## SUPER-INTENSIVE FISH FARMING TECHNOLOGY

# A CASE STUDY OF INNOVATION

Victor Øiestad – Dr. Philos.
Akvaplan-niva - Norway
Spanish office

## The Building Blocks

- **SHALLOW RACEWAY SYSTEM (SRS) TECHNOLOGY**
  - RESOURCE-SAVING
  - WELFARE-DRIVEN
  - TESTED ON 14 FISH SPECIES
- **RE-CIRCULATION AQUACULTURE SYSTEM TECHNOLOGY (**optional**)**

## Shallow Raceway System ➔

**Seven levels – Dover sole (The Netherlands)**

## Four level – Atlantic halibut (Norway)

## Six levels – turbot (Spain)

## ➔ AQUACULTURE CLUSTERS 1992

INDUSTRIELLE PRODUKSJONSSENTRA FOR SJØMAT

"QUALITY IN AQUACULTURE" (1995). European Aquaculture Society, Spec. Publ. 23, 384-385

SHALLOW RACEWAYS AS THE BASIS FOR INDUSTRIAL PRODUCTION CENTRES OF SEAFOOD

Victor Øverstad

## ➔ AQUACULTURE CLUSTERS 1995

Introduction

Future expansion of Norwegian fish farming industry will partly be on marine fish species. In many cases these species will be farmed on land in closed rearing systems as many of them are tropical living species like halibut, wolffish and turbot. Some of them demand above ambient water temperature. Warm water might be supplied from petrochemical and melting industry. Net-pen rearing of salmon will always represent a risk with respect to fish diseases, escape of salmon and environmental loading. A possible solution might be to design fish farms on land with tanks suited for salmon as well as for bottom-dwelling fish species to give needed flexibility and escape from most of the open sea challenges. But the high costs of moving on land should stop this ideal solution unless a low-cost approach could be set forward.

The basic idea of the present draft is to supply a huge multispecies fish farm with warm Atlantic seawater (6-8°C) through a tunnel from an appropriate depth and make all farming in shallow raceways. The raceway will have a maximum water depth of 20cm to 50cm while being 50m to 100m long and 4m to 6m wide. A centre production per year of 10.000tonnes should justify most types of services on each centre. Seed production partly based on recycling off-falls, slaughtery, processing plant with a potential supply also from the fishing fleet, juvenile production and inlandmarketing.

The hypotheses for shallow raceways have been these:
- bottom-dwelling fish species feel more comfortable in captivity when kept close together at high densities

## From the start in 1988

- **- 120,000 turbot juveniles in one raceway (1988)**
- **- Testing of 10 species from 1990-2000**
- **- Commersial testing 1998-2011**
  - **- Norway (2)**
  - **- Spain (1)**
  - **- Portugal (1)**
  - **- The Netherlands (3)**

## Patents of SRS

- **- Spain 2007**
- **- Texas A&M University (pending patent)**

Royal Caridea, LLC, has purchased the worldwide rights to shrimp farming technology developed by Dr. Addison Lawrence at the **Texas A&M University:**

"Super-Intensive Raceway Shrimp Farming Technology"

## Initiatives through 22 years

- **- Most aquaculture-related R&D-personnel in Norway**
- **- All large aquaculture enterprises in Norway**
- **- Numerous aquaculture-related conferences, journals and magazines – with minor reactions**
- **- Some important companies in Europe**
- **- European partners in SRS-related projects (Raceways 2006-2008 – under 6FP)**

## What are the problems?

- **- Water security – can be solved**
- **- Very high fish density – but animal welfare always in focus**
- **- No interest in land-based farming**
- **- No success stories**

**Fish density can be very high**

| TYPE OF FISH | SIZE RANGE (GRAM) | DENSITY (g/l or % bottom cover) | COMM/ TEST |
|---|---|---|---|
| **FLATFISH** | | | |
| **HALIBUT** | **0.1 – 15,000** | **100-300%** | **C** |
| **TURBOT** | **0.1 – 10,000** | **100-400%** | **C** |
| **DOVER SOLE** | **0.1 - 500** | **100-200%** | **C** |
| **SENEGAL SOLE** | **0.1 - 500** | **100-300%** | **C** |
| CALIFORNIA HALIBUT | 0.05 - 10 | 100% | T |
| WINTER FLOUNDER | 0.05 - 10 | <100% | T |
| **BENTHIC** | | | |
| **SPOTTED WOLFFISH** | **0.2 – 20,000** | **500 g/l** | **C** |
| COMMON WOLFFISH | 0.2 – 5,000 | 500 g/l | T |
| LUMPSUCKER | 0.05 - 50 | 100 g/l | T |
| **DEMERSAL** | | | |
| COD | 0.05 - 50 | 230 g/l | T |
| WHITE SEABASS | 0.05 - 30 | 100 g/l | T |
| SEA-BREAM | 0.02 - 20 | 300 g/l | T |
| **PELAGIC** | | | |
| SALMON (PRE-SMOLT) | 0.2 - 60 | 550 g/l | T |

## A FLAGSHIP APPROACH

- "But we can – and must do – much better"
- "We need to get more innovation out of our research"
- "…accelerate research, development and market deployment of innovations"
- "Our strengths in design and creativity must be better exploited"
- "The Commission proposes to promote the competitiveness of EU aquaculture production by developing a competitive, diversified aquaculture sector, supported by innovation" (January 2011)

## CAN MARCOM+ BE INSTRUMENTAL?

- "The exploration of mechanisms to identify potential technologies that are ready for transfer and the instruments for efficient implementation through increased cross-sector collaboration"