

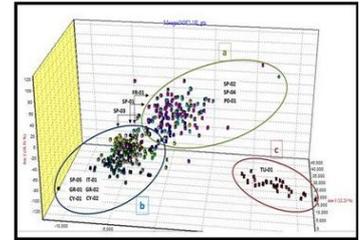


DIVERSIFY IN AQUACULTURE EUROPE 2015

This fourth newsletter provides an overview of the major achievements of the project on each of its six species. The summary is based on the presentations at the DIVERSIFY session at AQUACULTURE EUROPE 2015 conference (October 22nd 2015, Rotterdam, The Netherlands). The meeting focused on the work carried out by the project during 2014 and 2015 and was chaired by the Project coordinator of DIVERSIFY, Dr. Constantinos C. Mylonas, and the Dissemination leader, Dr. Rocío Robles. Summary presentations were given by each of the six Species leaders of DIVERSIFY and by other researchers on specific topics. The session was titled **New/emerging finfish species (EU Diversify project)** and up to 120 persons attended the meeting.

MEAGRE (*Argyrosomus regius*). Species leader Dr. Alicia Estevez presented the different results about this species.

Reproduction & Genetics: The two main achievements have been the description of the genetic variability of a large number of broodstock groups, demonstrating that the available broodstock in the Mediterranean comes from three main origins: Spain, France and the Aegean Sea. The French lineage is represented in most commercial hatcheries throughout the Mediterranean Sea. The second achievement was the demonstration that meagre can respond to repeated hormonal therapies for the induction of spawning. A method has been developed for hormonal induction during 17 consecutive weeks of the same female and the pair mating of specific females with weekly changes of males, in order to produce large numbers of families for the future breeding programs implementation.



Nutrition and Larval husbandry: The experiment carried out in this area shows that supplementation of early weaning diets with n-3 HUFA, vit C and vit E has beneficial effects on larval performance.



Grow out husbandry: The results of size variability tests (no compensatory growth in different fish classes after grading), as well as the distribution of fish in sea cages using echo integrator were shown, along with the results of the use of light or air bubbling as stimuli for the conditioning of fish to anticipate feeding in juveniles, expanding knowledge on feeding behavior on this species.

Health: The results showed that replacement of fish oil with essential oils has a positive immune response in juveniles. Moreover, the influence of nutrition in Systemic Granulomatosis and the evolution of Chronic Erosive Dermatopathy are being analyzed.

GREATER AMBERJACK (*Seriola dumerilli*). The summary on greater amberjack was presented by Species leader Dr. Nikos Papandroulakis.

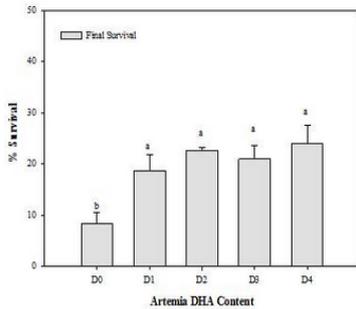
Reproduction & Genetics: A large number of wild fish was acquired to establish 6 broodstock groups. Progress has been achieved towards a spawning induction protocol providing large numbers of good quality eggs. Gametogenesis in captivity is not complete in Mediterranean stocks, whereas, in the East Atlantic stocks, spontaneous and induced spawning have been achieved obtaining high quality eggs. Sampling of wild and reared specimens in different gametogenesis phases started to describe the reproductive cycle and detect possible dysfunctions in captivity.



Co-funded by the Seventh Framework Programme of the European Union

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Nutrition: The requirements during first feeding have been studied and the enrichment products were improved. Five levels of DHA were tested for *Artemia* enrichment and the results showed that the higher content of DHA improved performance and minimized bone malformations, while excess levels reduced the growth. Different sources and levels of LC-PUFA rich lipids were tested for rotifer enrichment and the results indicated that enrichment using marine lecithin provided the best results compared to the lipid composition of wild fish eggs.

Larval and Grow out husbandry: Trials were performed to establish the appropriate methodologies for semi-intensive and intensive larval rearing.

Experiments were carried out to determine optimum larval stocking density. Density of 50 eggs l⁻¹ provided the best growth. The effect of light was studied and continuous photophase resulted in better performance. Furthermore, light intensity and spectrum was studied using 3 background tank colors (white, green and black) without difference between the treatments. The results that define the feeding pattern of juveniles show that juveniles need between 1 and 6 meals per day.

Health: Gill parasites have been identified in broodstock and juvenile populations: *Zeuxapta seriolae*, *Neobenedenia melleni* and *Paradeontacylix* sp. Primers were designed to study key immune genes that will be cloned later in the study. Finally, increase mucus production through dietary stimulation products seems to reduce parasitic incidence.

