



*Workshop: EUSAIR Pillar I: Innovation for Sustainable Blue Economy
MED MRS Week 2022 Slovenia*

**The BLUE BIO MED Project: promoting
sustainability, diversification and
competitiveness in the fisheries and aquaculture
sectors with a transnational approach**

23. September 2022

Riccardo Priore



BLUE BIO MED - MEDITERRANEAN INNOVATION ALLIANCE FOR SUSTAINABLE BLUE ECONOMY

BLUEBIOMED (September 2020- September 2022) is a strategic project co-financed by the Interreg Mediterranean Programme that supports the better governance of blue bioeconomy innovation policies from three points of view:

- **Orienting** the objectives of the innovation policy in the direction pointed by UN **Agenda 2030 Sustainable Development Goals (SDGs)**;
- **Ensuring coherent frameworks** for actions at different level of government and territorial scales, aligning different sectoral and thematic policies, ensuring that short term actions are supportive of long-term development goals;
- **Improving inclusiveness** and openness of the quadruple helix (QH) actors.



DURATION



BUDGET



CONSORTIUM

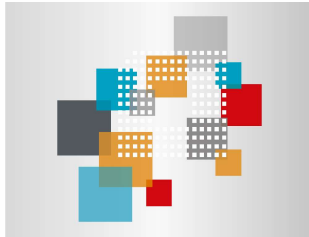
11 members
9 countries



The Malta Council for Science & Technology



THE CONTRIBUTION OF THE PATLIB NETWORK



Building C1, Campus Padriciano - TRIESTE



THE CONTRIBUTION OF THE NATIONAL INSTITUTE OF OCEANOGRAPHY AND APPLIED GEOPHYSICS OGS



THE CHALLENGE

[According to the Food and Agriculture Organization](#) of the United Nations (FAO), **global seafood consumption** has more than **doubled over the past 50 years**, driven by multiple factors including **population growth**, rising **incomes**, and major **transformations in fish production**.

Aquaculture, which already represents more than 50% of consumption globally, is **the fastest-growing food sector** and may represent [more than 63%](#) of fish production by 2023.

While the growth of the aquaculture industry will be vital to support future protein demand, intensification of **aquaculture poses challenges to the quality of its products and the environmental impact** of its production processes. Moreover, consumers demand **greater transparency of and visibility into the overall production** of products, which is an additional challenge given the historic reputation of aquaculture's potential environmental impacts.

Increased attention to value chains from primary stakeholders, corporate bodies, and governments has important implications for improving the environmental and social outcomes from aquaculture practices associated with evolving standards.



TODAY AGENDA

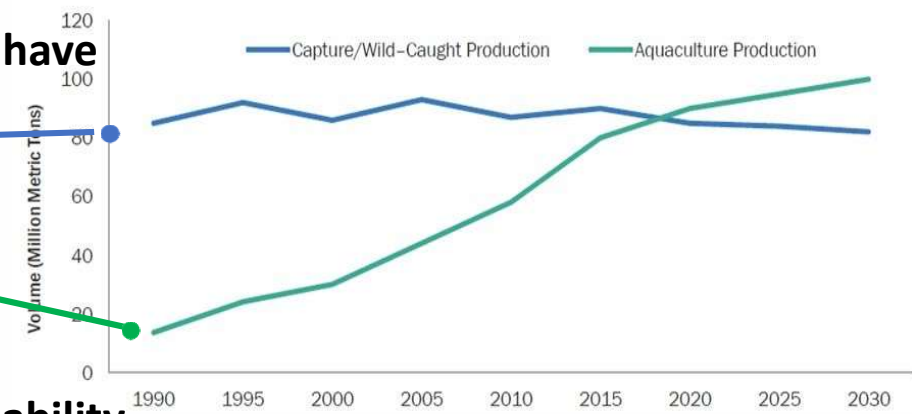
- Overview of the main results from the Blue Bio Med analysis, focusing on the Fishery and Aquaculture sectors and technologies.
- Potential improvements, as suggested by an independent analysis regarding the Fishery and Aquaculture sectors.
- Examples of ICT patent applications driven implementations specific for the marine/submarine environment.



Fishery and aquaculture



Nevertheless fishery and aquaculture have very distinct patterns and issues: fisheries is worldwide declining in production, aquaculture is strongly increasing



For both there are issues related to sustainability but in quite different aspects:

-FISHERY: is suffering because of general **overcapacity and overfishing**, there is great need to control exploitations through strong management to avoid overexploitation. This implies to **not increase exploitation but increase sector EFFICIENCY** (e.g., reduction of costs), increase **SELECTIVITY** (e.g., less waste), improving technological activities after catch operations.

-AQUACULTURE: the trend is improving, but needs to **avoid ecological IMPACTS**, and this is pursued through **REPLACEMENT of FISH PROTEINS** in feed, **improved rearing technologies and rearing of low trophic level species**.



Technology and Market Forecast



D.3.2.3 Technology and market forecast

Fishery and Aquaculture

Pelagic and Demersal Large-Scale Fisheries (LSF) and Distant Water Fleet (DWF)

Small Scale Fishery (SSF)

Marine Finfish aquaculture (MFA)

Shellfish aquaculture (SA)

Seafood processing and trade



Blue biotechnologies

Healthcare and Pharmaceutical applications

Agriculture, Livestock, Food processing

Industrial Processes and Manufacturing

Biofuel

Biomonitoring and Bioremediation



Blue sustainable development

Monitoring and Observing systems for marine environment

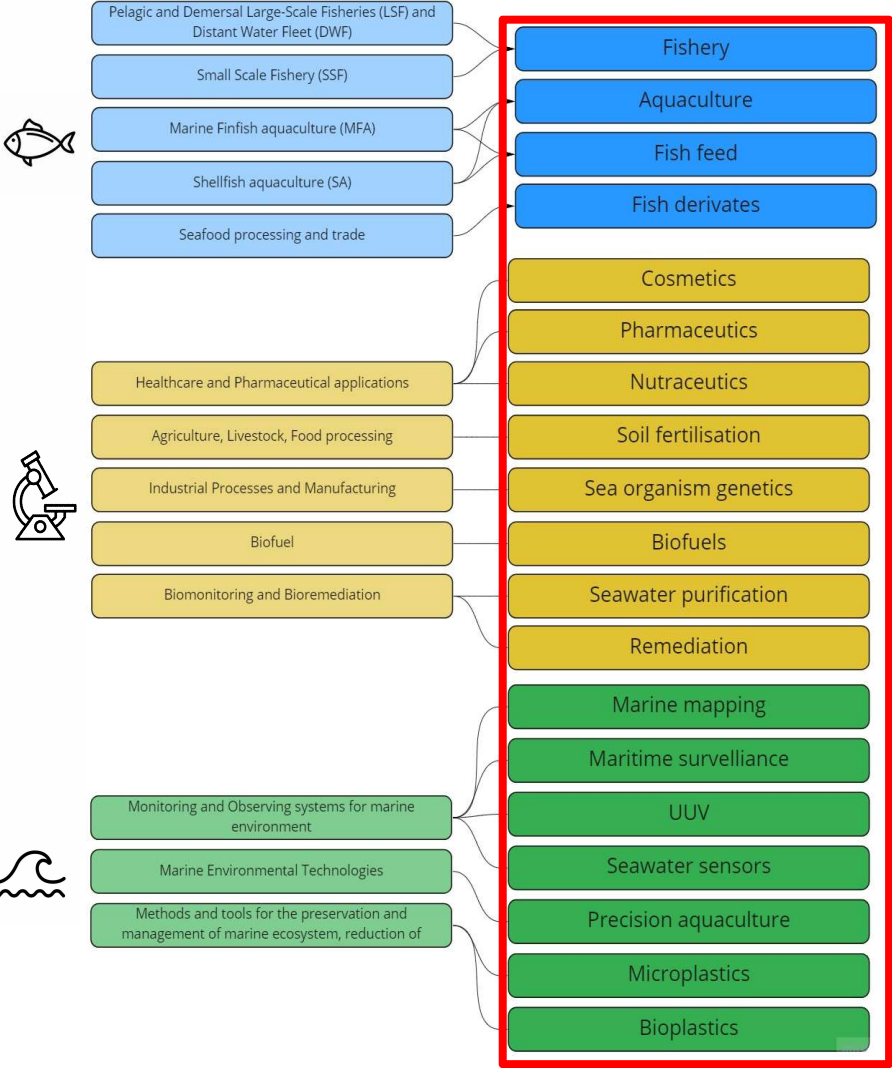
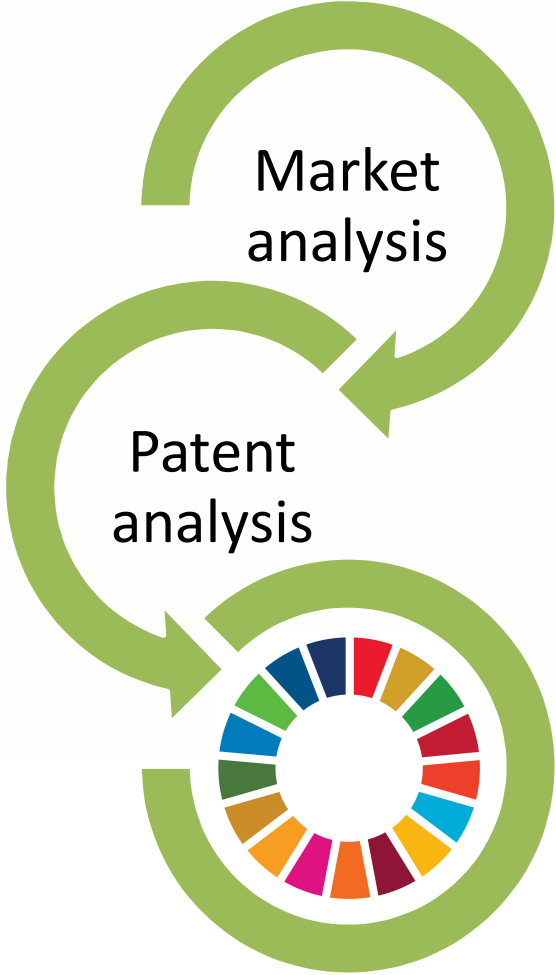
Marine Environmental Technologies

