific disease or diseases for which *required surveillance and control measures* are applied and *basic biosecurity conditions* are met for the purpose of international trade.

Stepwise Approach:

1. Develop and apply a Basic Biosecurity Plan
2. Demonstrate effectiveness over time
3. Conduct targeted surveillance
4. Declare disease freedom





PRINCIPLES FOR DEFINING COMPARTMENTALIZATION

Aquatic Code: Section. 4/Chapter 4.3/Article 4.3.2

- A compartment may be established for a **specific disease or diseases**
- Must be **clearly defined**, including:
  - **Location** of all components (e.g. broodstock facilities, hatcheries, grow-out, slaughterhouses, processing plants)
  - Description of **interrelationships** among components
- Must demonstrate **epidemiological separation** from other populations with different health status
- Definition should consider:
  - **Disease-specific epidemiological factors**
  - **Aquatic animal species** involved
  - **Production systems** and **infrastructure**
  - **Biosecurity practices**
  - **Surveillance**

TRANSMISSION PATHWAYS

Pathogenic agents

Move into, spread within and/or Released

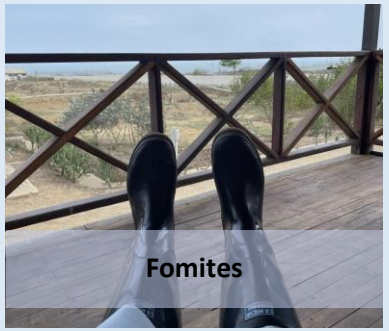
Aquaculture establishments


Aquatic Animals


Aquatic animal products and aquatic animal waste

Water


Feed


Fomites


Vectors


Personnel and visitors

INTRODUCTION OF AQUATIC ANIMALS

Introduction and Frequency of Live Animals and Genetic Material

Requirement of official permits/licenses

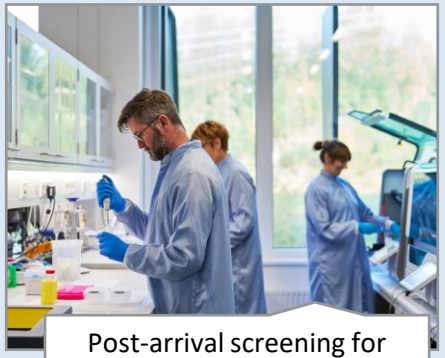
Requirement of health status documentation

Application of quarantine and isolation

Have a quarantine zone separated from other production areas

Cleaning and disinfection of quarantine facilities before use

Application of therapeutic or prophylactic measures



Post-arrival screening for mandatory / important diseases

Dedicate clothes or clean and disinfect the clothes after leave the quarantine area

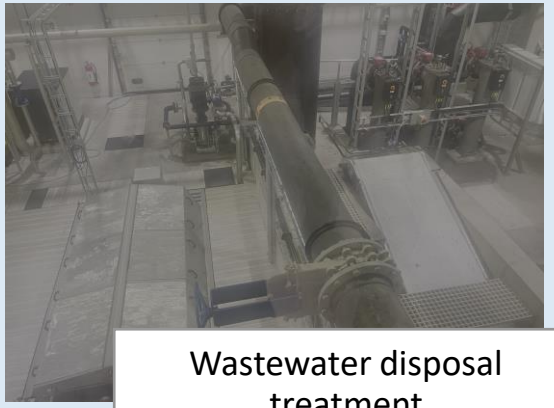
Have a traceability system and record the origin.

