

	EUROPEAN COMMISSION RE SEARCH AND INNOVATION DG	Periodic Report
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**Project No:** 603121

**Project Acronym:** DIVERSIFY

**Project Full Name:** Exploring the biological and socio-economic potential of new/emerging candidate fish species for the expansion of the European aquaculture industry

## Periodic Report

**Period covered:** from 01/12/2017 to 30/11/2018

**Start date of project:** 01/12/2013

**Project coordinator name:**

Dr. Constantinos Mylonas

**Version:** 1

**Date of preparation:** 03/01/2019

**Date of submission (SESAM):** 08/02/2019

**Project coordinator organisation name:**

HELLENIC CENTRE FOR MARINE RESEARCH

# Periodic Report

## PROJECT PERIODIC REPORT

<b>Grant Agreement number:</b>	603121
<b>Project acronym:</b>	DIVERSIFY
<b>Project title:</b>	Exploring the biological and socio-economic potential of new/emerging candidate fish species for the expansion of the European aquaculture industry
<b>Funding Scheme:</b>	FP7-CP-TP
<b>Date of latest version of Annex I against which the assessment will be made:</b>	02/10/2018
<b>Period number:</b>	4th
<b>Period covered - start date:</b>	01/12/2017
<b>Period covered - end date:</b>	30/11/2018
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<b>Project website address:</b>	www.diversifyfish.eu

## Declaration by the scientific representative of the project coordinator (1)

I, Dr. Constantinos Mylonas HELLENIC CENTRE FOR MARINE RESEARCH , as scientific representative of the coordinator of the project DIVERSIFY and in line with the obligations as stated in Article II.2.3 of the Grant Agreement declare that:

The project has fully achieved its objectives and technical goals for the period.

The attached periodic report represents an accurate description of the work carried out in this project for this reporting period.

The public website is up to date.

To my best knowledge, the financial statements which are being submitted as part of this report are in line with the actual work carried out and are consistent with the report on the resources used for the project (section 6) and if applicable with the certificate on financial statement.

All beneficiaries, in particular non-profit public bodies, secondary and higher education establishments, research organisations and SMEs, have declared to have verified their legal status. Any changes have been reported under section 5 (Project Management) in accordance with Article II.3.f of the Grant Agreement.

<b>Name</b>	Dr. Constantinos Mylonas HELLENIC CENTRE FOR MARINE RESEARCH
<b>Date</b>	08/02/2019

This declaration was visaed electronically byConstantinos MYLONAS(ECAS user name nmylocon) on 08/02/2019

# 1. Publishable summary

## Summary description of project context and objectives

The European Union (EU) is the largest importer of fisheries and aquaculture products in the world. Of the seafood produced in the EU, aquaculture provides only 20% and capture fisheries provide the rest (Eurostat 2018), while the worldwide contribution of aquaculture towards seafood consumption is already >50%. This situation can be attributed partially to a lack of diversity of aquaculture products in Europe, since European demand increases for a diverse range of fish products, especially for fish fillets and other processed products. Nevertheless, aquaculture is undertaken in all EU states, and plays an important role in the supply of high-quality seafood to the European consumer. The EU aquaculture is a modern industry providing direct employment for 85,000 people, producing 1.3 million tons worth €4 billion (<https://ec.europa.eu/fisheries/cfp/aquaculture/>). Many world-class researchers and facilities exist in research centers and universities throughout Europe, while the private sector employs highly skilled and educated personnel, with modern production facilities. Therefore, the sector is well situated to become the world leader in the efficient and sustainable production of safe seafood of the highest quality and nutritional value, considering consumer preferences and life styles, and the immense diversity of aquatic products from the wild, to which the consumer is accustomed.

Even though some 35 aquatic species are cultured in Europe, finfish aquaculture production is dominated both in volume and value by a handful of species --such as Atlantic salmon (*Salmo salar*), rainbow trout (*Oncorhynchus mykiss*), common carp (*Cyprinus carpio*), European sea bass (*Dicentrarchus labrax*) and gilthead sea bream (*Sparus aurata*)-- that in turn limit the number of aquaculture processed products available in the market. In fact, the 10 most common species account for up to 90% of the production and 87% of its value (Eurostat 2018). An efficient, sustainable and market-oriented expansion of the EU aquaculture sector based on new species and products will reduce the dependence of the EU consumer on imports from countries of questionable production, health, environmental and social standards, and it will reduce the pressure on over-exploited fisheries in the EU.

The objective of DIVERSIFY was to support the EU aquaculture industry in diversifying its production with new/emerging species with important advantages over the ones cultured currently, such as fast growth, large size or low requirement in fishmeal and oil. In addition, the project identified the drivers for market acceptance of the new food prototypes in order to position the EU aquaculture sector in relation to imports from outside the EU. Although the emphasis of DIVERSIFY was on Mediterranean cage-culture, fish species suitable for cold-water, pond/extensive and fresh water aquaculture have been included as well. The fish species studied were meagre (*Argyrosomus regius*) and greater amberjack (*Seriola dumerili*) for warm-water marine cage culture, wreckfish (*Polyprion americanus*) for warm- and cool-water marine cage culture, Atlantic halibut (*Hippoglossus hippoglossus*) for marine cold-water culture, grey mullet (*Mugil cephalus*) a euryhaline herbivore for pond/extensive culture and pikeperch (*Sander lucioperca*) for freshwater intensive culture using recirculating aquaculture systems (RAS).

A strong socioeconomic component was included in DIVERSIFY, in order to address important bottlenecks in aquaculture development, beyond biological/production issues. The socioeconomic part of the project had a science based applied market development approach, with a lot of components. These included the perception of aquaculture products in general and products specifically, market potential and demand factors, consumer and professional buyer preferences, new product development, creating added value in relation to raw products and market development. An important limita

tion in aquaculture consumption is that in many countries and/or segments of the EU market, aquaculture fish have a weaker image than wild fish. Parallel to technological improvement of production methods for the new species, expansion opportunities for the EU aquaculture sector have been identified.

The combination of biological, technological and socioeconomic research activities developed in DIVERSIFY are expected to support the diversification of the EU aquaculture industry and help in expanding production, increasing aquaculture products and development of new markets.

## Description of work performed and main results

After five years of implementation, DIVERSIFY has acquired the knowledge needed to solve bottle necks in reproduction, juvenile production, grow-out, nutrition and feeding husbandry, new product development and marketing of six new/emerging species.

In meagre, sufficient genetic variation for breeding programs was confirmed around Europe and protocols have been developed for paired spawning and in vitro fertilization. A protocol for early weaning was developed and the nutritional requirements of the species were better described, especially in relation to the pathological condition Systemic Granulomatosis. Feeding in sea cages can be carried out using optical and mechanical stimuli to improve feeding behavior. Immune markers have been established for the innate, adaptive and inflammatory responses of the immune system of meagre in order to develop vaccines. Methods to prevent Chronic Ulcerative Dermatopathy and to address parasitic and bacterial infections have been developed.

In pikeperch, a genetic map comparing captive and wild broodstock was developed for use in breeding programs. Studies have identified the nutrient requirements of the species, and the optimal combinations of environmental, feeding and population factors to improve survival and growth during larval rearing in recirculating aquaculture systems (RAS). Low light intensity and red-light spectrum was shown to be less stressful and the effect was confirmed in RAS farm conditions. Domestication level was shown to influence stress responsiveness and immune response.

In greater amberjack, hormonal induction methods have been developed to induce spawning, producing large numbers of eggs of good quality for commercial larval rearing. Hatchery-produced (F1) individuals were shown to undergo reproductive maturation. The ontogeny of the digestive and vision system has been described. Significant breakthroughs were achieved in larval nutrition and husbandry, allowing the production of large numbers of juveniles for commercial production. On growing resulted in important information on feeding patterns and stocking densities. Identification of immune markers and health management tools under aquaculture conditions were developed, including probes for the early detection of epitheliocystis, and methods to control infestations of the parasites *Zeuxapta seriolae* and *Neobenedenia* spp.

In Atlantic halibut, use of gonadotropin releasing hormone (GnRH $\alpha$ ) implants advanced and synchronized spawning, resulting in improved egg production, though egg quality remained highly variable. First feeding of larvae in RAS systems resulted in improved growth and development compared to flow through systems. Metagenomic analyses of the microbial communities in the water and larvae of the two systems revealed interesting differences, which will be useful in industrial applications.

In grey mullet, spawning was achieved using GnRH $\alpha$  and metoclopramide therapies. Algal addition during larval rearing provided beneficial effects on survival and growth. After metamorphosis, commercial feeds for juveniles should be designed for the omnivorous feeding of this species. Larvae

have a high taurine requirement during rotifer feeding, and the benefit of this nutrient during early feeding was still apparent during juvenile growth. Diets with low fishmeal content can be used successfully for on growing.

In wreckfish, the reproductive cycle of wild fish was described in captivity. Spontaneous spawning takes place in the Spring, with a periodicity between spawns of 3-5 days. Males may be in full spermiation throughout the year. A new broodstock diet resulted in successful maturation and production of high-quality eggs. The ontogeny of the digestive and vision system has been described. Successful larval rearing was implemented, producing a small number of juveniles.

