

12th International aquaculture symposium „2016 – 2020 (2023) - a key point for aquaculture development in Croatia “

“Quo vadis” EU aquaculture



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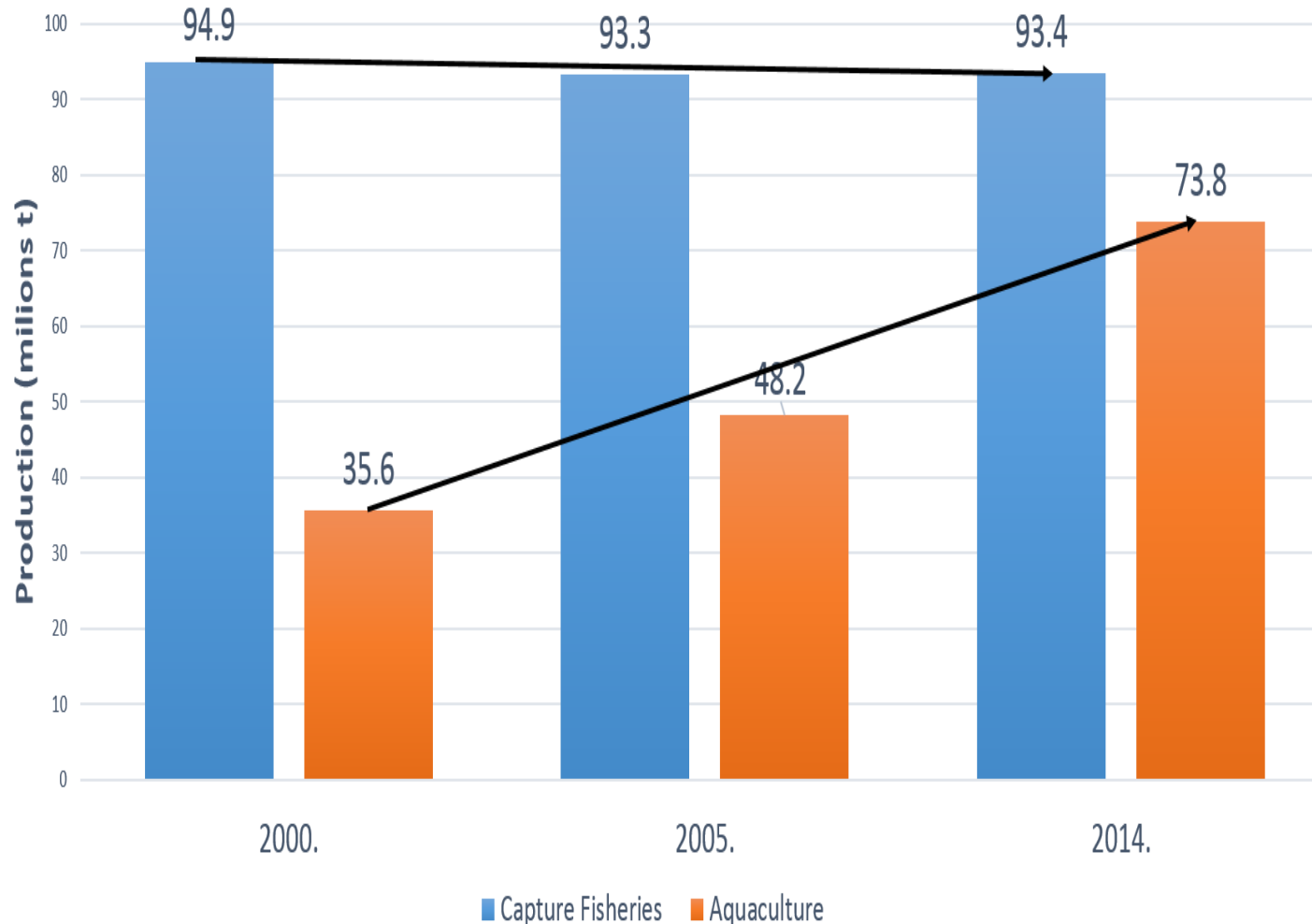
CONTENT

I. An overview of global seafood production

II. European aquaculture – status and trends

III. Mediterranean aquaculture – challenges and perspectives

World Seafood Supply from Fisheries and Aquaculture production, excluding plants (in million tonnes)



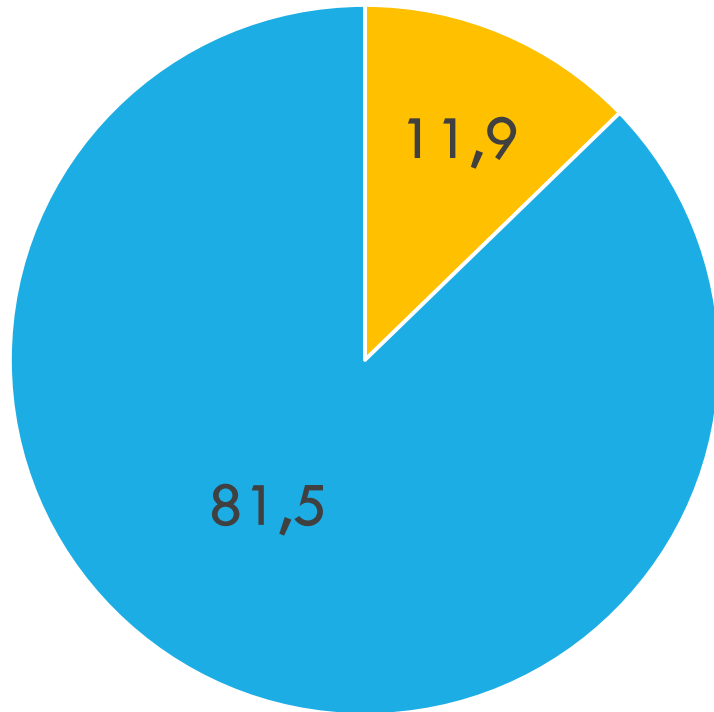
ASSUMPTIONS

- **Aquaculture growth follows recent trends**
- **Capture fisheries remain stable at current production**

(source: FAO, 2016)

