



**Recent evolution of mariculture production in the world :  
tendances, main problems, how research answer ?**

*by*

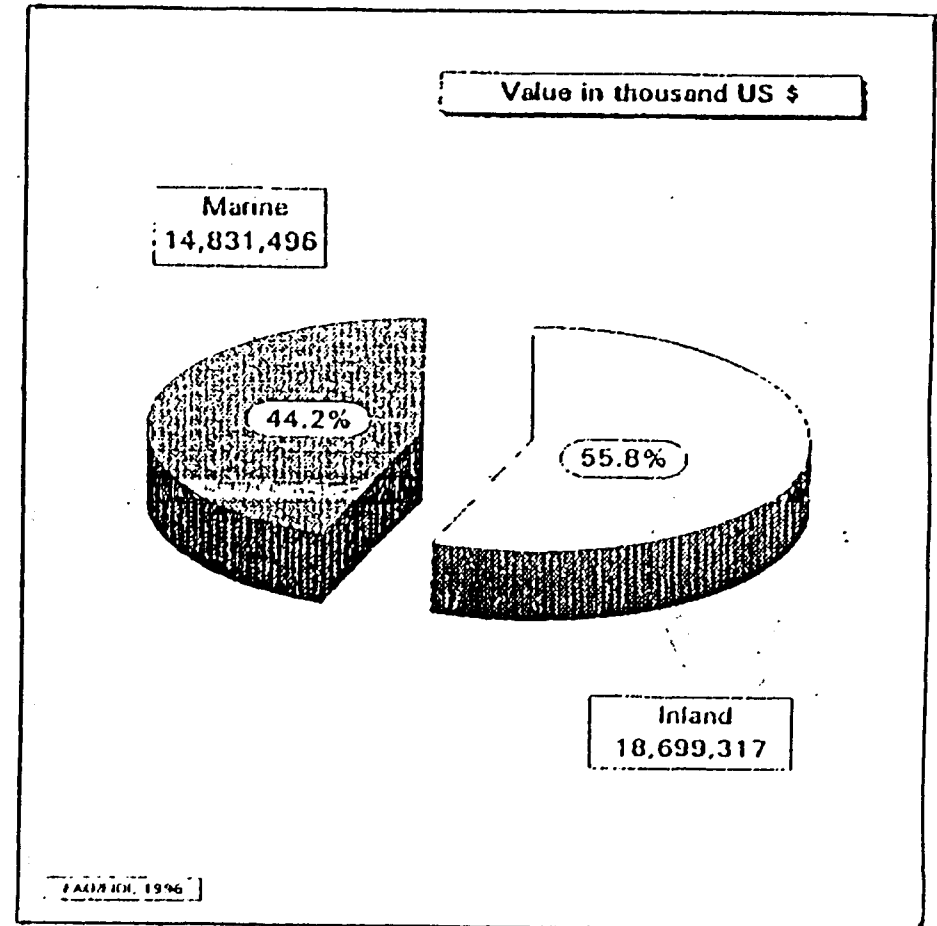
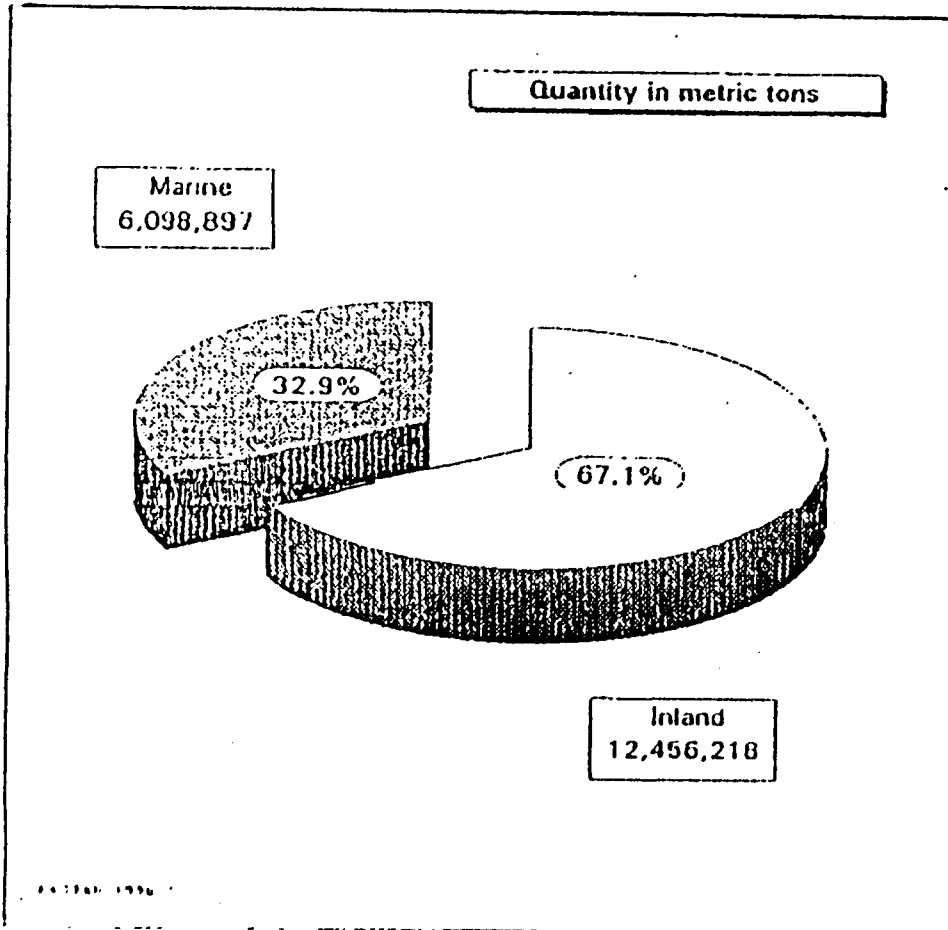
**Maurice HERAL  
IFREMER/CNRS - CREMA-L'HOUMEAU  
BP 5 - 17137 L'HOUMEAU - FRANCE  
Fax 33 546 50 06 60  
Email : mheral@ifremer.fr**