In the Socioeconomics area, market research identified market potential in cross-cultural consumer segments, with increased-to-strong interest in new products in the main EU fish markets. Especially involved consumers are open to try new species. Most value added new products developed were positively perceived in terms of healthiness, convenience and overall quality, and were characterized by high nutritional value (protein and Omega-3). Buyers and consumers would welcome new species, if they are a) sustainably farmed, ideally in domestic or EU waters; b) fresh (especially southern-EU) or mildly processed (northern-EU); c) easy to prepare and/or ready to eat; and d) competitively priced. In Europe, greater amberjack shows the most promising market opportunities, given its large size, processing potential and superior sensory characteristics. Grey mullet is a very interesting species due to the higher sustainability of its production methods. No specific preference region has been identified for this species. Wreckfish has very firm flesh that discriminates it readily from other fish. The remaining species (Atlantic halibut, pikeperch and meagre) have certain advantages due to their biological and physical characteristic and are of interest to specific regions in Europe.

### **Expected final results and potential impacts**

The DIVERSIFY consortium integrated a multidisciplinary group of research and academic institutions, small and medium-sized enterprises, large The DIVERSIFY consortium integrated a multidisciplinary group of research and academic institutions, small and medium-sized enterprises, large enterprises, five professional associations and one consumer NGO from 12 European countries. The acquired knowledge and developed methods will enhance the production of the selected emerging species (meagre, Atlantic halibut, pikeperch) by the European aquaculture and will enable the incorporation of some new species (greater amberjack and grey mullet).

In the area of reproduction, DIVERSIFY has provided improved understanding of the regulation of reproduction and the dysfunctions that occur when fish are maintained in captivity. The project has defined optimal broodstock management conditions and has developed species-specific spawning induction protocols for the acquisition of optimal gamete quality. In addition, DIVERSIFY has focused on the genetic characterization of various broodstocks of two species with current relevant industrial production, in order to overcome future inbreeding problems in these two species and solve current problems with variable growth rates (meagre) and stress sensitivity (pikeperch). Thus, it acquired the necessary knowledge and developed the required methods for the implementation of breeding selection programs, which are imperative for the development of an efficient, profitable and sustainable aquaculture industry.

The cost of feeding in aquaculture production is around 40-70% of total production cost; therefore, improving feed conversion efficiency and growth rates is directly related to the profitability of the industry. New species in aquaculture are fed with available diets designed for other well-established species, which may constraint their growth performance, welfare and health. For this reason, it is important to develop species-specific feeds that consider the nutritional requirements of each species at

different stages of development and that can improve their performance, quality and health condition. To achieve this goal, DIVERSIFY has established the nutritional requirements of several macro- and micronutrients for most of the species considered in the proposal. In addition, specific live prey enrichment products have been developed. Specific formulated feeds, live prey enrichment products and feeding protocols will result in new products that can be commercialized worldwide.

A larval and juvenile rearing system is a complex artificial environment, with numerous factors influencing fish development and performance, as well as behavior and survival. These factors can be environmental, nutritional, social and genetic. For species such as meagre, pikeperch, grey mullet and Atlantic halibut, improvements in fish growth and husbandry have been addressed to refine the existing protocols and facilities in order to solve existing bottlenecks. In contrast, emphasis has been given to developing new species-specific larval rearing protocols in the case of greater amberjack and wreckfish, since these were species with important knowledge gaps in these areas. The output of these tasks is the development and refining of rearing protocols for the selected species that will result in the improvement of current practices, and will provide an increase in production yields.

Fish health is a key aspect to be optimized in cultured fish. The effect of the developmental stage, rearing conditions and nutrition on the capacity to modulate specific immune responses will help predict vaccine responsiveness and fish health. DIVERSIFY has characterized the immune system of meagre and greater amberjack to identify key immune molecules as potential markers of immune system development, and induction of antiviral and antibacterial responses in preparation for vaccine development for disease management. In addition, potential solutions for specific bacterial infections and parasitoses have been investigated, providing means to prevent and/or minimize these issues at an industrial scale. DIVERSIFY has produced practical health manuals for meagre and greater amberjack, which are freely available and can be used immediately by the industry in order to improve their stock management.

Sustainability of aquaculture production is a major concern worldwide. DIVERSIFY has considered this issue from different points of view. For example, the acquired knowledge will support the growth and expansion of the sector based on different production systems that can be regarded as more sustainable: cage culture – no competition with land resources; RAS- ecologically friendly, with efficient use of water; extensive pond-lagoon culture, with very low environmental effects and in some cases even contributing to the restoration of ecosystems. Also, the introduction of an omnivorous fish into the aquaculture sector, such as the grey mullet, with positive influence in the environment where it is cultured and requiring low or close to no input from fish meal/oils, will contribute to the reduction of the pressure in the capture fisheries. The determination of species-specific dietary requirements, as well as feeding behavior will result in less waste of diets and nutrients into the environment. Altogether, these factors will ensure a sustainable growth and expansion of aquaculture within the EU and EEA member states.

In the Socioeconomics area, DIVERSIFY identified a market potential in cross-cultural consumer segments, with increased-to-strong interest in new products in the main EU fish markets. A number of new products have been developed and were perceived positively as healthy, convenient and of high quality and nutritional value. Buyers and consumers were shown to welcome new species, if some important requirements are met (see previous section). Introduction of the new species seems to have the most impact if it is done country by country instead of pan-European, because in each market other buying factors and motives are important.

So, overall, the main expected impact of DIVERSIFY will be the improvement of production technologies for the new/emerging species of the project. Furthermore, DIVERSIFY is expected to have

also a significant impact on providing more insights in markets and consumer's perception and preferences, potentially resulting in increases in the EU consumption of aquaculture products. Such an integrated combination of biological, technological and socioeconomic activities will lead to a reduction in the dependence of the EU on imports from third countries of at times questionable production, health, environmental and social standards.

**Project public website address:**

[www.diversifyfish.eu](http://www.diversifyfish.eu)

## **2. Core of the report**

**Project objectives, Work progress and achievements, and project management during the period**

The Project Summary Pdf document contains the core of the report.



### 3. Deliverables and milestones tables

Deliverables (excluding the periodic and final reports)										
Del. no.	Deliverable name	Version	WP no.	Lead beneficiary	Nature	Dissemination level	Delivery date from Annex I (proj month)	Actual / Forecast delivery date	Status	Comments
1	Kick-off meeting	1.0	1	HELLENIC CENTRE FOR MARINE RESEARCH	Other	RE	2	10/02/2014	Submitted	
2	Consortium Agreement	2.0	1	HELLENIC CENTRE FOR MARINE RESEARCH	Other	CO	3	13/03/2015	Submitted	
3	Annual Coordination Meeting for Y2	1.0	1	HELLENIC CENTRE FOR MARINE RESEARCH	Other	RE	13	28/11/2014	Submitted	
4	Periodic Report, including financial and administrative reports for Mo 1-12	1.0	1	HELLENIC CENTRE FOR MARINE RESEARCH	Report	CO	14	23/01/2015	Submitted	
5	Interactions with other projects	1.0	1	HELLENIC CENTRE FOR MARINE RESEARCH	Report	RE	18	29/05/2015	Submitted	
6	Annual Coordination Meeting for Y3	1.0	1	HELLENIC CENTRE FOR MARINE RESEARCH	Other	RE	25	07/03/2016	Submitted	
7	Mid-term evaluation of progress	1.0	1	HELLENIC CENTRE FOR MARINE RESEARCH	Report	PU	30	22/11/2016	Submitted	
8	Periodic Report, including financial and administrative reports for Mo 13-30	1.0	1	HELLENIC CENTRE FOR MARINE RESEARCH	Report	CO	32	01/08/2016	Submitted	
9	Annual Coordination	1.0	1	HELLENIC	Report	RE	37	10/03/2017	Submitted	

	Meeting for Y4			CENTRE FOR MARINE RESEARCH						
10	Annual Coordination Meeting for Y5	1.0	1	HELLENIC CENTRE FOR MARINE RESEARCH	Report	RE	49	01/03/2018	Submitted	
11	Periodic Report, including financial and administrative reports for Mo 31-48	1.0	1	HELLENIC CENTRE FOR MARINE RESEARCH	Report	RE	50	24/02/2018	Submitted	
12	Annual Coordination Meeting (Final)	1.0	1	HELLENIC CENTRE FOR MARINE RESEARCH	Report	RE	60	30/11/2018	Submitted	
13	Periodic Report, including financial and administrative reports for Mo 49-60	1.0	1	HELLENIC CENTRE FOR MARINE RESEARCH	Report	PU	60	30/11/2018	Submitted	
14	Final Report	1.0	1	HELLENIC CENTRE FOR MARINE RESEARCH	Report	RE	60	30/11/2018	Submitted	
1	SNP library and chip to genetically characterise meagre or to use in marker assisted breeding programs (M18)	2.0	2	HELLENIC CENTRE FOR MARINE RESEARCH	Report	PU	18	01/06/2015	Submitted	
2	Genetic characterisation of different meagre captive broodstocks and evaluation of available variability (M12)	1.0	2	FUNDACION CANARIA PARQUE CIENTIFICO TECNOLOGICO DE LA UNIVERSIDAD DE LAS PALMAS DE GRAN CANARIA	Report	PU	12	15/12/2014	Submitted	
3	Protocol for paired spontaneous tank spawning of meagre	1.0	2	INSTITUT DE RECERCA I TECNOLOGIA AGROALIMENTARIES	Report	PU	21	22/09/2015	Submitted	