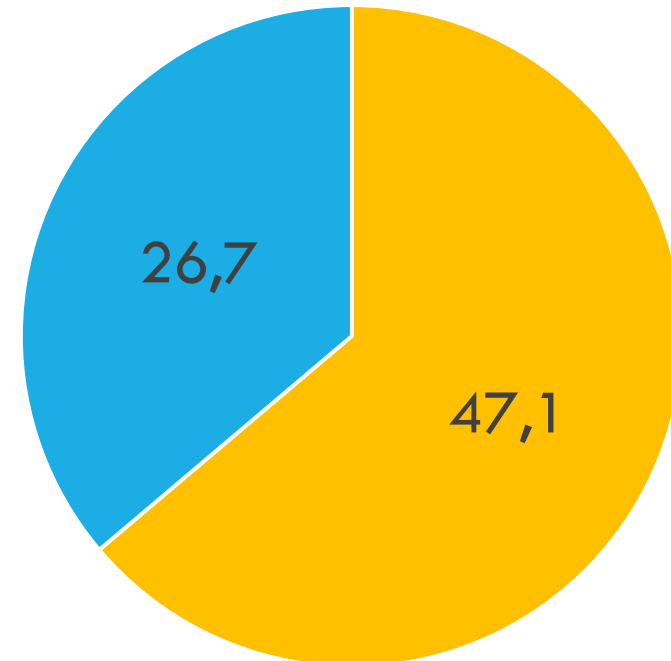
WORLD CAPTURE FISHERIES VS AQUACULTURE

Capture fisheries = 93,4 Mt



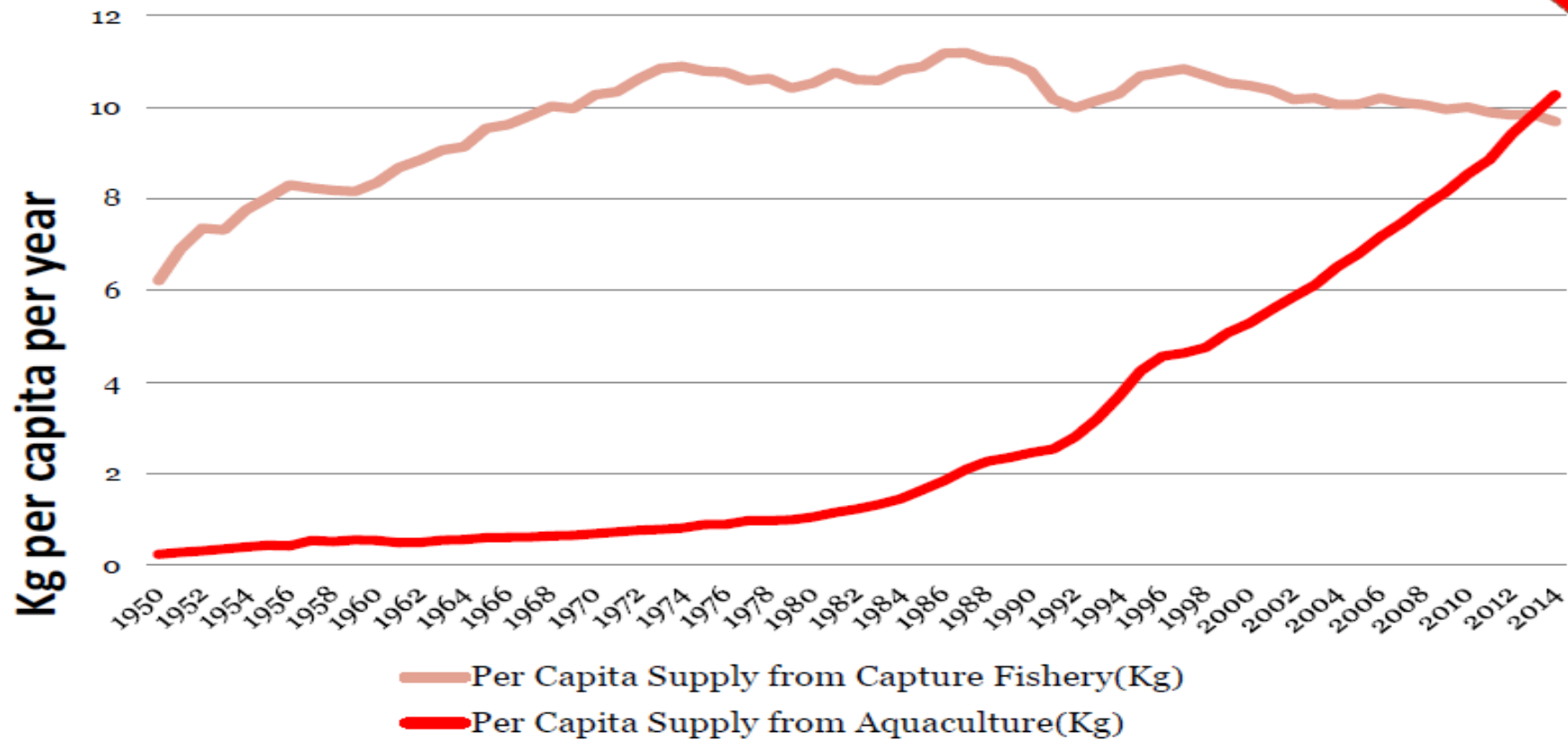
■ Inland ■ Marine

Aquaculture =
73,8 Mt + 27,3 Mt aquatic plants
Total aquaculture production = 101,1 Mt



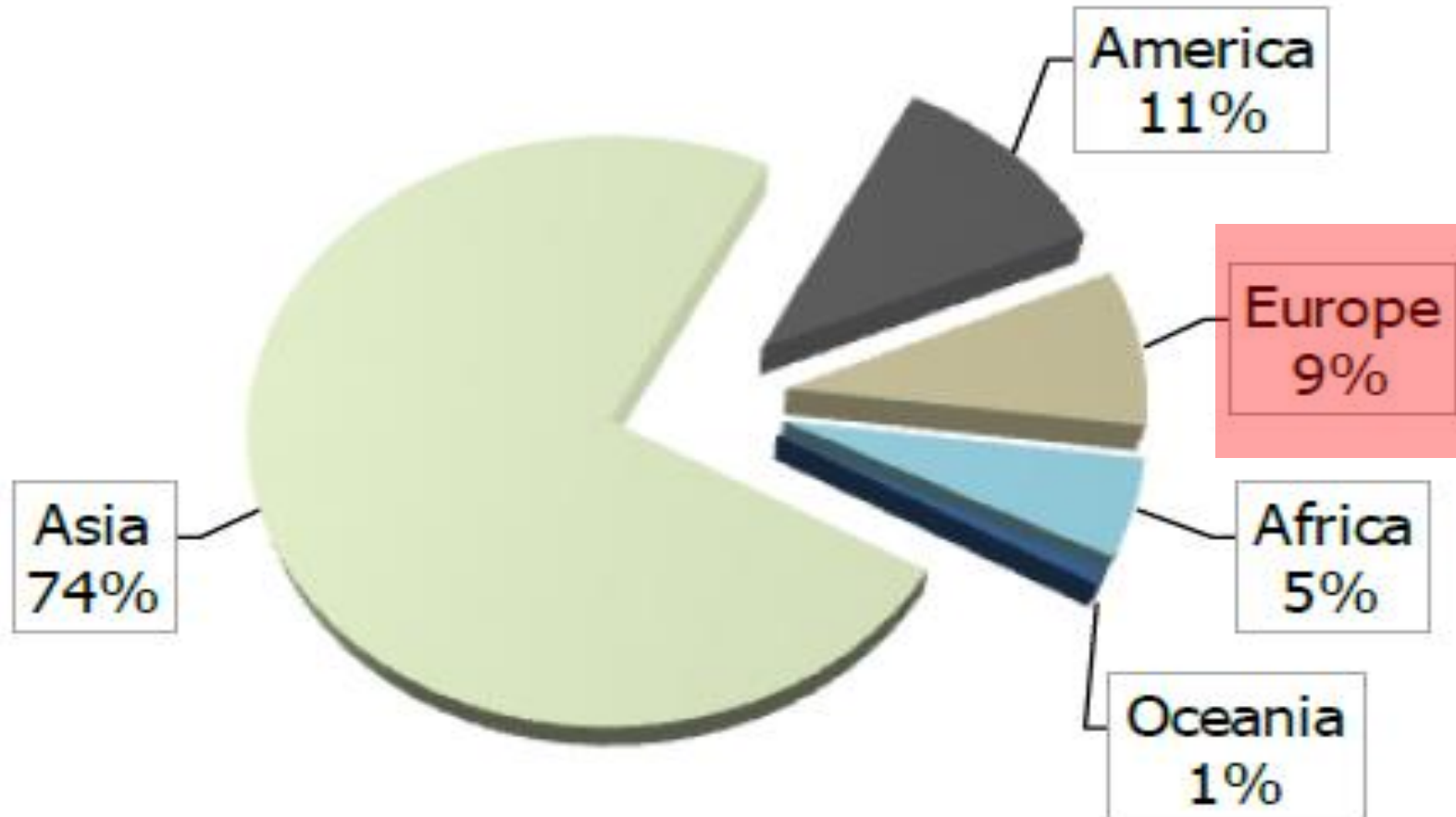
■ Inland ■ Marine

Per capita fish supply for human consumption 1950 to 2014



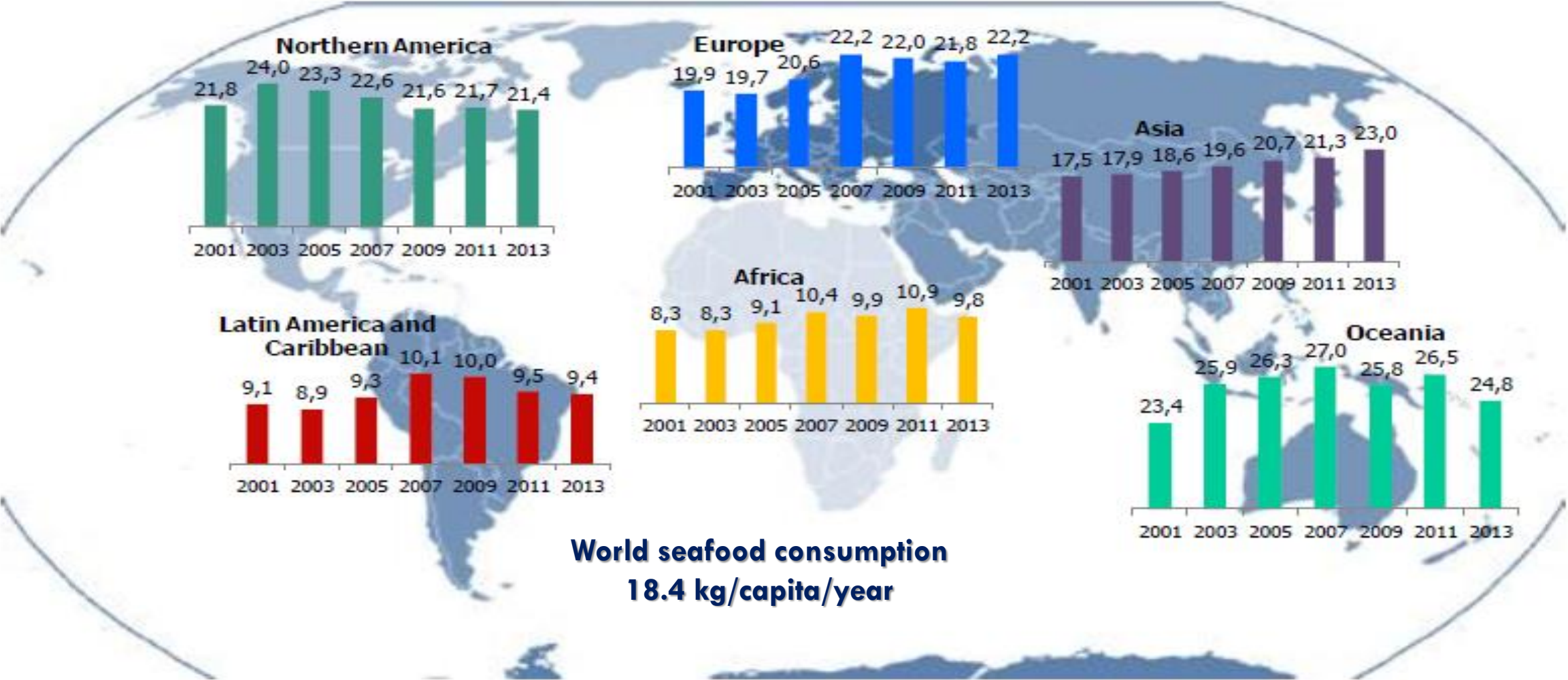
In 2014
Aquaculture supply
Is larger than wild capture

WORLD SEAFOOD PRODUCTION (FISHERIES AND AQUACULTURE) BY CONTINENTS, IN VOLUME (2014)