SOURCE OF WATER AND ITS QUALITY

Source of water used at the facility

Shared water source with other aquatic animal facilities

Implementation of intake water treatment



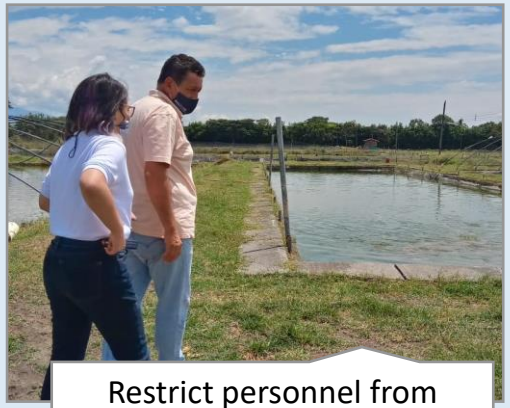
Wastewater disposal treatment

Water quality monitoring and analysis

Disinfection of water supply tanks

PERSONNEL AND VISITORS

Implement measures for personnel and visitors' entry*



Restrict personnel from visiting other aquaculture facilities

Personnel must wash their hands regularly during daily activities

Visitor access is restricted

Visitors are informed of the facility’s biosecurity protocols

Prohibit visitors close contact with aquatic animals

Washing and disinfection of protective clothing for personnel and visitors

SURVEILLANCE, MONITORING AND VACCINATION

Inspection of abnormal behavior, feeding, and clinical signs

Perform necropsies and diagnostic tests for disease monitoring at a defined frequency.

Vaccination against diseases of concern

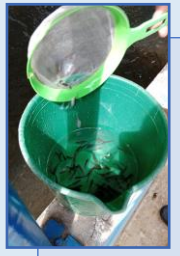
Promptly remove of dead animals

Final disposal of dead animals

Report unusual mortality or detected diseases to the Competent Authority

Have a defined process for handling the aquatic animals

Use equipment designed and operated to minimize physical injuries to aquatic animals



Define a process for loading and unloading animals to minimize stress and prevent injuries