4	Construction of a genetic linkage map in meagre	1.0	2	HELLENIC CENTRE FOR MARINE RESEARCH	Report	PU	36	28/11/2016	Submitted	
5	Identification of genetic markers related to growth for use in marker assisted breeding programs for meagre through QTL mapping	1.0	2	HELLENIC CENTRE FOR MARINE RESEARCH	Report	PU	36	30/11/2016	Submitted	
6	Description of sperm characteristics and cryopreservation protocol of meagre sperm	1.0	2	INSTITUT FRANCAIS DE RECHERCHE POUR L'EXPLOITATION DE LA MER	Report	PU	36	08/11/2016	Submitted	
7	Protocol for the strip spawning of meagre females and in vitro fertilization	1.0	2	INSTITUT DE RECHERCHE TECHNOLOGIA AGROALIMENTARIES	Report	PU	36	17/11/2016	Submitted	
1	Establishment of quantitative PCR assays to measure transcript levels of target genes in greater amberjack (i.e., LH#, FSH#, leptin, Vg and Vg receptor)	1.0	3	ISRAEL OCEANOGRAPHIC AND LIMNOLOGICAL RESEARCH LIMITED	Report	PU	12	17/03/2015	Submitted	
2	Establishment of hormone specific ELISAs for measuring LH, FSH and leptin in greater amberjack	2.0	3	ISRAEL OCEANOGRAPHIC AND LIMNOLOGICAL RESEARCH LIMITED	Report	PU	18	19/12/2017	Submitted	
3	Identification of possible reproductive dysfunction of gametogenesis of greater amberjack reared in captivity based on the comparative evaluation of fish sampled in the wild, in terms of proliferating	1.0	3	UNIVERSITA DEGLI STUDI DI BARI ALDO MORO	Report	PU	24	26/01/2016	Submitted	
4	Establishment of a Com	1.0	3	INSTITUT	Report	PU	32	22/07/2016	Submitted	

	puter Assisted Sperm Analysis (CASA) for the evaluation of greater amberjack sperm			FRANCAIS DE RECHERCHE POUR L'EXPLOITATION DE LA MER						
5	Description of the process of oogenesis in captive greater amberjack, including (a) aspects of growth and body indices, (b) histological evaluation of ovarian development, (c) pituitary levels of FSH	1.0	3	UNIVERSITA DEGLI STUDI DI BARI ALDO MORO	Report	PU	46	06/12/2017	Submitted	
6	Description of the process of spermatogenesis in captive greater amberjack, including (a) aspects of growth and body indices, (b) histological evaluation of testicular development, (c) pituitary level	1.0	3	UNIVERSITA DEGLI STUDI DI BARI ALDO MORO	Report	PU	46	06/12/2017	Submitted	
7	Comparative effectiveness of a GnRH $\alpha$ injection vs GnRH $\alpha$ implant treatment for the induction of spawning of greater amberjack in the eastern Atlantic	1.0	3	FUNDACION CANARIA PARQUE CIENTIFICO TECNOLOGICO DE LA UNIVERSIDAD DE LAS PALMAS DE GRAN CANARIA	Report	PU	48	31/10/2017	Submitted	
8	Dose response of GnRH $\alpha$ implant therapy for the induction of spawning in F1 generation broodstock of greater amberjack in the eastern Atlantic	1.0	3	INSTITUTO ESPANOL DE OCEANOGRAFIA	Report	PU	54	16/07/2018	Submitted	
9	Development of a spawning induction therapy for captive reared broodstock in the Mediterranean Sea based on the use of GnRH $\alpha$ in the correct mode of administration (hormone/implant), dose	1.0	3	HELLENIC CENTRE FOR MARINE RESEARCH	Report	PU	54	20/10/2018	Submitted	

	and timing of									
10	Method for inducing spawning and collecting greater amberjack eggs in sea cages	1.0	3	HELLENIC CENTRE FOR MARINE RESEARCH	Report	PU	54	28/09/2018	Submitted	
1	Genetic analysis of domesticated pikeperch broodstocks	1.0	4	HELLENIC CENTRE FOR MARINE RESEARCH	Report	PU	12	19/11/2014	Submitted	
2	Population genetic analysis of wild and comparison with domesticated pikeperch populations to be applied in future breeding programs of the species	1.0	4	HELLENIC CENTRE FOR MARINE RESEARCH	Report	PU	16	19/03/2015	Submitted	
1	Documentation of reproductive performance in wild-captured vs cultured female Atlantic halibut	1.0	5	HAVFOR SKNINGSINSTITUTTET	Report	PU	30	27/09/2016	Submitted	
2	An optimised GnRHa therapy protocol to improve spawning performance of F1/F2 Atlantic halibut, and to increase availability of eggs of stable and predictable quality	1.0	5	HAVFOR SKNINGSINSTITUTTET	Report	PU	30	12/05/2016	Submitted	
3	Identification of potential disturbances in reproductive development in F1/F2 Atlantic halibut females	1.0	5	HAVFOR SKNINGSINSTITUTTET	Report	PU	48	10/05/2018	Submitted	
1	Computer Assisted Sperm Analysis (CASA) for wreckfish sperm	1.0	6	INSTITUT FRANCAIS DE RECHERCHE POUR L'EXPLOITATION DE LA MER	Report	PU	24	27/11/2015	Submitted	
2	Cryopreservation method for wreckfish	1.0	6	INSTITUTO ESPAÑOL DE OCEANOGRAFIA	Report	PU	24	27/11/2015	Submitted	

3	Spawning induction methods with in vitro fertilization of wreckfish	1.0	6	INSTITUTO ES PANOL DE OCEANO GRAFIA	Report	PU	36	30/11/2018	Submitted	
4	Establish reliable collection methods and protocols to form new wreckfish broodstocks	1.0	6	CONSELLERIA DO MAR - XUNTA DE GALICIA	Report	PU	36	19/11/2018	Submitted	
5	Description of the reproductive cycle of wreckfish	1.0	6	INSTITUTO ES PANOL DE OCEANO GRAFIA	Report	PU	48	30/11/2018	Submitted	
6	An in vitro fertilization protocol to be employed by the industry to spawn wreckfish	1.0	6	INSTITUTO ES PANOL DE OCEANO GRAFIA	Report	PU	48	24/11/2018	Submitted	
7	Spawning induction method for spontaneous spawning of wreckfish in large tanks	1.0	6	HELLENIC CENTRE FOR MARINE RESEARCH	Report	PU	54	21/10/2018	Submitted	
1	Establishment of a Computer Assisted Sperm Analysis (CASA) for the evaluation of grey mullet sperm	1.0	7	INSTITUT FRANCAIS DE RECHERCHE POUR L'EXPLOITATION DE LA MER	Report	PU	12	12/12/2014	Submitted	
2	Production of recombinant bioactive LH and FSH assay for grey mullet	1.0	7	ISRAEL OCEANOGRAPHIC AND LIMNOLOGICAL RESEARCH LIMITED	Report	PU	18	12/06/2015	Submitted	
3	Comparative effectiveness of hormonal treatments for spawning induction in captive grey mullet	1.0	7	ISRAEL OCEANOGRAPHIC AND LIMNOLOGICAL RESEARCH LIMITED	Report	PU	24	27/11/2015	Submitted	
4	Protocol for shipping grey mullet eggs	2.0	7	ISRAEL OCEANOGRAPHIC AND LIMNOLOGICAL RE	Report	PU	24	16/02/2017	Submitted	

				SEARCH LIM ITED						
5	Description of the process of oogenesis in captive-reared vs hatchery-produced grey mullet, including aspects of growth, body indices, and histological evaluation of ovarian development	1.0	7	UNIVERSITA DEGLI STUDI DI BARI ALDO MORO	Report	PU	48	24/07/2018	Submitted	
6	Culture procedure that identifies the on-growing period for the production of grey mullet roe (bottarga) from wild and hatchery juveniles	1.0	7	ISRAEL OCEAN OGRAPHIC AND LIMNOLO GICAL RE SEARCH LIM ITED	Report	PU	54	11/12/2018	Submitted	
7	Development of a breeding protocol for captive reared grey mullet brood stock based on optimized hormonal treatment, group structure and photothermal regime	1.0	7	ISRAEL OCEAN OGRAPHIC AND LIMNOLO GICAL RE SEARCH LIM ITED	Report	PU	60	19/12/2018	Submitted	
1	Improvement of larval weaning diets	1.0	8	FUNDACION CANARIA PARQUE CIE N TIFICO TEC NO LOGICO DE LA UNIVERSI DAD DE LAS PAL MAS DE GRAN CANARIA	Report	PU	24	03/12/2015	Submitted	
2	Recommended essential fatty acids contents in diets to promote meagre growth, welfare and health	1.0	8	FUNDACION CANARIA PARQUE CIE N TIFICO TEC NO LOGICO DE LA UNIVERSI DAD DE LAS PAL MAS DE GRAN CANARIA	Report	PU	48	24/12/2017	Submitted	
1	Optimum levels and ratios of essential fatty acids in relation to Tau and com	1.0	9	FUNDACION CANARIA PARQUE CIE N	Report	PU	24	16/12/2015	Submitted	