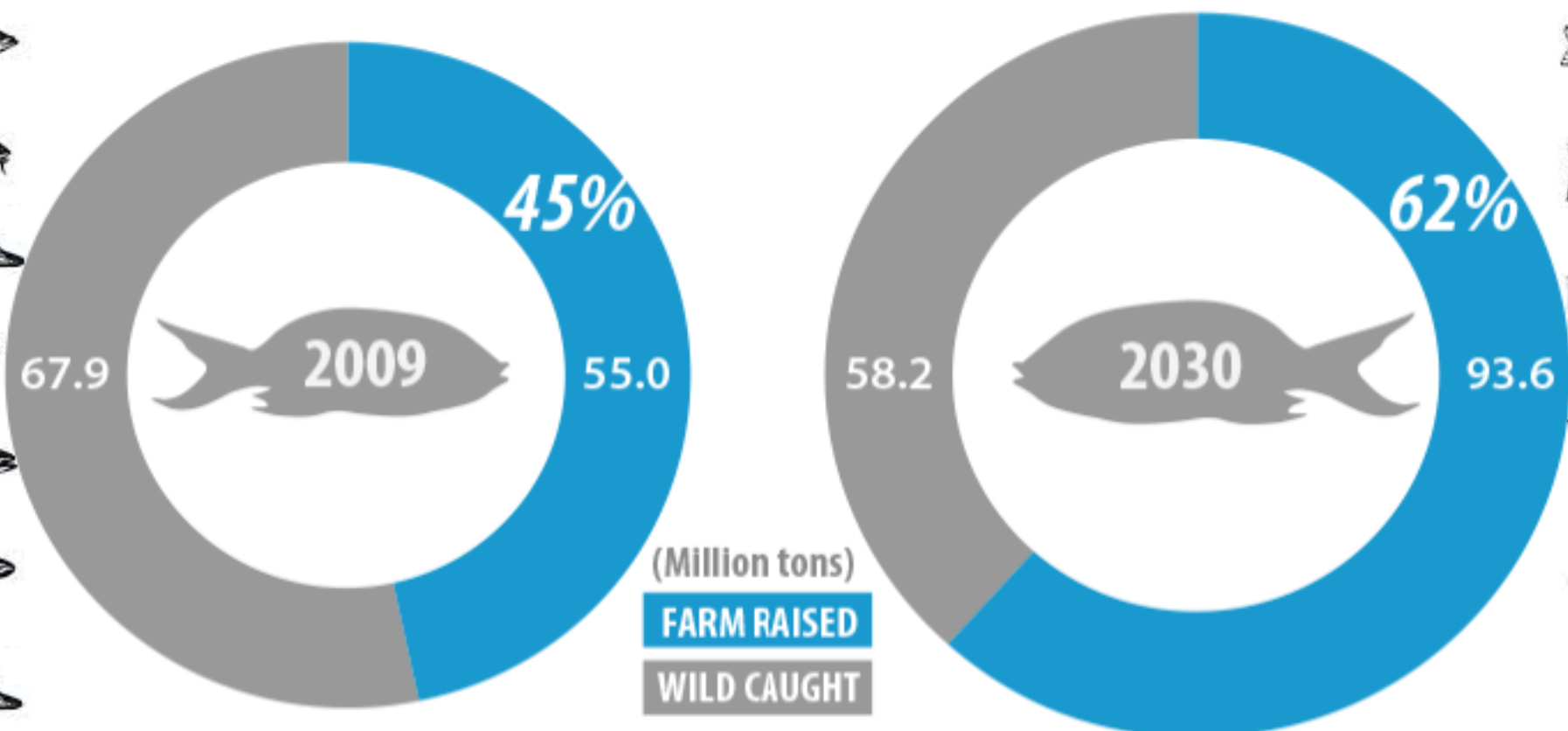
Source: EUROSTAT (for fishery EU-28), FAO (for extra-EU countries and EU aquaculture)

CONSUMPTION PER CAPITA IN THE WORLD (KG 2001-2013)



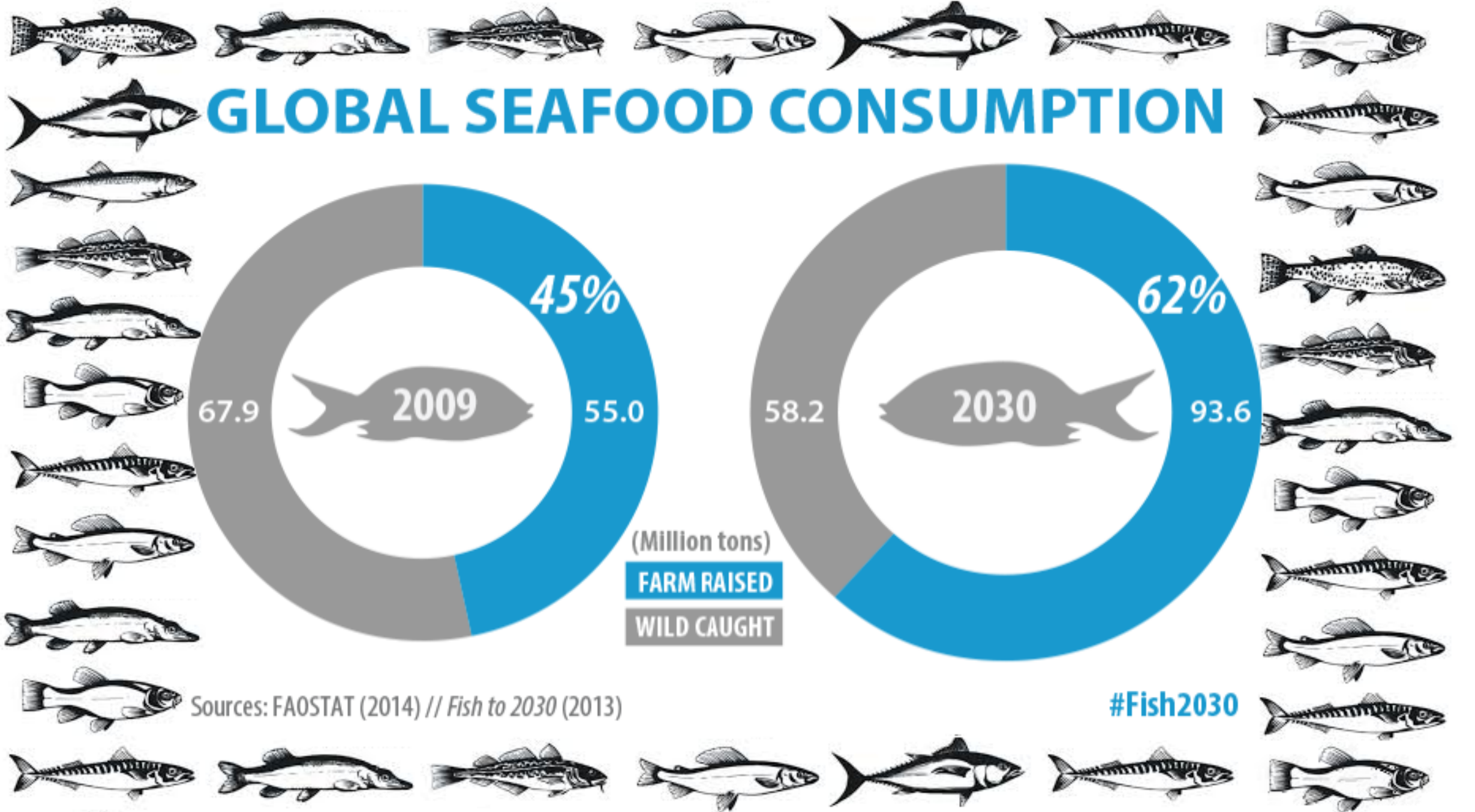
Source: FAO

GLOBAL SEAFOOD CONSUMPTION



Sources: FAOSTAT (2014) // *Fish to 2030* (2013)

#Fish2030

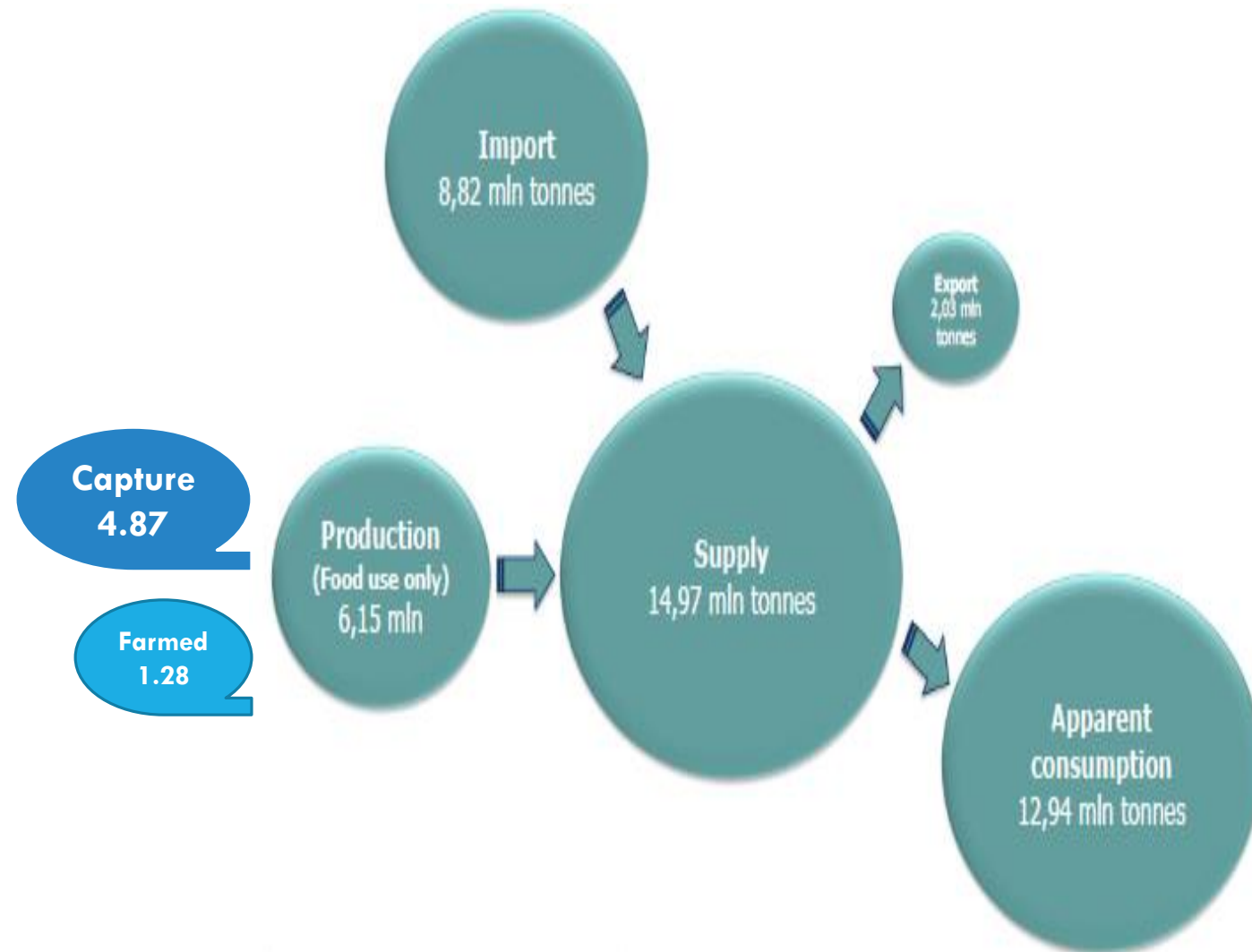


Seafood European market in 2014

Highlights from European Seafood Market

- Expenditure for fishery and aquaculture products is 4 times lower than for meat
- Per capita consumption of fish and seafood proteins in the EU accounted for 7% of the total protein intake
- Almost 80% of the EU processed fish product are directed to internal consumption
- Farmed fish product represent 24% of EU total fish consumption; Every 4th fish consumed comes from aquaculture