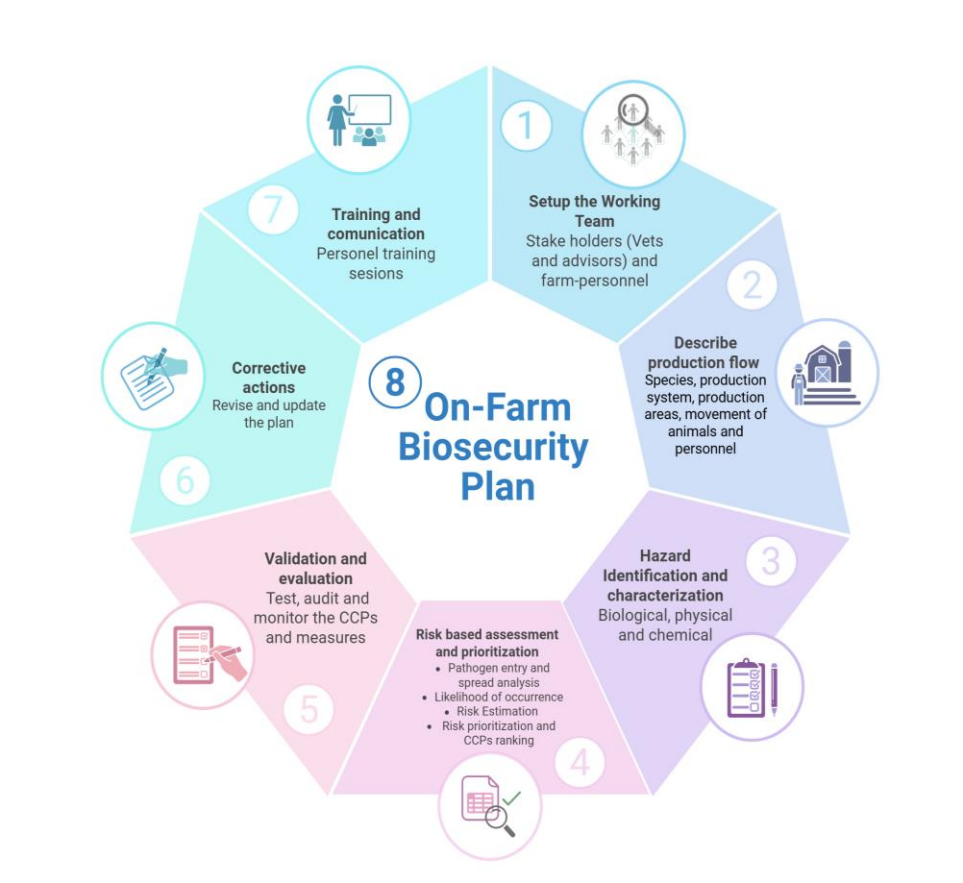
EQUIPMENT, DISINFECTION AND MANAGEMENT

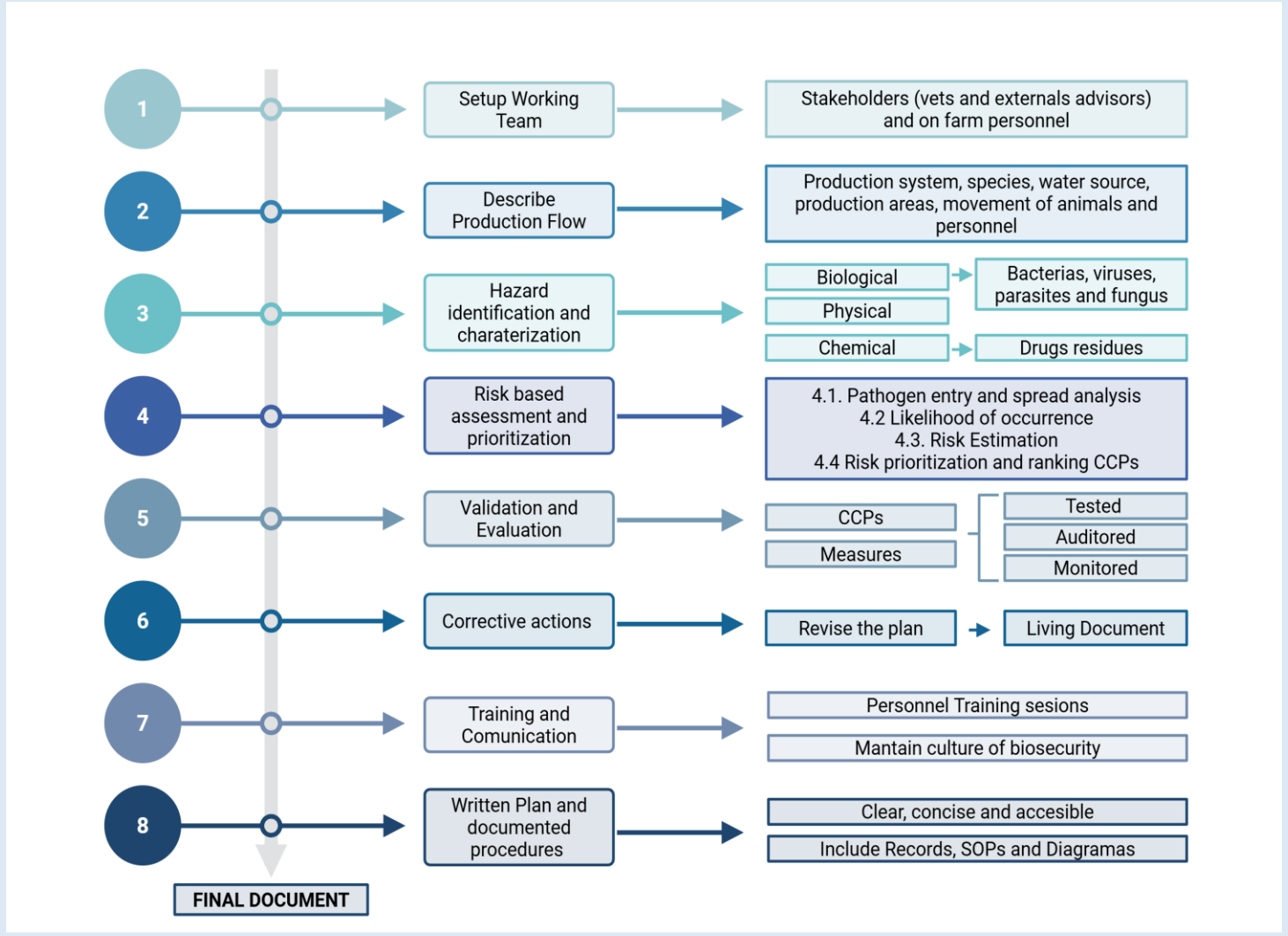
					
<u>Do not share</u> equipment and materials between batches whitin the facility	Use dedicated equipment for handling dead and moribund animals	Cleaning and disinfection of facilities and equipment between batches	Perform fallowing before introducing new animals	Conduct soil treatment in all earth ponds	Do not apply untreated animal feces as pond fertilizer