PIKEPERCH (*Sander lucioperca*). Results were presented by Species leader Dr. Pascal Fontaine.

Reproduction and Genetics: The genetic variability of wild and captive populations from Tunisia to Finland was characterized using a microsatellite multiplex method. Two genetically differentiated groups were identified (a northern group and a south-central European group) and the key position of the Hungarian population was questioned. It was also shown that captive populations do not suffer from inbreeding. This new data will be available for future breeding programs with the objective of maintaining a high variability in domestic broodstocks.



Nutrition and Larval husbandry: A first protocol was proposed to improve pikeperch larval rearing in order to obtain better survival and growth rates, and to reduce cannibalism, which is a major problem in the culture of this species. Finally, a multifactorial experiment had been realized for studying the effects of husbandry practices and environmental factors on growth, physiological and immune status.

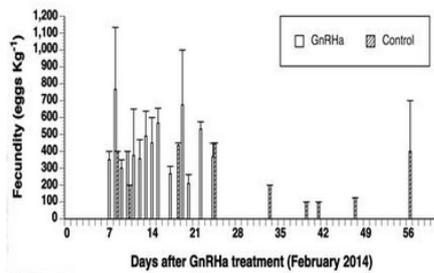
Grow out husbandry: The effects of various factors (size grading, fish density, light intensity and spectrum, photoperiod, temperature and diet) and their interactions were determined. An important objective is to reduce the fish stress and mortality rate. Further processing of the multifactorial experiment results will provide more outcomes in the coming months.

ATLANTIC HALIBUT (*Hippoglossus hippoglossus*). The fourth species summary was presented by Species leader Dr. Birgitta Norberg.



Reproduction & Genetics: Pilot trials have been carried out on the implantation with gonadotropin releasing hormone agonist implants. The results were not conclusive, but suggested that hormone therapy may be a useful tool to increase egg production in Atlantic halibut broodstock, and synchronizing egg production within a shorted period of time.

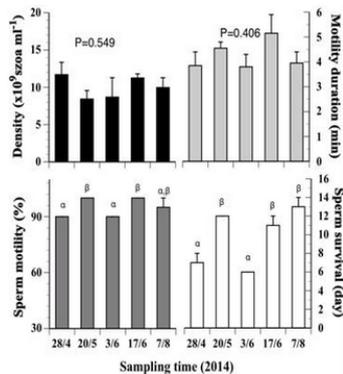
Nutrition and Larval husbandry: The work in 2015 focused on the development of a protocol for feeding on-grown *Artemia*. Nutrient composition of on-grown *Artemia* reflected the enrichment diet, while nutrient composition in Atlantic halibut larvae remained largely unaffected by the diet during the feeding period chosen. Further work needs to be done to conclude about the usefulness of the use of this method for this species.



Health: The virulence of a number of *Vibrio* strains has been tested in challenge experiments in the presence of probiotic candidates. As a first step towards developing a vaccine for these bacteria, expression systems for a capsid protein present on the VNN virus have been developed in bacteria, a protozoan and in tobacco plant. All systems expressed the capsid, but the protozoan and plant systems need to be optimized.

WRECKFISH (*Polyprion americanus*). Species leader Dr. Jose Benito (Tito) Peleteiro presented the results.

Reproduction and Genetics: Wild-caught animals from the Azores Islands' fisheries and breeders in captivity were studied. Samples from flesh, viscera and fins, morphometric measurements, blood, sperm and oocytes were taken from broodstock in captivity. Their analysis delivered information on biochemical composition, reproductive cycle and habits. Spontaneous spawning was obtained in captivity, producing viable eggs and larvae,



which were cultured up to 20 days post-hatching. Hormonal induction was also performed and sperm characterization was completed, determining biochemical composition, density, motility characteristics and duration. The males in captivity produce a good sperm quality for a very long period of time. Sperm cryopreservation was tested in order to establish an *in vitro* fertilization protocol, as it seems that in most situations wreckfish females undergo maturation and ovulation, but they fail to have reliable spawning in captivity, with poor egg quality. Currently, a new diet is available for wreckfish breeders in order to improve egg quality.

GREY MULLET (*Mugil cephalus*). The sixth summary was presented by the Species leader Dr. William (Bill) Koven.

Reproduction and Genetics: Establishing a Computer Assisted Sperm Analysis (CASA) for the evaluation of grey mullet sperm was one of the first achievements in this area. The preliminary results indicate that the major biotechnical setting, such as dilution of sperm, quality of activation and mastering of video recordings have been determined and can now be applied to experimental protocols. The current results will help improving the assessment of the effect of different treatments on reproductive performances of grey mullet males.