Methods and tools for the preservation and management of marine ecosystem, reduction of anthropogenic pressure

miro



Investigated technologies



Investigated technologies



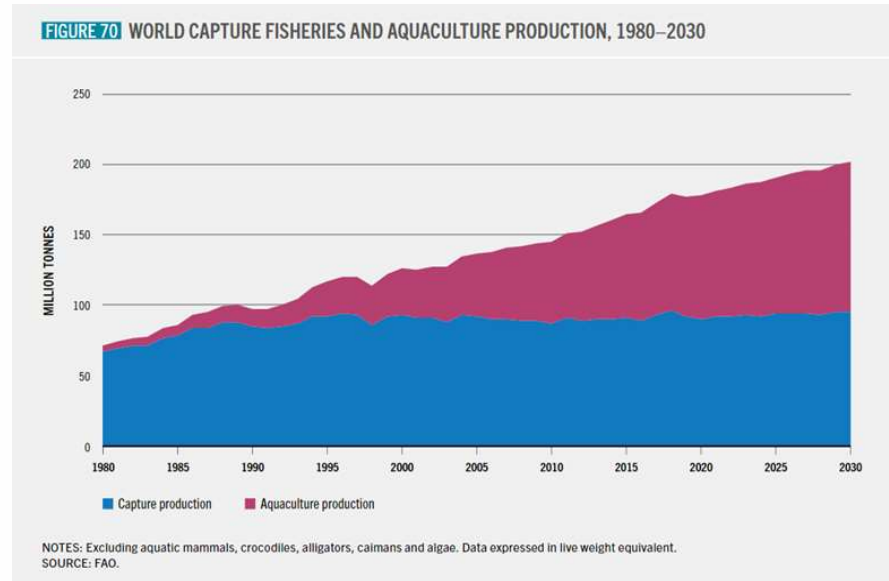
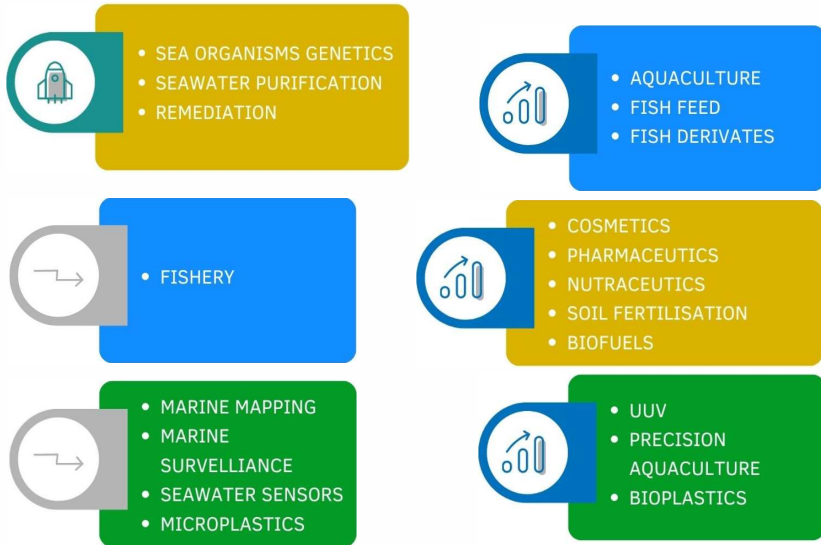
THE PATENT SEARCH CRITERIA

The selection of the patent documents has been performed using the database Orbit Intelligence (see also the report “How to read this document “and the chapter “References”). The queries are listed in the following table:

	Dataset	Orbit query (FamPat collection)	ND Patent families	Applications
Blue Biotechnology	Cosmetics	(+ALGA+ OR SEA WEED+)/TI/AB/CLMS/ADB/ICLM/KEYW AND (A61K-036/02 OR A61K-036/03 OR A61K-036/04 OR A61K-036/05)/IPC/CPC (A61K-008 OR A61Q-019 OR A61P-017)/IPC/CPC ((SEA OR MARIN+ OR MARITIM+)) /TI/AB/CLMS/ADB/ICLM/KEYW 2 AND 3 1 AND 4	833	2778
	Pharmaceutics	((DRUG+ OR ANTI_MICROB+ OR BIO_POLIM+ OR ENZYM+ OR MEDICAMENT+) 5D (SEA+ OR MARIN+ OR	191	433



Market analysis: overview



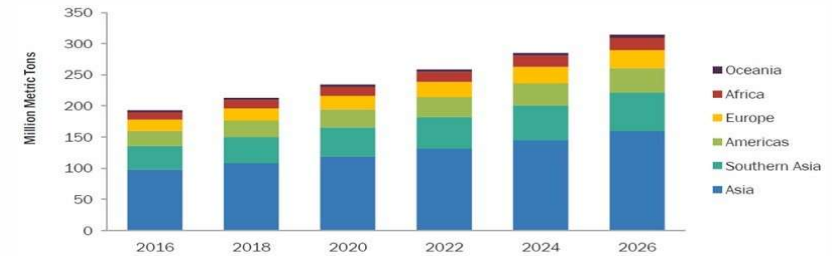
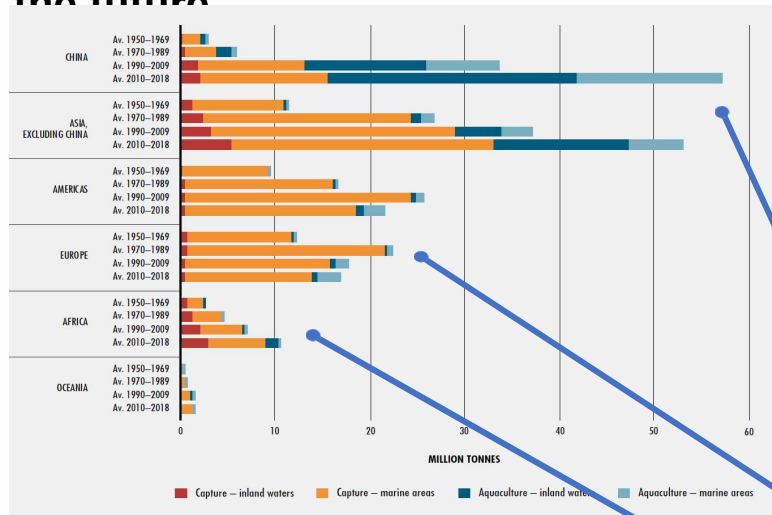
World capture fishery and aquaculture production, 1980-2030

FAO. 2022. *The State of World Fisheries and Aquaculture 2022. Towards Blue Transformation*. Rome, FAO. <https://doi.org/10.4060/cc0461en>



Fishery and aquaculture

The consumption of marine products from fishery and aquaculture is growing in time and this positive trend is expected to grow in the future



Analysis of production by country vs consumption by country highlights:

- Countries highly dependent on seafood;
- Countries increasing market demand;
- Main producers;

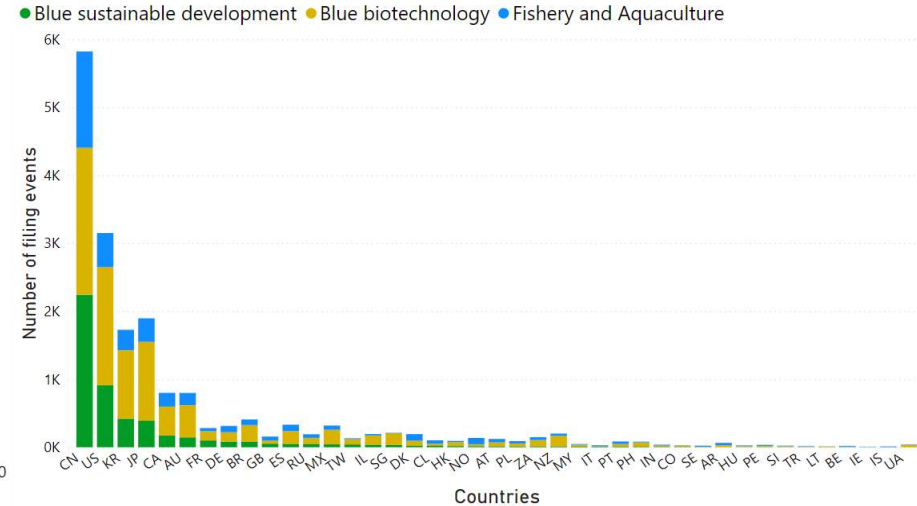
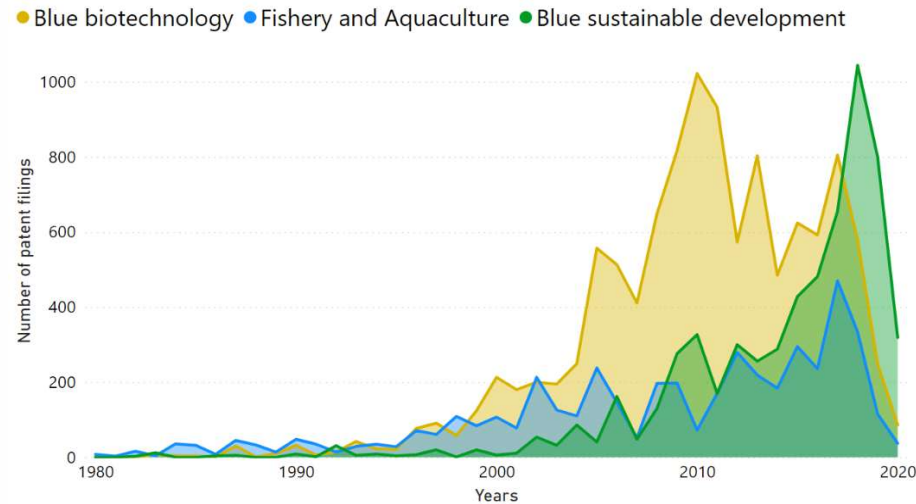
Insights:

