

POTENTIAL USE OF OCTOPUS SPECIES FOR AQUACULTURE: PRESENT STATE OF THE SITUATION, PERSPECTIVES AND LIMITATIONS

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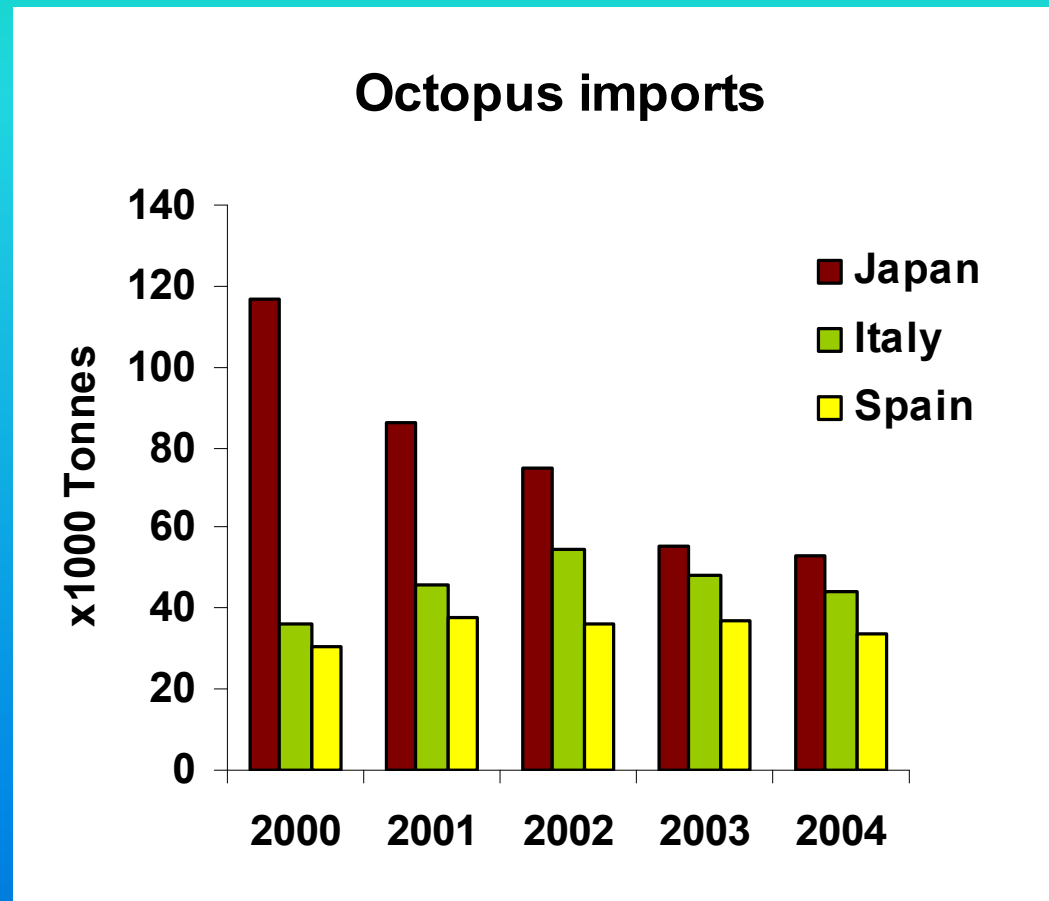
World octopus captures

Country	1997	1999	2001	2003
Japan	56,6	57,4	45,2	61,1
Morocco	38,2	84,6	112,6	28,9
Thailand	23,1	25	22,3	21,3
Korea Rep.	23,1	22,7	20,0	17,8
Spain	33,7	31,8	24,5	17,1
Mexico	18,7	20,2	21,4	16,7
Senegal	2,7	37,3	3,0	10,9
Mauritania	14,6	12,8	13,6	12,2
Italy	11,1	9,9	11,7	9,4
Portugal	9,3	9,5	8,2	10,2
China	3,2	7,5	5,1	117,4
Others	39,10	34,30	29,70	32,90
TOTAL	273,4	353,0	317,3	355,9

x1000 tonnes

Source: Globefish, 2005

Top world octopus importers



Source: Globefish, 2005



Why rearing octopus?

