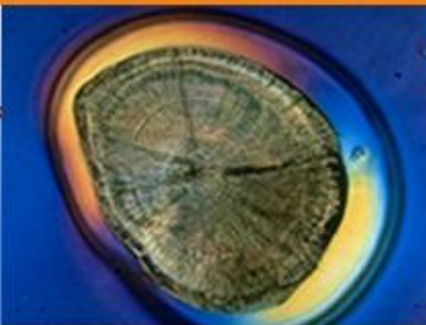




INSTITUTE OF MARINE RESEARCH



Rolf Engelsen

Centre for Development Cooperation in Fisheries

Norwegian competence and relevance to aquaculture in Asia

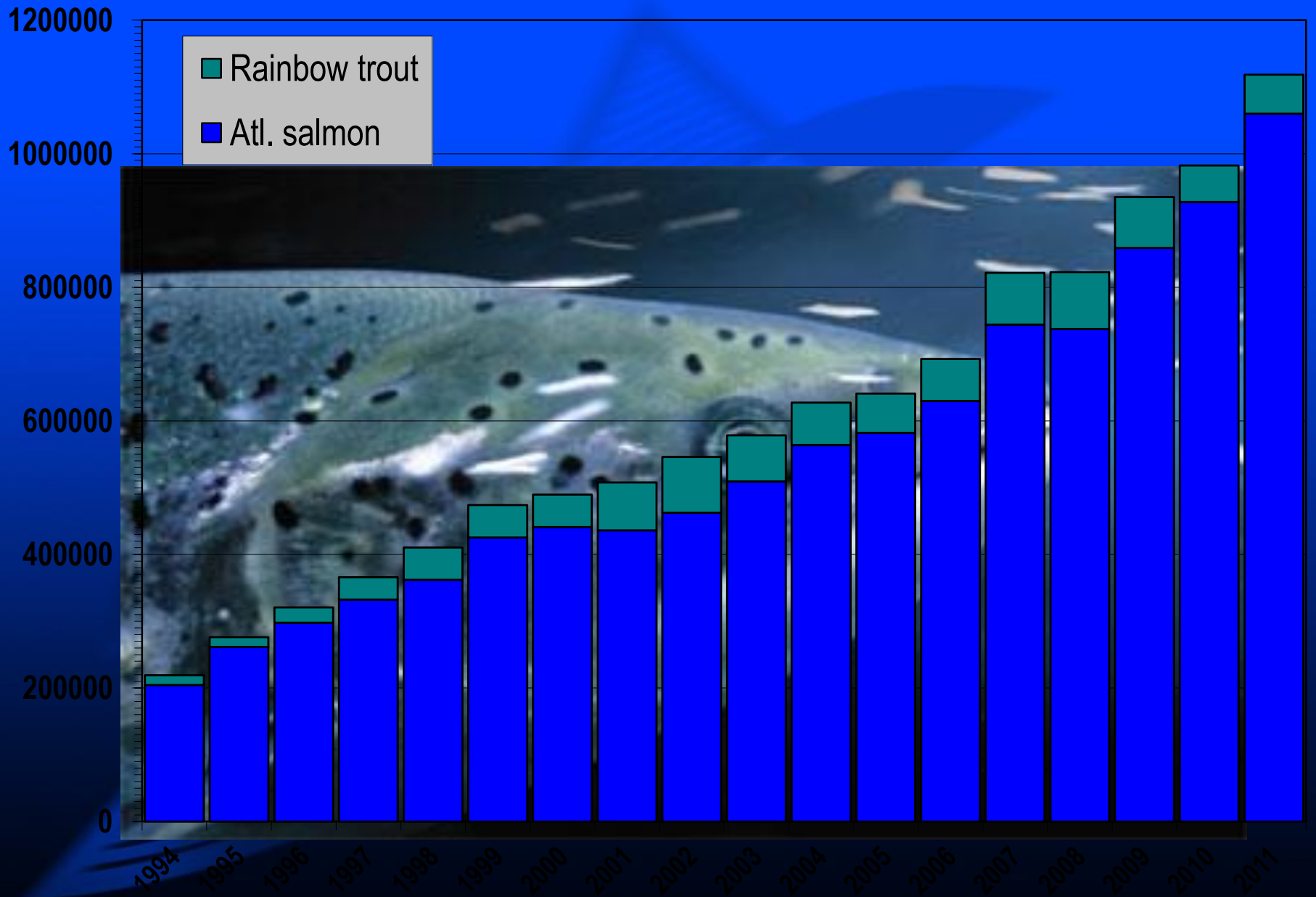
Regional seminar on aquaculture for Embassies, Norad and fisheries advisers

Bangkok 16. January 2013

The Norwegian Farmed Salmon great success story?



The Norwegian Aquaculture Governance System a success story?



Only 3 Norwegian "superclustre"

- Offshore oil and gas
- Maritime industries/Shipping
- Sea Food: Aquaculture/Fisheries

Areas where Norway has an "edge".

Norway: salmonids in the future?

- 2012 1,2 million tons
- Further increase to 2 million tons?
- 2050: 5 million tons (Sintef)?
- Norway position: no 1 Sea Food Nation?
- The Norwegian aquaculture case attracts great interest – what do we show the foreign guests?