	bined PUFA-carotenoids in greater amberjack enrichment products			TIFICO TECNOLOGICO DE LA UNIVERSIDAD DE LAS PALMAS DE GRAN CANARIA						
2	Lys requirements of greater amberjack juveniles	1.0	9	HELLENIC CENTRE FOR MARINE RESEARCH	Report	PU	36	20/02/2017	Submitted	
3	Performance of grow-out diets for greater amberjack developed in order to maximize growth potential	1.0	9	CANARIAS EXPLOTACIONES MARINAS SL	Report	PU	58	12/11/2018	Submitted	
4	Recommended protein, carotenoids, Tau and EFA levels in greater amberjack broodstocks	2.0	9	INSTITUTO ESPANOL DE OCEANOGRAFIA	Report	PU	58	24/11/2018	Submitted	
1	Recommended Ca/P, vitamins and phospholipids to improve larval development and reduce skeleton alterations in pikeperch	1.0	10	DANMARKS TEKNISKE UNIVERSITET	Report	PU	36	21/09/2018	Submitted	
2	Protocol for optimal early fatty acid enrichment to reduce stress sensitivity in pikeperch	1.0	10	DANMARKS TEKNISKE UNIVERSITET	Report	PU	36	21/12/2017	Submitted	
3	Formulation for a diet better adapted to pikeperch requirements	2.0	10	FISH 2 BE NV	Report	PU	48	05/12/2018	Submitted	
1	Report on nutrient profile of Artemia nauplii and on grown Artemia from IMR and SWH	1.0	11	HAVFOR SKNINGSINSTITUTTET	Report	PU	24	27/11/2015	Submitted	
2	Report on optimal characteristics of feed particles and feeding environment for early weaning of Atlantic halibut larvae	1.0	11	HAVFOR SKNINGSINSTITUTTET	Report	PU	36	28/11/2016	Submitted	
3	Report on the nutrient re	1.0	11		Report	PU	36	28/11/2016	Submitted	



	tention and digestive physiology in Atlantic halibut larvae fed Artemia nauplii and on-grown Artemia									
4	Report on the nutrient retention and digestive physiology in Atlantic halibut larvae reared in RAS vs FTS	1.0	11		Report	PU	36	28/11/2016	Submitted	
5	Report on the effect of dietary phospholipids on Atlantic halibut juveniles	1.0	11		Report	PU	48	25/09/2018	Submitted	
1	Effect of live prey enrichment products on wreck fish larval performance	1.0	12	CONSELLERIA DO MAR - XUNTA DE GALICIA	Report	PU	54	12/11/2018	Submitted	
2	Recommendations for wreckfish broodstock feeds	1.0	12	CONSELLERIA DO MAR - XUNTA DE GALICIA	Report	PU	57	11/10/2018	Submitted	
1	Determine changes in the essential fatty acid requirement as a function of developmental stage and ambient salinity in grey mullet	1.0	13	ISRAEL OCEANOGRAPHIC AND LIMNOLOGICAL RESEARCH LIMITED	Report	PU	18	30/11/2018	Submitted	
2	Determine a developmental stage ability to synthesize key enzymes in Tau and bile acid synthesis in grey mullet	1.0	13	ISRAEL OCEANOGRAPHIC AND LIMNOLOGICAL RESEARCH LIMITED	Report	PU	18	23/02/2018	Submitted	
3	Determine the effects of pigments, essential fatty acids and Tau in grey mullet broodstock diets on egg quality, fecundity, hatching success, larval first feeding and vitellogenin expression accumulation	1.0	13	ISRAEL OCEANOGRAPHIC AND LIMNOLOGICAL RESEARCH LIMITED	Report	PU	36	30/11/2018	Submitted	

4	Determine the effects of essential fatty acids and Tau in non-fish meal feeds on flesh and bot targa quality in grey mullet	1.0	13	ISRAEL OCEANOGRAPHIC AND LIMNOLOGICAL RESEARCH LIMITED	Report	PU	48	30/11/2017	Submitted	
5	Evaluate and maximize the dietary incorporation of a non-GMO genetically selected soybean meal that will increase nutrient absorption and reduce DT inflammation	1.0	13	UNIVERSITA DEGLI STUDI DI BARI ALDO MORO	Report	PP	55	27/12/2018	Submitted	
1	Improved larval rearing protocol for meagre that includes weaning at an earlier age leading to reduced cost in live feed production and better quality juveniles	1.0	14	INSTITUT DE RECERCA I TECNOLOGIA AGROALIMENTARIES	Report	PU	18	11/05/2016	Submitted	
1	Effective greater amberjack larval stocking densities	2.0	15	FUNDACION CANARIA PARQUE CIENTIFICO TECNOLOGICO DE LA UNIVERSIDAD DE LAS PALMAS DE GRAN CANARIA	Report	PU	16	10/05/2016	Submitted	
2	Efficient prey density and protocol of using immune modulators in greater amberjack larval rearing	1.0	15	INSTITUTO ESPANOL DE OCEANOGRAFIA	Report	PU	27	28/02/2017	Submitted	
3	Optimum hydrodynamics and light conditions during greater amberjack larval rearing	1.0	15	FUNDACION CANARIA PARQUE CIENTIFICO TECNOLOGICO DE LA UNIVERSIDAD DE LAS PALMAS DE GRAN CANARIA	Report	PU	27	16/03/2017	Submitted	
4	Ontogeny of greater amberjack larval visual and	2.0	15	HELLENIC CENTRE FOR	Report	PU	27	24/06/2016	Submitted	

	digestive system			MARINE RE SEARCH						
5	An industrial protocol for greater amberjack larval rearing	1.0	15	INSTITUTO ES PANOL DE OCEANO GRAFIA	Report	PU	48	17/10/2018	Submitted	
1	Determine effect of environmental factors on pike perch larval rearing	1.0	16	UNIVERSITE DE LORRAINE	Report	PU	12	27/07/2016	Submitted	
2	Determine effect of nutritional factors on pike perch larval rearing	1.0	16	UNIVERSITE DE LORRAINE	Report	PU	24	27/11/2016	Submitted	
3	Determine effect of population factors on pike perch larval rearing	1.0	16	UNIVERSITE DE LORRAINE	Report	PU	36	31/10/2017	Submitted	
4	Identification of optimal combinations of factors for pikeperch larval rearing	1.0	16	UNIVERSITE DE LORRAINE	Report	PU	48	25/07/2018	Submitted	
5	Evaluation of selected rearing combinations for pikeperch on farm condition	1.0	16	UNIVERSITE DE LORRAINE	Report	PU	57	05/11/2018	Submitted	
6	Proposition of an industrial protocol for pikeperch rearing	2.0	16	ASIALOR SARL	Report	PU	57	05/12/2018	Submitted	
1	Production protocol of on-grown Artemia	1.0	17	HAVFOR SKNINGSINSTI TUTTET	Report	PU	24	25/11/2015	Submitted	
2	Determine if RAS is a more effective protocol than FT for Atlantic halibut larvae	1.0	17	HAVFOR SKNINGSINSTI TUTTET	Report	PU	36	30/08/2018	Submitted	
3	The effect of probiotics on Atlantic halibut larval microbiota and survival	1.0	17	HAVFOR SKNINGSINSTI TUTTET	Report	PU	36	30/10/2018	Submitted	
4	Comparison of feeding on-grown Artemia versus Artemia nauplii on Atlantic halibut larval per	1.0	17	HAVFOR SKNINGSINSTI TUTTET	Report	PU	36	01/12/2016	Submitted	

	formance								
5	Development of an industrial protocol for probiotic treatment of halibut larvae	1.0	17	HAVFOR SKNINGSINSTITUTTET	Report	PU	48	26/07/2018	Submitted
1	Development of the digestive system of wreckfish	1.0	18	HELLENIC CENTRE FOR MARINE RESEARCH	Report	PU	36	31/10/2017	Submitted
2	Determine optimum temperature conditions for rearing wreckfish larvae	2.0	18	INSTITUTO ESPANOL DE OCEANOGRAFIA	Report	PU	36	18/11/2018	Submitted
3	Develop a feeding protocol for wreckfish larvae	1.0	18	HELLENIC CENTRE FOR MARINE RESEARCH	Report	PU	36	05/12/2018	Submitted
4	Determine the most effective culture system (RAS vs flow-through) for wreckfish larvae	1.0	18	INSTITUTO ESPANOL DE OCEANOGRAFIA	Report	PU	48	26/11/2018	Submitted
1	Determine most effective type and concentration of algae used in grey mullet larval rearing	1.0	19	ISRAEL OCEANOGRAPHIC AND LIMNOLOGICAL RESEARCH LIMITED	Report	PU	24	19/11/2016	Submitted
2	Determining the effect of co-feeding ciliates and rotifers on digestive tract maturation and enzyme production	1.0	19	ISRAEL OCEANOGRAPHIC AND LIMNOLOGICAL RESEARCH LIMITED	Report	PU	36	27/12/2018	Submitted
3	Determining the effect of co-feeding copepods and Artemia nauplii on digestive tract maturation and enzyme production	1.0	19	ISRAEL OCEANOGRAPHIC AND LIMNOLOGICAL RESEARCH LIMITED	Report	PU	58	14/11/2017	Submitted
4	Evaluate the effectiveness of replacing live algae with lyophilized algae	1.0	19	INSTITUT DE RECERCA I TECNOLOGIA	Report	PU	48	26/07/2018	Submitted