⇒ **High prices in the market and a very wide world market**

⇒ **High demand in some countries**

⇒ **Interesting biological characteristics:**

✓ **Short life cycle (1-2 years)**

✓ **Fast growth rate**

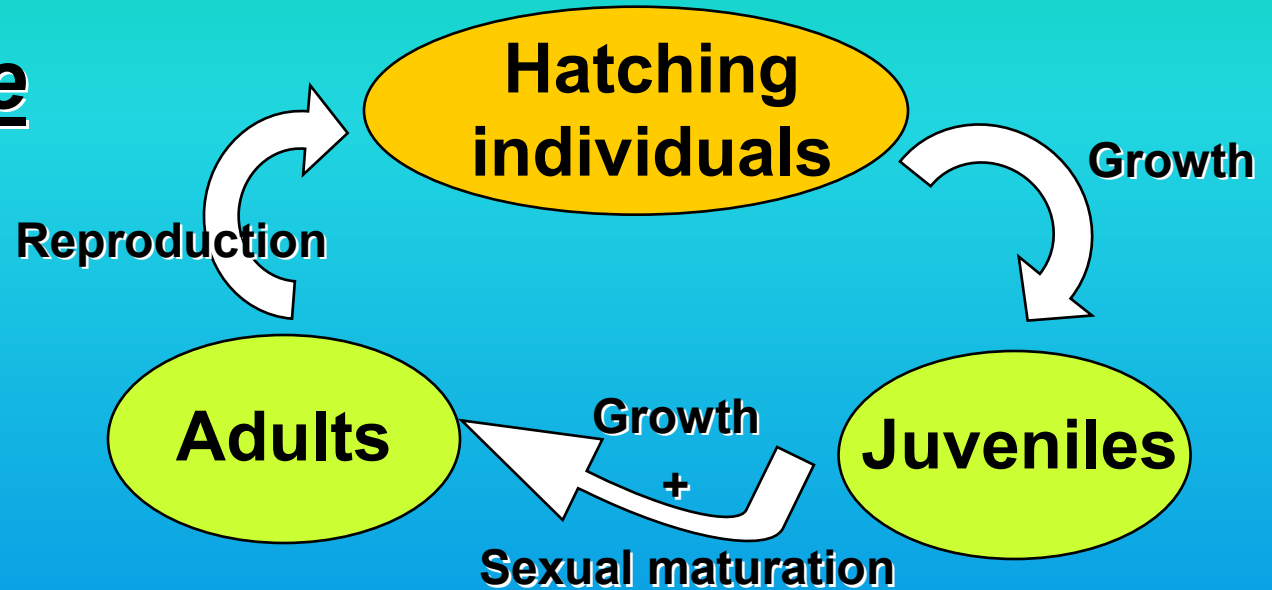
✓ **Easy adaptation to captivity**

✓ **Do not need lots of space (other cephalopods do)**

✓ **High fertility**

Definitions

Culture



Rearing



The *Octopus* genus has:
~ 100 species





Octopus species being subject of study for culture:

- *Octopus vulgaris*
- *Octopus dofleini*
- *Octopus lobensis (Argentina)*
- *Octopus maya (Mexico)*
- *Octopus mimus (North of Chile)*
- *Eledone cirrhosa*
- *Eledone moschata*
- *Enteroctopus megalocyatus (South of Chile)*

Octopus rearing

Steps involved:

- 1) • Catch of octopuses in nature
- 2) • Transport until the rearing place
- 3) • Rearing process
 - ➡ food availability
 - ➡ water temperature
 - ➡ salinity

Steps 1 and 2

1) • Catch of octopus in nature

Artisanal traps, plastic pots, diving, bottom trawling



2) • Transport of octopus

In plastic dens, inside a net bag, individualized
Caution with oxygen levels



Once arrived to the rearing cages...

they are separated by size.