**Abstract :**

World marine aquaculture still present a large increase of the marine production as well for shellfish (molluscs and shrimps) and marine finfish. For example 98 % of atlantic salmon consumed in the world is produced by aquaculture, 90 % of the oysters and 25 % of the shrimps are cultivated. During that exponential development mariculture production had some major difficulties related with deseases, with environmental problems, spatial conflicts and economical difficulties. Different programs of research tried to find solutions to help industry, how these national and international programs could be strenghtened, it is a new challenge if aquaculture productivity is maintained in a sustainable development process. What is the ICES role ?

# 1994 World Aquaculture Production

by Quantities and Values for Inland and Marine Waters



Aquaculture production per group of species (1995)

Fishes	Molluscs	Crustaceans	Total
14,73	5,09	1,13	20,94 millions tons

Aquaculture production in the different geographical areas 1995

Asia	Africa	Europe	America	Total
18,27	0,05	1,70	0,92	20,94

Marine production per group of species 1995

Fishes	Molluscs	Crustaceans	Total
1,41	5,08	1,07	7,56

Fish aquaculture production for marine species 1997 in millions tons

Salmonide	Mullet	Lates	Milkfish	Various	Total
0,71	0,15	0,12	0,35	0,08	1,41

Source FAO

Evolution of aquaculture production between 1988 and 1994

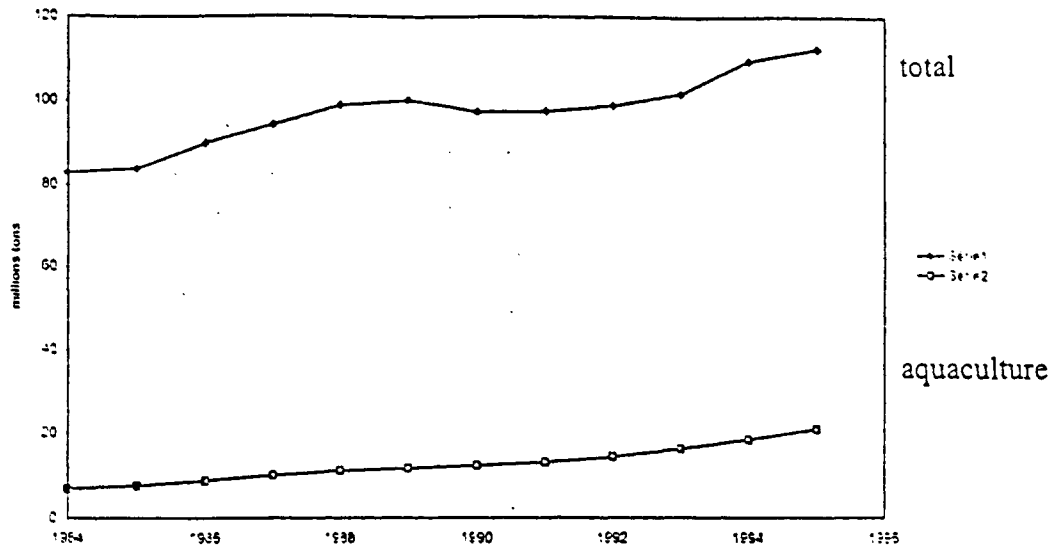
1988 Tons	Total	(1) fish	by group of species			by environnement	
			(2) crustacean	(3) bivalves	(4) seaweed	(a) fresh	(b) marine water
Europe (*)	1 290 000	520 000	3 000	760 000	-	350 000	910 000
World (**)	14 650 000	7 600 000	650 000	3 000 000	3 400 000	7 350 000	7 300 000

1988 Tons	Total	(1) fish	by group of species			by environnement	
			(2) crustacean	(3) bivalves	(4) seaweed	(a) fresh	(b) marine water
Europe (*)	1 520 000	730 000	2 500	780 000	5 000	390 000	1 100 000
World (**)	25 410 000	13 050 000	1 070 000	4 390 000	6 900 000	11 150 000	14 260 000

(\*) including Eastern Europe (except former USSR) and Mediterranean Basin - source : European Commission, IFREMER, SIPAM network, FAO