- China and Asia are the main global producers esp. for aquaculture
- Europe is a net importer (especially of aquaculture products)
- Africa has large potential

Source: FAO, SOFIA, 2020



Patent analysis: overview



Patent filing events are mainly associated with innovation technologies related with the *Blue biotechnology* and *Blue sustainable development* sectors

The Chinese patent office (CNIPA/SIPO) scores the highest number of filings in the three sectors

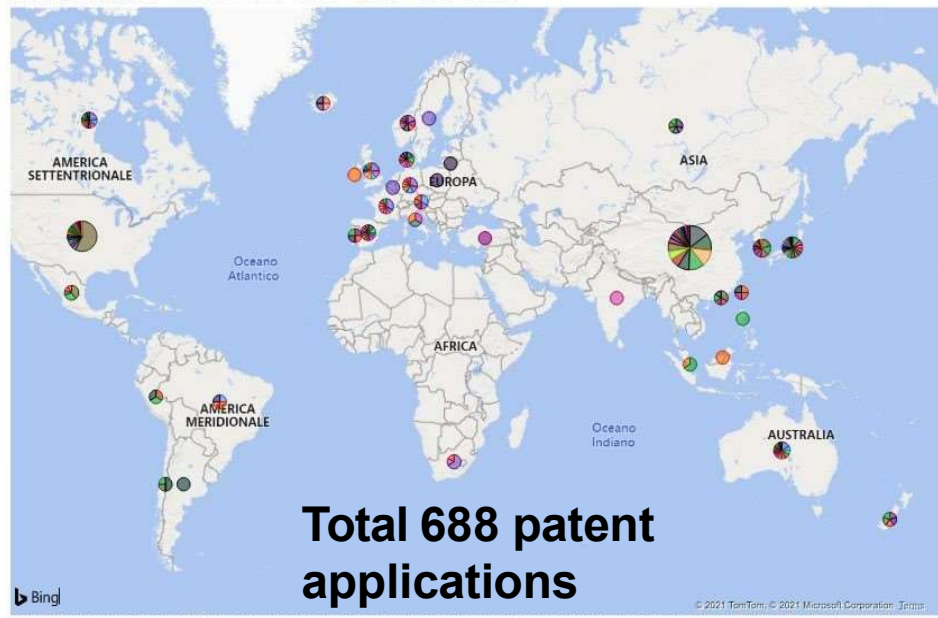


Fishery and aquaculture

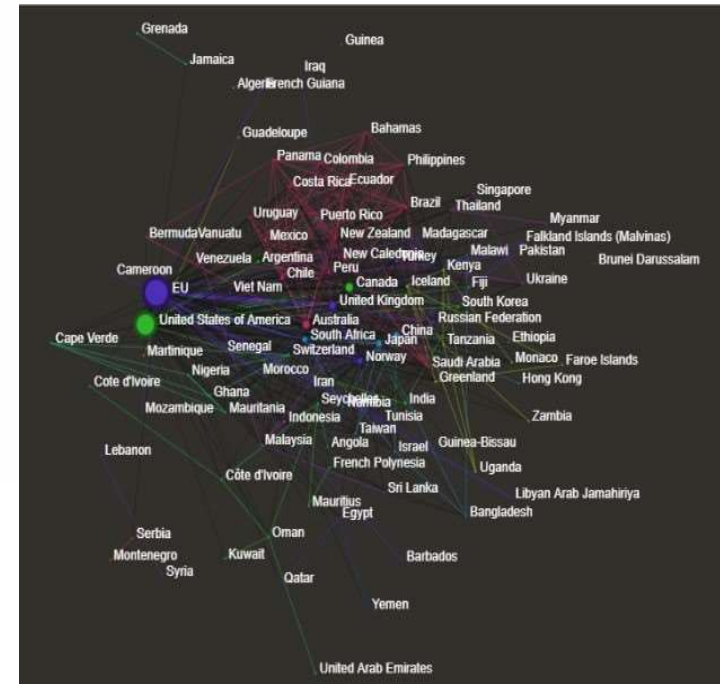
PATENT ANALYSIS: Relevant impact on the commercialization of innovative technical solutions on fisheries sector regard especially territories such as the USA or China

Nr. of filing events partitioned according to the earliest filing year (EP and PCT not included):

earliest_filing_year ● 2015 ● 2016 ● 2017 ● 2018 ● 2019 ● 2020



NPL ANALYSIS: Other divulgation modalities (such as the scientific publications, the books, the reviews, funded projects etc) showed a relevant proportion of attention being concentrated in the EU countries.



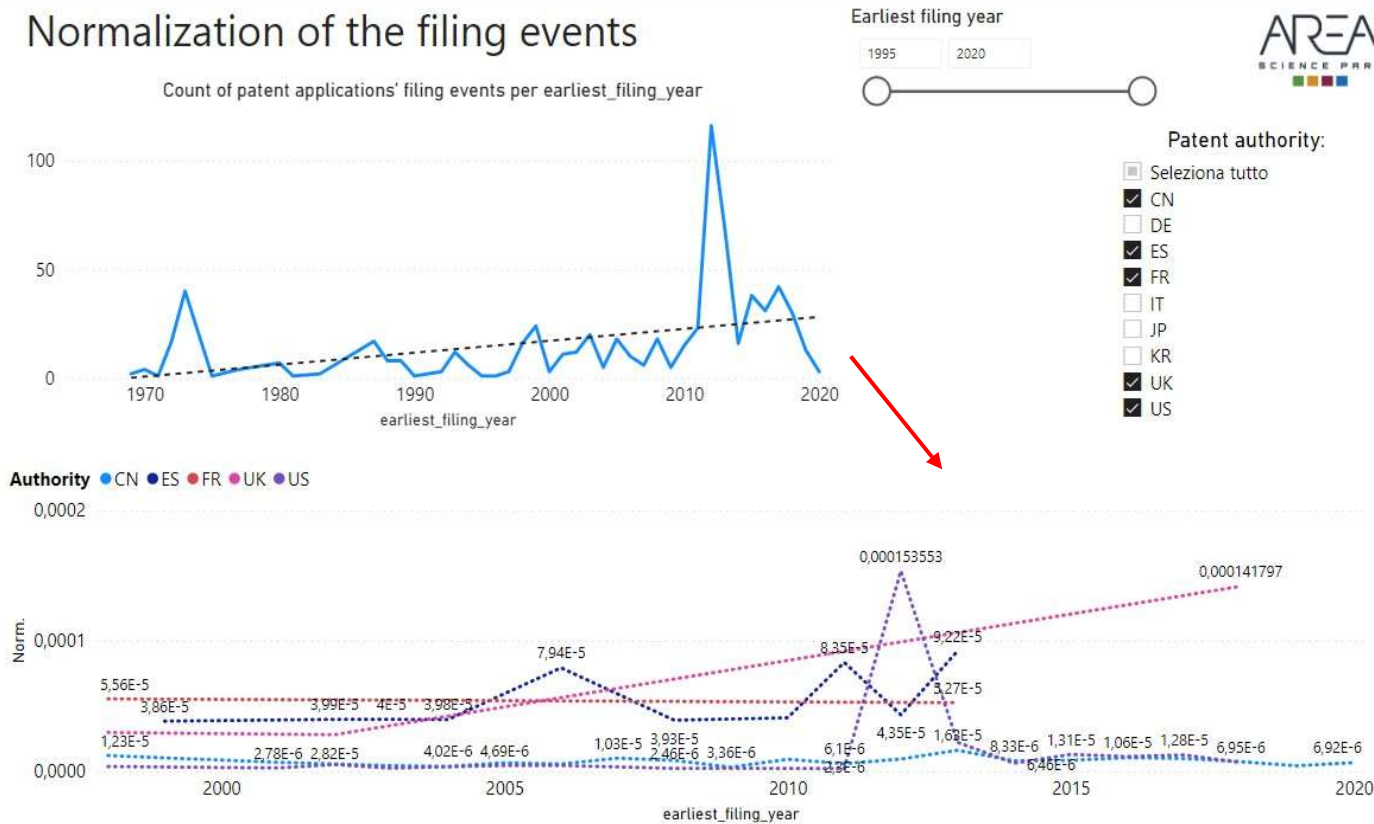
Fishery and aquaculture

I.a Fisheries: Pelagic and Demersal Large-Scale Fisheries (LSF) and Distant Water Fleet (DWF)

Players to be monitored: example
THE NEW ZEALAND INSTITUTE FOR
PLANT AND FOOD RESEARCH (NZ)