Ex: (750 g – 1.0 Kg) / (> 1.0 Kg – 1.3 Kg)

Step 3 – rearing stage

- Metallic structure
- Floats
- Dens for all octopuses
(~100 PVC or plastic dens)



Circular cages



Feeding octopus

Diets utilized:

⇒ Feed ration: 3-10% biomass.day⁻¹

Fish ➤ discards or fish not sold in fishing harbours:
blue whiting (*Micromesistius poutassou*)
bogue (*Boops boops*)
sardine (*Sardina pilchardus*)
scad (*Trachurus trachurus*)

Crabs ➤ green crab (*Carcinus maenas*)
crab (*Polybius henslowi*)

Molluscs ➤ mussels (*Mytilus* sp.)
shortfin squid (not sold in the market)

Development of artificial diets?



Laboratory and industrial results

⇒ In the lab:

N° Individ.	Time (months)	Initial weight (g)	Final weight (g)	Feed rate %·day ⁻¹	Conversion rate	Growth g·day ⁻¹	Mortality (%)
10	10	1.300	12.300	3	3.0	36.5	0
18	8	600	5.400	6	3.6	20.2	0
13	4	300	2.200	10	4.8	15.6	11

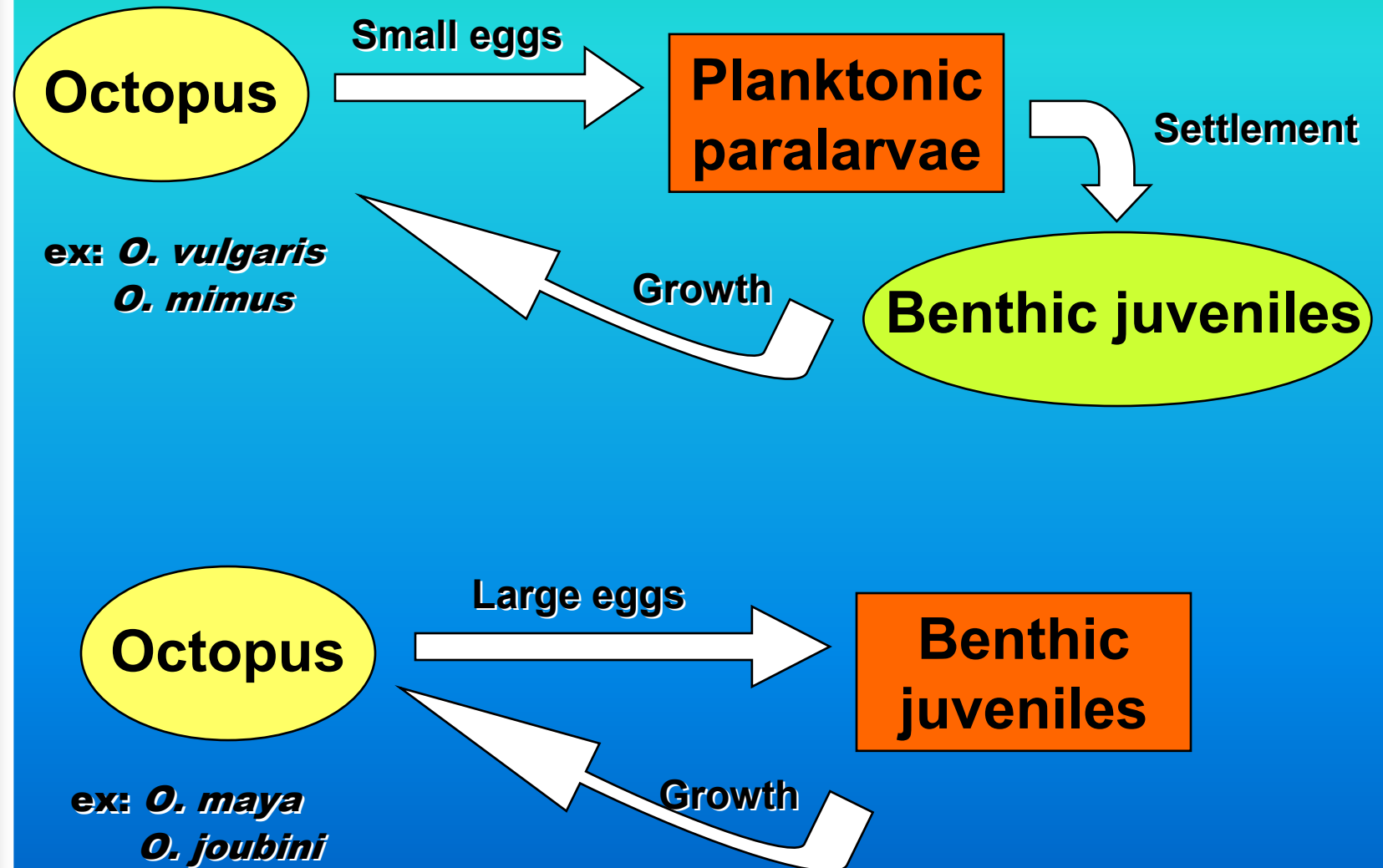
Conditions: rectangular tanks (5-10 m²), open circuit, T °C: 13-19.5°C, Salinity: 32-35 ppt, water circulation 1.2 m³/h, density 1-8 kg/m³, food: 80% crustaceans, 15% fish, 5% molluscs

