# GWP Grow out Husbandry WP20-23

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Kick-off meeting
Heraklio, 29-30 January 2014

… DIVERSIFY will address the **main documented species specific bottlenecks in the production** of the selected species, in order to **develop adequate husbandry practices and technologies for the industry** to enable production (greater amberjack and wreckfish) or to optimize production (meagre, pikeperch, Atlantic halibut and grey mullet)…

# **cosmopolitan** species….

- **large size and fast growth**, potential of rearing in sea cages -especially offshore (meagre, greater amberjack),
- **freshwater fish** of high demand for RAS culture (pikeperch),
- **cold-water** of the sub-arctic northern Europe (Atlantic halibut)
- **euryhaline warm-water** suitable for extensive aquaculture.

# Structure of the GWP

- WP 20: Meagre
- WP 21: G. amberjack
- WP 22: Pike perch
- WP 23: Grey mullet

# Methodology (general)

- Trials in tanks and cages

- Evaluation with
  - growth performance
  - hematological , biochemical, immunological, hormonal evaluation
  - behavior (distribution in cages)
  - health status
  - feed efficiency
  - juvenile quality - morphological aspects
  - resistance to infectious diseases
  - ……

# WP 20. Meagre

- Technologies and practices used  for grow out, similar to those for gilthead sea bream and European sea bass
- Meagre is different in
  - growth rates
  - feeding and spatial behaviour in the cage
- Species-specific husbandry practices and methods can improve the performance

- The objectives of this WP are
  - **development of method to avoid size variability in juveniles**
  - **development of feeding method respecting the specific behaviours of meagre**
  - **modification of applied methodologies for cage culture to maximize the performance**

# Task 20.1

**Size variability at juveniles**

- Difference in growth depends on genetic origin?
- Potential of low-growth fish for compensatory growth?

- Tank  experiments at juvenile stage
  - Genetic characterization of juveniles for parental assignment
  - Growth studies
  - Economic analysis

- Result:
  - identification of causes
  - Development of methodology

- Implementation: IRTA, HCMR

# Task 20.2

**Effect of rearing environment**

- Which is proper environment for meagre rearing?

- Trials for cage depth
- Trials for light intensity
  - Two size groups [(200 – 600g) and (800-1500g)]
  - Duration 8+8 months
  - Monitoring
    - growth performance
    - hematological , biochemical, immunological, hormonal evaluation
    - behavior (distribution in cages)

- Result:
  - Definition of optimal depth
  - Definition of optimal light intensity

- Implementation: HCMR, Argosaronikos SA

# Task 20.3

## Development of feeding methodology

- Is the feeding method applied adequate for meagre?
- Can we develop an “industrial” feeding system?

- Test in tanks
  - 2 different size groups [(50 – 100g) and (700-900g)]
  - different feeding stimuli
  - different feeding methods

- Test in cages
  - 2 feed distribution methods from the surface and from the bottom (HCMR)
  - Comparison hand feeding with demand type industrial (MAREMAR)

- Result: Development of feeding system for industrial application

- Implementation: HCMR, IRTA Argosaronikos SA, CULMAREX SA

# Deliverables

- D20.1 Methodology to avoid size variability in meagre juveniles (P, Re, 24)
- D20.2 Definition of the optimum conditions for cage culture of meagre (P, Re, 39)
- D20.3 Methodology for meagre feeding (P, Re, 42)

# Budget

- HCMR: 231,679€
- IRTA: 123,506€
- ARGO: 120,000€
- CULMAREX: 82,500€

# Time frame

| | | Year 1 (2014) | | | | Year 2 (2015) | | | | Year 3 (2016) | | | | Year 4 (2017) | | | | Year 5 (2018) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Ma | Ju | Se | De | Ma | Ju | Se | De | Ma | Ju | Se | De | Ma | Ju | Se | De | Ma | Ju | Se | De |
| | | 3 | 6 | 9 | 12 | 15 | 18 | 21 | 24 | 27 | 30 | 33 | 36 | 39 | 42 | 44 | 48 | 51 | 54 | 57 | 60 |
| WP20 | Grow out husbandry-meagre | | | | | | | | | | | | | | | | | | | | |
| | Task 20.1 Size variability at juveniles | | | | | | | | | | | | | | | | | | | | |
| | Task 20.2 Effect of rearing environment | | | | | | | | | | | | | | | | | | | | |
| | Task 20.3 Development of feeding methodology | | | | | | | | | | | | | | | | | | | | |

