

# **The ethology perspective: fish welfare and the quality of the final product**

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# Fish behaviour and welfare

- **What is fish welfare within an industrial culture setting? – health, rapid growth, normal unstressed behaviour**
- **Why is fish welfare important? – production, regulatory requirements, market demands**
- **How can we better integrate knowledge of basic biology and good fish welfare into designs for offshore farms?**

# Overview of coastal seacage fish culture

- **Global production of > 2.5 million tons finfish**
- **China – 600 000 t**
- **Chile – 500 000 t**
- **Norway – 500 000 t**
- **Japan – 260 000 t**
- **Scotland – 250 000 t**
- **Mediterranean – 160 000 t**
- **Canada – 150 000 t**

# Major culture species

## ‘Cold-water’

Salmon, Trout, Cod, Halibut, Haddock

## ‘Warm-water’

- Sea bass, Sea bream, Kingfish, Cobia, Tropical snappers, Tropical groupers

Will there be only a few species suitable for industrial production, as on land?

Design farms on a species by species basis

## **A simple principle for offshore culture**

*Offshore farms must function at least as well as current inshore farms in most respects and have distinct advantages in other respects*

**Higher quality environmental conditions should provide this ‘distinct advantage’**

**Farms should adapt to the surrounding environment to optimise culture conditions**

# Advantages of offshore culture

- **Growth** – stable environment – temperature, oxygen, salinity
- **Health** – disease, parasites
- **Welfare** – low levels of stress, stocking densities
- **Environment** – greater nutrient dispersal, fewer problems with interactions with wild species (escapes, disease, parasites)
- **Reduce coastal zone conflict**

# Challenges for offshore culture

**Operational procedures may reduce welfare**

- **Mortality/Stress during transfer of juveniles**
- **Stress during grow-out e.g. storm periods**
- **Stress during crowding and harvesting procedures**

# Integrating biology into offshore cage design

- Submerged systems often discussed as the future for offshore aquaculture – attractive from a structural perspective
- Submergence introduces difficulties from a biological perspective
- Salmon – Can they tolerate submerged culture?

*SINTEF's SubSalmon project*

- Tolerance limits will affect design of offshore farms