	during grey mullet larval rearing			AGROALIMENTARIES						
5	Evaluate an improved grey mullet larval rearing protocol in a commercial hatchery	1.0	19	DOR DGEY YAM LTD	Report	PU	55	23/07/2018	Submitted	
1	Methodology to avoid size variability in meagre juveniles	1.0	20	INSTITUT DE RECERCA I TECNOLOGIA AGROALIMENTARIES	Report	PU	24	25/11/2015	Submitted	
2	Definition of the optimum conditions for cage culture of meagre (Report)	1.0	20	HELLENIC CENTRE FOR MARINE RESEARCH	Report	PU	39	24/04/2018	Submitted	
3	Methodology for meagre feeding	1.0	20	HELLENIC CENTRE FOR MARINE RESEARCH	Report	PU	42	25/07/2018	Submitted	
1	Definition of optimum feeding methods for greater amberjack grow out	1.0	21	INSTITUTO ES PANOL DE OCEANOGRAFIA	Report	PU	42	28/07/2017	Submitted	
2	Definition of optimum conditions for cage culture of greater amberjack	2.0	21	FUNDACION CANARIA PARQUE CIENTIFICO TECNOLOGICO DE LA UNIVERSIDAD DE LAS PALMAS DE GRAN CANARIA	Report	PU	57	24/11/2018	Submitted	
1	Effects of multiple variables on stress, immune response and growth performances and recommendations of optimal conditions for pikeperch grow out	1.0	22	UNIVERSITE DE NAMUR ASBL	Report	PU	24	17/05/2016	Submitted	
2	Validation of optimal rearing variables under commercial farm condi	1.0	22	ASIALOR SARL	Report	PU	42	12/06/2018	Submitted	

	tions								
3	Effects of domestication level and geographical origin on stress, immune response and growth performances and strain recommendation	1.0	22	UNIVERSITE DE NAMUR AS BL	Report	PU	48	20/06/2018	Submitted
1	Cost-effective weaning strategies for wild-caught grey mullet grow out and their effect on growth and health status	1.0	23	INSTITUT DE RECERCA I TECNOLOGIA AGROALIMENTARIES	Report	PU	18	01/10/2015	Submitted
2	Stocking protocols for pond monoculture grow out of F1 and wild caught grey mullet	2.0	23	ISRAEL OCEANOGRAPHIC AND LIMNOLOGICAL RESEARCH LIMITED	Report	PU	30	18/11/2018	Submitted
3	Comparison of the project's improved grey mullet grow-out feed under the different environmental and water conditions in Israel, Greece and Spain	1.0	23	ISRAEL OCEANOGRAPHIC AND LIMNOLOGICAL RESEARCH LIMITED	Report	PU	40	27/12/2018	Submitted
1	The effect of vitamin D inclusions in diets in the development of Systemic Granulomatosis in meagre	1.0	24	HELLENIC CENTRE FOR MARINE RESEARCH	Report	PU	20	08/01/2016	Submitted
2	The effect of Ca/P ratio in the diet in the development of Systemic Granulomatosis in meagre	1.0	24	HELLENIC CENTRE FOR MARINE RESEARCH	Report	PU	24	15/06/2016	Submitted
3	Cloning of key marker genes of innate and adaptive immune responses in meagre	1.0	24	THE UNIVERSITY COURT OF THE UNIVERSITY OF ABERDEEN	Report	PU	26	20/01/2016	Submitted
4	Efforts towards the isolation and characterization of Nocardia from infected meagre	1.0	24	HELLENIC CENTRE FOR MARINE RESEARCH	Report	PU	36	13/12/2016	Submitted

5	The effect of high plant protein diets in the development of Systemic Granulomatosis in meagre	1.0	24	HELLENIC CENTRE FOR MARINE RESEARCH	Report	PU	36	25/05/2017	Submitted	
6	Testing of commercial Vibrio vaccine	1.0	24	HELLENIC CENTRE FOR MARINE RESEARCH	Report	PU	42	30/11/2018	Submitted	
7	Diagnostics protocol for Chronic Ulcerative Dermatopathy in meagre, aetiological factors and solutions	1.0	24	HELLENIC CENTRE FOR MARINE RESEARCH	Report	PU	44	26/04/2018	Submitted	
8	Report on the prevention/treatment of Chronic Ulcerative Dermatopathy in meagre	1.0	24	HELLENIC CENTRE FOR MARINE RESEARCH	Report	PU	44	27/03/2018	Submitted	
9	Determination of effective treatments for common monogenean parasites in meagre	1.0	24	INSTITUT DE RECERCA I TECNOLOGIA AGROALIMENTARIES	Report	PU	48	01/03/2018	Submitted	
10	Kinetics of antibody and cytokine production established post-pathogen exposure or stimulation with PAMPs	1.0	24	THE UNIVERSITY COURT OF THE UNIVERSITY OF ABERDEEN	Report	PU	48	16/11/2017	Submitted	
11	Recommended levels of pro- and anti-oxidant nutrients to prevent Systemic Granulomatosis in meagre	1.0	24	FUNDACION CANARIA PARQUE CIENTIFICO TECNOLOGICO DE LA UNIVERSIDAD DE LAS PALMAS DE GRAN CANARIA	Report	PU	54	18/05/2018	Submitted	
12	Determination of the efficacy of vaccination of meagre against Vibriosis	1.0	24	INSTITUT DE RECERCA I TECNOLOGIA AGROALIMENTARIES	Report	PU	54	18/10/2018	Submitted	
13	Description of immune	1.0	24	INSTITUT DE	Report	PU	54	30/11/2018	Submitted	

	gene expression post-immunisation and challenge of meagre with a Vibrio vaccine			RECERCA I TECNOLOGIA AGROALIMENTARIES						
14	Diagnostics protocol for Systemic Granulomatosis, causes and solutions in meagre	1.0	24	HELLENIC CENTRE FOR MARINE RESEARCH	Report	PU	54	30/10/2018	Submitted	
15	Report on the prevention/treatment of Systemic Granulomatosis in meagre	1.0	24	HELLENIC CENTRE FOR MARINE RESEARCH	Report	PU	54	31/10/2018	Submitted	
16	Report of the major bacterial and viral diseases found in meagre, and where useful treatments have been developed, complete protocols for their implementation by the industry will be provided	1.0	24	FUNDACION CANARIA PARQUE CIENTIFICO TECNOLOGICO DE LA UNIVERSIDAD DE LAS PALMAS DE GRAN CANARIA	Report	PU	57	23/09/2018	Submitted	
17	Diagnostic-recommendation manual for meagre fish health	1.0	24	HELLENIC CENTRE FOR MARINE RESEARCH	Report	PU	57	20/11/2018	Submitted	
1	Marker genes of mucosal immunity in greater amberjack cloned and ways to increase their expression level determined	1.0	25	THE UNIVERSITY COURT OF THE UNIVERSITY OF ABERDEEN	Report	PU	39	16/03/2017	Submitted	
2	Mucus defences of greater amberjack analysed and immune potential characterised	1.0	25	FUNDACION CANARIA PARQUE CIENTIFICO TECNOLOGICO DE LA UNIVERSIDAD DE LAS PALMAS DE GRAN CANARIA	Report	PU	39	26/05/2017	Submitted	
3	Impact of dietary regime on parasite resistance and mucosal defences of greater amberjack juven	1.0	25	THE UNIVERSITY COURT OF THE UNIVERSITY	Report	PU	42	27/07/2017	Submitted	



	iles			OF ABERDEEN						
4	Protocol for early diagnosis of epitheliocystis during early stages of greater amberjack culture	1.0	25	HELLENIC CENTRE FOR MARINE RESEARCH	Report	PU	44	02/07/2018	Submitted	
5	Impact of oral administration of greater amberjack with mucus stimulation products on immune resistance to parasitic infections and development of molecular markers for its evaluation	1.0	25	FUNDACION CANARIA PARQUE CIENTIFICO TECNOLOGICO DE LA UNIVERSIDAD DE LAS PALMAS DE GRAN CANARIA	Report	PU	57	30/08/2018	Submitted	
6	Rearing protocol against monogenean parasites	1.0	25	INSTITUTO ESPANOL DE OCEANOGRAFIA	Report	PU	57	05/11/2018	Submitted	
7	Report on the major bacterial and viral diseases found in greater amberjack, and where useful treatments have been developed, complete protocols for their implementation by the industry will be provided	1.0	25	FUNDACION CANARIA PARQUE CIENTIFICO TECNOLOGICO DE LA UNIVERSIDAD DE LAS PALMAS DE GRAN CANARIA	Report	PU	57	05/10/2018	Submitted	
8	Diagnostic-recommendation manual for greater amberjack fish health	1.0	25	HELLENIC CENTRE FOR MARINE RESEARCH	Report	PU	57	12/12/2018	Submitted	
1	Assess the use of two eukaryotic expression systems; microalgae and a protozoa (Leishmania tarentolae) for production of nodavirus capsid protein	1.0	26	HAVFOR SKNINGSINSTITUTTET	Report	PU	24	13/11/2015	Submitted	
2	Testing of the delivery of vaccine candidates through Artemia to Atlantic halibut larvae	1.0	26	HAVFOR SKNINGSINSTITUTTET	Report	PU	36	27/04/2018	Submitted	
3	Determine immune re	1.0	26	HAVFOR	Report	PU	40	02/05/2018	Submitted	