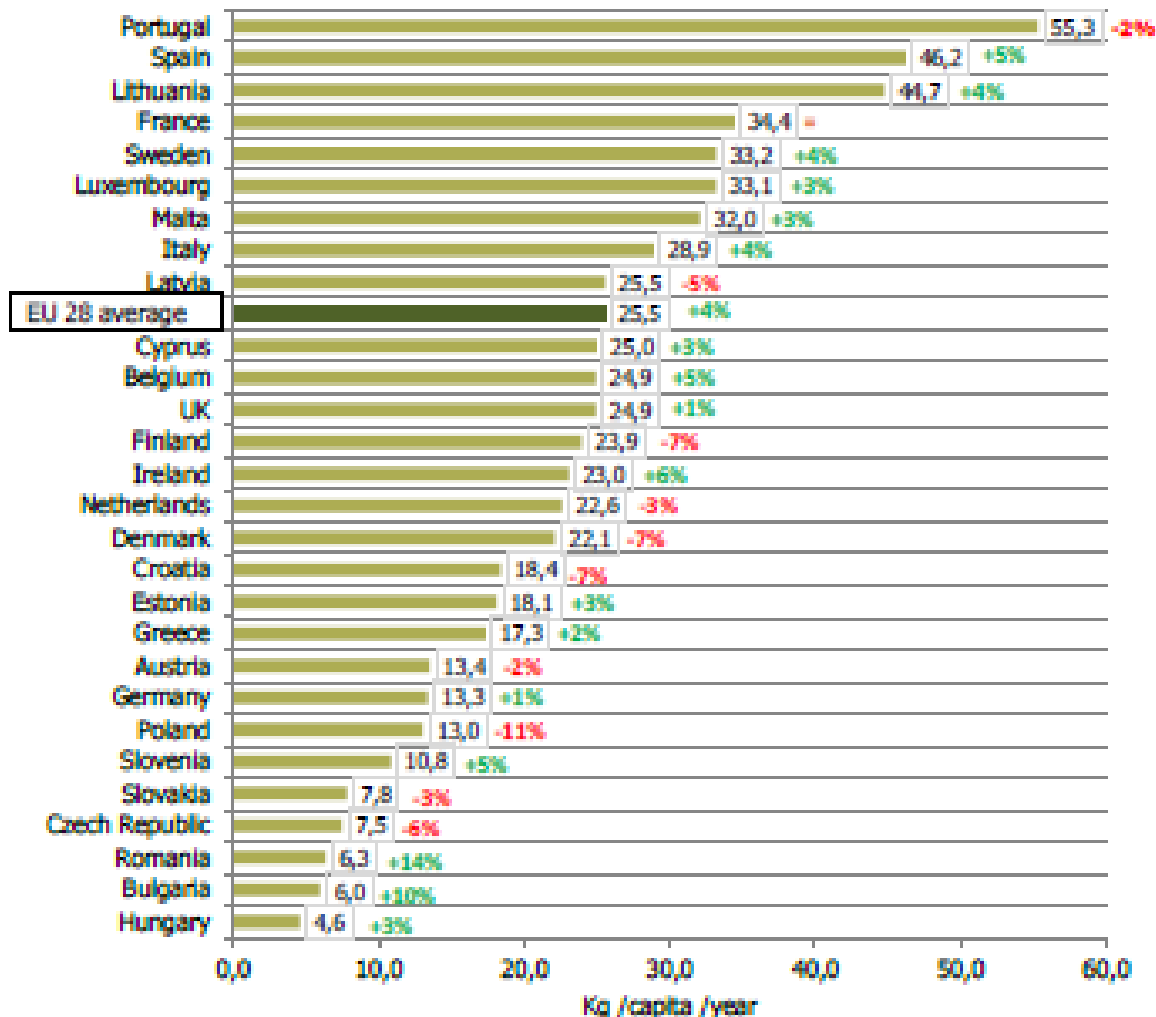
Source: EUMOFA based on EUROSTAT data



PER CAPITA CONSUMPTION BY EU-28 COUNTRIES AND SPECIES

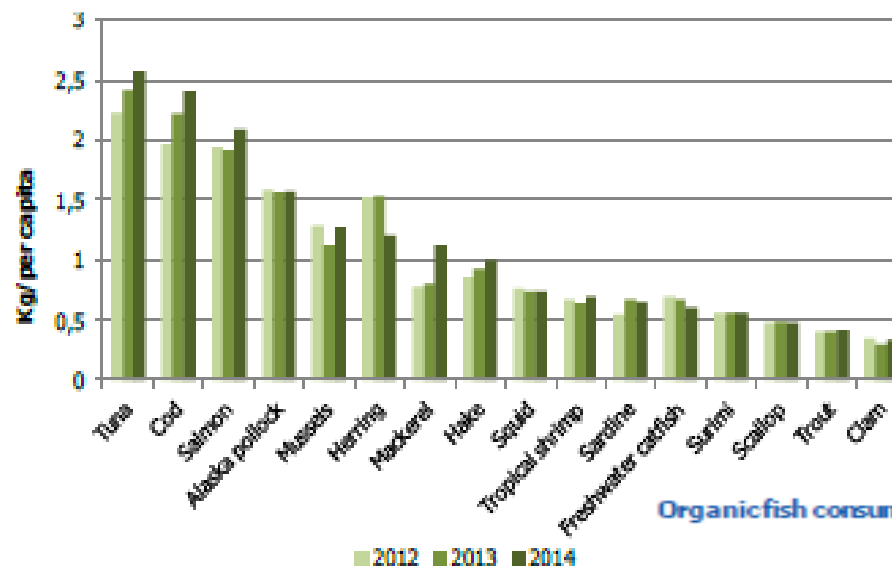
Per capita consumption of fish and seafood (Live weight equivalent – kg capita/year) per Member State, 2014 and % variation 2014/2013

Source: EUMOFA based on elaboration of EUROSTAT data



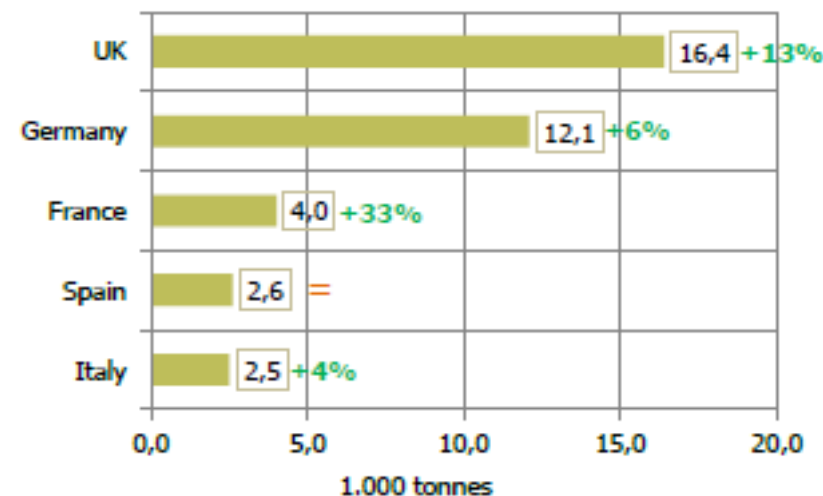
Apparent consumption of most important species in 2012, 2013 and 2014