EQUIPMENT, DISINFECTION AND MANAGEMENT

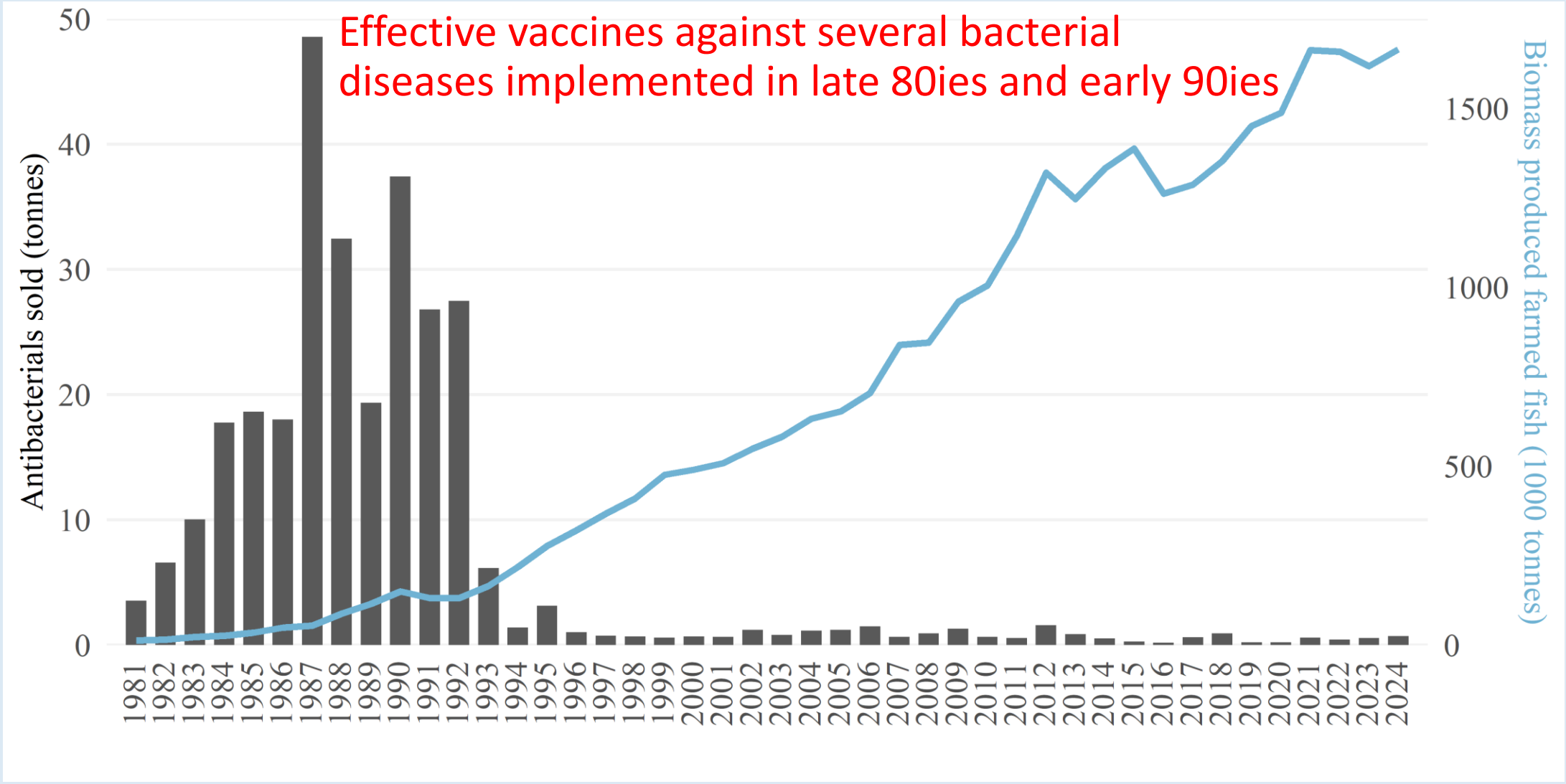
				
Routinely clean and disinfect handling equipment	Proper and safe use of treatments • Pesticides, herbicides, fertilizers, probiotics and prebiotics.	Regularly remove debris and waste from the facility	Handwashing after contact with sick or dead aquatic animals	Ensure all personnel are properly trained in biosecurity protocols.