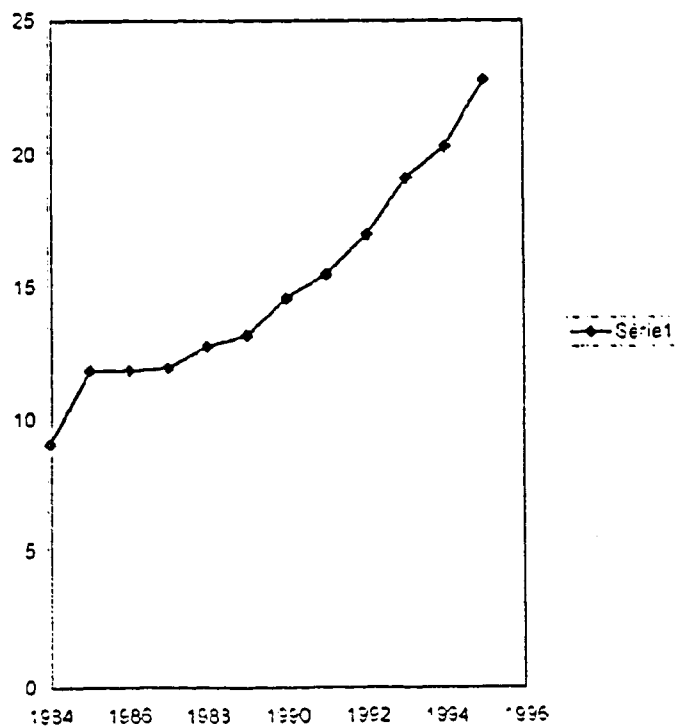
(\*\*) source FAO

(3) bivalves include all mussels from aquaculture, restocking on located areas or fisheries