Cage farm visit by Malaysian Guests





Strategy

Strategy for an environmentally sustainable Norwegian aquaculture industry



NORWEGIAN MINISTRY OF
FISHERIES AND COASTAL AFFAIRS

Barge with offices, monitoring, feed storage and automatic feeding system



Juveniles produced in hatcheries



Landbased cod hatchery (intensive technology)





Every fingerling is vaccinated against diseases

Wellboat for transport of fingerlings as well as fish to the slaughtering station



Automatic handling of fish always "in water"



Big fish pump in operations (Sterner Fish Tech AS)

The Workboat, a necessary tool



Salmon Farming Companies

- Marine Harvest
- Cermaq
- Lerøy Seafood
- Salmar
- All together: 80 companies

Market value of the four approx NOK 40 billion

Feed companies

- Ewos
- Skretting
- Biomar

Suppliers of technology

- Aquanor Exhibition (list of suppliers on the homepage)
- Market leader: Akva Group
- Market leader cages: Aqualine
- A number of others



Your Partner in Aquaculture Technology

The company has more than 700 employees, offices in 8 countries and a total turnover of 900 MNOK in 2011.. AKVA group is recognized as a pioneer and technology leader through more than 30 years. Corporate headquarters are in Norway.

Aqualine Cage

Diameters from 12m - 100m

Designed to withstand the storm
that appears every 50-year

Transfer of Norwegian technology Pilot Sea Cage Farm, Phuket



Transfer of technology and competence:
hatchery, live feed section



Transfer of technology and competence:
hatchery, larval rearing section



New nursesey section, Phuket



Vaccine, therapeutic and fish health companies

- Pharmaq
- Novartis
- MSD AH Norge
- Pathogen AS
- Fish Health services companies

Competence – The Norwegian Research Institutes

- Sintef Fisheries and Aquaculture, Trondheim
- The Food Research Institute (NOFIMA), Tromsø/Ås
- Akvaplan-Niva, Tromsø
- The Norwegian Institute for Nature Research (NINA), Trondheim



Competence : the Governmental Research Institutes

- Institute of Marine Research
- National Institute for Nutrition and Seafood Research
- National Veterinary Institute



Competence – The Universities

- The Norwegian University of Life Sciences, Ås
- The University of Oslo, Oslo
- The University of Bergen, Bergen
- The Norwegian University of Science and Technology, Trondheim
- The University of Nordland, Bodø
- The University of Tromsø, Tromsø



UNIVERSITY OF
NORDLAND



Others

- Innovation Norway
- Norges Vel
- AquaGen
- SalmoBreed



Training and Education in Aquaculture i

- "Fagbrev" Technical colleges - Skilled worker certificate
- The Norwegian University of Life Sciences, UMB, Ås
- The University of Oslo, UiO, Oslo
- The University of Bergen, UiB, Bergen
- The Norwegian University of Science and Technology, NTNU, Trondheim,
- The University of Nordland, Bodø
- The University of Tromsø, UiT, Tromsø

Financing and insurance

- All the major Norwegian Banks
- Most of the Norwegian insurance companies
- Norfund – The Norwegian Investment Fund for Developing Countries



Industrial Farming: The Norwegian Competence

- People , companies and institutions with experience from the salmon and marine fish value chain.
- Highly specialized and knowledgebased
- Not a "one man show"

Core relevance: Big Cage Farming

- Biophysical conditions:
 - Calm sea water areas with optimal currents and enough depths
- Basic critical conditions for industrial development
 - Development of the whole value chain needed
 - Effective fish health management and regulations in general
 - Profitably i.e. return on investment (species dependent)

Asian Cage culture (1)

Overall the future prospects for all forms of cage farming look relatively bright for Asia. However the large-scale, capital-intensive, vertically integrated marine cage-farming practices seen in northern Europe (e.g. Norway) ... are unlikely to occur in Asia. Instead of large-scale farms, clusters of small farms generating synergies, acting in unison and thereby attaining a high level of efficiency are likely to be the norm.

Asian Cage culture (2)

Off-shore cage farming is unlikely to be widespread in Asia, as its development is hampered by availability of capital and the hydrography of the surrounding seas, which does not allow the technology elsewhere to be easily transferred.