	sponse and effectiveness of orally delivered VNN capsid protein on protection of Atlantic halibut larvae			SKNINGSINSTITUTET						
1	Report on external environmental factors that affect or will affect the production chains of meagre, greater amberjack, pike perch, Atlantic halibut, wreckfish and grey mullet	1.0	27	STICHTING WAGENINGEN RESEARCH	Report	PP	3	22/05/2014	Submitted	
2	Report on current certification schemes and standards and their business dynamics in the fish supply chain	1.0	27	STICHTING WAGENINGEN RESEARCH	Report	PP	3	07/03/2014	Submitted	
3	Report on competitive analysis for the supply chains of meagre, greater amberjack, pikeperch, Atlantic halibut, wreckfish and grey mullet	1.0	27	STICHTING WAGENINGEN RESEARCH	Report	PU	12	23/01/2015	Submitted	
4	Report on trend mapping for the European aquaculture, seafood sector and protein market in the (near) future	1.0	27	STICHTING WAGENINGEN RESEARCH	Report	PU	12	05/12/2014	Submitted	
5	Report with results of international survey on industrial buyers' attitudes and perceptions regarding cultured fish	1.0	27	STICHTING WAGENINGEN RESEARCH	Report	PU	12	28/11/2014	Submitted	
6	List of critical success factors for market acceptance	1.0	27	STICHTING WAGENINGEN RESEARCH	Report	PU	12	20/02/2015	Submitted	
7	Report on the analysis of the business models and supply chains of the participating SME's	1.0	27	STICHTING WAGENINGEN RESEARCH	Report	PU	12	28/11/2014	Submitted	
1	Report with results of focus groups with con	1.0	28	AARHUS UNIVERSITET	Report	PU	14	14/04/2015	Submitted	

	sumers and experts regarding ideas for new products									
2	List of ideas for new product development	1.0	28	HELLENIC CENTRE FOR MARINE RESEARCH	Report	PU	16	21/07/2015	Submitted	
3	Report on product and process solutions for each species based on technological, physical and sensory characteristics	1.0	28	HELLENIC CENTRE FOR MARINE RESEARCH	Report	PU	18	05/10/2015	Submitted	
4	Physical prototypes of new products from the selected species meagre, greater amberjack, wreck fish, pikeperch and grey mullet	1.0	28	INSTITUT DE RECERCA I TECNOLOGIA AGROALIMENTARIES	Report	PU	26	19/04/2016	Submitted	
5	Report on results of quality evaluation study on basic quality characteristics of the developed products	1.0	28	HELLENIC CENTRE FOR MARINE RESEARCH	Report	PU	54	12/06/2018	Submitted	
6	Report on results of sensory descriptive analysis of the developed products	1.0	28	HELLENIC CENTRE FOR MARINE RESEARCH	Report	PU	54	15/05/2018	Submitted	
7	Report on correlation of technical quality with nutritional - rearing history	1.0	28	UNIVERSIDAD DE LA LAGUNA	Report	PU	54	29/10/2018	Submitted	
8	Technical assessment of selected species	1.0	28	HELLENIC CENTRE FOR MARINE RESEARCH	Report	PP	58	03/10/2018	Submitted	
1	Dataset of consumers' perceptions, attitudes, buying intentions, consumption, willingness to buy and pay, and value perceptions towards the selected species in the five	1.0	29	STICHTING WAGENINGEN RESEARCH	Report	PU	9	27/08/2014	Submitted	

2	Report on the segmentation analysis based on consumer value perceptions about the selected species in the five countries investigated (value-based segmentation task)	1.0	29	AARHUS UNIVERSITET	Report	PU	24	07/10/2015	Submitted	
3	Development of the actual product samples from the selected species for the sensory testing with consumers in the five countries investigated	1.0	29	INSTITUT DE RECERCA I TECNOLOGIA AGROALIMENTARIES	Report	PU	28	04/04/2016	Submitted	
4	Report on the actual products' sensory profiling in the five countries investigated	1.0	29	INSTITUT DE RECERCA I TECNOLOGIA AGROALIMENTARIES	Report	PU	29	13/09/2016	Submitted	
5	Development of the product mock-ups for use in the experimentation with consumers in the five countries investigated	1.0	29	AARHUS UNIVERSITET	Report	PP	30	22/07/2016	Submitted	
6	Report on the experimentation with product mock-ups in the five countries investigated and identification of the optimal intrinsic-extrinsic product quality profiles for targeted segments	2.0	29	AARHUS UNIVERSITET	Report	PU	36	15/03/2017	Submitted	
7	Development of the stimulus (i.e. written and broadcasted information material) that will be used in the communication experiments in the five countries investigated	1.0	29	AARHUS UNIVERSITET	Report	PP	42	28/07/2017	Submitted	
8	Report on the experimentation with the communication stimulus and evaluation of their effectiveness in changing con	1.0	29	AARHUS UNIVERSITET	Report	PU	44	31/10/2017	Submitted	

	sumers attitudes and behaviour towards the products coming from the selected									
1	Report on value propositions for the producers and Partners	1.0	30	TECHNISCHE UNIVERSITEIT EINDHOVEN	Report	PU	46	31/10/2017	Submitted	
2	Report on indications of resources for creating customer value for the specific products	1.0	30	TECHNISCHE UNIVERSITEIT EINDHOVEN	Report	PU	46	31/10/2017	Submitted	
3	Guidelines to cultivate buyer-supplier relationships per species	1.0	30	TECHNISCHE UNIVERSITEIT EINDHOVEN	Report	PU	48	06/12/2017	Submitted	
4	Revenue (pricing & costs structures) model per species	1.0	30	TECHNISCHE UNIVERSITEIT EINDHOVEN	Report	PU	48	16/02/2018	Submitted	
5	New product marketing strategies per species and product	1.0	30	TECHNISCHE UNIVERSITEIT EINDHOVEN	Report	PU	52	24/04/2018	Submitted	
6	Report on results of test markets per species	1.0	30	TECHNISCHE UNIVERSITEIT EINDHOVEN	Report	PU	54	12/10/2018	Submitted	
7	Feasibility study	1.0	30	STICHTING WAGENINGEN RESEARCH	Report	PU	60	24/12/2018	Submitted	
8	Report on EU and international market development plans and recommendations	1.0	30	TECHNISCHE UNIVERSITEIT EINDHOVEN	Report	PU	58	30/11/2018	Submitted	
1	Establishment of web site (fishDIVERSIFY.eu)	1.0	31	FUNDACION CENTRO TECNOLOGICO ACUICULTURA DE ANDALUCIA	Report	PU	4	02/04/2014	Submitted	
2	Project logo and brochure	1.0	31	FUNDACION CENTRO TECNOLOGICO ACUICULTURA DE ANDALUCIA	Report	PU	6	24/06/2014	Submitted	

				CIA						
3	Publication of the first of two articles in Food Today	1.0	31	EUROPEAN FOOD INFORMATION COUNCIL	Report	PU	6	30/05/2014	Submitted	
4	Production and release of audiovisual material	1.0	31	FUNDACION CENTRO TECNOLOGICO ACUICULTURA DE ANDALUCIA	Report	PU	6	24/06/2014	Submitted	
5	Collaboration agreement with food industry and consumer organization; linkage of websites	1.0	31	FUNDACION CENTRO TECNOLOGICO ACUICULTURA DE ANDALUCIA	Report	PU	9	18/11/2014	Submitted	
6	Annual presentation of DIVERSIFY (Y1) at a relevant conference (mainly Aqua Europe meetings, EU Forum) by the Project Coordinator	1.0	31	HELLENIC CENTRE FOR MARINE RESEARCH	Report	PU	9	27/10/2014	Submitted	
7	Production and release of audiovisual material	1.0	31	FUNDACION CENTRO TECNOLOGICO ACUICULTURA DE ANDALUCIA	Report	PU	12	15/01/2015	Submitted	
8	Production and release of audiovisual material	1.0	31	FUNDACION CENTRO TECNOLOGICO ACUICULTURA DE ANDALUCIA	Report	PU	18	21/08/2015	Submitted	
9	Annual presentation of DIVERSIFY (Y2) at a relevant conference (mainly Aqua Europe meetings, EU Forum) by the Project Coordinator	1.0	31	HELLENIC CENTRE FOR MARINE RESEARCH	Report	PU	21	29/10/2015	Submitted	
10	Presentations of DIVER	1.0	31	HELLENIC	Report	PU	21	16/11/2015	Submitted	