Page 1

### Evolution of aquaculture production and total landings

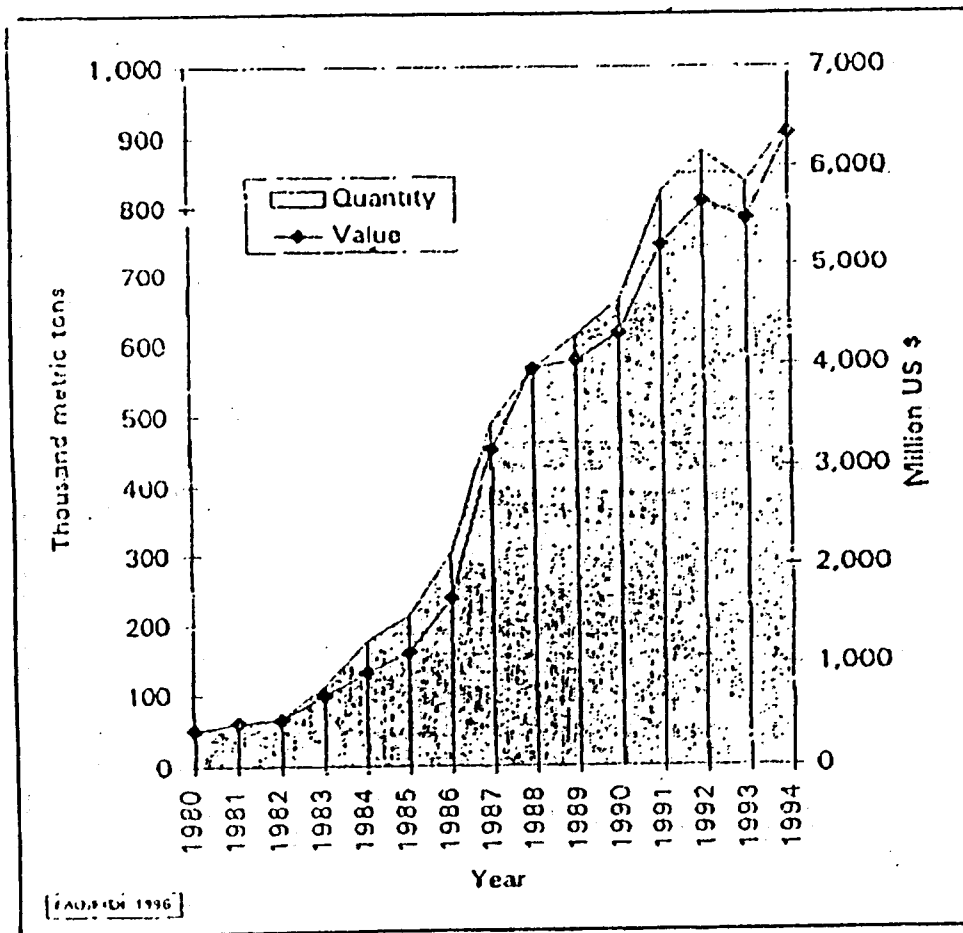


### Percentage of aquaculture production versus fisheries

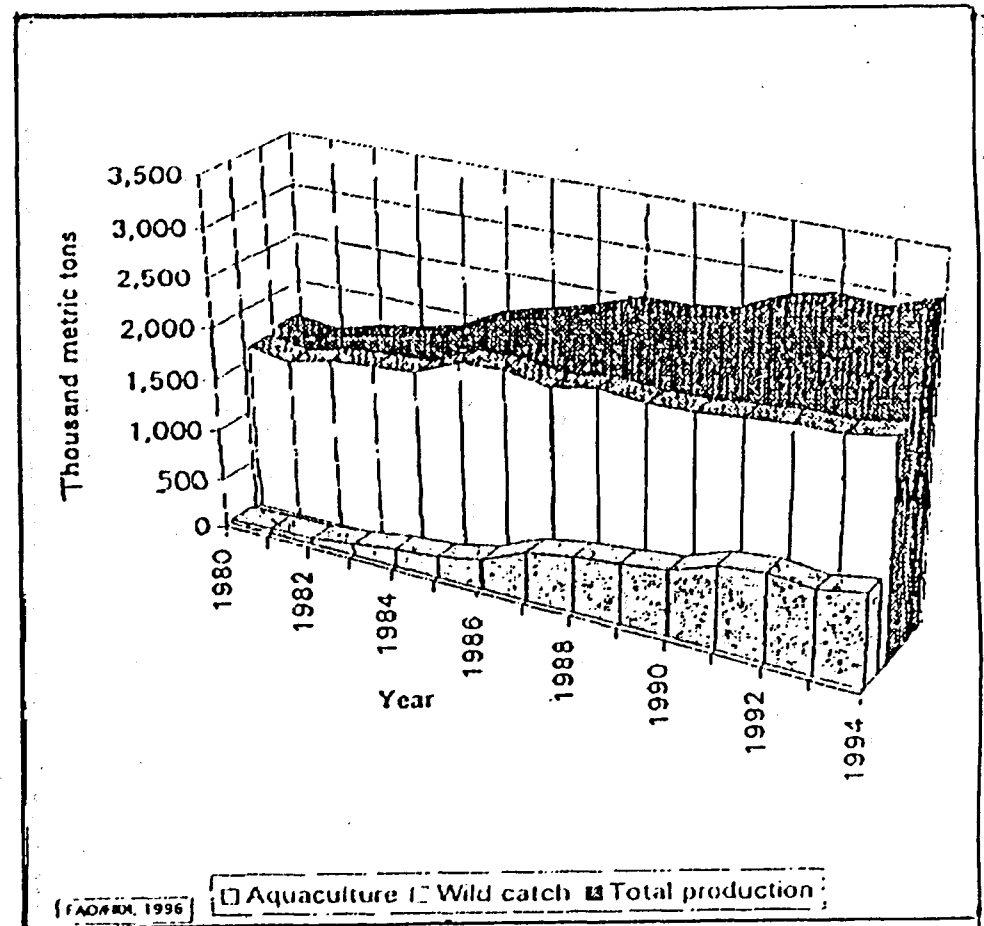
# Aquaculture Production of Shrimps

by Quantity and Value and Comparison with Total Production, 1980-1994

Shrimps: Aquaculture by Quantity and Value, 1980-1994



