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

by

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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

**Quantity in metric tons**
- **Marine**: 6,098,897 (67.1%)
- **Inland**: 12,456,218 (32.9%)

**Value in thousand US $**
- **Marine**: 14,831,496 (55.8%)
- **Inland**: 18,699,317 (44.2%)
Aquaculture production per group of species (1995)

<table>
<thead>
<tr>
<th>Species</th>
<th>Molluscs</th>
<th>Crustaceans</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fishes</td>
<td>14.73</td>
<td>1.13</td>
<td>20.96</td>
</tr>
<tr>
<td>Molluscs</td>
<td>5.09</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crustaceans</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Aquaculture production in the different geographical areas 1995

<table>
<thead>
<tr>
<th>Region</th>
<th>Asia</th>
<th>Africa</th>
<th>Europe</th>
<th>America</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fishes</td>
<td>18.27</td>
<td>0.05</td>
<td>1.70</td>
<td>0.92</td>
<td>20.94</td>
</tr>
</tbody>
</table>

Marine production per group of species 1995

<table>
<thead>
<tr>
<th>Species</th>
<th>Molluscs</th>
<th>Crustaceans</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fishes</td>
<td>1.41</td>
<td>5.08</td>
<td>7.56</td>
</tr>
</tbody>
</table>

Fish aquaculture production for marine species 1997 in millions tons

<table>
<thead>
<tr>
<th>Species</th>
<th>Salmonide</th>
<th>Mullet</th>
<th>Lates</th>
<th>Milkfish</th>
<th>Various</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fishes</td>
<td>0.71</td>
<td>0.15</td>
<td>0.12</td>
<td>0.35</td>
<td>0.08</td>
<td>1.41</td>
</tr>
</tbody>
</table>

Source FAO

Evolution of aquaculture production between 1988 and 1994

<table>
<thead>
<tr>
<th>Year</th>
<th>Total</th>
<th>(1) fish</th>
<th>(2) crustacean</th>
<th>(3) bivalves</th>
<th>(4) seaweed</th>
<th>by environnement</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>(a) fresh</td>
<td>(b) marine water</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Europe (*)</td>
<td>1,290,000</td>
<td>520,000</td>
<td>3,000</td>
<td>7,600,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>World (**)</td>
<td>14,650,000</td>
<td>7,600,000</td>
<td>650,000</td>
<td>3,000,000</td>
<td>3,400,000</td>
<td>7,250,000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year</th>
<th>Total</th>
<th>(1) fish</th>
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<th>(4) seaweed</th>
<th>by environnement</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>(a) fresh</td>
<td>(b) marine water</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Europe (*)</td>
<td>1,320,000</td>
<td>750,000</td>
<td>2,500</td>
<td>7,800,000</td>
<td>5,000</td>
<td>390,000</td>
</tr>
<tr>
<td>World (**)</td>
<td>23,410,000</td>
<td>13,650,000</td>
<td>1,070,000</td>
<td>4,390,000</td>
<td>6,900,000</td>
<td>11,150,000</td>
</tr>
</tbody>
</table>

(*) 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
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

Wild Catch
1.8%

Aquaculture
98.2%

Pacific Salmon Production, 1994

Aquaculture
8.0%

Wild Catch
92.0%
Production of Atlantic and Pacific Salmons
by Aquaculture and Wild Catch, 1980-1994

Atlantic Salmon

Pacific Salmons

Legend: □ Aquaculture production, □ Wild catch, ■ Total production]
Table 3: Evolution of Atlantic salmon production in Europe (metric ton)

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

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

<table>
<thead>
<tr>
<th></th>
<th>France</th>
<th>Greece</th>
<th>Italy</th>
<th>Spain</th>
<th>Other countries</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1988</td>
<td>160</td>
<td>800</td>
<td>1680</td>
<td>90</td>
<td>650</td>
<td>3380</td>
</tr>
<tr>
<td>1989</td>
<td>235</td>
<td>600</td>
<td>1950</td>
<td>365</td>
<td>1475</td>
<td>4625</td>
</tr>
<tr>
<td>1990</td>
<td>375</td>
<td>1600</td>
<td>1900</td>
<td>590</td>
<td>1830</td>
<td>6315</td>
</tr>
<tr>
<td>1991</td>
<td>750</td>
<td>8800</td>
<td>2500</td>
<td>1090</td>
<td>2850</td>
<td>15990</td>
</tr>
<tr>
<td>1992</td>
<td>1250</td>
<td>5000</td>
<td>2900</td>
<td>1750</td>
<td>4340</td>
<td>15240</td>
</tr>
<tr>
<td>1993</td>
<td>2350</td>
<td>10000</td>
<td>3500</td>
<td>2350</td>
<td>7340</td>
<td>25690</td>
</tr>
<tr>
<td>1994</td>
<td>3400</td>
<td>13000</td>
<td>4000</td>
<td>2700</td>
<td>9300</td>
<td>32400</td>
</tr>
<tr>
<td>1995</td>
<td>3650</td>
<td>17800</td>
<td>7600</td>
<td>3170</td>
<td>10000</td>
<td>42120</td>
</tr>
</tbody>
</table>

Sources SIPAM-IFREMER - Federation of European Aquaculture Producers.
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
◆ 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 recommendations 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

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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.