	SIFY at the Aqua Europe meetings (Diversification Sessions) by the Species leaders (Y2)			CENTRE FOR MARINE RESEARCH						
11	Scientific publications in relevant journals	1.0	31	HELLENIC CENTRE FOR MARINE RESEARCH	Report	PU	60	30/11/2018	Submitted	
12	Production and release of audiovisual material	1.0	31	FUNDACION CENTRO TECNOLOGICO ACUICULTURA DE ANDALUCIA	Report	PU	24	30/11/2015	Submitted	
13	Production and release of audiovisual material	1.0	31	FUNDACION CENTRO TECNOLOGICO ACUICULTURA DE ANDALUCIA	Report	PU	30	27/06/2016	Submitted	
14	Annual presentation of DIVERSIFY (Y3) at a relevant conference (mainly Aqua Europe meetings, EU Forum) by the Project Coordinator	1.0	31	HELLENIC CENTRE FOR MARINE RESEARCH	Report	PU	33	14/10/2016	Submitted	
15	Production and release of audiovisual material	1.0	31	FUNDACION CENTRO TECNOLOGICO ACUICULTURA DE ANDALUCIA	Report	PU	36	09/12/2016	Submitted	
16	Promotional workshops for specialized audience in fish market sector (Spain, Greece, UK or Italy) (1st workshop)	1.0	31	FUNDACION CENTRO TECNOLOGICO ACUICULTURA DE ANDALUCIA	Report	PU	37	28/07/2017	Submitted	
17	Production and release of audiovisual material	1.0	31	FUNDACION CENTRO TECNOLOGICO ACUICULTURA DE ANDALUCIA	Report	PU	42	31/10/2017	Submitted	

				CIA						
18	Promotional workshops (2nd) for specialized audience in fish market sector (Spain, UK, Italy or Greece)	1.0	31	FUNDACION CENTRO TECNOLOGICO ACUICULTURA DE ANDALUCIA	Report	PU	43	08/11/2017	Submitted	
19	Annual presentation of DIVERSIFY (Y4) at a relevant conference (mainly Aqua Europe meetings, EU Forum) by the Project Coordinator	1.0	31	HELLENIC CENTRE FOR MARINE RESEARCH	Report	PU	44	02/11/2017	Submitted	
20	Presentations of DIVERSIFY at the Aqua Europe meetings (Diversification Sessions) by the Species leaders (Y4)	1.0	31	HELLENIC CENTRE FOR MARINE RESEARCH	Report	PU	44	03/11/2017	Submitted	
21	Presentation of DIVERSIFY at the European SEA FOOD Expo	1.0	31	FUNDACION CENTRO TECNOLOGICO ACUICULTURA DE ANDALUCIA	Report	PU	44	25/10/2017	Submitted	
22	Production and release of audiovisual material	1.0	31	FUNDACION CENTRO TECNOLOGICO ACUICULTURA DE ANDALUCIA	Report	PU	48	17/07/2018	Submitted	
23	Promotional workshops for specialized audience in fish market sector (Spain, Greece, UK or Italy) (3rd workshop)	1.0	31	FUNDACION CENTRO TECNOLOGICO ACUICULTURA DE ANDALUCIA	Report	PU	49	02/05/2018	Submitted	
24	Technical leaflets	1.0	31	FUNDACION CENTRO TECNOLOGICO ACUICULTURA DE ANDALUCIA	Report	PU	54	30/10/2018	Submitted	



25	Audio-visual document with the project's activities and main achievements	1.0	31	HELLENIC CENTRE FOR MARINE RESEARCH	Report	PU	54	30/11/2018	Submitted	
26	Audio-visual popularization document and publication of the second article in Food Today, electronic journal of EUFIC	1.0	31	EUROPEAN FOOD INFORMATION COUNCIL	Report	PU	54	24/12/2018	Submitted	
27	Promotional workshops for specialized audience in fish market sector (Spain, Greece, UK or Italy) (4th workshop)	1.0	31	FUNDACION CENTRO TECNOLOGICO ACUICULTURA DE ANDALUCIA	Report	PU	55	02/10/2018	Submitted	
28	Annual presentations of DIVERSIFY at the Aqua Europe meetings (EU Forum) by the Project Coordinator (Y5)	1.0	31	HELLENIC CENTRE FOR MARINE RESEARCH	Report	PU	57	18/10/2018	Submitted	
29	"Know-how Transfer" seminar for the aquaculture industry (Spain), presenting the progress achieved in DIVERSIFY in the technology for meagre, greater amber jack, wreckfish and/or grey mullet	1.0	31	INSTITUT DE RECERCA I TECNOLOGIA AGROALIMENTARIES	Report	PU	57	21/10/2018	Submitted	
30	"Know-how Transfer" seminar for the aquaculture industry (Greece), presenting the progress achieved in DIVERSIFY in the technology for meagre, greater amber jack, wreckfish and/or grey mullet	1.0	31	HELLENIC CENTRE FOR MARINE RESEARCH	Report	PU	57	12/10/2018	Submitted	
31	Pikeperch "Know-how Transfer" seminar for the aquaculture industry (potential location: France, Belgium, Denmark), presenting the pro	1.0	31	UNIVERSITE DE LORRAINE	Report	PU	58	21/09/2018	Submitted	

	gress achieved through DIVERSIFY in the production technology									
32	Atlantic halibut “Know-how Transfer” seminar for the aquaculture industry (potential location: Norway), presenting the progress achieved through DIVERSIFY in the production technology	1.0	31	HAVFOR SKNINGSINSTITUTTET	Report	PU	58	04/10/2018	Submitted	
33	“Know-how Transfer” seminar for the aquaculture industry ( Spain), presenting the progress achieved in DIVERSIFY in the technology for meagre, greater amber jack, wreckfish and/or grey mullet	1.0	31	INSTITUTO ES PANOL DE OCEANO GRAFIA	Report	PU	59	02/10/2018	Submitted	
34	“Know-how Transfer” seminar for the aquaculture industry (Italy), presenting the progress achieved in DIVERSIFY in the technology for meagre, greater amber jack, wreckfish and/or grey mullet	1.0	31	UNIVERSITA DEGLI STUDI DI BARI ALDO MORO	Report	PU	59	12/06/2018	Submitted	
35	Production and release of audiovisual material	1.0	31	FUNDACION CENTRO TECNOLOGICO ACUICULTURA DE ANDALUCIA	Report	PU	60	30/11/2018	Submitted	

## Milestones

Milestone no.	Milestone name	Work package no	Lead beneficiary	Delivery date from Annex I	Achieved Yes/No	Actual / Forecast achievement date	Comments
1	Kickoff and annual co	1	1	31/12/2013	Yes	30/01/2014	P1. HCMR, Crete,

	ordination meeting (for Y1)						Greece
2	Consortium agreement	1	1	31/01/2014	Yes	20/03/2014	
3	Annual coordination meeting for Y2	1	1	31/01/2015	Yes	06/11/2014	P13. UNIBA, Bari
4	Periodic Report (Mo1-12) to DG RTD, including financial and administrative reports	1	1	31/01/2015	Yes	30/12/2014	
5	Annual coordination meeting (for Y3)	1	1	31/01/2016	Yes	04/02/2016	P.9. UL, Nancy, France
16	SNIP library with candidate SNIPs potentially associated with growth in meagre	2	2	30/05/2015	Yes	30/05/2015	
17	Database of genetic variability of pikeperch	4	1	30/11/2014	Yes	30/11/2014	Excel database completed
18	Documentation of ovulatory cycles in wild and F1 halibut broodstock	5	7	31/05/2016	Yes	31/05/2016	
19	Basic diet formulation for meagre grow out studies	8	2	30/11/2014	Yes	30/11/2014	
20	Digestive utilization of experimental weaning diets for meagre	8	2	30/11/2015	Yes	30/11/2015	
21	Basic diet formulation for greater amberjack grow out studies	9	2	30/11/2014	Yes	30/11/2014	
22	Definition of reproductive quality parameters to be studied in amberjack	9	2	30/11/2014	Yes	30/11/2014	Literature search completed
23	Definition of parameters for skeleton study in pikeperch	10	21	30/11/2014	Yes	30/11/2014	Definitions and analytical parameters for skeleton studies have been included in the experimental protocols
27	Definition of methodology to study cost-be	13	4	30/11/2014	Yes	30/11/2015	

	nefit of grey mullet weaning studies						
28	Protocol for weaning meagre larvae	14	2	31/05/2015	Yes	16/05/2016	
29	Successful maturation and spawning of eastern Atlantic or Mediterranean Sea wild, F1 generation greater amberjack producing good quality eggs	15	2	31/05/2014	Yes	30/06/2014	Provision of eggs for larval nutrition and rearing experiments in Greece and Spain.
30	Successful maturation and spawning of eastern Atlantic or Mediterranean Sea wild, F1 generation greater amberjack	15	2	31/05/2015	Yes	30/06/2015	Egg production has been achieved in both Mediterranean and Atlantic broodstocks, as well as in F1 broodstocks in Y2
31	Protocol for tank design, lighting and probiotics of larval rearing of greater amberjack	15	2	31/05/2015	Yes	30/07/2016	
32	Successful maturation and spawning of eastern Atlantic or Mediterranean Sea wild, F1 generation greater amberjack	15	2	31/05/2016	Yes	30/06/2016	
34	Successful maturation and spawning of wreck fish to produce good quality eggs	6	8	30/04/2014	No	30/06/2014	Eggs were produced both in Greece and Spain, but their quality was poor and did not allow implementation of larval rearing experiments.
35	Successful maturation and spawning of wreck fish to produce good quality eggs	6	8	30/04/2015	Yes	30/06/2015	Eggs were produced both in Greece and Spain, and allowed a limited implementation of the larval rearing experiments.
36	Successful maturation and spawning of wreck fish to produce good quality eggs	6	8	30/04/2016	Yes	31/05/2016	Eggs were produced in Spain, and allowed a limited implementation of the larval rearing experi

							ments
38	Successful maturation and spawning of grey mullet broodstock to produce good quality eggs and larvae	19	4	30/08/2014	Yes	31/10/2015	Millions of eggs of high quality were produced, allowing the start of larval rearing experiments.
39	Successful maturation and spawning of grey mullet broodstock to produce good quality eggs and larvae	19	4	30/08/2015	Yes	31/10/2015	
42	Results on feeding stimuli of meagre	20	3	01/06/2015	Yes	01/06/2015	
43	First cage trials (different volume and light conditions) with meagre implemented	20	3	30/11/2015	Yes	01/12/2015	
44	Results on feed distribution method in cages with meagre	20	3	30/11/2015	Yes	01/12/2016	
45	Feeding pattern of greater amberjack fry available	21	1	31/08/2015	Yes	31/08/2015	
46	First results on optimum husbandry practice (thermal ranges, stocking density) of greater amberjack	21	1	31/03/2016	Yes	31/03/2016	
47	First experiment on cage culture condition (net volume, cage type) of greater amberjack implemented	21	1	31/05/2016	Yes	01/09/2016	
48	Experiment on the definition of optimal conditions for pikeperch on growing implemented	22	16	31/05/2016	Yes	31/05/2016	
50	Experimental trials of grey mullet in the three locations implemented	23	4	28/02/2015	Yes	31/05/2016	