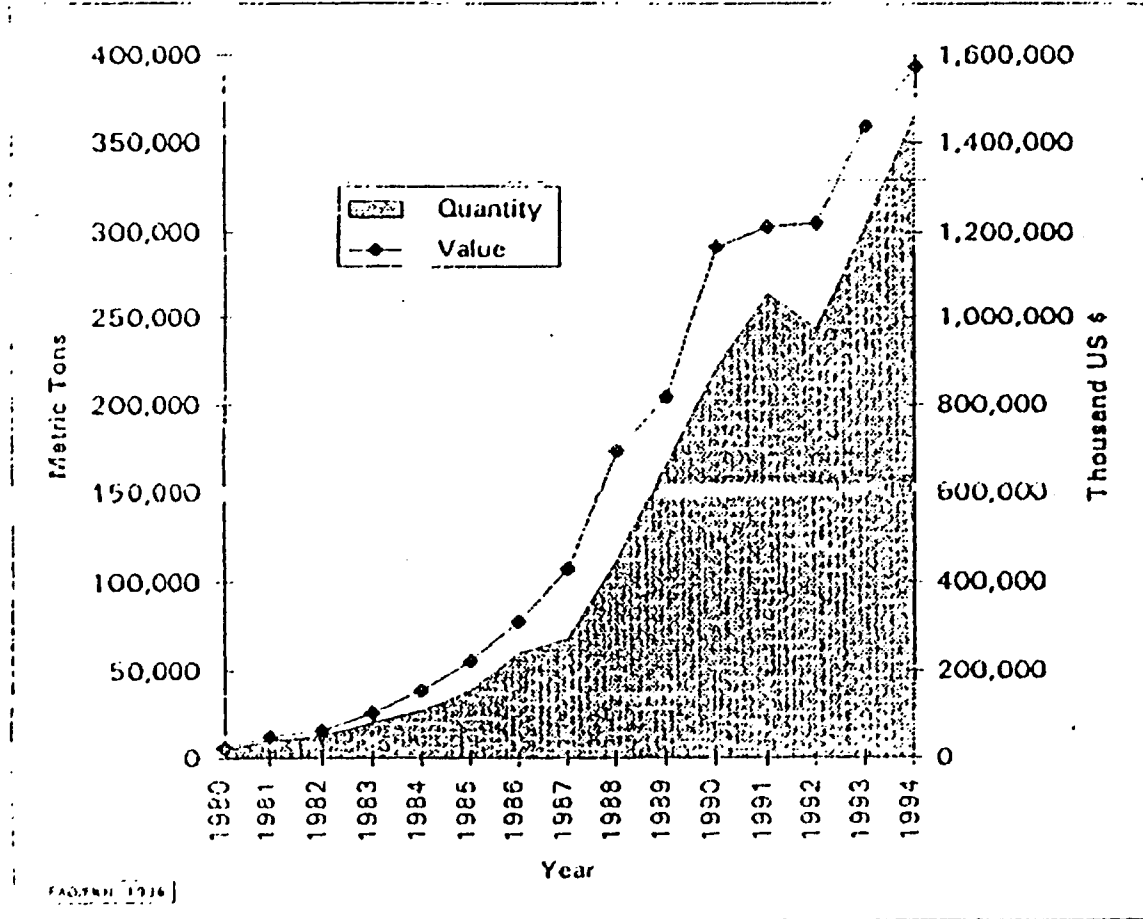
Shrimps: Total Production, 1980-1994



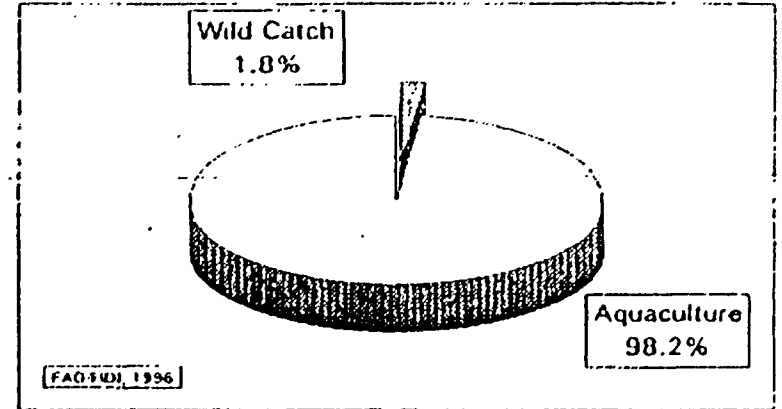
# Aquaculture Production of Atlantic Salmon

and Comparison with Wild Catch of Atlantic and Pacific Salmons for 1994

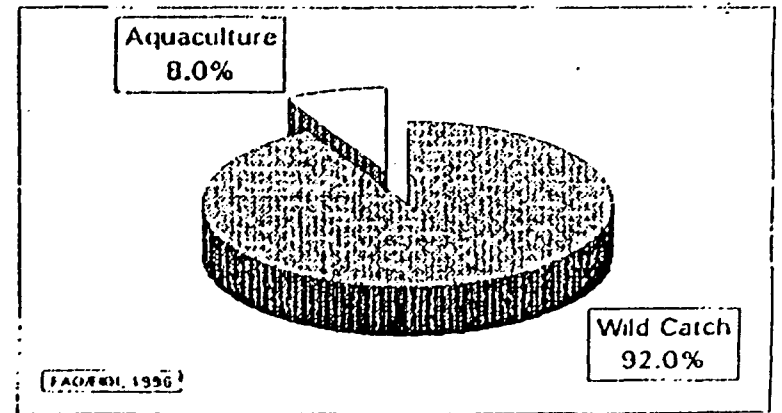
Atlantic Salmon: Aquaculture by Quantity and Value, 1980-1994