APPROACH FOR DEVELOPING BIOSECURITY PLAN





ANTIBACTERIALS SOLD AND BIOMASS IN NORWAY



Source: NORM-VET 2024

NUMBER OF VACCINE DOSES SOLD IN NORWAY

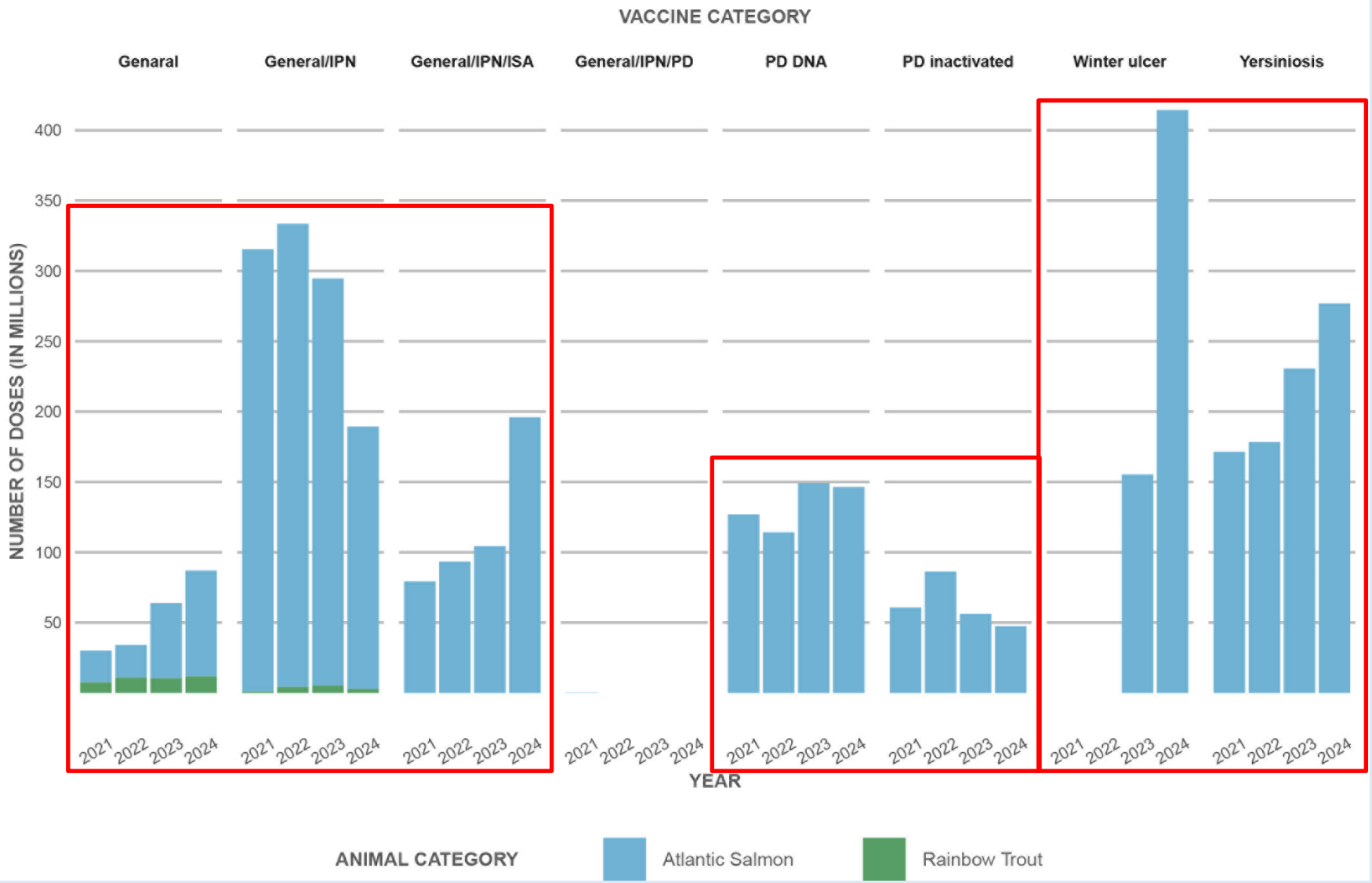


Figure: Leif Lukas Löfling

NUMBER OF CONFIRMED ISA OUTBREAKS PER YEAR

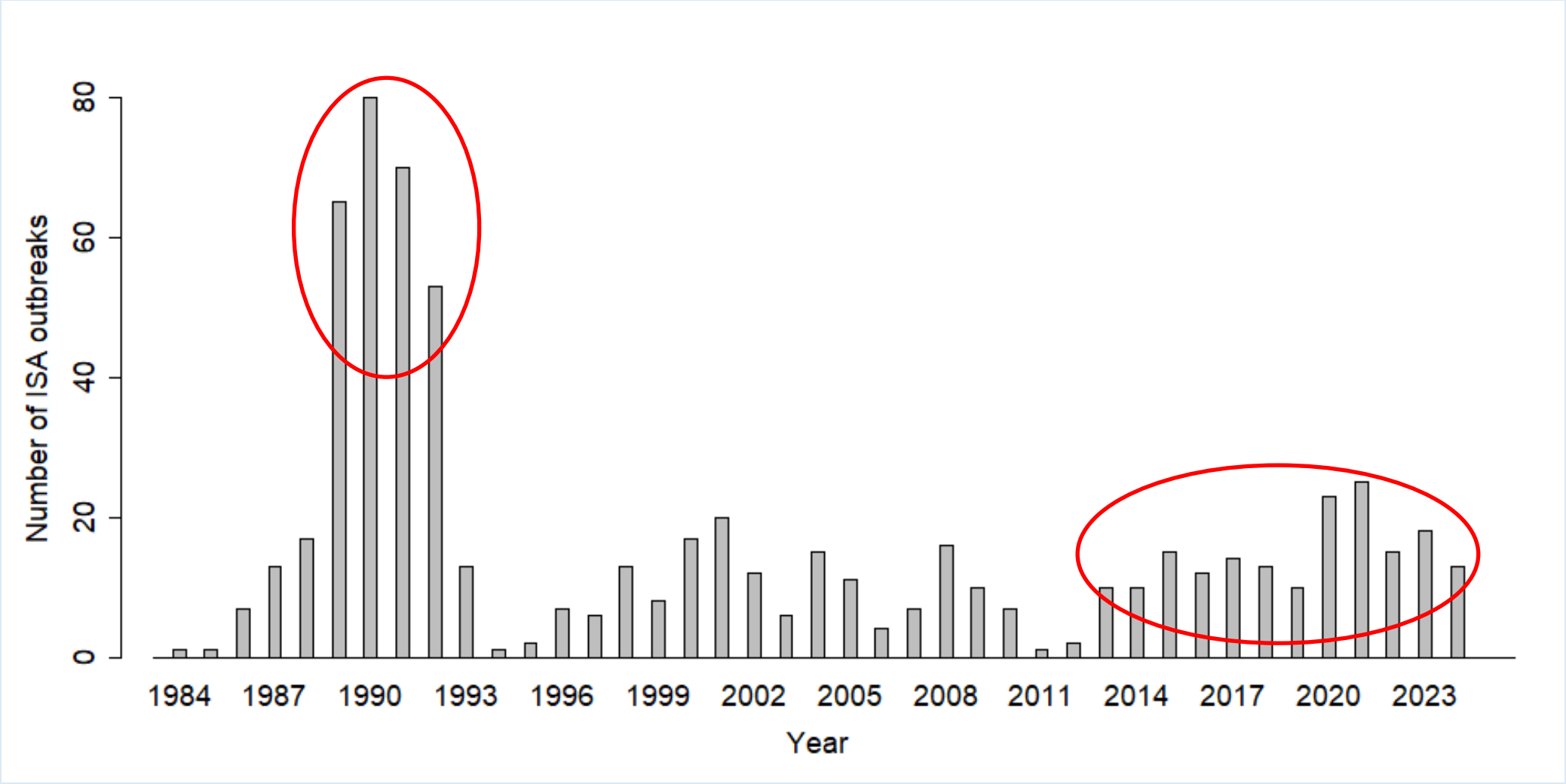


Figure: Hege Løkslett