Source: our elaboration based on EUMOFA data



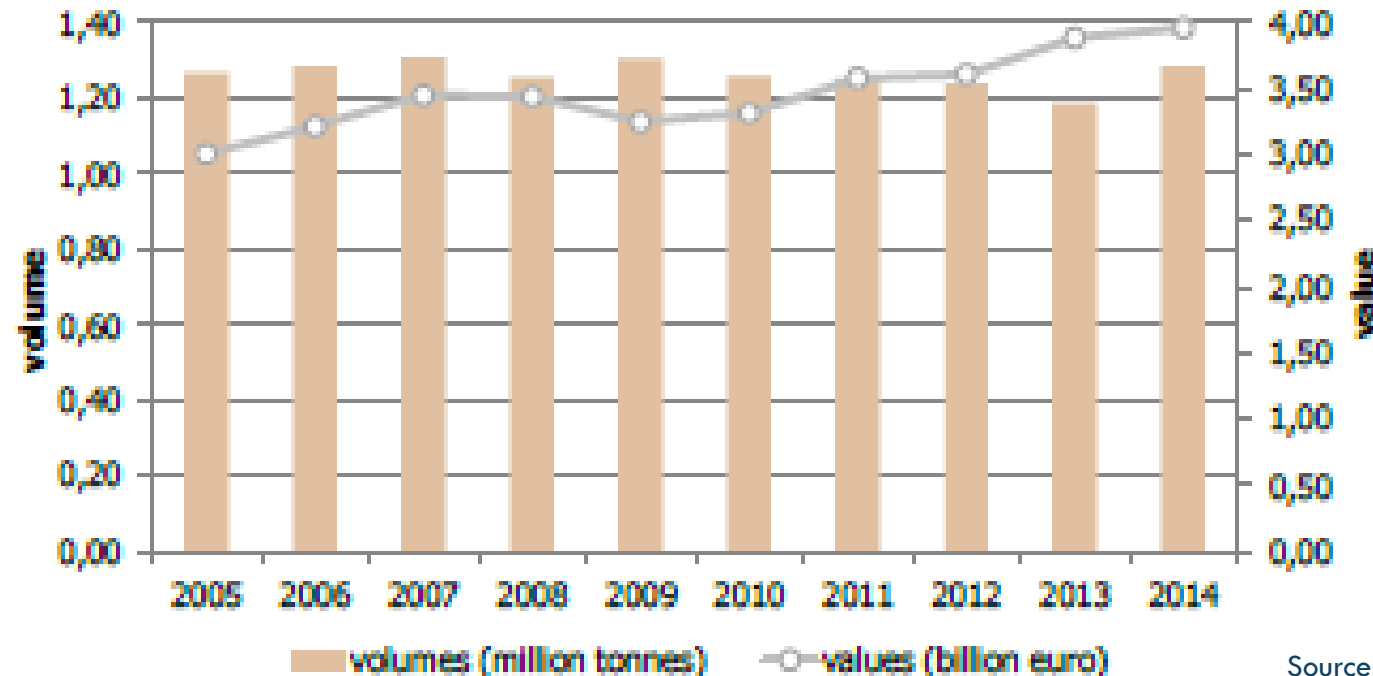
Organic fish consumption in 2015 and % variation 2015/2014

Source: EUMOFA, based on Euromonitor

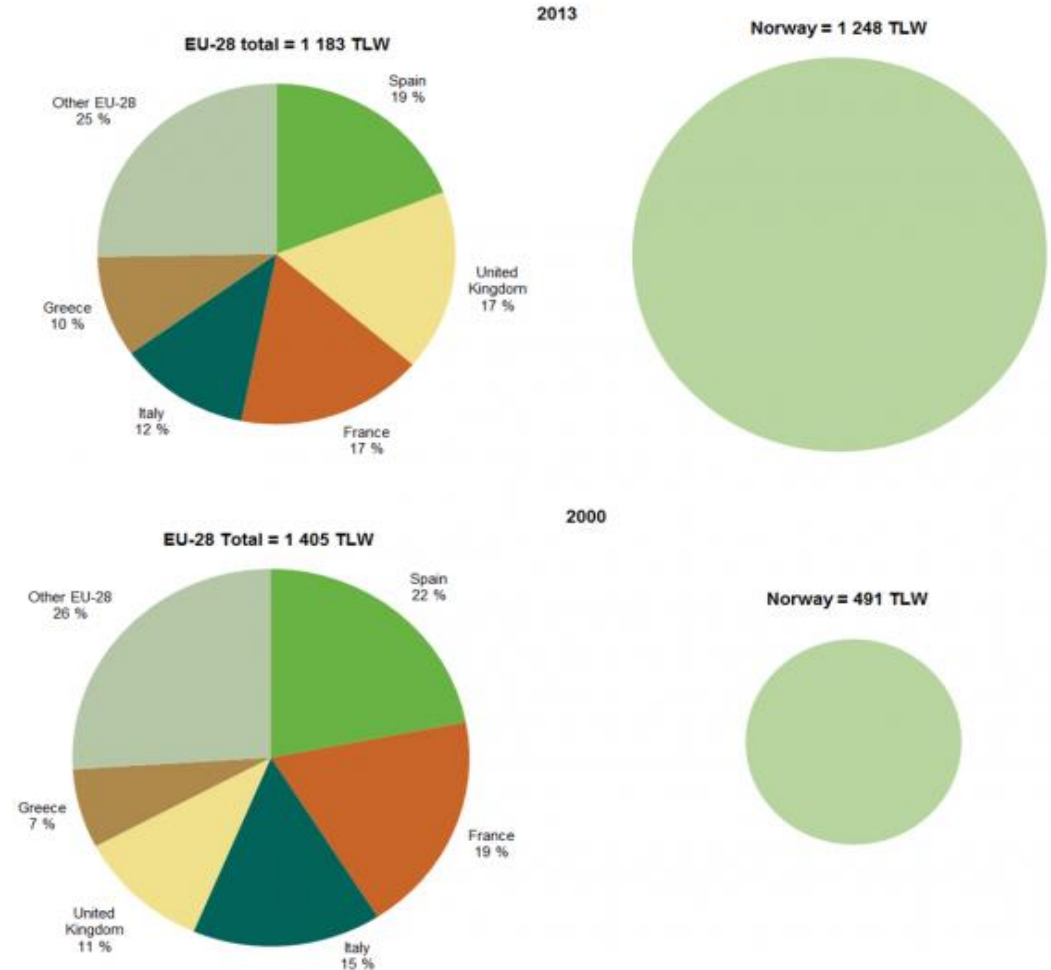
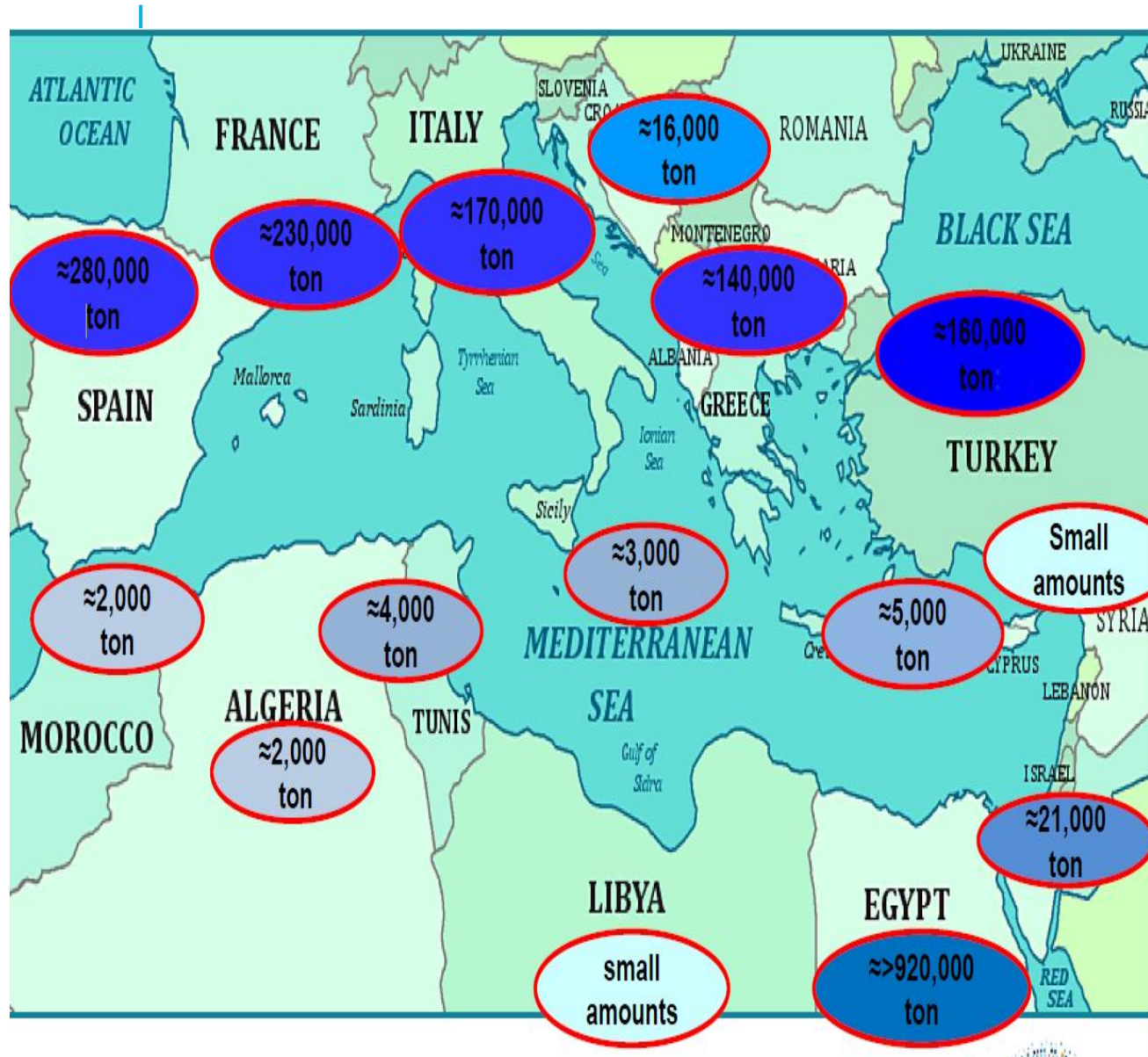


STATUS OF EUROPEAN AQUACULTURE

- EU represents **2 %** by volume and **4.3 %** in terms of value in global aquaculture.
- EU-28's total aquaculture production of 1.28 million tonnes that represents around **24%** of the total EU fisheries production
- Total economic value in 2014 amounts to € 3.96 billion Euros.
- Mussels, mostly Mediterranean and blue mussel accounted for more than a third (roughly 400 thousand tonnes)
- Gilthead seabream, European seabass, rainbow trout, and Turbot accounted for another 25 %.
- Although cultivated in only few EU countries, mostly in the UK, Atlantic **salmon has far the highest economic value** (almost EUR 0.9 billion)



MAIN AQUACULTURE PRODUCERS, EU-28 AND EU VS NORWAY, 2000 AND 2013 (1000 TONNES LIVE WEIGHT)



(*) Excluding production from hatcheries and nurseries, fish eggs for human consumption, ornamental and aquarium species.