Sena S. De Silva/Michael J. Phillips, 2007

Locality Classes NS-9415

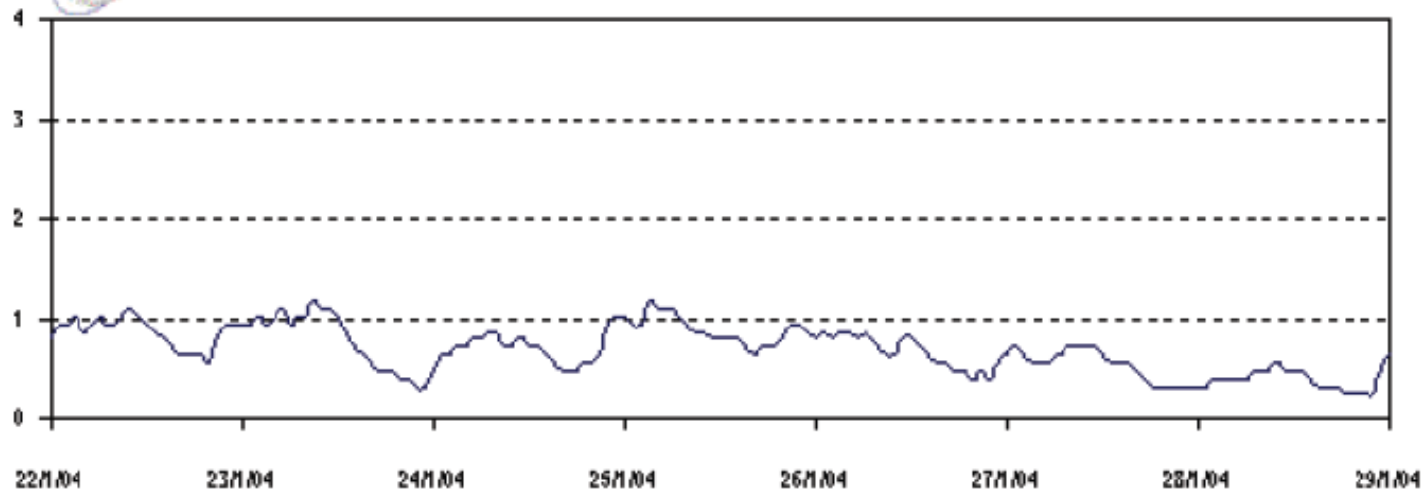
Significant Wave Height (m)		Current Speed (m/s)				
		a	b	c	d	e
		< 0,3	0,3 - 0,5	0,5 - 1,0	1,0 - 1,5	> 1,5
A	< 0,5	Aa	Ab	Ac	Ad	Ae
B	0,5 - 1,0	Ba	Bb	Bc	Bd	Be
C	1,0 - 2,0	Ca	Cb	Cc	Cd	Ce
D	2,0 - 3,0	Da	Db	Dc	Dd	De
E	> 3,0	Ea	Eb	Ec	Ed	Ee