⇒ Industrial scale: in cages

	Initial N° ind.	Final N° ind.	Initial W Averg. (g.)	Final W Averg. (g)	Final Biomass (kg)	Mortality (%)
Total	90	74	761 ± 123	3074 ± 722	227,52	17,78
Males	41	30	768 ± 125	3341 ± 739	100,23	26,83
Females	49	44	755 ± 122	2893 ± 660	127,29	10,20

T °C: 16-19°C, Salinity: 32-35 ppt, rearing time: 115 days. food: 80% fish, 15% crustaceans, 5% molluscs.

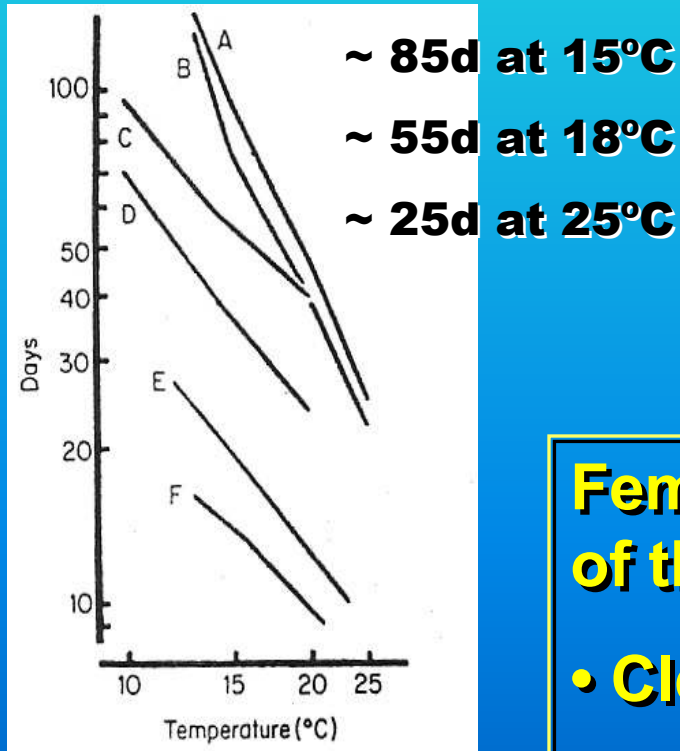
Reproduction



Egg laying (*O. vulgaris*)