Source: Eurostat ([fish_aq_a](#)) and ([fish_aq2a](#))

European share from global aquaculture production (2012)

Europe
4.3%

- Aquaculture is the most heavily regulated food production sector in Europe
- Increasing competition for space with other users and environmental concerns about aquaculture are some of the major issues

Leading region in the production of some species



Salmon



Trout



Seabass



Seabream

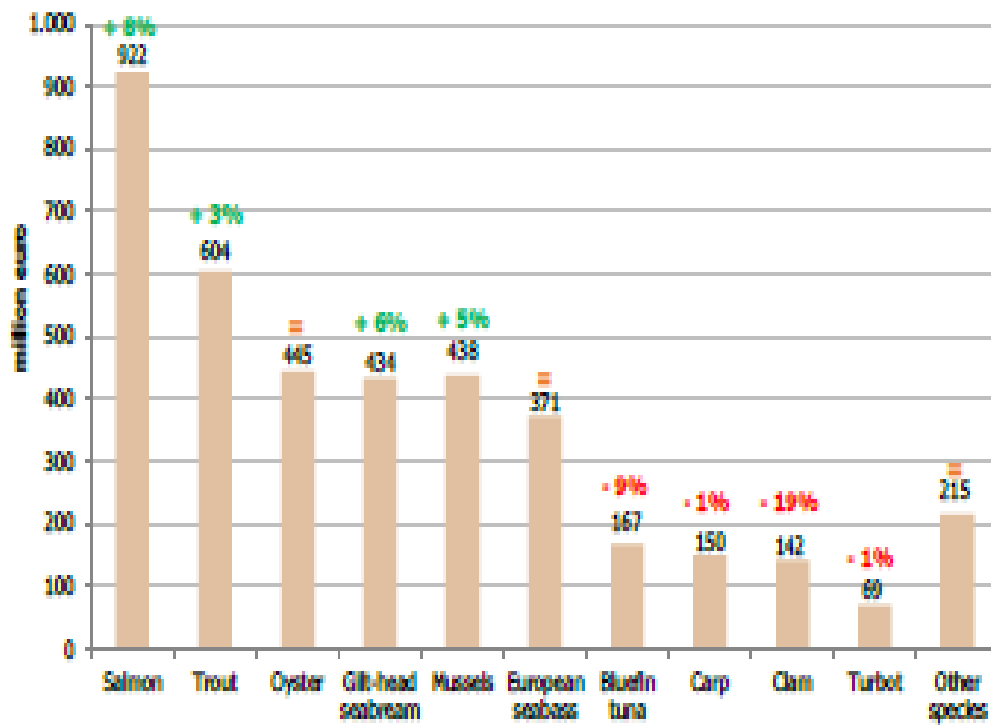


Turbot

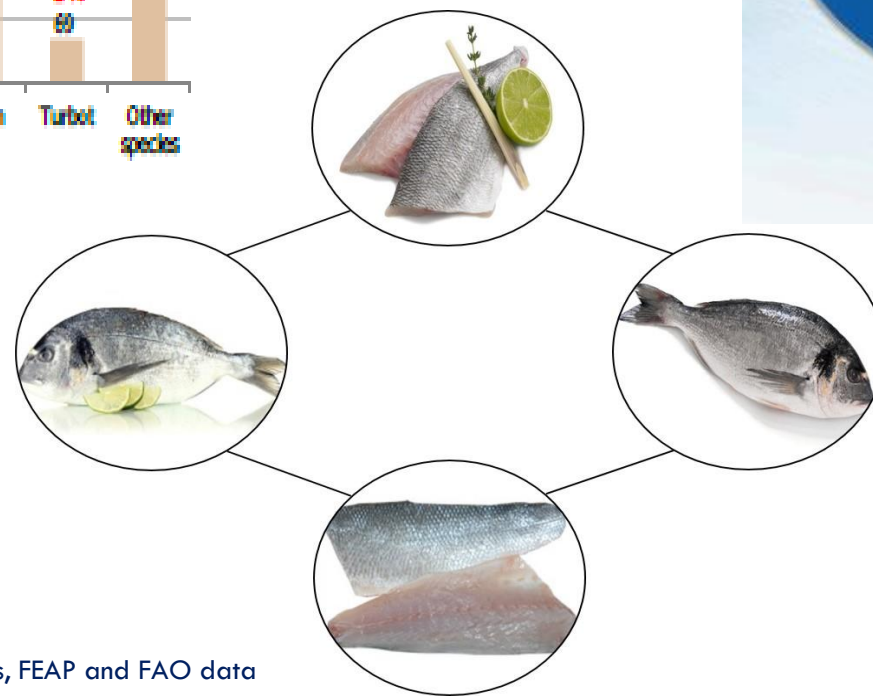


Mussels

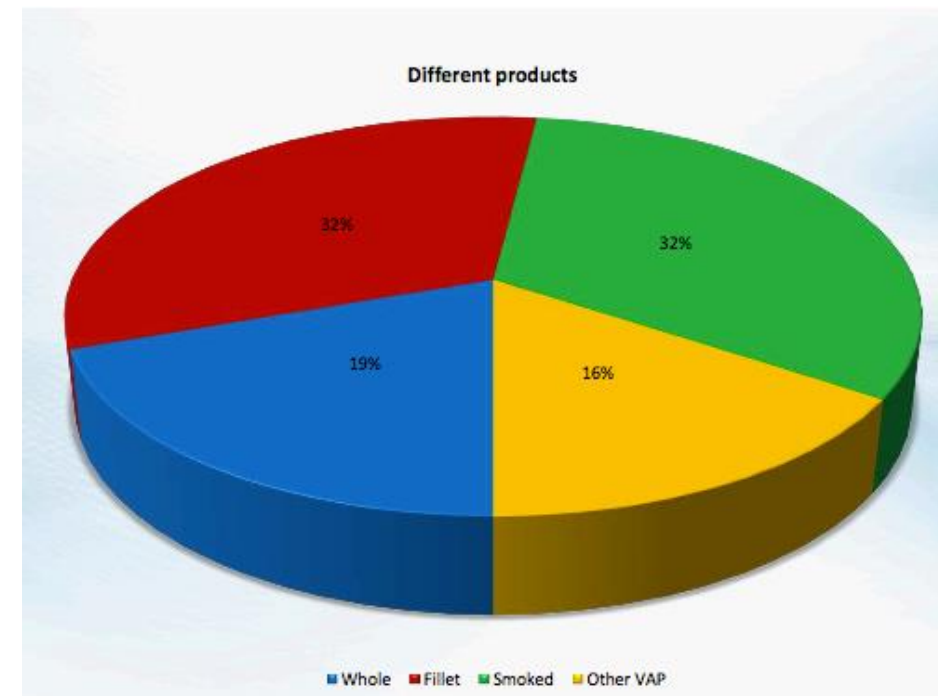
Values of the main aquaculture products in the EU in 2014 and %variation 2014/2013



Product diversification of seabream and sea bass is progressing



Salmon diversified products



Sustaining Aquaculture Growth to meet future fish demand



Aquaculture growth rate during 2007-2030	Expected APR (%)	Required APR (%)
World	4.0	5.6
Africa	7.2	11.5
Asia	4.0	5.3
Europe	3.1	4.0
L.A. & C.	4.4	7.6
Northern A.	0.4	9.0
Oceania	2.6	7.9