# WP21. Greater amberjack

- Preliminary data for grow out of greater amberjack suggested that growth performance is high
- Further studies are required to
  - Develop rearing method in cages
    - adequate volume and
    - test the application of submersible cages
  - Develop feeding methods
  - Develop appropriate husbandry practices
    - specific thermal ranges for optimal growth and health,
    - optimum rearing density

# Task 21.1

## Development of rearing method in cages

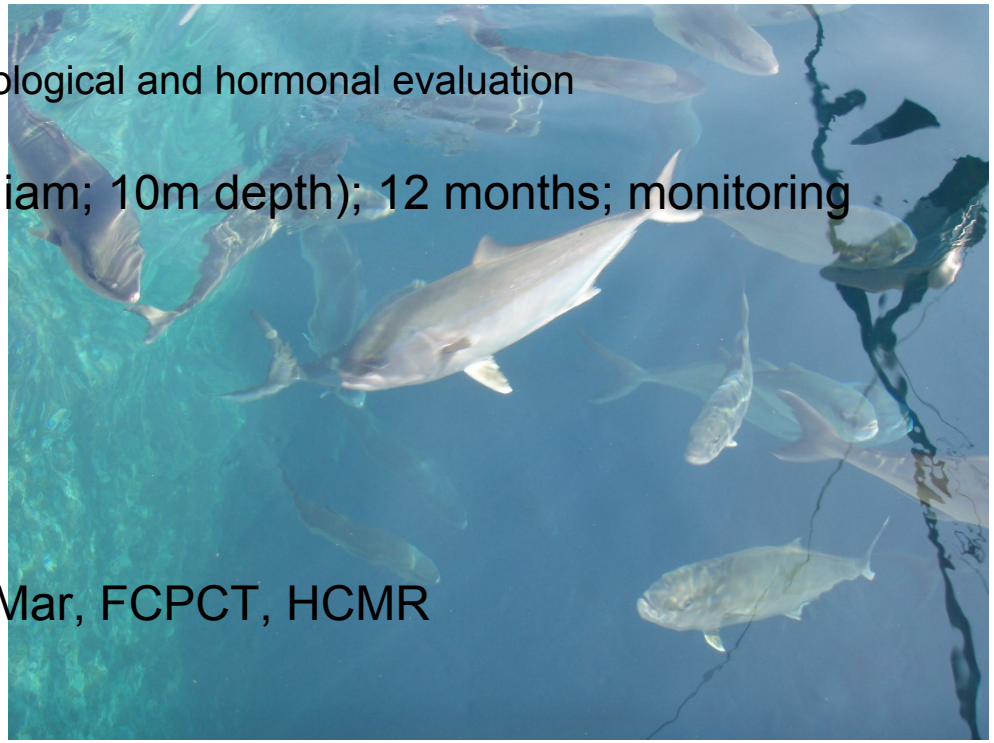
- Which is the proper volume (depth) of cages?
- Can we use submerged cages?