Atlantic Salmon Production, 1994



Pacific Salmons Production, 1994



# Production of Atlantic and Pacific Salmons

by Aquaculture and Wild Catch, 1980-1994

Atlantic Salmon

Pacific Salmons

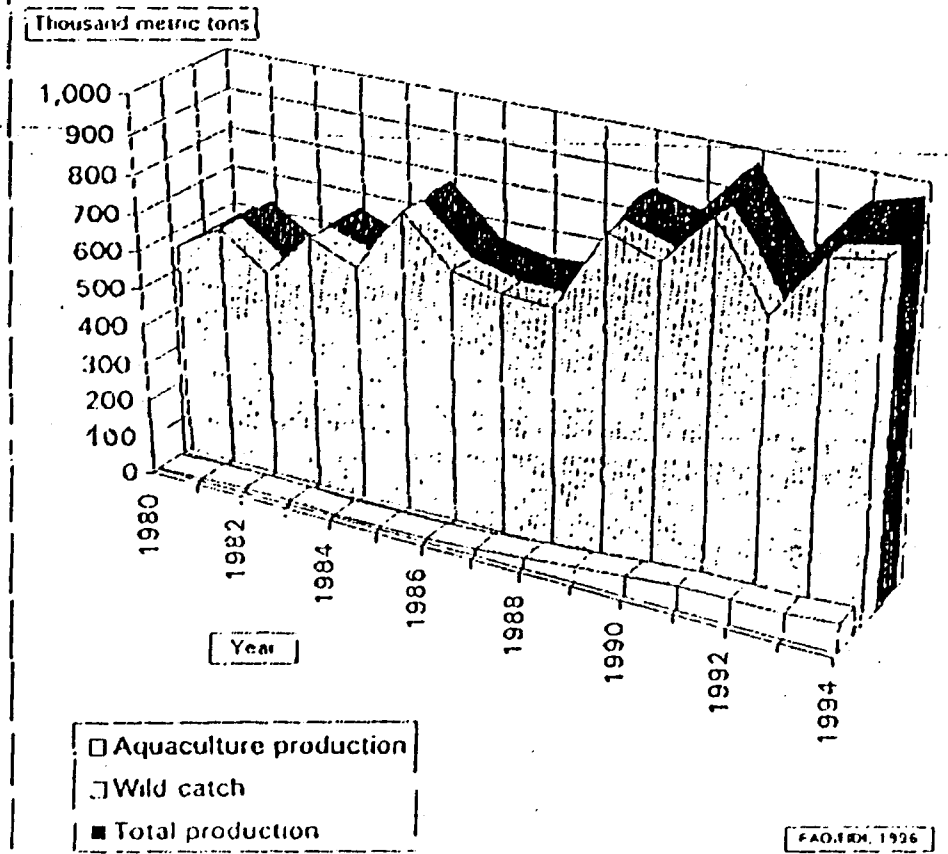
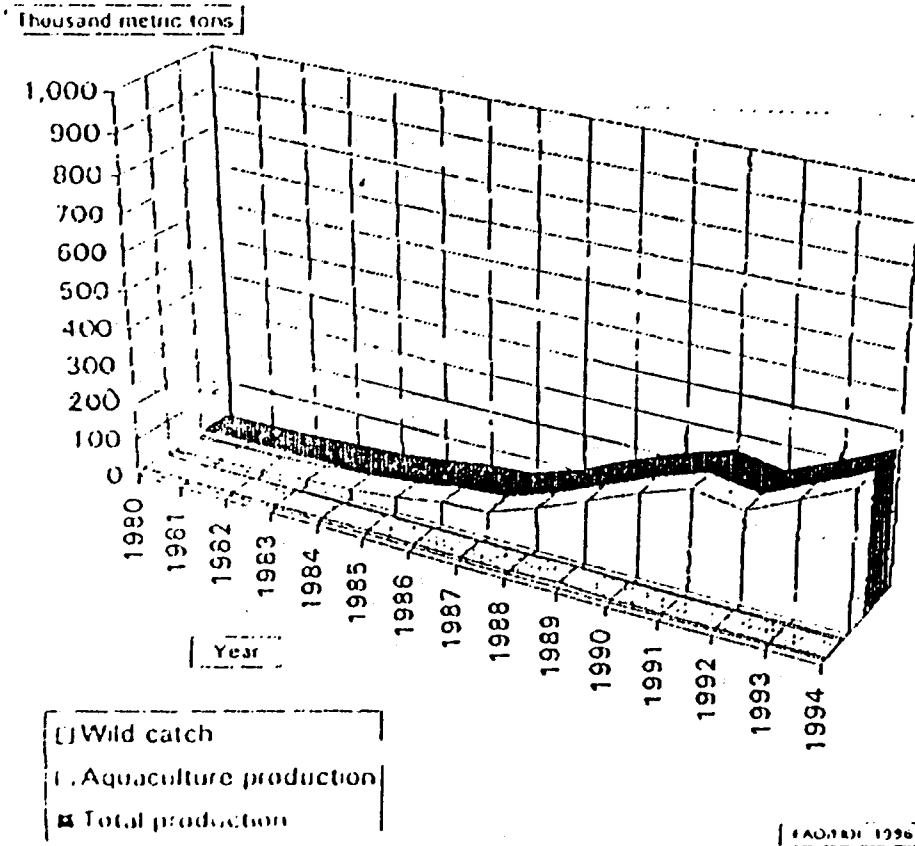


Table 3 : Evolution of Atlantic salmon production in Europe (metric ton)

	Norway	Scotland	Island and Feroe Isles	Irlande	France	Spain	TOTAL
1988	74 000	16 300	5 500	4 000	650	150	100 800
1990	130 000	30 000	15 700	6 000	200	350	182 250
1992	130 000	36 000	20 200	9 700	200	800	19 690
1993	180 000	49 000	17 200	12 400	240	600	25 944
1994	210 000	54 000	12 200	11 800	450	900	28 935
1995	249 000	72 000	13 000	12 500	500	1 250	348 250