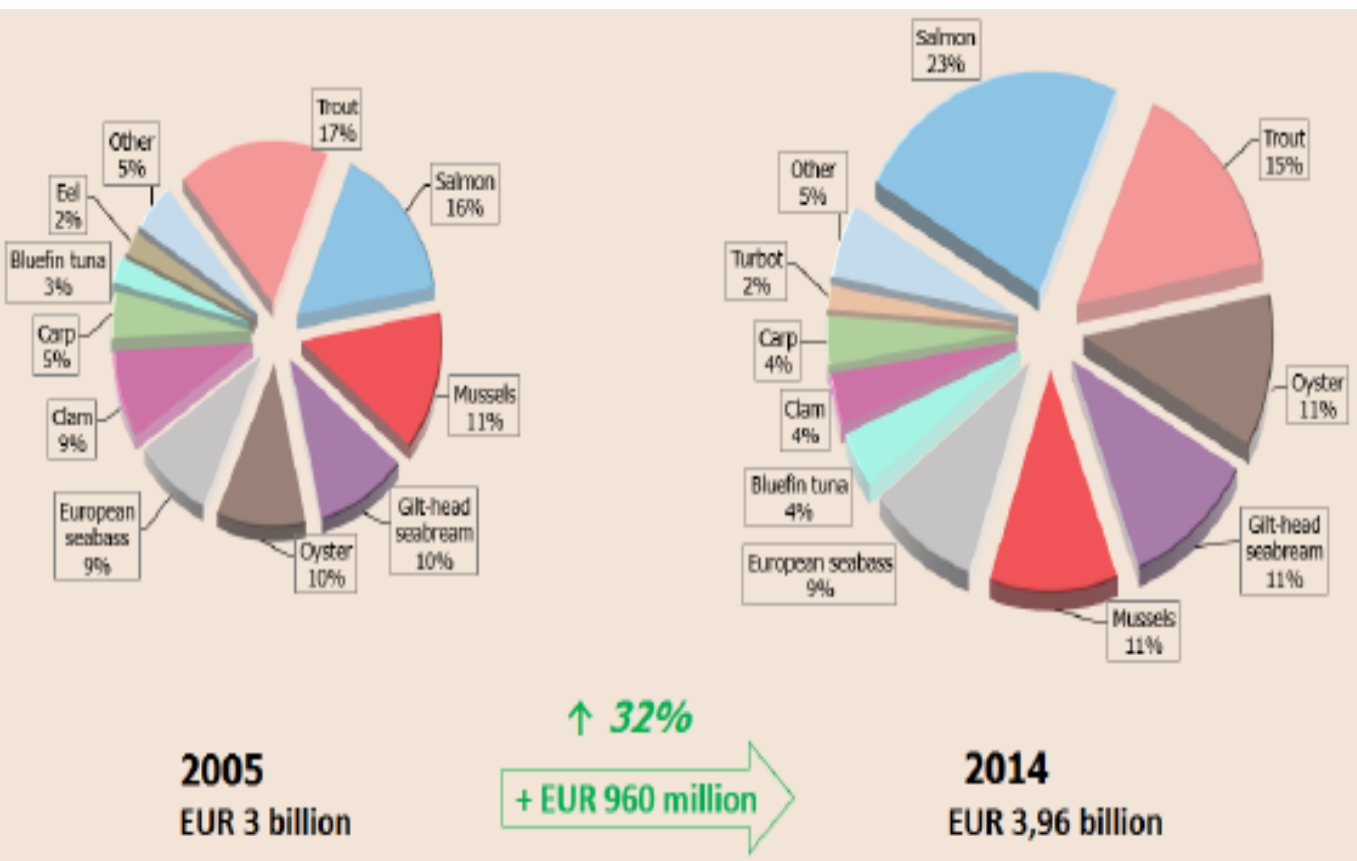
Source: Estimation of FI Department

- ❖ If countries aquaculture production follow the recent trend, expected aquaculture growth rate:
 - ❖ 4.0 percent annually.
- ❖ To feed growing and wealthier world population, required aquaculture growth rate:
 - ❖ 5.6 percent annually.

Trends in EU aquaculture production by species or group of species in values and volumes

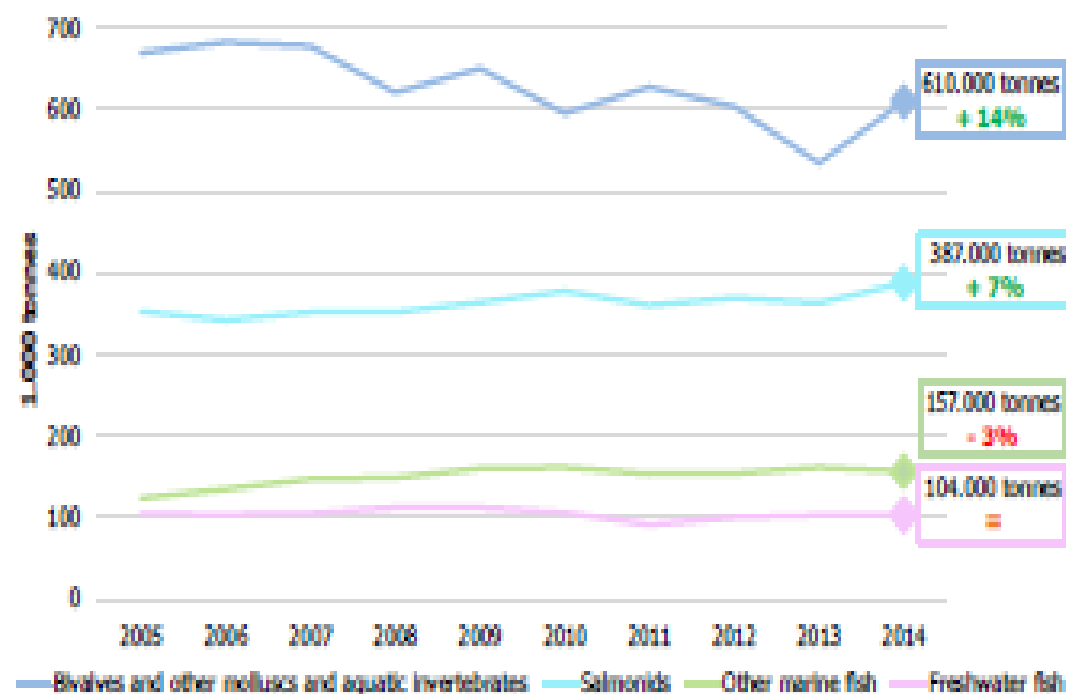
Composition of farmed products in the EU by value

Source: EUMOFA based on elaboration of EUROSTAT, National sources, FEAP and FAO data



Volumes of most important groups of species and % variations 2014/2013

Source: EUMOFA based on elaboration of EUROSTAT, National sources, FEAP and FAO data



EU Freshwater aquaculture

Main species:

- **Trout** (191,000 t); main producing countries: Denmark, France, Italy
- **Carp** (80,000 t) in Poland, Czech Republic and Hungary
- **Eel** (5,200 t), Netherland


Trends:

- Trout and carp are not expected to increase production in the near future
- Expansion of lesser-known species: catfish, sturgeon, etc. are expected
- Diversification of species, and/or products, technological improvement and more advanced zotechniques will be applied



Freshwater - Growth Forecasts

Challenges

-  Identify advantages of freshwater aquaculture
-  Complex legislation hindering development
-  Define clear targets for lesser-known species
-  Integrate RAS better and improved use of outputs
-  Raise productivity of traditional farms
-  Better recognition of contributions to society

Action Plan

- Encourage diversification and integration
- Increase competitiveness and maintain highest product quality
- Promote innovation for sustainability
- Improve responses to predators
- Improve market understanding
- Define environmental services
- Focus on local economies
- Establish a genetic bank of native populations

Effects

- Production will grow to 480,000 tons of fish



- Moderate growth for established species
€1.4 billion, increasing €0.5 billion ex-farm value



- 7,000 more jobs, highest rise to occur in processing



- 30,000 hectares of space needed for expansion, mainly for extensive production



- Hatcheries to supply over 1.3 billion juvenile fish



- Overall feed requirement up by 80,000 tons

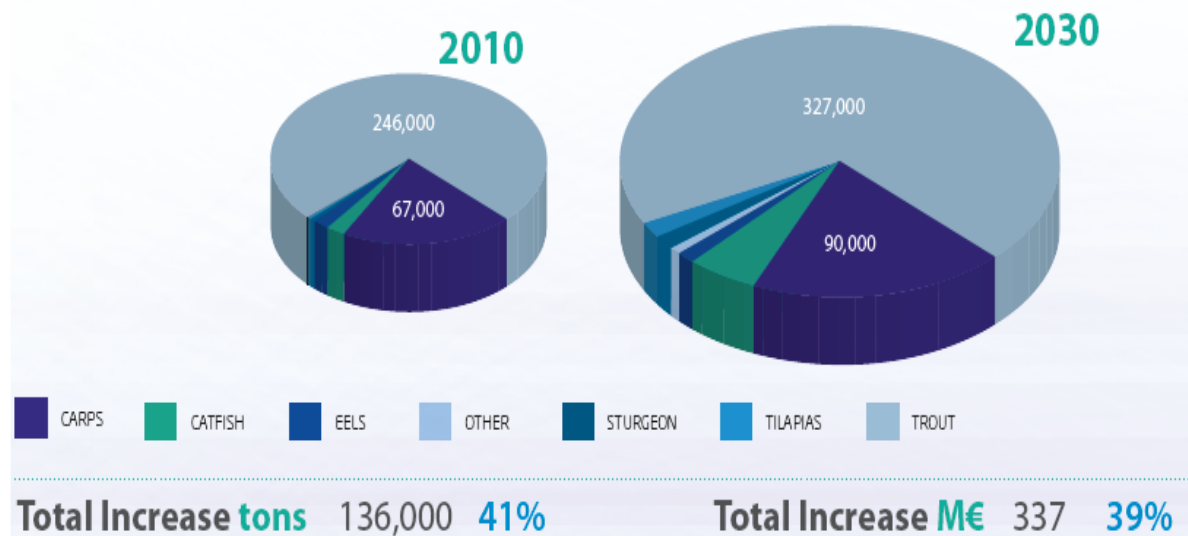


- Active diversification within the sector



Vision 2030

- Production growth >40% = 1.5%/year
- Trout and carp remain core products
- Will diversify & establish new activities
- Recognition and expansion of ecosystem services
- Product diversity for mass and target niche markets
- Productivity increases of 50%/employee
- FCR decreases to 0.9 for trout (15% improvement)