Apparatus and method for
harvesting aquatic animals

Normalization of the filing events



Patent Application Publication Sep. 18, 2014 Sheet 23 of 29 US 2014/0259861 A1

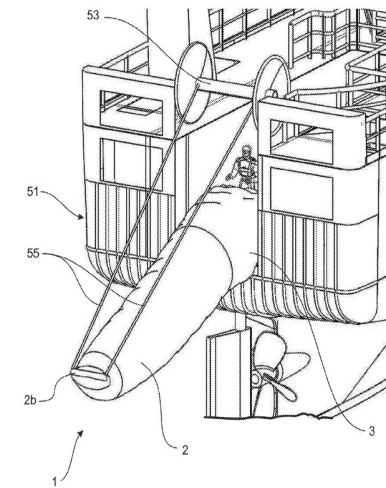


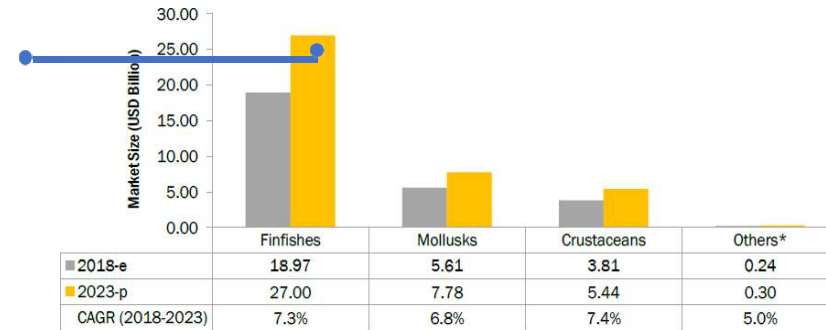
FIGURE 24



Fishery and aquaculture

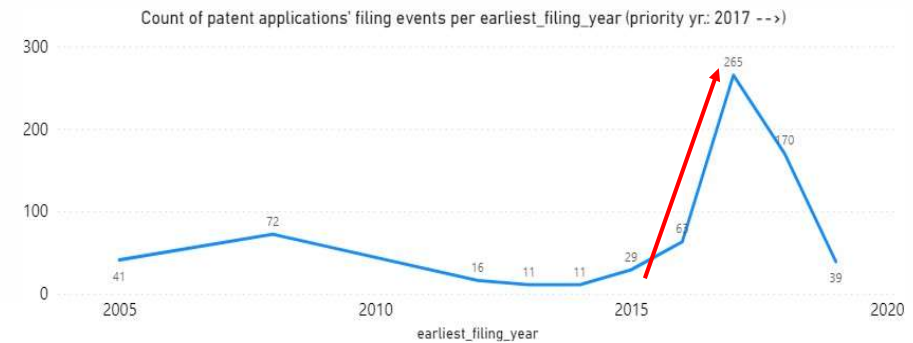
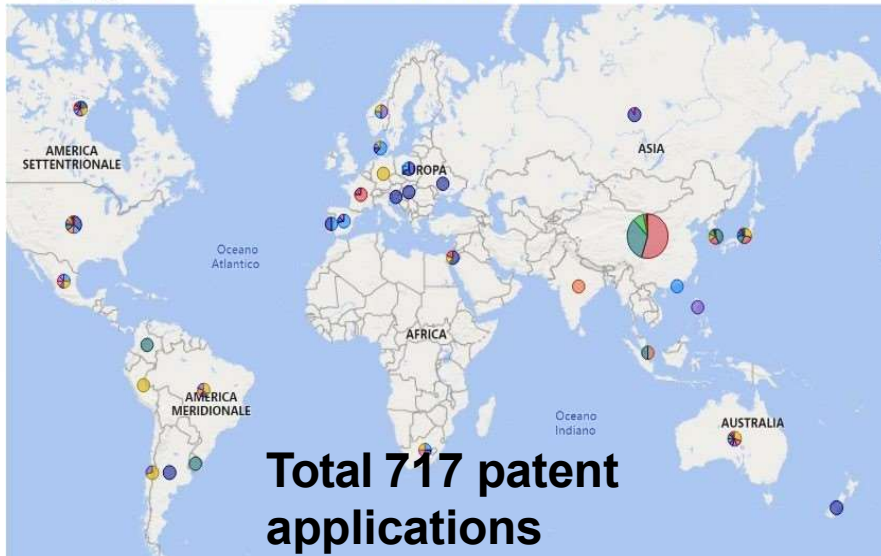
I.b Aquaculture: Marine Finfish aquaculture (MFA) and Shellfish aquaculture (SA)

Market demand for products is robustly forecasted as increasing in the next future. After a period of recession, after yr. 2015 there was a relevant positive trend in patent applications filed to European authorities.



Nr. of filing events partitioned according to the earliest filing year (EP and PCT not included):

earliest_filing_year ● 2005 ● 2008 ● 2012 ● 2013 ● 2014 ● 2015 ● 2016 ● 2017 ● 2018 ● 2019

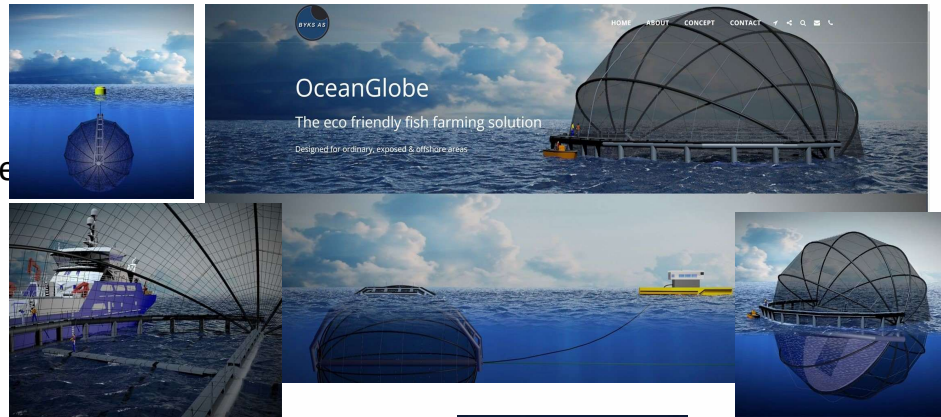


Fishery and aquaculture

I.b Aquaculture: Marine Finfish aquaculture (MFA) and Shellfish aquaculture (SA)

Players to be monitored. Example 1: BYKS AS (NO)

OceanGlobe is a globular fish farming construction designed to be used in both ordinary, exposed and offshore locations. Developed for farm fish in exposed and offshore areas. Flexible anchoring, working platform, continuous centre pole, can be emerged and submerged, elevate and submerge the complete fish farm, rotation (also for easy cleaning). Volume of about 40,000 m³, for fish farming but also for storage and transportation of wild fish.



Example 2: HAUGE AQUA (NO)

Egget is sheltered workplace addresses health and safety for the staff by eliminating many high-risk operations. The water intake is located at the bottom of the unit.



Fishery and aquaculture

I.c Fish meal

PATENT ANALYSIS: large number of patents, great importance of European countries and in particular France (largest in EU) with several companies.

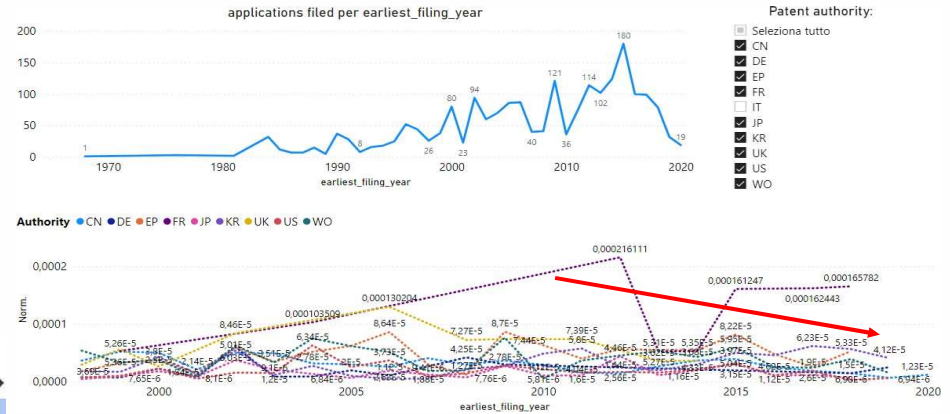
In the last decade slightly declining in EU.

Nr. of filing events partitioned according to the earliest filing year (EP and PCT not included):

earliest_filing_year ● 1968 ● 1976 ● 1981 ● 1984 ● 1985 ● 1986 ● 1987 ● 1988 ● 1989 ● 1990 ● 1991 ● 1992 ● 1993



Total 2037 patent applications



- Several patent applications referring to:
 - substances helpful to reinforce the fish skeleton
 - vitamins to be used in aquaculture applications
 - use of microalgae or other products for animal feed production



Fishery and aquaculture

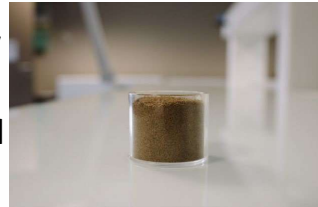
I.c Fish meal

Players to be monitored: example YNSECT (FR)

Ynsect uses pioneering proprietary technology protected globally by c.300 patents to produce Molitor and Buffalo mealworms in vertical farms.



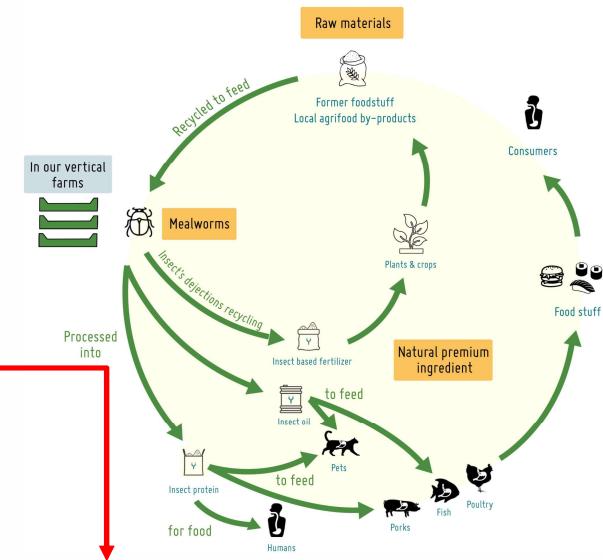
Ynmeal is an ingredient naturally rich in highly digestible proteins (more than 70%). Formulated with Molitor larvae, and produced in powder form, Ynmeal is perfectly suitable for the nutrition of farmed fish and shellfish. It is used at a level of 5 to 30% in the formulation of nutritional rations



Ynoil is a light oil, rich in polyunsaturated fatty acids, extracted by a mechanical process from Molitor larvae. Ynoil is perfectly adapted to the diet of farmed fish and shellfish



YNSECT CIRCULAR MODEL



(19) RÉPUBLIQUE FRANÇAISE
 INSTITUT NATIONAL
 DE LA PROPRIÉTÉ INDUSTRIELLE
 COURBEVOIE
 (11) N° de publication : **3 087 092**
 (à n'utiliser que pour les
 commandes de reproduction)
 (2) N° d'enregistrement national : **18 59486**
 (6) Int. CIP : A 23 K 50/00 (2019.01), A 23 K 10/20

(12) **BREVET D'INVENTION** B1

(54) POUDRE D'INSECTES POUR EVITER UNE DEFORMATION SQUELETTIQUE D'UN POISSON ET/OU RENFORCER LA SOLIDITE D'UNE ARETE DE POISSON PENDANT L'ELEVAGE.