Norwegian Standard (NS-9415) Site Classification Scheme



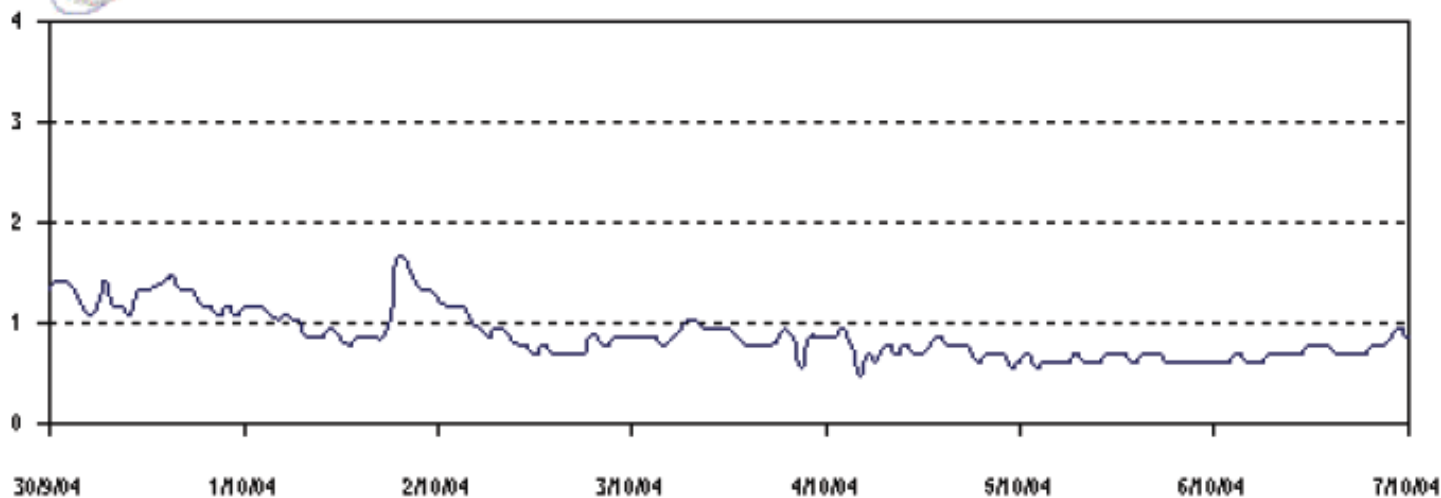
Significant wave height (m) Ko Phuket

Week No. 4



Significant wave height (m) Ko Phuket

Week No. 39

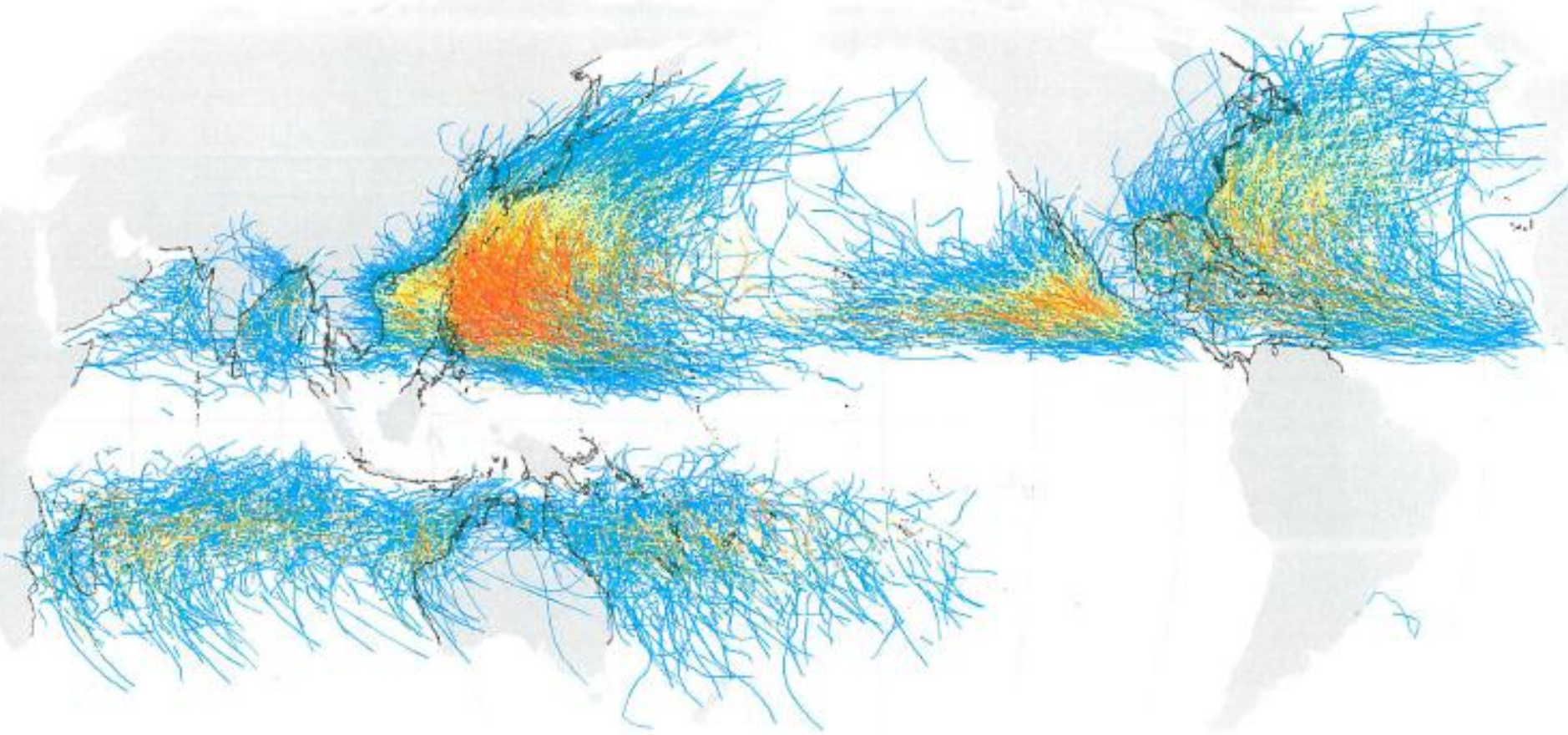


Wave
Heigh

Ko
Phuket

Significant wave height for two weeks (week 4 and 39 in 2004).

Tropical Cyclones, 1945-2000



Saffir-Simpson Hurricane Scale:

tropical
depression

tropical
storm

hurricane
category 1

hurricane
category 2

hurricane
category 3

hurricane
category 4

hurricane
category 5



LAOS

THAILAND

VIETNAM

Philippine Sea

MYANMAR

PHILIPPINES

Pacific Ocean

CAMBODIA

South China Sea

BRUNEI

MALAYSIA

Celebes Sea

SINGAPORE

Medan

Pematangsiantar

Manado

Pekanbaru

Pontianak

KALIMANTAN

Samarinda

Halmahera

PAPUA
NEW GUINEA

Padang

Sumatra

Jambi

Borneo

Sulawesi

Ceram Sea

Jayapura

BARISAN MTS.

Palembang

Barito

Banjarmasin

Moluccas Is.

Puncak Jaya

MAORE MTS.