Nutrition: The effect of dietary taurine on the performance of grey mullet larvae and juveniles was investigated in relation to developmental stage and the shift of grey mullet larvae from carnivory to herbivory. In the first experiment three taurine levels were used to enrich rotifers and/or *Artemia* nauplii, which were fed to grey mullet larvae (all fish being weaned onto a starter diet from 20-44 dph, days post hatching). Larvae fed with the highest taurine enriched rotifers grew significantly better than those consuming the low and medium taurine enriched live food.



In addition to that, the taurine treatment fish (32 days after the rotifer treatments) continued to be significantly larger than the non-taurine control. Moreover, taurine enrichment of *Artemia* alone or together with the rotifers did not demonstrate a clear growth advantage over the only rotifer taurine enrichment. Nevertheless, better larval survival was achieved when both rotifer and *Artemia* were enriched with the highest level of taurine.

It has been also shown that dietary taurine supplementation in juvenile grey mullet continued to give a growth advantage.

Larval husbandry: The effect of "greening" larval rearing tanks



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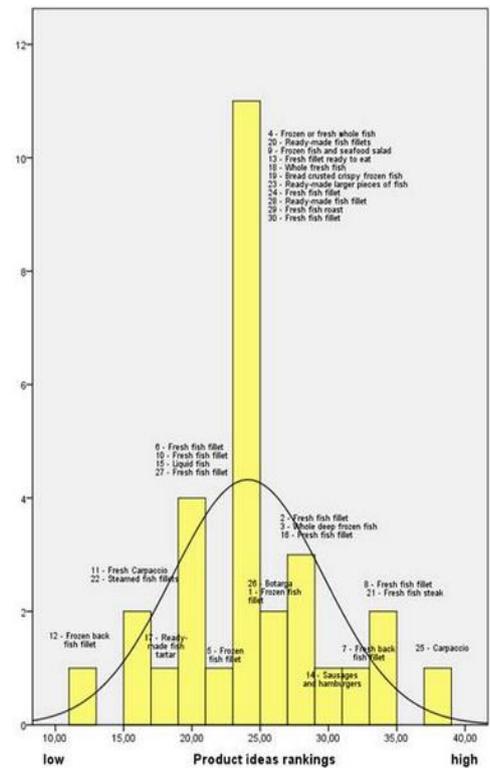
(from 2-30 dph) with one of two different algal species (*Nannochloropsis oculata* or *Isochrysis galbana*) at different turbidities and its consequent effect on prey capture were investigated. A high relationship between turbidity and tank biomass was found with *Isochrysis galbana*, as well as a very high relationship between turbidity and survival with both species. Thus, this study concluded that algal turbidity, and not algal type, was the dominating factor affecting grey mullet larval performance from 2-30 dph.

Grow out husbandry: A large multi-partner (Israel, Greece and Spain) 1 year study is currently evaluating the performance of an improved mullet grow-out diet in monoculture, in function of stocking density and pond type. The IOLR and the SME DOR (Israel) are feeding the grow-out diet to F1 juveniles stocked at different densities in cement (30 m²; 4 and 6 juveniles m⁻²) and earthen ponds (6000 m², 0.5 and 1 juvenile m⁻²), respectively. Partner GEITONAS (Greece) will similarly test this diet on wild caught juveniles at the same densities in 6 cement ponds (20 m²), while Partner CTAQUA (Spain) will evaluate the diet for wild caught juveniles at the earthen pond densities (2 ponds at 1100 m² each).

SOCIOECONOMICS.

New products development was addressed by Dr. Athanasios Krystallis, with a presentation entitled “The time is right for fish production innovation: an exploration of European consumer attitudes towards sustainable new fish product ideas”. One of the outcomes has been the elaboration of a catalogue with 41 ideas for new product presentations applicable to the DIVERSIFY species. A second presentation, by Dr. Machiel Reinders, remarked the importance of consumer perception towards new products. A dissertation entitled “Customer value perceptions towards new farmed fish: European consumer segmentation” explained that consumer segmentation yielded three groups of consumers: 1) involved traditional, 2) involved innovators and 3) ambiguous indifferent. This study will allow the project to target specific market segments and to set the stage for the development of fish products based on new/emerging species for the expansion of the European aquaculture industry.

Overall, this Special session at AQUACULTURE EUROPE 2015 showed that a significant progress has been achieved in the study of new/emerging species for the EU aquaculture industry. The knowledge acquired so far, and the one expected to be accumulating in the upcoming years, will allow the incorporation of the new species in the commercial production of the European aquaculture industry, with the objective of increasing their annual production with the inclusion of species that offer significant biological and market advantages.



Next **DIVERSIFY's Annual Coordination Meeting** will take place at the University of Lorraine in Nancy, France, from **2-4 February 2016**. During these three days, the progress of the current research work will be presented. During the public presentation day, invited guests will contribute with talks about project related subjects.

... read about these news and more in <http://www.diversifyfish.eu>



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