(22) Date de dépôt : 12.10.18.

(30) Priorité :

(60) Références à d'autres documents nationaux apparentés :

Demande(s) d'extension :

(71) Demandeur(s) : YNSECT Société par actions simplifiée — FR.



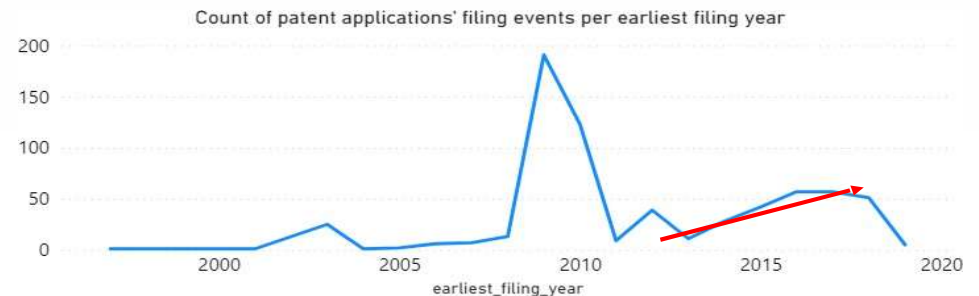
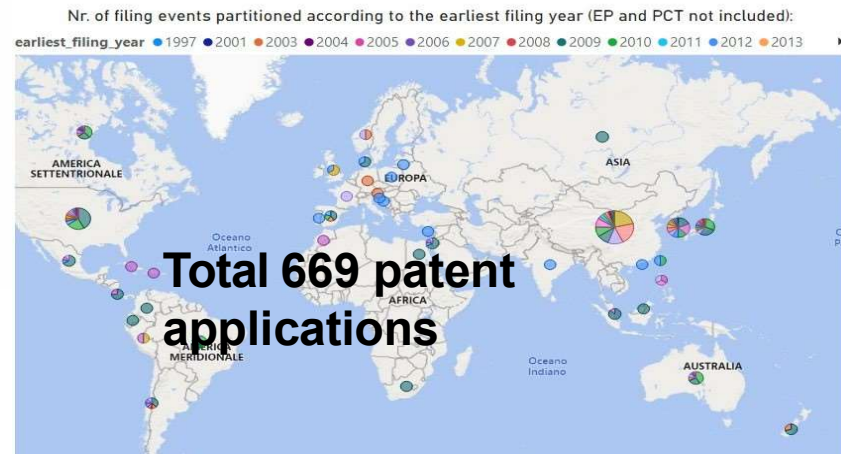
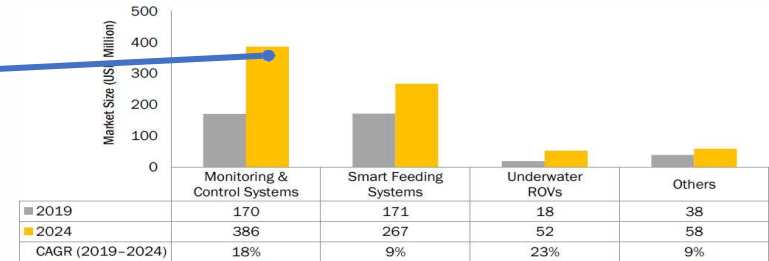
Fishery and aquaculture

III.d Precision aquaculture

Precision aquaculture market is increasing.

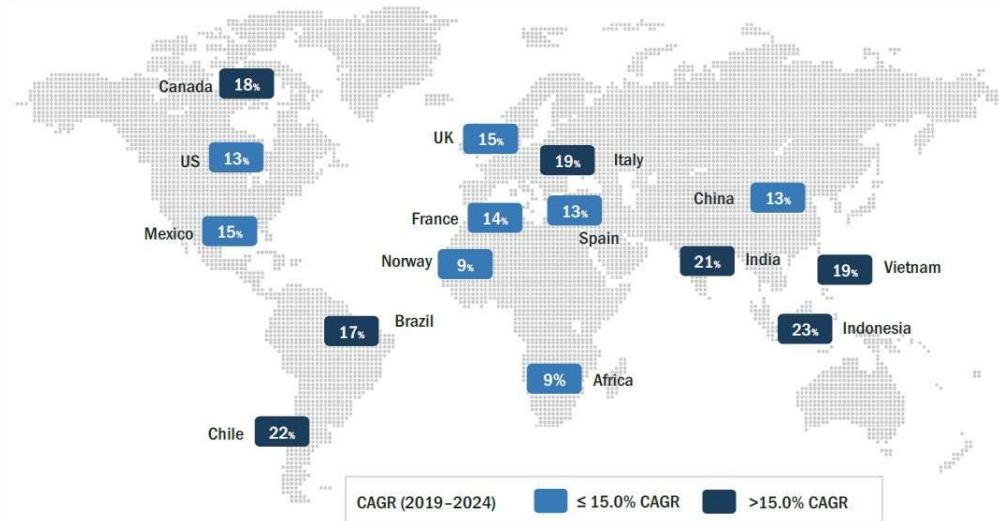
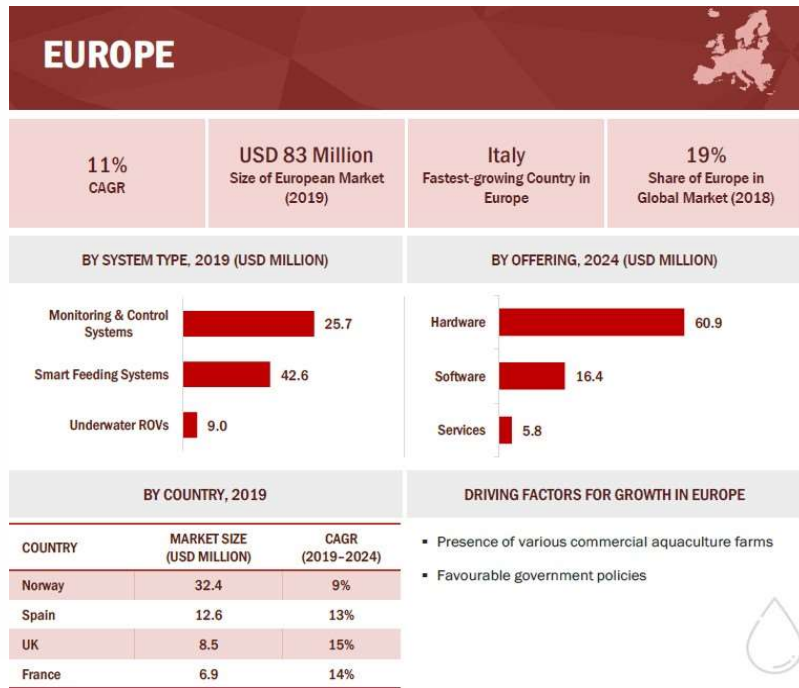
PA market include adoption of advanced technologies such as Internet of Things (IoT), remotely operated vehicles (ROVs), and artificial intelligence (A.I.) in aquaculture farms.

- Growing investments for adoption of innovative devices;
- Rising demand for protein-rich fish feed (smart feeding);
- Increasing worldwide the governments' support.



Fishery and aquaculture

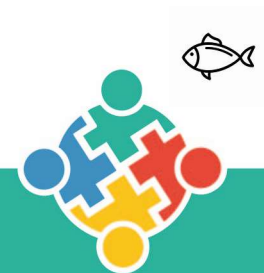
III.d precision aquaculture



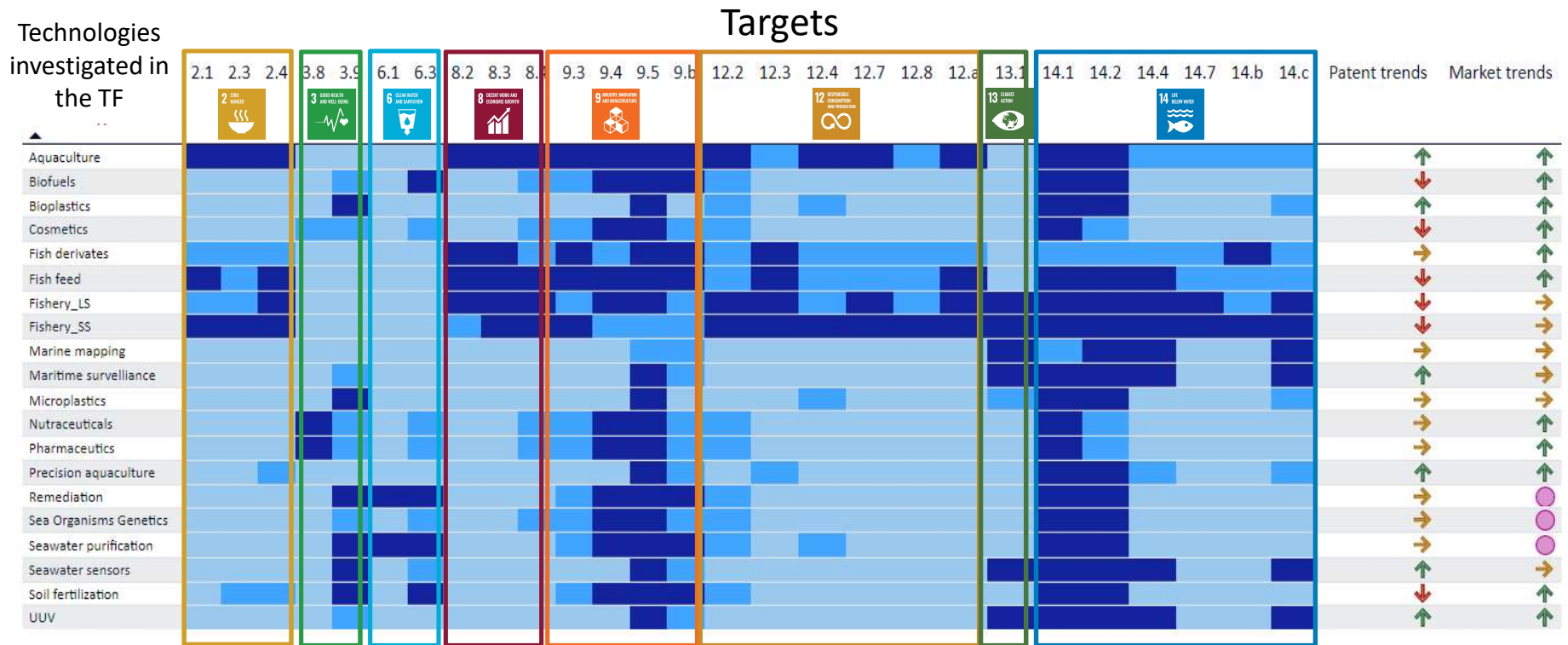
Technology and Market Forecast and alignment with SDGs