Sunda Strait

JAKARTA

Mount Merapi

Madura

Flores Sea

Makassar

Banda Sea

IRIAN
JAYA
New
Guinea

Bogor

Bandung

Surabaya

Lombok

Flores

INDONESIA

Indian Ocean

Java

Bali

Sumbawa

Kupang

Timor

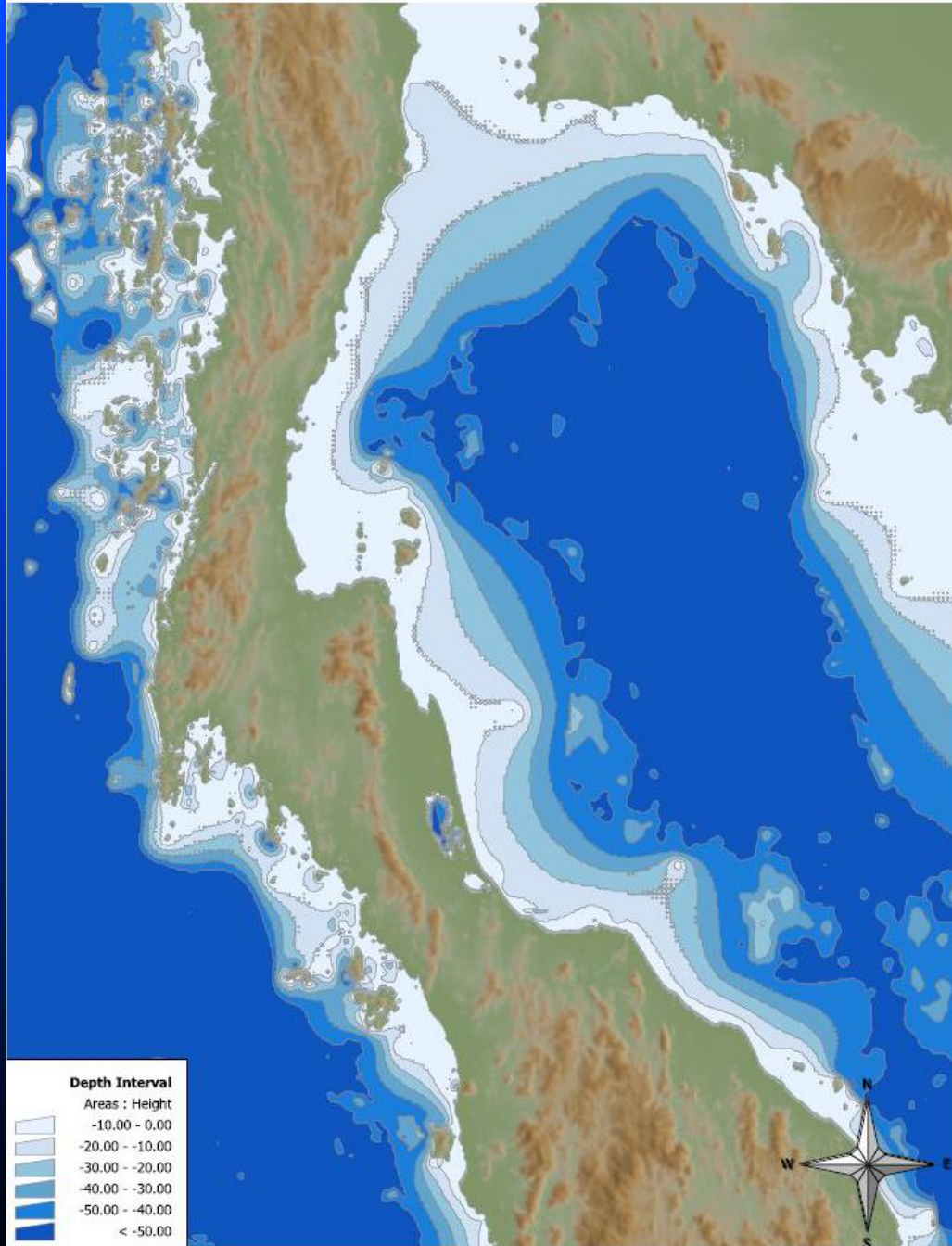
EAST
TIMOR

Timor Sea

Arafura Sea

AUSTRALIA

Thai sea waters with depth intervals



Map of Andaman Sea and Gulf of Thailand with depth intervals

Species selection a critical condition for industrial farming

Is there a "tropical salmon"?

Candidates (long- and short-term):

- Tuna
- Cobia
- Sea Bass
- Pompano
- Grouper
- Others?

Cobia



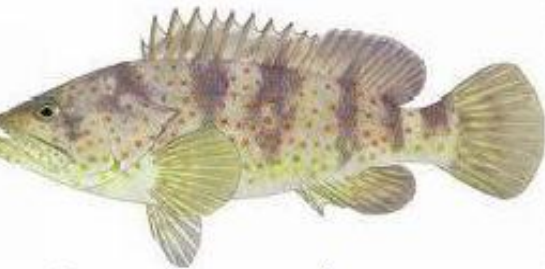
Asian Sea Bass



Tunas; Albacore, Atlantic Bluefin, Skipjack, Yellowfin and Bigeye



MARINE FIN FISH AQUACULTURE (TROPICAL CANDIDATES)



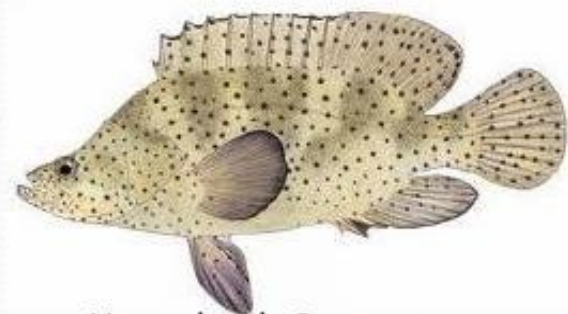
Orange spotted grouper
(*Epinephelus coioides*)



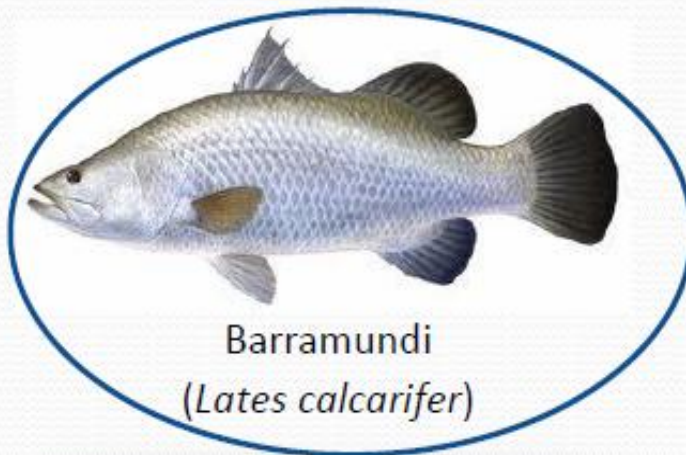
Coral Trout
(*Plectropomus leopardus*)



Tiger Grouper
(*Epinephelus fuscoguttatus*)