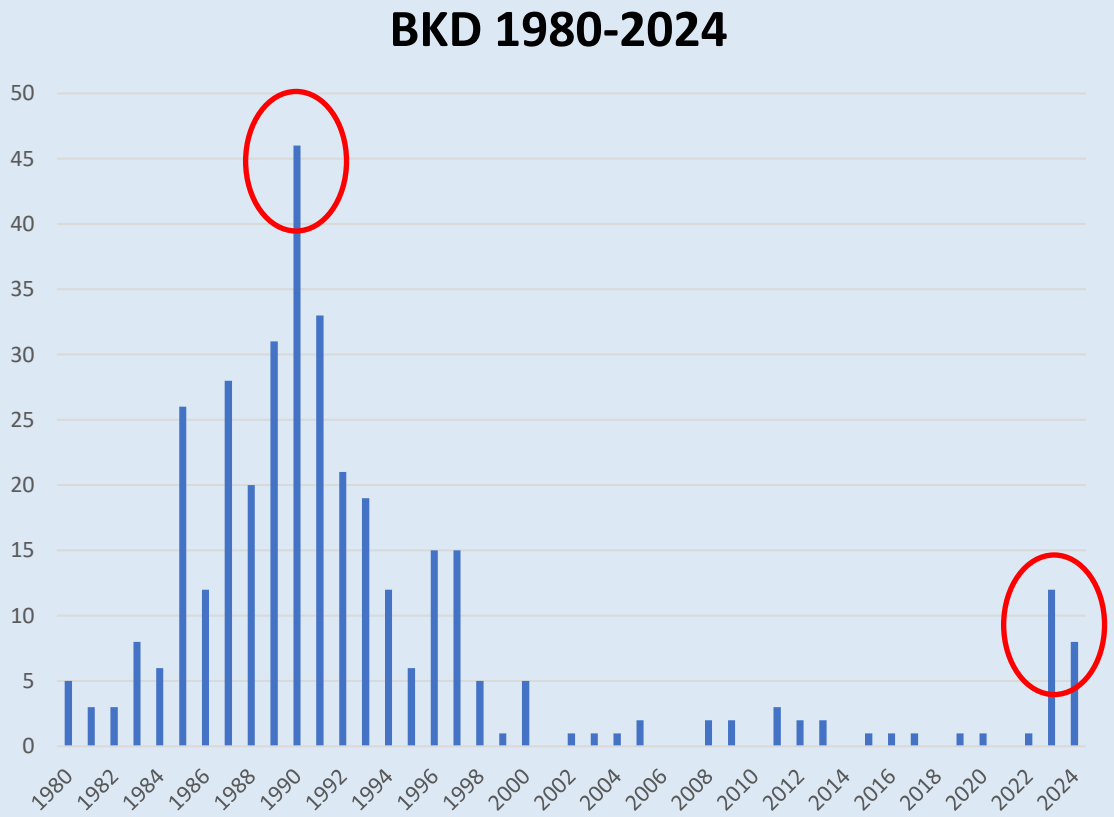
WELL BOATS AND DELOUSING WESSELS

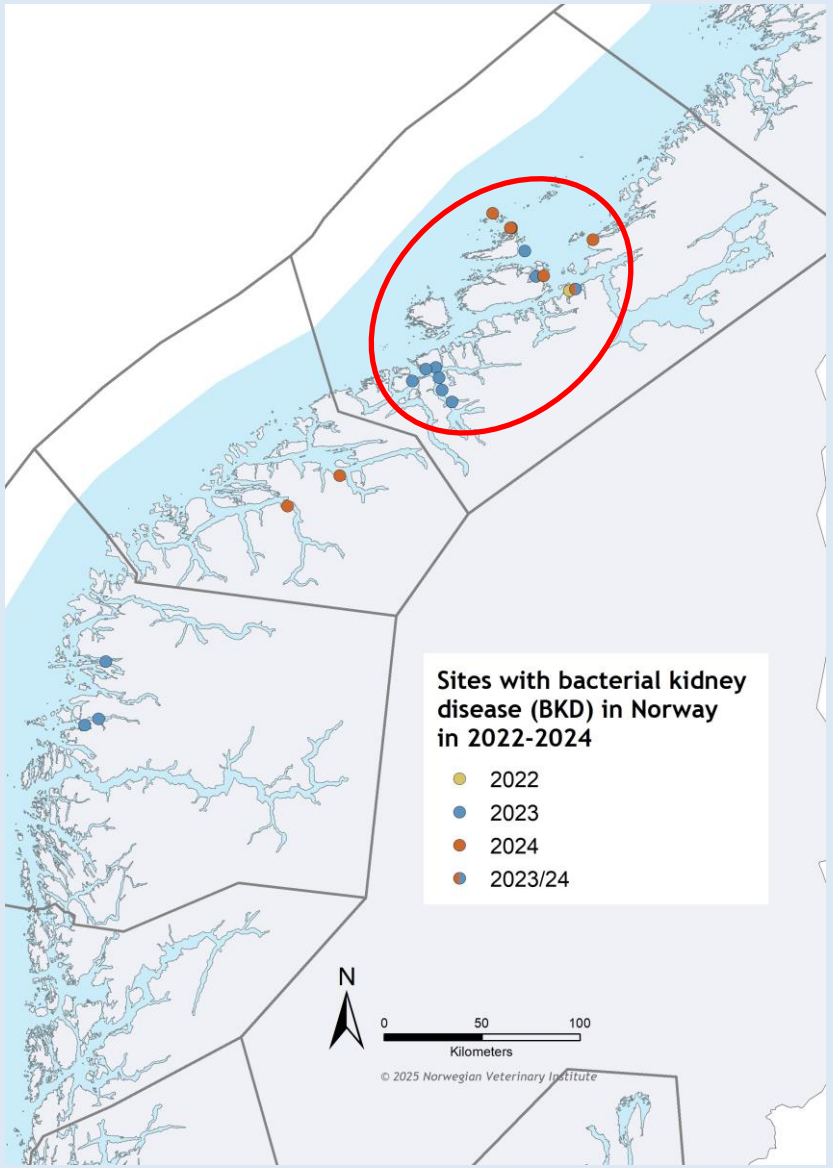
Source: https://www.rostein.no

Well boats are used for transport from hatcheries to sea sites, for delousing and sorting at the sea sites and transport from sea sites to slaughter house

Well boats and delousing wessels may pose a risk for spread of several pathogens

EXAMPLE: SPREAD OF RENIBACTERIUM SALMONIARUM





Map: Attila Tarpai

SUMMARY

Biosecurity can be defined as a set of management and physical measures designed to reduce the risk of introduction, establishment and spread of diseases, infections, or infestations to, from and within an aquatic animal population.

Pathogens can be introduced and spread via aquatic organisms, water and vectors as equipment, well boats and other vessels.

Vaccination can be effective as prevention in addition to other measures and regulations.

ACKNOWLEDGMENTS

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Thank you!

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