- Trials in commercial cages (10m and 6m depth); 12 months; monitoring
  - growth performance
  - muscle quality,
  - hematological , biochemical, immunological and hormonal evaluation

- Trials in commercial cages (20m diam; 10m depth); 12 months; monitoring
  - growth performance
  - health status

- Result
  - definition of optimal depth
  - definition of optimal technology

- Implementation: FORKYS, CanexMar, FCPCT, HCMR



# Task 21.2

## Development of feeding methods

- Do we feed properly the greater amberjack?
- Which is the feeding pattern

- Test in tanks for 4 months with fry (5g) and juveniles (200g)
  - different feeding methods (continuous vs fix ratios)
  - Estimation of daily rhythm and frequency
  - Monitoring
    - growth performance
    - feed efficiency
    - k index
    - juvenile quality - morphological aspects
    - hematological, histological, biochemical and immunological

- Result: definition of optimal feeding method – feeding pattern

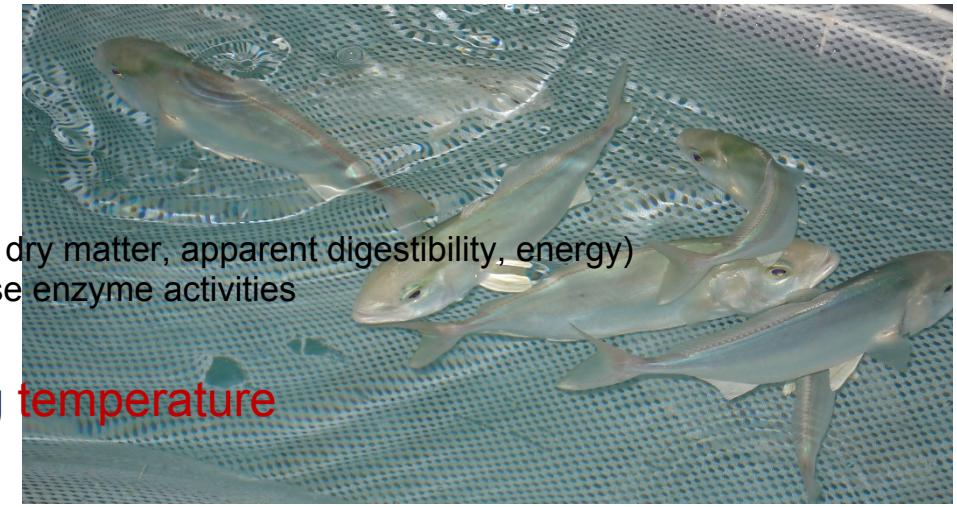
- Implementation: IEO , FCPCT

# Task 21.3

## Development of appropriate husbandry practice

- Which is the optimum temperature range?
- Which stocking density is optimal?

- Test in tanks for 4 months with individuals of 5g and 200g
  - 2 different temperature ranges 14-17 $^{o}$C and 26-29 $^{o}$C
  - Monitoring
    - growth performance,
    - feeding activity
    - gut transit time
    - digesta sample analysis (protein, fat, dry matter, apparent digestibility, energy)
    - protease, trypsin, chymotrypsin, lipase enzyme activities



- Result: definition of optimal rearing temperature
- Implementation: FCPCT; HCMR

# Task 21.3 (cont.)

## Development of appropriate husbandry practice

- Which stocking density is optimal?

- Test in tanks for 4 months with individuals of 5g (500L) and 150g (4000L)
  - 3 different stocking densities
  - Monitoring
    - growth performance,
    - feed efficiency,
    - k index
    - quality including morphological aspects,
    - hematological, histological, biochemical and immunological studies
    - oxidative stress enzymes

- Result: definition of optimal rearing density

- Implementation: IEO, ULL

# Deliverables

- D21.1 Definition of optimum feeding methods for greater amberjack grow out (R PU 42)
- D21.2 Definition of optimum conditions for cage culture of greater amberjack (R PU 57)

# Budget

- HCMR: 45,000€
- FCPCT: 95,000€
- IEO: 60,000€
- ULL: 15,000€
- FORKYS: 65,096€
- CANEXMAR: 100,000€

# Time frame

| | | Year 1 (2014) | | | | Year 2 (2015) | | | | Year 3 (2016) | | | | Year 4 (2017) | | | | Year 5 (2018) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
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| | | 3 | 6 | 9 | 12 | 15 | 18 | 21 | 24 | 27 | 30 | 33 | 36 | 39 | 42 | 44 | 48 | 51 | 54 | 57 | 60 | 63 |
| WP21 | Grow out husbandry-greater amberjack | | | | | | | | | | | | | | | | | | | | | |
| | Task 21.1 Development of rearing method in cages | | | | | | | | | | | | | | | | | | | | | |
| | Task 21.2 Development of feeding methods | | | | | | | | | | | | | | | | | | | | | |
| | Task 21.3 Development of appropriate husbandry practice | | | | | | | | | | | | | | | | | | | | | |