➤ **High fertility 100.000 - 500.000 eggs**

Incubation period



Boletzky, S. 1987



Female take care of the eggs:

- **Cleaning**
- **Oxygenation**



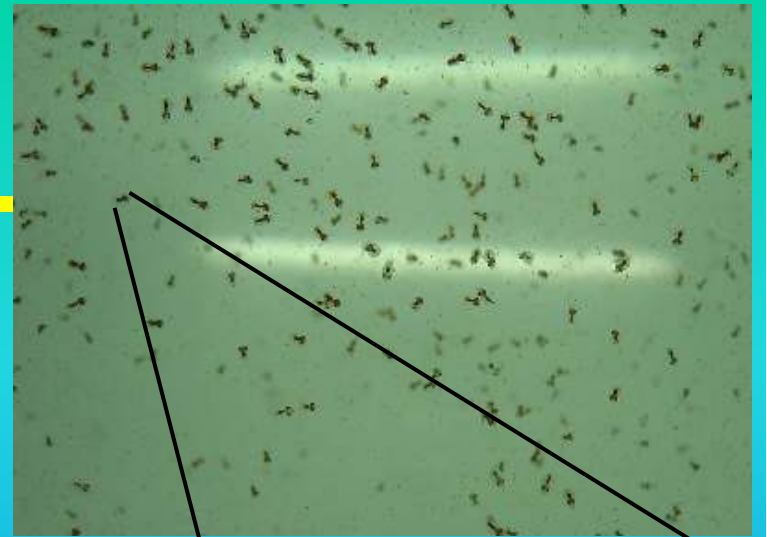
Paralarvae (*O. vulgaris*)

- Hatching rate ~ 98-100%
- Planktonic life (first 35-60 d of life)
- High growth rate (up to 11.5%bw.d⁻¹)
- Active swimmers
- Active predators
- 3 mm TL



Paralarvae rearing

- Water quality
- Light intensity
- Temperature
- Food availability



Bottleneck of octopus culture!

Planktonic
paralarvae



Benthic juveniles

What preys should be given?

- Rotifers (-) very small
- *Artemia* (++)
- Fish eggs (-)
- Copepods (+)
- Microcapsules designed for paralarvae (+)
- Zoeae (+++)

Acceptance level (-/+/>++)



Successfully trials

	Itami et al., 1963	Villanueva, 1995	Iglesias et al., 2002/04	Carrasco et al., 2003/05
Food	Shrimp zoeae <i>Palaemon serrifer</i> 2-4 mm	<i>Liocarcinus depurator</i> and <i>Pagurus prideaux</i> zoeae 1,3-3,1 mm <i>Artemia</i> (enriched nauplius)	Spider crab zoeae <i>Maja squinado</i> 1,5 mm <i>Artemia</i> fed mixed microalgae 2-4 mm	Spider crab zoeae <i>Maja squinado</i> 1,0 mm <i>Artemia</i> fed <i>Tetraselmis suecica</i> 2-3 mm
Prey density/ml	-	1,0 2,0-6,0	0,01-0,1 0,05-0,1	0,7-1,0 0,5-0,7
Paralarvae density/ml	25	13-48	5	25
T°C	23 - 26,7	19 - 23	18 - 22	19 - 22
Aeration	-	No	Yes, gentle	Yes, gentle

However, achieved a very reduced number of benthic juveniles!



Are we facing a nutritional problem?

Nutritional requirements:

- High dietary DHA/EPA fatty acids; phospholipids
- High proteic diet (peptides, aa?)
- Minerals: copper, strontium

New research lines

- ***Artemia* enrichment; crustacean zoeae achievement**
- **Improvement of inert diets as co-feeding**
- **Tank design, light intensity, water currents, dissolved nutrients in the water, walls and bottom colors, etc..**
- **Mesocosms**
- **Field studies (there is poor observation of paralarvae in nature)**

Thank you