Humpback Grouper
(*Cromileptes altivelis*)



Barramundi
(*Lates calcarifer*)



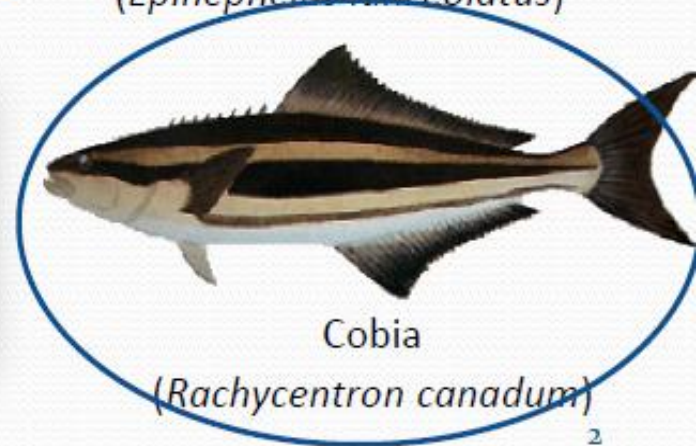
Giant Grouper
(*Epinephelus lanceolatus*)



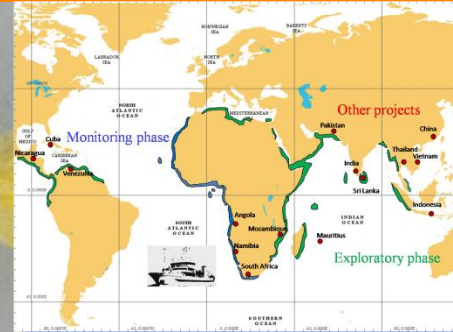
Golden travelly
(*Grathanodon sp.*)



Pompano
(*Trachinotus blochii*)



Cobia
(*Rachycentron canadum*)