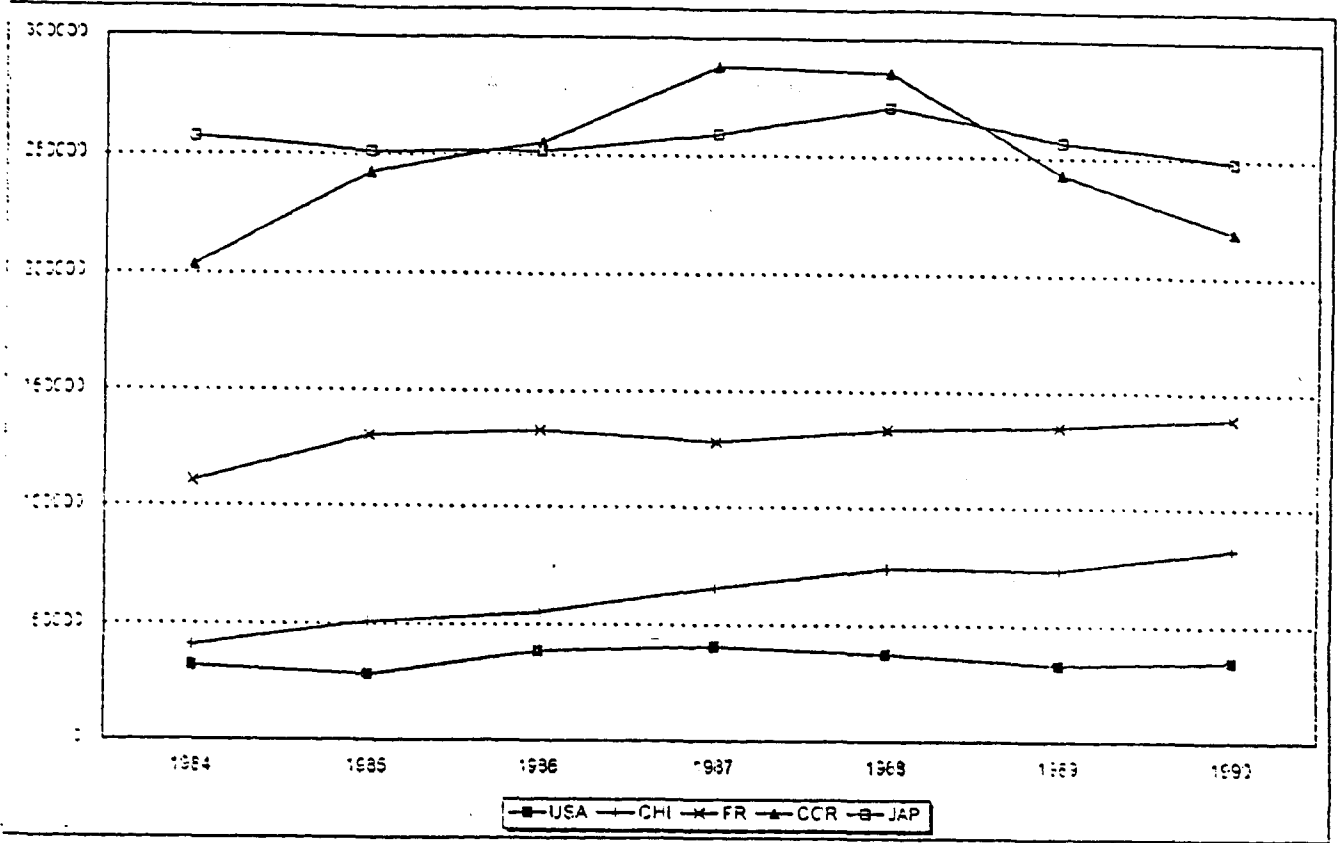
Table 4 Evolution of sea bass and sea bream production in the Euro-Mediterranean ara (metric tons).

	France	Greece	Italy	Spain	Other countries	TOTAL
1988	160	800	1680	90	650	3 380
1989	235	600	1 950	365	1 475	4 625
1990	375	1 600	1 900	590	1 850	6 315
1991	750	8 800	2 500	1 090	2 850	15 990
1992	1 250	5 000	2 900	1 750	4 340	15 240
1993	2 350	10 000	3 500	2 500	7 340	25 690
1994	3 400	13 000	4 000	2 700	9 300	32 400
1995	3 650	17 800	7 600	3 170	10 000	42 120

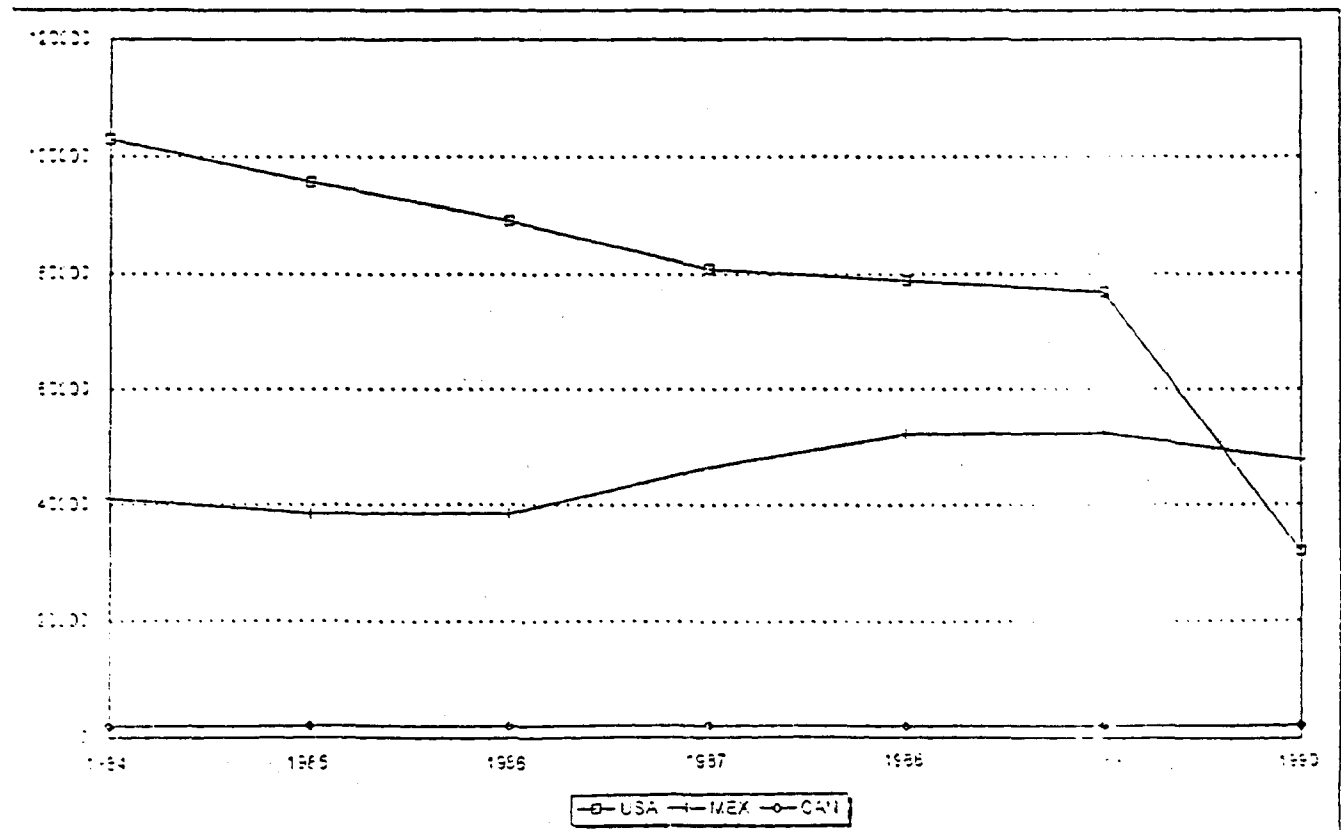
Sources SIPAM-IFREMER - Federation of European Aquaculture Producers.



