



Best Management Practice Manual

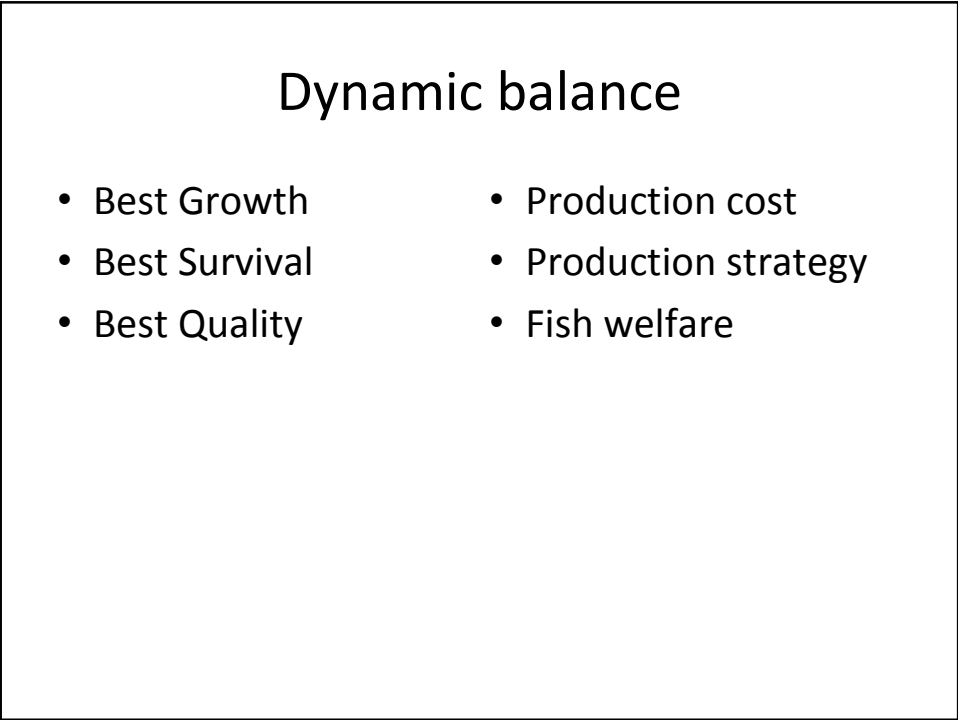
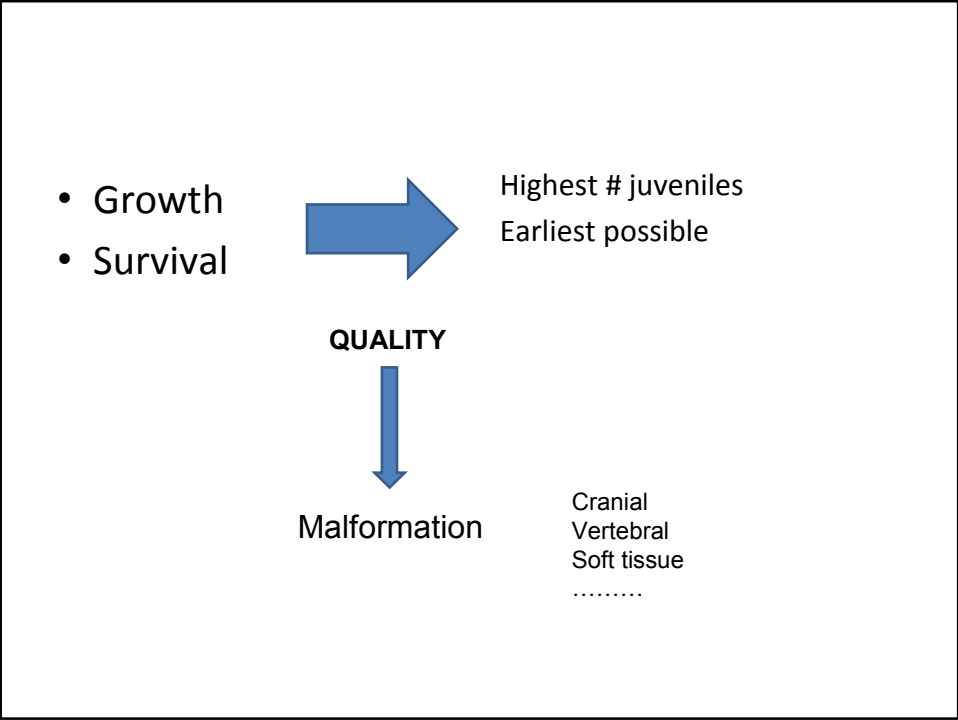
for reducing malformation in sea bream and sea bass
hatcheries



The Best Management Practice (BMP) Manual

- General Manual for Hatchery operation
- BMP manual for reducing malformations (species specific)

Standardization – Harmonization of Procedures
(is it possible for the Mediterranean hatcheries?)



Structure

- Principles of BMP (general recommendations for all aspects of hatchery procedures
To do / not to do, FAO manual)
- Conclusions of the RTD performers targeted on malformation

Deliverable

- When
- Which form
- Availability

New knowledge

- Abiotic factors
- Nutritional factors

Abiotic factors

- Temperature (sea bream & sea bass)
- Salinity (sea bream)
- Currents (ORCIS, Koumoundouros et al 2009)

Sea bream scientific result list

- Sea bream best growth (22) best survival (16-19) – HCMR
- Lower deformities opercular and caudal fin (19 & 22) – UoP (based on HCMR's exper.)
- No effect of T on survival & deformities – NCM
- 40 ppt reduces SB inflation and survival - NCM

From the above:

- If there are problems with caudal fin and opercula then try 19-22° C
- If there is a SB inflation problem try to reduce salinity

Sea bass result list

- Sea bass best growth (21), best survival (15-18)...growth compensation (+ Feminization !)
- Best temperature for haemal lordosis (15), jaw deformities?

Recommendations

- Best performance between known thermal range (18-21)
- 15 from epiboly up to metamorphosis increases the resistance to swimming induced haemal lordosis

Nutritional factors

- Vitamin mix (sea bass)
- Vitamin A (sea bream & sea bass)
- Vitamin D & C (sea bass)

Vitamin mix

- Refine the proportions of vitamins in VM 4.0
- Avoid high HUFA levels in diets for the first 3 weeks of both species

Vitamin A – sea bass

- Affects growth and probably ossification and mineralization
- Actual levels in commercial feeds might be currently too high
- High Vit A levels at early stages induce cranial deformations
- Dynamic nutrition (according to developmental stage)

Vitamin A- sea bream

- High Vit A levels affect growth and induce malformation (swim bladder, cranial) in early stage.
- High Vit A levels induce skeletal deformities at later stages

Vitamin A recommendation

- Optimal level : 15 $\mu\text{g/g}$ DW
- If you have high incidence of cranial deformities check Vit A levels especially during rotifer's phase

Vitamin D & C (sea bass)

- Low Vit D influences bone mineralization (fish meal / enrichment ???)
- Low Vit C induces abnormalities / High Vit C affects bone formation and lipid metabolism
- Vit C should be assessed concurrently with lipids

Recommendations (vitamins)

- Vitamin A should not exceed 100 ng/mg in rotifers and less than 450 ng/mL enrichment
- Vitamin C around 50 mg/g DW depending on lipids (microdiets)
- Avoid EPA+DHA dietary levels higher than 1,5 g/100g DW (normal procedure is around 3%)

Recommendations for PC/PI levels

- Sea bream: 1.28
- Sea bass: 2.18