17 Goals
169 Targets
247 Indicators



Technologies investigated and SDGs



Legend:

- strong impact 
- weak impact 
- not assessed 

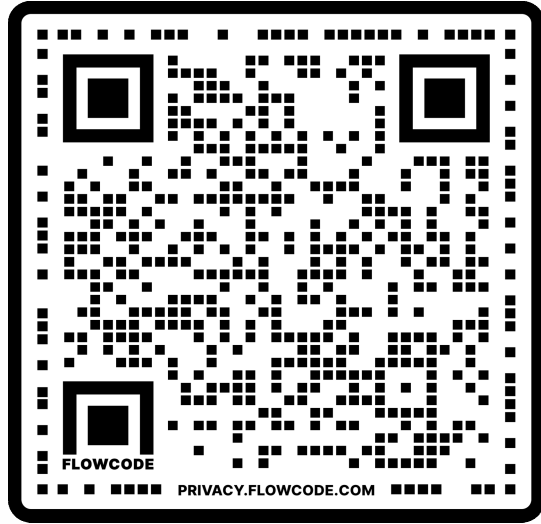


Players to be monitored:

- **BYKS** ([BYKS AS - OceanGlobe](#))
- **THE NEW ZEALAND INSTITUTE FOR PLANT AND FOOD RESEARCH** ([Seafood Technologies: Plant & Food Research \(plantandfood.co.nz\)](#))
- **XYLECO** (<https://www.xyleco.com/impacts/>)
- **DSM NUTRITIONAL PRODUCTS** (<https://www.dsm.com/corporate/about/businesses/dsm-nutritional-products.html>)
- **KIVERDI, Inc.** (<https://www.kiverdi.com/>)
- **HAUGE AQUA** (<https://haugaqua.com/>)
- **GENOCEAN** (<https://opencorporates.com/companies/fr/518466305>)
- **KRAFT FOODS** (<https://www.kraftheinzcompany.com/>)
- **TRUE ORGANIC PRODUCTS Inc.** (<https://true.ag/>)
- **MARINE TECHNO**
(https://marinetechno.tradekorea.com/main.do;JSESSIONID_TK=8Uhw6vu8rUdNcBeZ69A0fVM2saYlCu5o-nCmEkic_0057K206CRk!-798423004!1742867100)
- **NESTEC** (<https://www.eitfood.eu/partners/partner/nestec>)
- **YNSECT** ([Ynsect, Premium Natural Feed](#))
- **ADISSEO** ([Nutrition animale | Adisseo](#))
- **FERMENTALG** ([Home - Fermentalg - Algae you can trust](#))
- **NIREUS AQUACULTURE** ([Homepage | NIREUS AQUACULTURE](#))



D.3.2.3 Technology and Market Forecast



Interreg Mediterranean BLUE BIO MED

TECHNOLOGY AND MARKET FORECAST

FACTSHEET #1 FISHERIES & AQUACULTURE

Within the BLUEBIO MED project, the "Fisheries and Aquaculture" sector encompasses 5 subsectors. The activities analysed in the report span from the harvesting of renewable biological resources, their conversion into food, feed, to bio-based products and their distribution along the supply chain. Among them, in this forecasting analysis 4 groups of relevant industrial technologies were investigated to detect innovation pathways throughout patent and market analysis.

Sectors, subsectors and technologies investigated in the report

Starting with the market analysis, it can be noticed that the market value for aquaculture products, fish feed alternatives and feed derivate applications has been steeply increasing in the last ten years whereas market value of wild fish capture has not been registering a similar increase in the same time span. On the contrary, there is a stable interest in wild fisheries products mainly related to the depletion of the natural fish stock caused by worldwide overfishing, mismanagements of the marine resources, climate change and other anthropogenic impacts on marine resources.

Looking at the patent analysis, since the year 2000 patent filings related to the innovation of the Fishery and Aquaculture sectors have steeply increased in particular since the year 2017 innovation revolving around new sustainable aquaculture installation and feed has gained momentum matching with its increasing market value as well. On the contrary, in the same timespan patent filings concerning fishery innovations have been decreasing due to the worldwide collapsing of natural wild stocks.

Filing events of patent applications in this sector are mainly registered by the Chinese patent authorities. At European level, the Spanish patent authorities registered the highest number of patent applications related to the sector followed by the German patent authorities (25 patent filings registered), the Austrian ones (10 filings) and French patent authorities (46 filings).

Finally, the Fishery and Aquaculture sector has got consistent dialogues with 4 SDGs. Starting with the environmental protection, this sector aligns its core mission with the Goal 14 "Life Below Water", which focuses specifically on the preservation of fishery and marine activities. However, the sector is relevant also for the achievement of SDGs not closely related to the marine environment highlighting its impact also on industry and society at large.

The "Technology and Market Forecast" report was developed by Area Science Park (www.area-sciencepark.it) in collaboration with the Istituto Nazionale di Oceanografia e di Geofisica Sperimentale - OGS (www.ogs.it). For a deeper insight into the "Technology and Market Forecast" report, please visit the following link BLUE BIO MED - Deliverables Database (interreg-med.eu).

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TECHNOLOGY AND MARKET FORECAST

FACTSHEET #2 BLUE BIOTECHNOLOGIES

The blue biotechnology sector includes the non-traditionally exploited groups of marine organisms and their commercial biomass applications. These organisms comprise macroalgae (seaweeds), microorganisms (microalgae, bacteria and fungi) and invertebrates (e.g., sea sponges, sea siphon). New commercial applications of these innovative biomasses are constantly under development. Hence, within the sector 5 subsectors were identified to explore the new application through the identification of 8 groups of relevant industrial technologies.

Sectors, subsectors and technologies investigated in the report

The market analysis highlighted that new technologies related to the extraction of high-value bioactive compounds for cosmetic, pharmaceutical and nutraceutical applications have a high market potential. More sustainable alternatives of marine-derived bioproducts are flourishing the markets especially as food supplement. Other innovative applications are also in the pipeline and show an increasing market value, such as the production of biomaterials or biofilm and new marine bioproducts use for fertilisation products. It is worth to be noticed that new markets are also emerging for the technologies based on the genomic information applied to the exploitation of the marine resources and bio-mitigation services based on marine biomass.

Considering the patent analysis, patent filings concerning innovative technologies for marine biomass valorisation are increasing from the beginning of the century. Technologies related to mitigation services, such as remediation and wastewater purification, are increasing in the decade 2010-2020. It is interesting to note that patents revolving around the production of biofilm, especially from algae, are decreasing since 2010 in contrast with their market trends.

The highest numbers of patent applications linked to the blue biotechnology sector concern the applications filed to the Chinese patent authority. In the European area, the national patent authority scoring the highest number of patent applications is the Spanish patent office, followed by the German (134 filing events) and French ones (136 filing events).

Finally, the blue biotechnology sector has consistent linkage with 4 SDGs. Each group of marine organisms, from bacteria to macroalgae, have potential for biotechnological valorisation which could improve the sustainability of several industries. The new solutions developed in the biomaterials field could also contribute to the Goal 4 "Clean water and sanitation", e.g. innovations derived from marine microorganisms could represent a better solution for the wastewater treatment. Moreover, the development of new products in nutraceutical, cosmeceutical and medical industries can boost the implementation of the Goal 3 "Good Health and Well-Being".

The "Technology and Market Forecast" report was developed by Area Science Park (www.area-sciencepark.it) in collaboration with the Istituto Nazionale di Oceanografia e di Geofisica Sperimentale - OGS (www.ogs.it). For a deeper insight into the "Technology and Market Forecast" report, please visit the following link BLUE BIO MED - Deliverables Database (interreg-med.eu).

Interreg Mediterranean BLUE BIO MED

TECHNOLOGY AND MARKET FORECAST

FACTSHEET #3 BLUE SUSTAINABLE DEVELOPMENT

The blue sustainable development sector gathers the external challenges that endanger the sustainability of the blue bioeconomy. Among them, the recent debate has mostly focused on the climate change and marine pollution, especially plastic pollution. Within this sector, 3 subsectors were identified and among them 7 groups of relevant technologies were analysed.

Sectors, subsectors and technologies investigated in the report

The market value for unmanned underwater vehicle (UUV), precision aquaculture and bioplastics is strongly increasing in the last decades whereas market value concerning microplastics mitigation, marine surveillance and mapping and water sensors is steady and does not register any relevant growing trend in the same period.

The patent analysis highlighted that patent filings revolving around the production of plastic from organic biomass is flourishing as well as technologies related to UUV, in line with their market trend. Additionally, advance monitoring systems such as seawater sensors are starting to gain momentum, contributing to assure in the years to come a deeper understanding of the marine ecosystems and improvement of its protection.

Globally, the Chinese patent authority scores the highest number of patent filings referred to the blue sustainable development sector. As far as the European area is concerned, the number of filing events is lower but still slowly increasing. French patent authorities registered the higher number of patent filings followed by German and Spanish offices with 83 and 82 registered events, respectively.