51	Design of primers for amplification of meagre target gene DNA sequences	24	5	30/11/2014	Yes	30/11/2014	
52	Grow-out of larvae and collection of samples from immune ontogeny time-line	24	5	30/11/2015	Yes	30/11/2015	
53	Amplification and sequencing of target gene sequences from stimulated tissues	24	5	31/05/2016	Yes	31/05/2016	
58	Design of primers for amplification of greater amberjack target gene DNA sequences	25	5	31/05/2015	Yes	31/05/2015	
59	Successful Chlamydia screening and sequencing	25	5	31/05/2016	Yes	01/05/2016	
60	Samples collected from stimulated primary cultures/explants, ready for immune gene expression analysis	25	5	31/05/2016	Yes	30/11/2015	PhD student Douglas Milne of P5. UNIABDN visited P1. FCPCT in November 2015 to undertake the work
61	Ideas for new products	28	1	31/05/2015	Yes	21/07/2015	
62	Optional physical new products	28	1	31/03/2016	Yes	19/04/2016	
63	Insights in the consumer and B2B market for cultured fish	29	1	30/11/2014	Yes	30/11/2014	
64	Selection of new products, with good sensory perception	29	1	31/05/2016	Yes	30/07/2016	
70	Agreement on project logo for website and publications, this will provide a recognizable image of DIVERSIFY	31	1	01/06/2014	Yes	01/06/2014	
71	Design and printing of project brochure	31	18	01/06/2014	Yes	24/06/2014	

	(hard-copy) including the project logo, inserts with project						
72	Agreements with food industry and consumers associations for web linkage	31	18	31/08/2014	Yes	20/11/2014	Considerable difficulties have been faced in reaching an agreement with the organizations proposed in the DOW.
6	Periodic Report (Mo13-30) to DG RTD, including financial and administrative reports	1	1	31/05/2016	Yes	29/07/2016	
7	Annual coordination meeting (Y4)	1	1	30/11/2016	Yes	18/01/2017	P3. IRTA, Barcelona, Spain
8	Annual coordination meeting (Y5)	1	1	30/01/2018	Yes	23/01/2018	P8. IEO and P15. ULL, Tenerife, Spain
24	Influence of salinity or temperature on LC-PUFAs synthesis in pike perch	10	21	30/11/2016	Yes	30/11/2016	
25	Ranges of digestive enzymes activities in Atlantic halibut	11	7	31/08/2016	Yes	31/08/2016	
26	Obtain viable gametes (oocytes and sperm) for larvae production in wreckfish	12	19	31/08/2016	Yes	31/08/2016	The egg production is still not optimal, and we have low fertilization and survival in the embryos, hindering some of the larval rearing experiments
33	Successful maturation and spawning of eastern Atlantic or Mediterranean Sea wild, F1 generation greater amber jack	15	2	31/05/2017	Yes	18/06/2017	
37	Successful maturation and spawning of wreckfish to produce good quality eggs	6	8	30/06/2017	Yes	06/03/2017	Eggs were produced both in Spain and Greece, but allowed only a limited implementation of the larval rearing experi

							ments
40	Successful maturation and spawning of grey mullet broodstock to produce good quality eggs and larvae	19	4	30/08/2016	Yes	30/09/2016	
41	Successful maturation and spawning of grey mullet broodstock to produce good quality eggs and larvae	19	4	30/08/2017	Yes	20/09/2017	
49	First trial with different strains of pikeperch implemented	22	16	30/11/2017	No	31/05/2018	It was not possible to have juveniles of different geographic origins and domestication levels due to a total loss of larvae by a Rhabdovirus occurrence in April 2016 in the URAFFPA facilities. Therefore, the in vivo experiment for this task has just started in October 2017, and will last 3 months.
54	Completion of challenge and collection of samples for study of immune gene modulation	24	5	30/11/2016	Yes	30/11/2016	
55	Complete preparation of cDNA synthesis from all meagre samples	24	5	31/05/2017	Yes	31/05/2017	
56	Complete gene expression analysis of immune ontogeny	24	5	31/05/2017	Yes	31/05/2017	
57	Complete genes analysis for immune stimulus/response	24	5	31/10/2017	Yes	31/10/2017	
65	Intrinsic and extrinsic attributes related to the new products	29	11	30/11/2016	Yes	30/11/2016	
66	Communication concept	29	11	31/08/2017	Yes	31/08/2017	



	for behavioral change to cultured fish						
67	Business models to market the new products	30	10	30/11/2017	Yes	31/10/2017	The work is in progress, but with some delays
73	Agreement on the Promotional workshop (1st) program	31	18	01/07/2016	Yes	01/07/2016	It was agreed by the association partners to organize the workshop during the spring /autumn seasons (out of high sales periods) to have more audience for the events
74	Agreement on the Promotional workshop (2nd) program	31	18	01/07/2016	Yes	01/06/2016	It was agreed by the association partners to organize the workshop during the spring /autumn seasons (out of high sales periods) to have more audience for the events
75	Agreement on the Promotional workshop (3rd) program	31	18	31/05/2017	Yes	01/11/2017	It was agreed by the association partners to organize the workshop during the spring /autumn seasons (out of high sales periods) to have more audience for the events
76	Agreement on the Promotional workshop (4th) program	31	18	30/11/2017	Yes	10/05/2018	
9	Final coordination meeting	1	1	30/09/2018	Yes	22/11/2018	Brussels, Belgium
10	Periodic Report (Mo30-48) to DG RTD, including financial and administrative forms	1	1	30/11/2018	Yes	21/01/2018	
11	Periodic Report (Mo49-60) to DG RTD, including financial and administrative forms	1	1	30/11/2018	Yes	31/01/2019	
12	Final report to DG RTD	1	1	30/11/2017	Yes	31/01/2019	
68	Business models to market the new products	30	10	31/05/2018	Yes	30/11/2018	

69	Marketable new products	30	10	30/11/2018	Yes	30/11/2018	
77	Agreement on the one-day State-of-the-art seminar program for meagre	31	3	31/12/2017	Yes	18/01/2018	The dates were confirmed during the ACM 2018 meeting
78	Agreement on the one-day State-of-the-art seminar program for greater amberjack	31	1	31/12/2017	Yes	18/01/2018	The dates were confirmed during the ACM 2018 meeting
79	Agreement on the one-day State-of-the-art seminar program for pike perch	31	9	31/01/2018	Yes	18/01/2018	The dates were confirmed during the ACM 2018 meeting
80	Agreement on the one-day State-of-the-art seminar program for Atlantic halibut	31	7	31/01/2018	Yes	18/01/2018	The dates were confirmed during the ACM 2018 meeting
81	Agreement on the one-day State-of-the-art seminar program for wreck fish	31	8	28/02/2018	Yes	18/01/2018	The dates were confirmed during the ACM 2018 meeting
82	Agreement on the one-day State-of-the-art seminar program for grey mullet	31	4	31/03/2018	Yes	18/01/2018	The dates were confirmed during the ACM 2018 meeting

#### **4. Explanation of the use of the resources**

The **explanation on the use of resources** was removed from the scientific periodic reports in SESAM. These details now have to be entered in the cost statement forms in FORCE instead.

<b>Attachments</b>	4th PR DIVERSIFY 20190125.pdf
<b>Grant Agreement number:</b>	603121
<b>Project acronym:</b>	DIVERSIFY
<b>Project title:</b>	Exploring the biological and socio-economic potential of new/emerging candidate fish species for the expansion of the European aquaculture industry
<b>Funding Scheme:</b>	FP7-CP-TP
<b>Project starting date:</b>	01/12/2013
<b>Project end date:</b>	30/11/2018
<b>Name of the scientific representative of the project's coordinator and organisation:</b>	Dr. Constantinos Mylonas HELLENIC CENTRE FOR MARINE RESEARCH
<b>Period covered - start date:</b>	01/12/2017
<b>Period covered - end date:</b>	30/11/2018
<b>Name</b>	
<b>Date</b>	08/02/2019

This declaration was visaed electronically by Constantinos MYLONAS (ECAS user name nmylocon) on 08/02/2019