# WP 22. Pike perch

- Bottlenecks (by SMEs)
  - unpredictable depression of growth
  - management manipulations are followed by high mortalities
- Reasons
  - high stress responsiveness to intensive culture conditions
  - use of pikeperch broodstock of various domestication levels, including wild populations
- Studies are required
  - Effect of husbandry practices and environment
    - farm conditions
  - Effect of domestication level and geographical origin

# Task 22.1

**Effect of husbandry practices and environmental factors on pikeperch immune and physiological status**

- Which are the main stressful factors for pikeperch?
- How the fish respond to stress?

- Trial for 8-12 months with juveniles (80-100 g)
  - Expose to various husbandry practices and environmental conditions
    - 8 factors (2 modalities per factor, using 16 experimental units).
    - light, rearing density, handling, sorting, T, S, pH, TAN, $NO_2$-N, $NO_3$-N, $O_2$, tank , rearing system
  - Monitoring
    - physiological stress responses, immune competence and global resistance to infectious diseases.
    - physiological and immune parameters and associated mortality,

- Result: identify an optimal combination of environmental and husbandry factors

- Implementation: FUNDP, DTU, UL, ASIALOR

# Task 22.2

**Characterization of pikeperch immune and physiological status in farm conditions**

- Are the results applicable in farm conditions?

- Comparative rearing of 2 or 3 batches (10 g to 1.5 kg) in farm conditions for 2 years
  - Monitoring on monthly base
    - Growth and physio- immunological status

- Result: best practice for rearing of pikeperch

- Implementation UL, FUNDP, ASIALOR

# Task 22.3

**Effect of pikeperch domestication level and geographical origin on stress sensitivity**

- How the level of domestication affect the stress response?

- Investigate the effects of domestication (wild vs domesticated strains) and geographical origin (freshwater vs brackish water strains)
  - Different batches of juveniles from larval stage in similar conditions
    - 3 or 4 different geographical origins,
    - 1 or 2 populations of the same geographical origin with 2 levels of domestication
  - Monitoring the genetic variability
    - physiological stress responses,
    - immune competence
    - global resistance to infectious diseases

- Implementation: UL, FUNDP, DTU, ASIALOR

# Deliverables

- D22.1 Effects of multiple variables on stress, immune response and growth performances and recommendations of optimal conditions for pikeperch grow out (R PU 24)
- D22.2 Validation of optimal rearing variables under commercial farm conditions (R PU 42)
- D22.3 Effects of domestication level and geographical origin on stress, immune response and growth performances and strain recommendation (R PU)

# Budget

- UL: 131,000€
- FUNDP: 161,008€
- DTU: 101,779€
- ASIALOR: 73,125€

# Time frame

| | | Year 1 (2014) | | | | Year 2 (2015) | | | | Year 3 (2016) | | | | Year 4 (2017) | | | | Year 5 (2018) | | | | |
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| | | 3 | 6 | 9 | 12 | 15 | 18 | 21 | 24 | 27 | 30 | 33 | 36 | 39 | 42 | 44 | 48 | 51 | 54 | 57 | 60 | 63 |
| WP22 | Grow out husbandry-pike perch | | | | | | | | | | | | | | | | | | | | | |
| | Task 22.1 Effect of husbandry practices and environmental factors on pike perch growth, immune and physiological status | | | | | | | | | | | | | | | | | | | | | |
| | Task 22.2 Characterization of pike perch growth, immune and physiological status in farm conditions | | | | | | | | | | | | | | | | | | | | | |
| | Task 22.3 Effect of pike perch domestication level and geographical origin on growth and stress sensitivity | | | | | | | | | | | | | | | | | | | | | |

# WP 23. Grey mullet

**Evaluating the geographic range for grow-out of mullet in the Mediterranean basin**

- Most **grey mullet** are reared extensively in polyculture systems
- Exists an established market (North Africa) and a growing one in the Med,
- Intensive monoculture has to be developed


  - Evaluating the geographic range for grow-out of grey mullet in the Mediterranean basin,
  - Determine the cost-benefit of different weaning diets on the performance and health status of juvenile grey mullet.