O GIGAS



O VIRGINICA



Production of oysters in tons (total weight)

## MAIN PROGRAMS OF RESEARCH

### 1) Control of biological cycles of cultivated species

- physiology of reproduction, growth and adaptation
- nutrition

### 2) Diseases

- Defense mechanisms
- identification of parasites
- epidemiology
- treatment, vaccination, antibiotics

### 3) Genetic

- Cytogenetic : polyploids, gynogenetic strain, monosex
- genetic characterization of the species
  - markers
  - population/escape
  - hybridation
- improvement and selection of strain
  - diseases resistant
  - growth rate
- gene transfer

### 4) Optimisation of the production in relation with economical studies market problems

### 5) Environmental impact

- Carrying capacity
- Holding capacity
- Biodiversity
- Water treatment

### 6) Integrated coastal zone management

- future place of mariculture  
facing with other industries

## ICES INPUTS

◆ Cooperation of scientists through :

the Annual Science Conference  
the Working groups  
the study group

Working group on environmental interaction of Mariculture

*H. Rosenthal*

● Working group on the application of genetics in fisheries and mariculture

*J. Mork*

Working group on marine fish culture

*B. Howel*

Working group on introduction and transfert

*J. Carlton*

Working group on pathology and diseases of marine organism

*AH Mc Vicar*

- the workshops : the workshop on shellfish bivalve cultivation, growth, modelling and impact on the ecosystem
- the symposiums : Environmental effects of mariculture

● ◆ advices to international agencies through ACME and recommandations to ICES and to associated countries

- Code of practice for introduction of non native species
- Chemicals used by aquaculture
- GMO

....

**REPORT OF THE WORKSHOP ON SHELLFISH BIVALVE  
CULTIVATION, GROWTH, MODELLING AND IMPACT ON  
THE ECOSYSTEM**

PLYMOUTH U.K.

6-10 October 1996

Convenors : M. HERAL\*, B. BAYNE

This report is not to be quoted without prior consultation with the General Secretary. The document is a report of an expert Group under the auspices of EU and the International Council for the Exploration of the Sea and does not necessarily represent the views of the Council and DG14.

\* IFREMER/CNRS - CREMA-L'HOUMEAU, BP 5, 17137 L'HOUMEAU, FRANCE  
E-mail : mheral@ifremer.fr

# INTERNATIONAL COUNCIL FOR EXPLORATION OF THE SEA

**Symposium : Environmental effects of mariculture**

## **FIRST ANNOUNCEMENT**

**Co-convenors : M. HERAL, D. WILDISH**

**St Andrews, N.B. Canada, 13-16 September 1999**

### **Objectives and scopes of the Symposium**

Marine Aquaculture development is facing towards several environmental problems which can limit its expansion if alternative management strategies are not found.

The goal of the Symposium is to identify, describe and model the positive and negative impact of Mariculture to give an exact state of the art. The symposium is concerned as well by the shellfish (molluscs, crustacean) and marine finfish. Sessions on the following subjects will be organized :

- Genetic problems (escapes, GMO,...),
- Introduction of non indigenous species,
- Chemicals used in mariculture,
- Organic wastes and depuration system,
- Impacts on biodiversity,
- Carrying capacity for shellfish,
- Holding capacity for finfish,
- Integrated coastal zone management and place of mariculture.

A steering committee will be nominated during the Baltimore Annual Science Conference to precise the topics and the organisation of the Symposium.