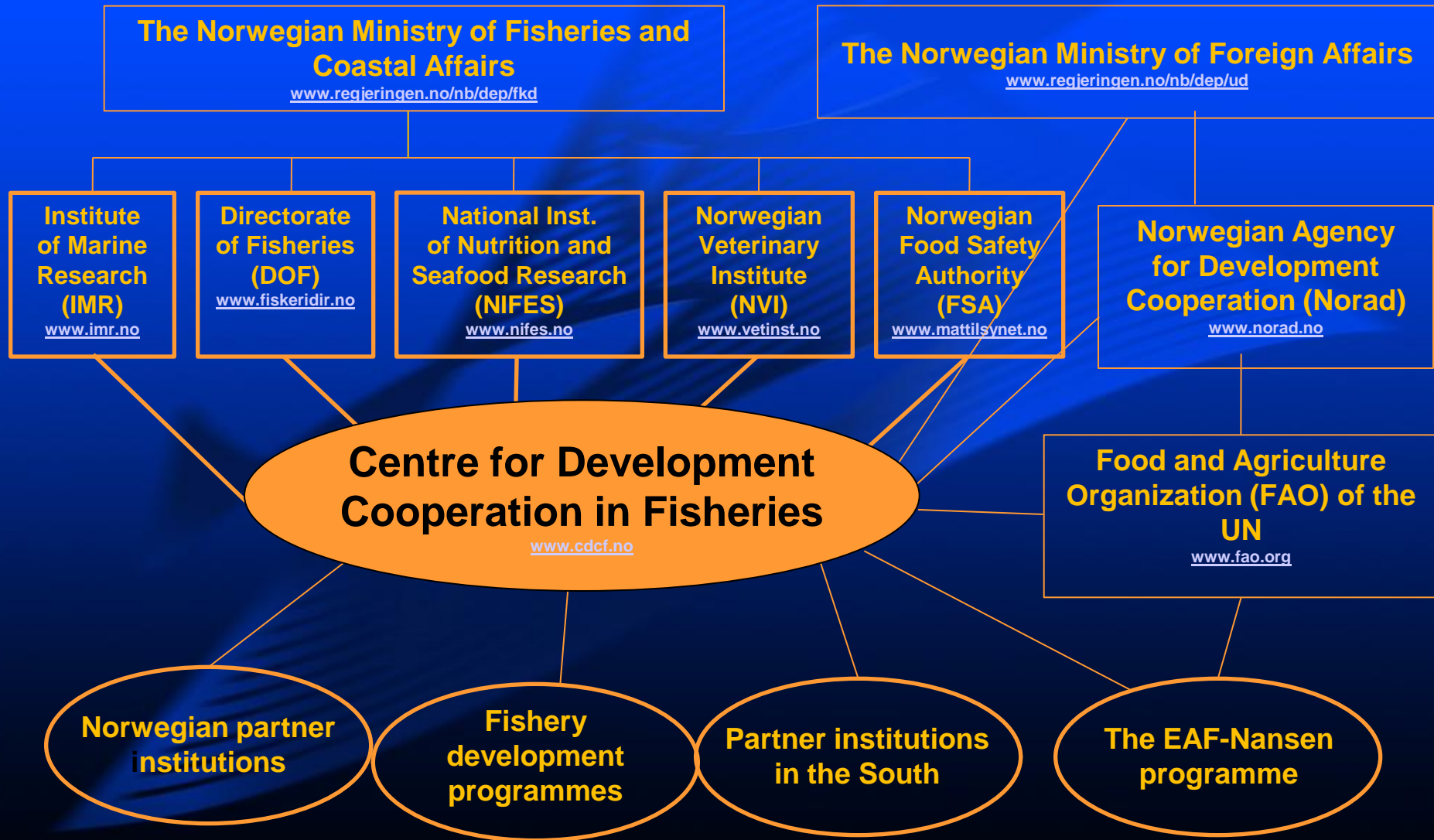


CDCF

Centre for Development Cooperation in Fisheries

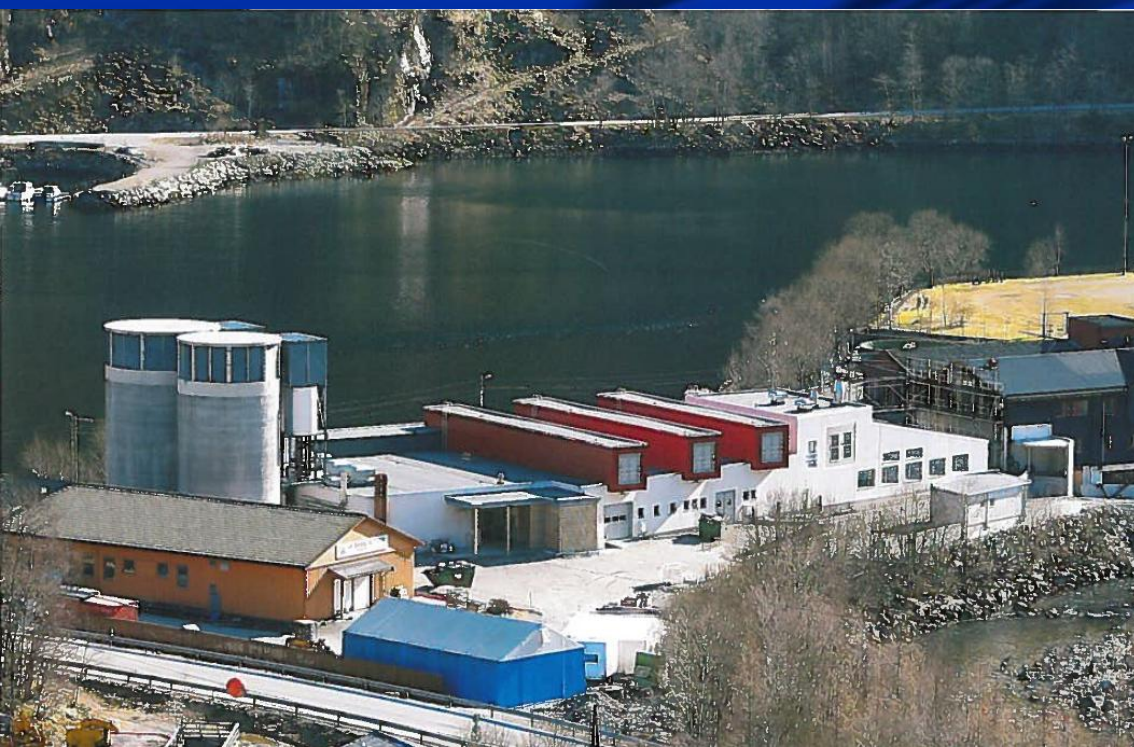
- CDCF is the coordinating national centre for development cooperation representing the main aquaculture governance institutions in Norway
- Coordinates the use of experts from these institutions as well as others
- Personnel 15 in CDCF + experts

CDCF, Cooperation Partners:





The major fisheries and aquaculture research institution in Norway



- **Aquaculture research & research facilities**
- **Site evaluation and mapping/ Zoning**
- **Scientific advise for political decisions**
- **Governmental decision support tools (AkvaVis)**
- **Environmental monitoring (MOM)**
- **Fish disease/Fish welfare**
- **Risk assessment**



Competence

- **Aquaculture policies and legislation**
- **Monitoring and surveillance**
- **Enforcement and sanctions**
- **Coastal zone management**
- **Implementing political decisions**
- **Processing applications and appeals**

Competence

- **Aquaculture policies and legislation**
- **Fish health /Fish welfare**
- **Food safety**
- **Monitoring, control and surveillance, enforcement and sanctions**
- **Coastal zone management**
- **Implementing political decisions**
- **Risk management**

Competence

- **Fish disease**
- **Feed/food safety**
- **Pathology**
- **Epidemiology**
- **Animal welfare**
- **Toxicology**
- **Preventive medicine**
- **Scientific advice to the government**

Competence

- **Fish nutrition/feed**
- **Alternate feed ingredients**
- **Seafood and human health**
- **Scientific advise for political decisions**
- **Feed safety**
- **Food Safety**
- **Feed risk assessment decisions**