# Task 23.1

**Determine the cost-benefit of different weaning diets on the performance and health status of wild juveniles**

- Which is the optimum weaning methodology?

- Test in tanks with wild juveniles following an adaptation period
  - the efficacy of different weaning diets in terms of
  - Different weaning strategies

- Monitoring
  - fish growth, survival maturation of digestive system, health status
  - economic efficiency.

- Result: recommendation of best weaning diet

- Implementation: IRTA

# Task 23.2,3,4

**Feeding an improved diet in monoculture**

- Which are the appropriate conditions of rearing?

- Test in cement (IL, GR), and earthen (IS, SP) ponds
  - Two stocking densities
    - 0.5 and 1 juvenile $m^{-2}$ for earthen ponds
    - 4 and 6 juvenile $m^{-2}$ for cement ponds
  - Using wild (GR, SP) or F1 (IL) juveniles
  - Monitoring
    - growth (FCR, PER, SGR)
    - survival
    - lipid class and fatty acid composition of selected tissues

- Result: best grow out management practice

- Implementation: IOLR, IRTA, HCMR, CTAQUA, DOR, GEI, IRIDA

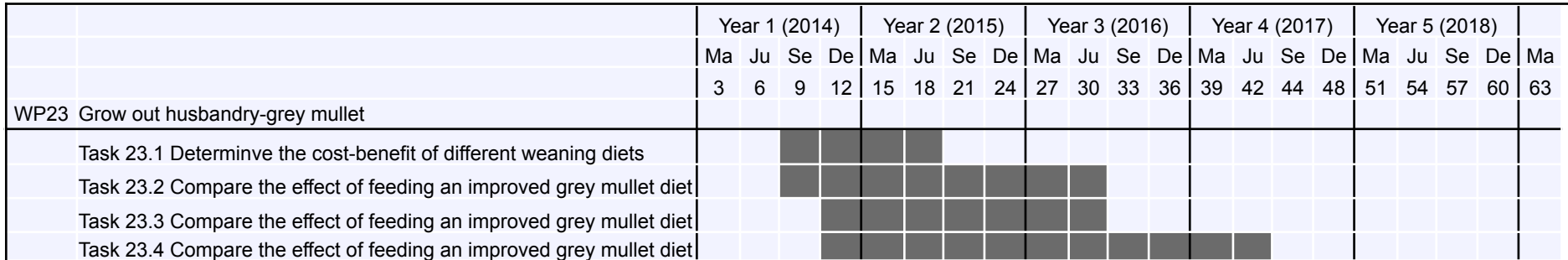
# Deliverables

- D23.1 Cost-effective weaning strategies for wild-caught grey mullet grow out and their effect on growth and health status (R PU 18)
- D23.2 Stocking protocols for pond monoculture grow out of F1 and wild caught grey mullet (R PU 30)
- D23.3 Comparison of the project's improved grey mullet grow-out feed under the different environmental and water conditions in Israel, Greece and Spain (R PU 40)

# Budget

- HCMR: 20,000€
- IRTA: 25,000€
- IOLR: 20,000€
- CTAQUA: 20,071€
- DOR: 30,000€
- GEI: 32,400€
- IRIDA: 45,600€

# Time frame



# General issues

- Availability of juveniles – individuals
  - commitment to distribute eggs
- “Crisis” management
  - What if a trial is not implemented?
- The SMEs involvement
  - A challenge