Finally, the blue sustainable development sector aligns with 4 SDGs. The progresses of the Goal 14 "Life Below Water" and Goal 13 "Climate Action" for a better use of seas and marine resources are closely linked to the project challenges, which are aimed to balance the economic, social, and environmental dimension for a sustainable development. Also, the marine natural capital of seas includes both living and non-living resources which are the source of marine ecosystem services. The ecosystem services are the benefits that people obtain from the marine ecosystems when functionalities are preserved. Ecosystem services deriving from marine ecosystems ensure a wider range of benefits encompassing health, economy, industrial development and leisure. For all these reasons, sustainable management of the marine areas could positively affect in multiple ways also Goals 3 "Good Health and Well-Being" and 9 "Industry, Innovation and Infrastructure".

The "Technology and Market Forecast" report was developed by Area Science Park (www.area-sciencepark.it) in collaboration with the Istituto Nazionale di Oceanografia e di Geofisica Sperimentale - OGS (www.ogs.it). For a deeper insight into the "Technology and Market Forecast" report, please visit the following link BLUE BIO MED - Deliverables Database (interreg-med.eu).

[Home](#) > [What we achieve](#) > [Deliverables database](#)

DELIVERABLES DATABASE



Fishery and Aquaculture: possible improvements

Sustainable sources of inputs

Replacing current production-limiting components with viable alternatives

Improving animal welfare

Promotes livestock immunocompetence and well-being, resulting in decreased animal stress and mortality

Reducing environmental impacts

Mitigating damage to water, land, and other ecosystem elements; includes reducing use of finite resources

Traceability and transparency

Achieves increased insight into and control over production processes as well as accountability

Source: Lux Research ([Lux Research \(luxresearchinc.com\)](http://luxresearchinc.com))



Fishery and Aquaculture: opportunities for sustainable innovation

FEED ALTERNATIVES

Refers to novel ingredients or production methods that **replace key macronutrients, with nonanimal-sourced alternatives**. These ingredients seek to promote **sustainable feed formulations** while delivering on cost, palatability, and performance compared with conventional sources, specifically fish meal and oil.

CULTIVATION SYSTEMS

Refers to the infrastructure used for aquaculture production. **Systems improve water quality, reduce energy consumption and resource use, and provide unique approaches to rearing multiple aquatic species simultaneously**. This area extends beyond on-land production to include offshore farming.

ANIMAL HEALTH

Intensification challenges the health of aquatic species. Farmers require **sustainable additives that enhance the immunocompetence of their stock**. While some solutions aim to **replace antibiotics**, most technologies are intended to **prevent disease** as well as promote feed conversion and growth in livestock.

MANAGEMENT & ANALYTICS

Technology that provides **real-time data acquisition and/or supports analytics to enable producers to make better farming and market decisions**. These systems fine-tune performance by **monitoring feeding, fish health, and environments as well as leverage data within transactions between sellers and buyers**.

Source: Lux Research ([Lux Research \(luxresearchinc.com\)](https://www.luxresearchinc.com))



Fishery and Aquaculture: opportunities for sustainable innovation

Feed alternatives

EMERGING TECHNOLOGY OPTIONS

Technology	Description
Plant-derived sources	Plant sources, such as barley and cottonseed meal, as well as recovered nutrients from food waste
Insect protein	Larvae feed on organic waste; black soldier fly larvae and mealworm larvae are the most relevant types of insects for aquaculture feed
Single-cell protein	Microorganisms, including bacteria, yeast, and other fungi, grown through fermentation; the microbes involved metabolize simple organic compounds that can be sourced from industrial emissions to promote commercial value
Algae	Photosynthetic organisms that, in the process of cultivation, use CO ₂ , water, and light to grow and produce biomass and algal oil

Source: Lux Research ([Lux Research \(luxresearchinc.com\)](http://luxresearchinc.com))



Fishery and Aquaculture: opportunities for sustainable innovation

Animal health

EMERGING TECHNOLOGY OPTIONS

Technology	Description
Functional ingredients	Any nutrient input fed to livestock to support health and performance; this includes probiotics, prebiotics, phytogenics, or other immune-boosting feed additives
Bacteriophages	Bacteriophages are viruses that target and kill specific bacteria or other microorganisms, such as fungi; phages may be naturally occurring or designed
Novel vaccines	Treatments designed to train the immune system to recognize and protect against specific pathogens or pathogen groups
Genetic stock improvement	Selective breeding and genomic selection improves disease resistance and other performance traits

Source: Lux Research ([Lux Research \(luxresearchinc.com\)](https://luxresearchinc.com))



Fishery and Aquaculture: opportunities for sustainable innovation

Cultivation systems

EMERGING TECHNOLOGY OPTIONS

Technology	Description
RAS (recirculating aquaculture systems)	Closed-loop system that requires extensive water treatment through biofiltration to reduce wastewater effluent volume and water-quality-related toxicity
Aquaponics	A hybrid approach that marries hydroponic plant production with fish production; nitrogen-rich fish waste is removed from the circulating system by plant roots
Emerging culture targets	The cultivation of aquatic plants and mollusks, particularly filter-feeding bivalves, provides a range of ecosystem services when conducted in open water
Offshore farming	Cultivation is carried out in an open ocean environment where cages can be floating, submersible, or moored in deep waters; otherwise, vessels can be used as a mobile production platform

Source: Lux Research ([Lux Research \(luxresearchinc.com\)](http://luxresearchinc.com))



Fishery and Aquaculture: opportunities for sustainable innovation

Management & analytics

As management & analytics solutions can leverage a wide range of sensing tools and devices for communication and connectivity, we break down the technology options by use-case: environmental, disease, feed, and supply chain.

EMERGING TECHNOLOGY OPTIONS

Technology	Description
Environmental management	Management solutions take many form factors, including sensors (e.g., radio-frequency identification tagging, computer vision, acoustic wave), AI, drones, robotics, and remote sensing, that typically connect with farms through satellites, Internet of Things, and mobile phones
Feed management	
Disease management	
Supply chain management	Includes e-commerce, in which transactions are carried out through an online marketplace , and ledger-based platforms, or distributed database technology that stores transactions by logging them in cryptographically linked blocks (e.g., blockchain)

Source: Lux Research ([Lux Research \(luxresearchinc.com\)](http://luxresearchinc.com))



Fishery and Aquaculture: opportunities for sustainable innovation driven by ICT patent applications

Management & analytics (ICT patent applications in general)

--IPC of ICT:

('F21H', 'F21K', 'F21L', 'F21S', 'F21V', 'F21W', 'F21Y', 'H01B', 'H01C', 'H01F', 'H01G', 'H01H', 'H01J', 'H01K', 'H01M', 'H01R', 'H01T', 'H02B', 'H02G', 'H02H', 'H02J', 'H02K', 'H02M', 'H02N', 'H02P', 'H02S', 'H05B', 'H05C', 'H05F', 'H99Z', 'G09F', 'G09G', 'G11B', 'H04R', 'H04S', 'H05K', 'G08C', 'H01P', 'H01Q', 'H04B', 'H04H', 'H04J', 'H04K', 'H04M', 'H04Q', 'H04L', 'H04W', 'H03B', 'H03C', 'H03D', 'H03F', 'H03G', 'H03H', 'H03J', 'H03K', 'H03L', 'H03M', 'G06C', 'G06D', 'G06E', 'G06F', 'G06G', 'G06J', 'G06K', 'G06M', 'G06N', 'G06T', 'G06V', 'G10L', 'G11C', 'G16B', 'G16C', 'G16Y', 'G16Z', 'G06Q', 'H01L')

('H04N 3', 'H04N 5', 'H04N 7', 'H04N 9', 'H04N 11', 'H04N 13', 'H04N 15', 'H04N 17', 'H04N 19', 'H04N 101', 'H04N 1', 'H04N 21')

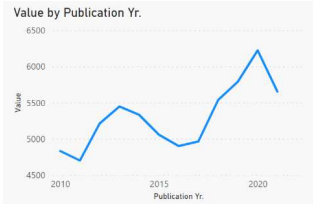
See: [Espacenet – patent classification](#) for meaning of IPC codes



Fishery and Aquaculture: opportunities for sustainable innovation driven by ICT patent applications

Management & analytics (ICT patent applications in general vs. the patent families (~ inventions) in the sea context)

ICT (in general) patent application counts



ITALY
6303

GERMANY
63640

FRANCE
37563

SWEDEN
21307

NORWAY
1041



13



41



32



13



23

ICT in the sea context:
Patent family count



Fishery and Aquaculture: opportunities for sustainable innovation

Management & analytics (ICT patent applications in general vs. the patent families (~ inventions) in the sea context)

GERMANY

63640



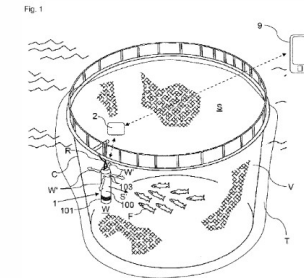
41



- <https://worldwide.espacenet.com/patent/search?q=EP20170758049>

INTELLIGENT OXYGEN CONTROL IN SEA CAGES

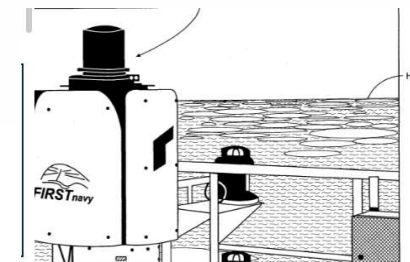
The invention relates to a **method for controlling a concentration of dissolved oxygen in a volume (V) of water (W), wherein a device (1) for dissolving oxygen in water (W) is submerged in said volume (V) of water, wherein oxygen is injected by the device (1) with an adjustable flow rate into a main water stream (W') sucked into a housing (100) of the device (1),**



- <https://worldwide.espacenet.com/patent/search?q=EP20120783084>

METHOD FOR AUTOMATIC REAL-TIME MONITORING OF MARINE MAMMALS

Monitoring the presence of marine mammals on the basis of detecting the thermal signature (TSM) has so far been carried out manually by observers or in simple, only partially automated prototypes. With such methods, fast and reliable image processing combined with a high degree of user-friendliness is problematic...