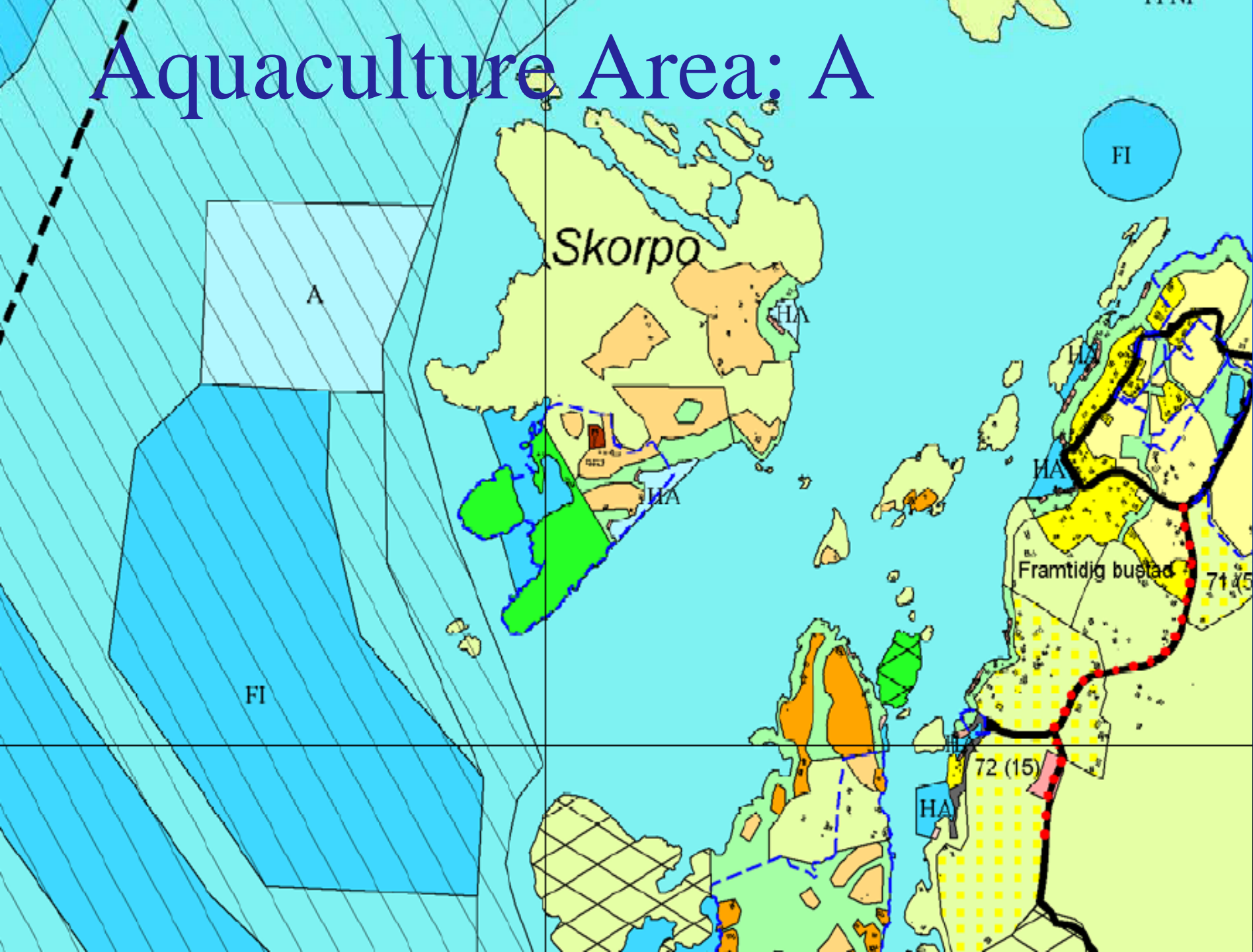
Core competence: the Norwegian Aquaculture Governance System

- General Regulatory System based on Law developed over 40 years
- Fish Health Management
- Monitoring, control and surveillance
- Enforcements and sanctions
- Managed by the Ministry of Fisheries and Coastal Affairs

Is the Norwegian Aquaculture System relevant for other regions?

- Is it based on universal principles or is it specific for a "Norwegian setting"?
- It is based upon experience and knowledge
- The system should reduce risk
- The system should aim at sustainability?
- The system is working not being just on paper

Aquaculture Area: A



Chinese cage mass





Trash fish feed



Sediments China



Commercial farm, Phuket, Thailand



Examples - Relevance?

- Licence – location in defined Aquaculture Areas
- Minimum distance between farms
- Site rotation
- Fallowing
- Zoning
- All in – all out: separation of yearclasses
- Pull out of dead fish ever day
- No slaughtering at the cage farm
- Report on drug use – comply with regulations
- Monitoring of environmental impact

Asian aquaculture i.e. fish farming in sea waters – some questions:

- No strict regulatory system in operation?
- Utilization of sea water farming potential not possible using traditional technology?
- Expansion of food production difficult?

- Very high mortalities?
- Heavy use of drugs?
- Environmental concerns?

- Compliance with universal principles of husbandry?

Requests to Norway from Asian countries regarding aquaculture (top list)

1. Big cage farming
2. Site mapping
3. Massproduction of fingerlings
4. Fish health management/ vaccines; bio-security
5. Regulation
6. Competence building
7. Breeding

Generic topics 1

- Basic practical training of aquaculturists in modern farming in selected countries
- Higher education; MSc and PhD
- Site investigation and mapping to define the bio-physical potential for selected regions
- Aquaculture R&D Stations producing juveniles for for the first stage of development as well as training of farmers in a few appropriate regions/countries
- Regulatory systems, control and enforcement
- Bio-security systems

Generic topics 2

- Selective Breeding (National breeding programs for disease free and/or diseases resistant high quality ova)
- Feed analysis and feeding
- Vaccine, analysis and early developments
- Animal welfare
- Environmental monitoring and systems
- Evaluation and monitoring of drug use



Koop khun krub