Fishery and Aquaculture: opportunities for sustainable innovation

Management & analytics (ICT patent applications in general vs. the patent families (~ inventions) in the sea context)

GERMANY

63640



41 →

- <https://worldwide.espacenet.com/patent/search?q=EP20180164114>

BOAT WITH AN APPARATUS FOR KILLING SEPARATED AND COLLECTED FISH PARASITES
The present disclosure relates to a ship (1) with a device (3) for **killing separated and collected fish parasites, the device (3) being a container (9)** which has an upwardly open or openable opening (11) and is designed for this purpose is to contain an immersion bath (13), - a filter bag (5) that can be filled with separated fish parasites and is permeable to water, and - a crane (7) for pivoting and immersing the filter bag (5) filled with separated fish parasites through the upper opening (11) of the container (9...

- <https://worldwide.espacenet.com/patent/search?q=EP20120805423>

METHOD FOR PROTECTING FISH

The invention relates to a **method for herding fish out of a specific region**. In said region, at least one grid is provided in the water, and **current and/or voltage pulses are applied to the at least one grid**.

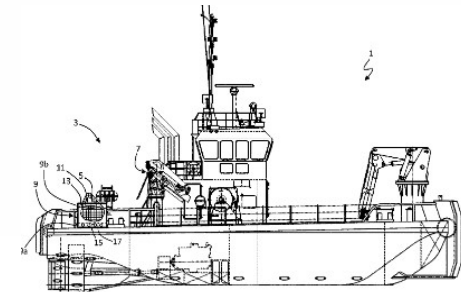


Fig 1



Fishery and Aquaculture: opportunities for sustainable innovation

Management & analytics (ICT patent applications in general vs. the patent families (~ inventions) in the sea context)

FRANCE

37563



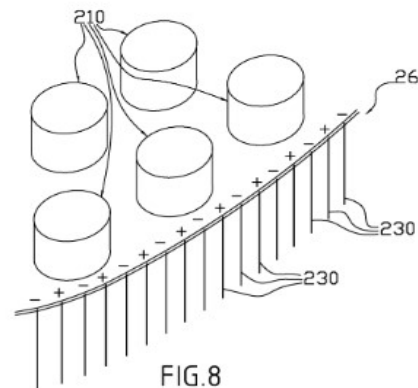
32



- <https://worldwide.espacenet.com/patent/search?q=EP20130812056>

CABLE ELECTRODE SYSTEM FOR A DEVICE FOR REDUCTION OF UNWANTED ORGANISMS IN A FISH AND/OR SHELLFISH CORRAL/FARM

A cable electrode comprising at least three sections a connection section, an active section and an end section is disclosed. The cable electrode comprises a central conductor which in the connection section is surrounded by a electrically insulating polymer layer, in the active section the central conductor is surrounded by a polymer layer comprising a conductive filler and in the end section the conductor is surrounded by a electrically insulating polymer layer. **The use of the cable electrode in an electrical fence for a fish corral is also disclosed.**



Fishery and Aquaculture: opportunities for sustainable innovation

Management & analytics (ICT patent applications in general vs. the patent families (~ inventions) in the sea context)

- <https://worldwide.espacenet.com/patent/search?q=EP20040021699>

SWEDEN

21307



13



Method that Improves Human Interpretation of Color Images with Limited Spectral Content

Abstract

The present invention relates to **image processing in general and more specifically to methods and means facilitating the human detection of physical object representations in colour images with a wide range of applications such as** aviation and air transport, land transportation, shipping, **submarine work, underwater inspections**, medical investigations, **marine archaeology**, land archaeology, agriculture, surveillance and security, food safety, energy systems and forestry. The invention achieves this by providing an image processing method for a colour image representation, IC, formed by at least two distinct colour pixel matrixes, Mi, by carrying out a histogram equalization processing step (250), which is carried out separately for each colour pixel matrix. Different pre-washing steps may be applied prior to the histogram equalization processing step (250). The invention also provides a number of apparatuses adapted for different applications using the method according to the invention.

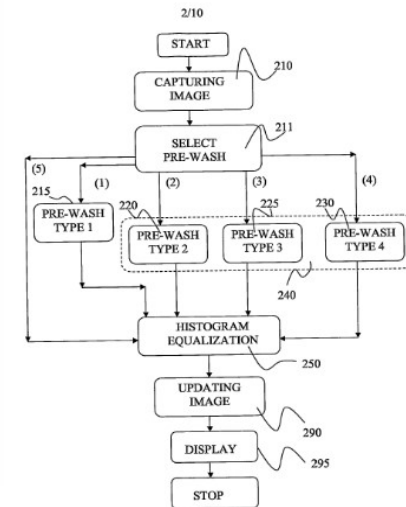


FIGURE 2



Fishery and Aquaculture: opportunities for sustainable innovation

Management & analytics (ICT patent applications in general vs. the patent families (~ inventions) in the sea context)

NORWAY

1041



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- <https://worldwide.espacenet.com/patent/search?q=EP20080779101>

MEANS AND METHOD FOR AVERAGE WEIGHT DETERMINATION AND APPETITE FEEDING

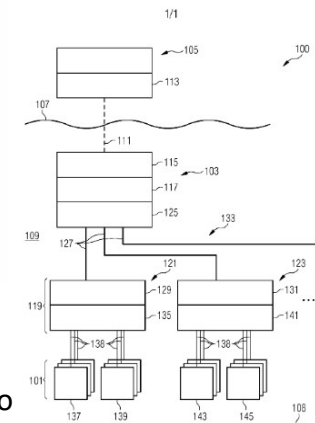
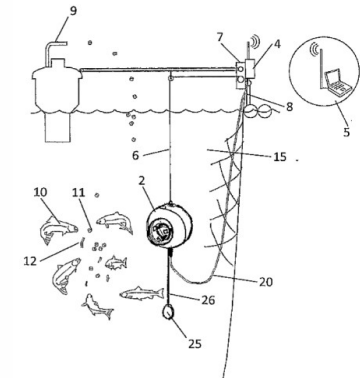
A method and system for registration of predominately freely moving objects in a fish farm netpen are described [...] **the computer processing unit (5) analyses the images taken at different angles to determine the main pattern of the objects, by grouping each pattern element based on relations between shape, size, contrast and/or colour, and to determine mutual distance between given pattern elements for identification of the main pattern and determine, based on the main pattern, whether the objects are fish (10), pellets (11), faeces (12) or other unknown elements.**

- <https://worldwide.espacenet.com/patent/search?q=EP20110711850>

ARRANGEMENT AND METHOD FOR CONTROLLING AND/OR MONITORING A SUBSEA DEVICE

WO2012041535A1

It is described an arrangement for controlling and/or monitoring at least one subsea device, the arrangement comprising: a first level node (103) communicatively, in particular electrically and/or fiberoptically connectable to an equipment (105) above a sea surface (107) of a sea (109); at least one second level node (119, 121, 123) communicatively, in particular electrically and/or fiberoptically connected to the first level node (103) and electrically connectable to the at least one subsea device (101,137,139,143,145),



Fishery and Aquaculture: opportunities for sustainable innovation

Management & analytics (ICT patent applications in general vs. the patent families (~ inventions) in the sea context)

- <https://worldwide.espacenet.com/patent/search?q=EP20140784104>

WEARABLE DEVICE FOR FISHING

NORWAY

1041



23

Various implementations described herein are directed to a wearable device (100) used to record fishing data. The wearable device may include a housing (120). The housing may include a sensor (140) or sensors to detect motion. **The housing may include a computer system (130) with a processor and memory.** The memory may have a plurality of executable instructions. When the executable instructions are executed by the processor, the processor may receive motion data from the sensor or sensors and determine whether a cast has been made.

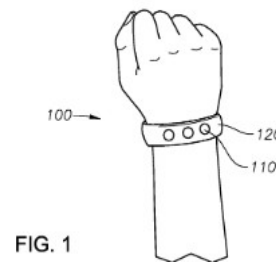
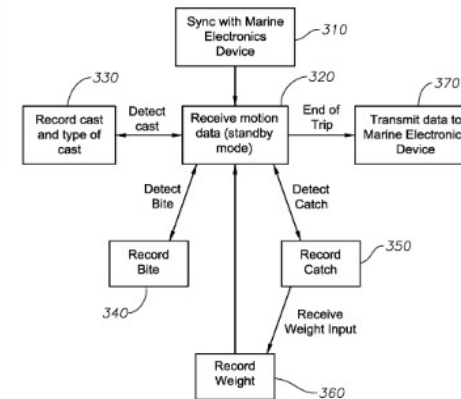


FIG. 1

FIG. 3
Fishing Motion Detection Software 300



Fishery and Aquaculture: opportunities for sustainable innovation

Management & analytics (ICT patent applications in general vs. the patent families (~ inventions) in the sea context)

According to the patent data regarding the **"ICT" sector in general**, there are several initiatives aimed at legally protecting the know-how by means of patent applications, especially in Germany, UK, France, Sweden and Switzerland. However, **a net increase of the patent publications' number in recent years can be detected only in the case of Germany, Sweden and Switzerland.**

Despite the consistent number of patent publications concerning the "ICT" sector in general, when the analysis is further restricted to **applications dedicated to the marine/maritime fields** (not excluding applications specifically dedicated to fish/algae sectors), **in every European country analyzed a dramatic limitation of the patent publications can be noticed.** Which is **not so surprising, considering that also the worldwide patent analysis dedicated to the 'Precision Aquaculture'**, which may be close in terms of kind of technology, has revealed only **269 patent families in a quite large timeframe.**

Quite often the small number of patent publications referring to ICT technologies deals with **marine propulsion control, energy production** (exploiting resources such as tides/wave energy, wind or sunlight) and **submarine cables enabling/optimising communication.**



Thank you!

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