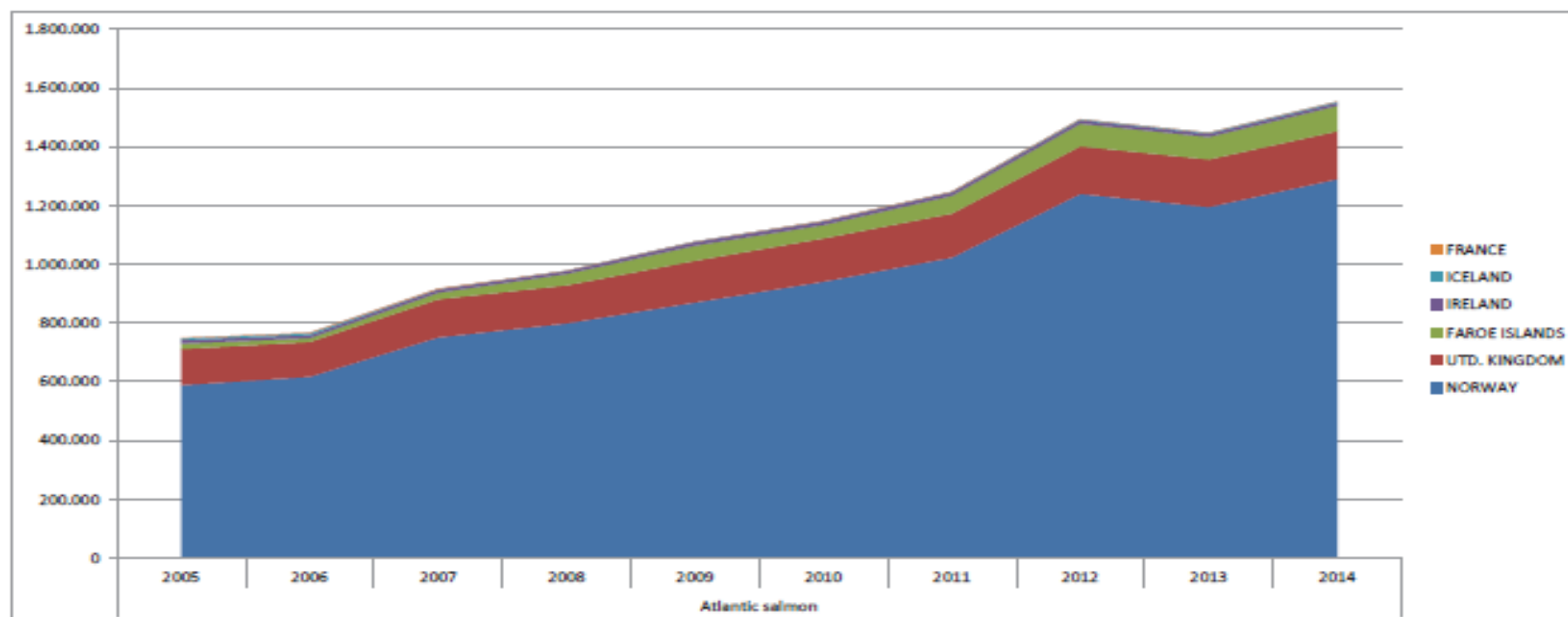


Source: The Future of European Aquaculture – EATiP 2012

Atlantic salmon production (tons) 2005-2014



PRODUCTION (tons)		YEAR										
SPECIES	COUNTRY	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	
Atlantic salmon	NORWAY	588.444	617.000	751.000	799.000	870.000	941.001	1.023.000	1.240.000	1.195.000	1.290.000	
	UTD. KINGDOM	123.000	118.525	129.930	129.545	142.283	147.412	150.000	162.223	162.234	163.347	
	FAROE ISLANDS	18.700	13.100	22.300	38.800	51.500	45.400	60.400	76.800	76.480	86.449	
	IRELAND	11.500	9.972	11.000	10.000	12.500	12.500	12.000	12.000	11.000	10.000	
	ICELAND	6.094	6.895	1.158	292	714	1.068	1.083	2.923	3.018	3.965	
	FRANCE	1.200	1.600	1.800	0	0	802	700	300	300	300	
Atlantic salmon Total		748.938	767.092	917.188	977.637	1.076.997	1.148.183	1.247.183	1.494.246	1.448.032	1.554.061	



Coldwater Marine - Growth Forecasts









Challenges

-  Develop robust, perhaps sterile, juvenile fish for exposed sites
-  Maintain PUFA quality while feed components (plants) change
-  Minimise impact of escapes
-  Production costs will influence species choice
-  New partnerships needed to promote/realise IMTA objectives
-  Mastering the management of offshore production

Action Plan

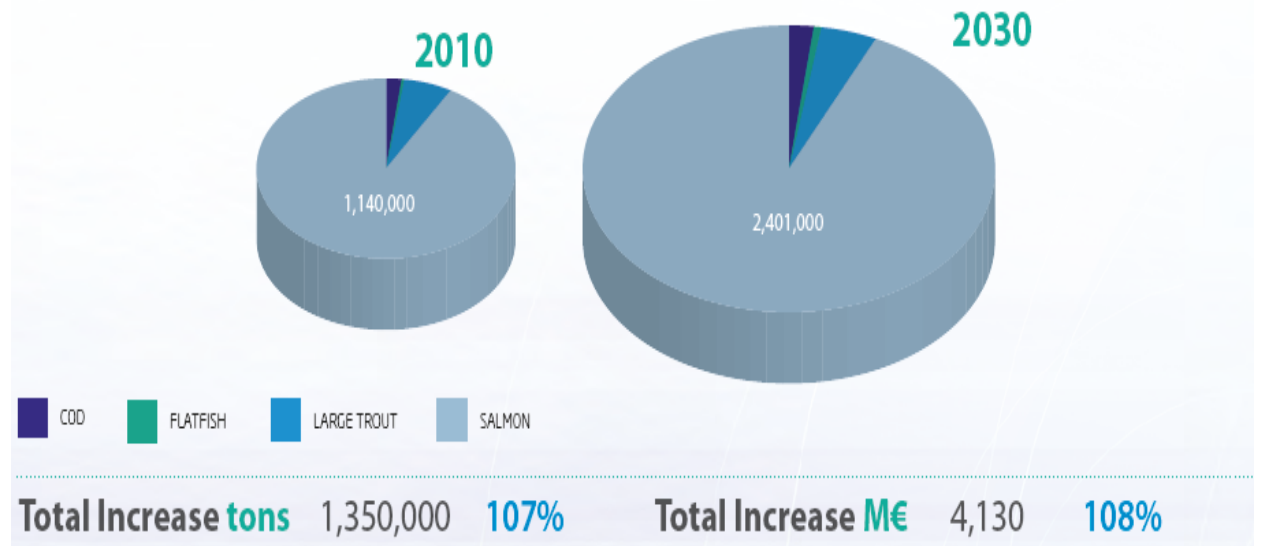
- Develop and use more plant materials for feeds
- Robust animals reared and customised for growing environment and markets
- Better communication and promotion
- Develop solutions for escapes
- Identify limitations for open sea on-growing
- Improve IMTA operation for integration with bioenergy production

Effects

- Production will double to provide 2.6 million tons

- Salmon will remain the major product

- €13.5 billion ex-farm but €20 billion increase in total value

- 6,000 more jobs

- 2,700 hectares of space for new farms

- Hatcheries to supply over 2.5 billion juvenile fish

- Overall feed requirement up to over 3 million tons

- Diversification will consolidate position of aquaculture


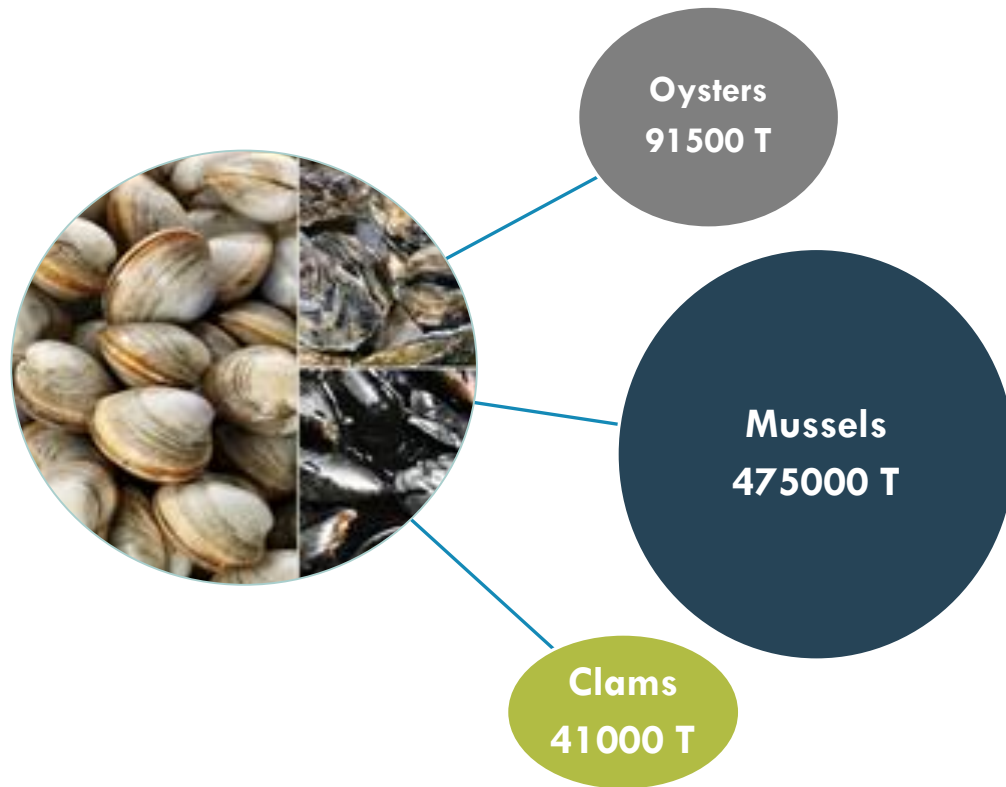
Vision 2030

- Production Growth of >100% = 4%/year
- Salmon will remain the main species but all others will increase
- FCR decreases to 1.2, 20% improvement
- Employee productivity increases by 50%
- Trend towards Integrated Multifunctional farms
- Higher levels of offshore aquaculture
- Maximise recognition of the product's health benefits



Source: The Future of European Aquaculture – EATiP 2012

EU SHELLFISH PRODUCTION (2014)



Source: Eurostat






Actions to be taken:

- To increase production (new areas, & integration with finfish production – IMTA)
- Fight against virus and bacteria (high mortality in summer)
- Resolve problem of seabream predation



Shellfish - Growth Forecasts

Challenges

-  Assuring production in deeper waters
-  Developing disease-resistant stock
-  Access to clean waters
-  Increasing competitiveness
-  Improving knowledge on pathogens – detection & quantification

Action Plan

- Improved environmental governance, enhanced by new technologies and knowledge
- Access to new space and better use of existing sites
- Genetic improvement for disease resistance and higher productivity
- Assure consistent quality control for continued product safety
- Increased hatchery supplies of spat
- Diversify species profile at commercial levels
- Planning tools for environmental governance and development

Effects

- Production will grow to around 850,000 tons of shellfish: Growth will be mainly for mussels in short-term



- €1.4 billion, increasing by €0.5 billion ex-farm value



- Higher workforce level, looking to bring skilled young people into the business



- 30,000 hectares of space needed for expansion, mainly for extensive production

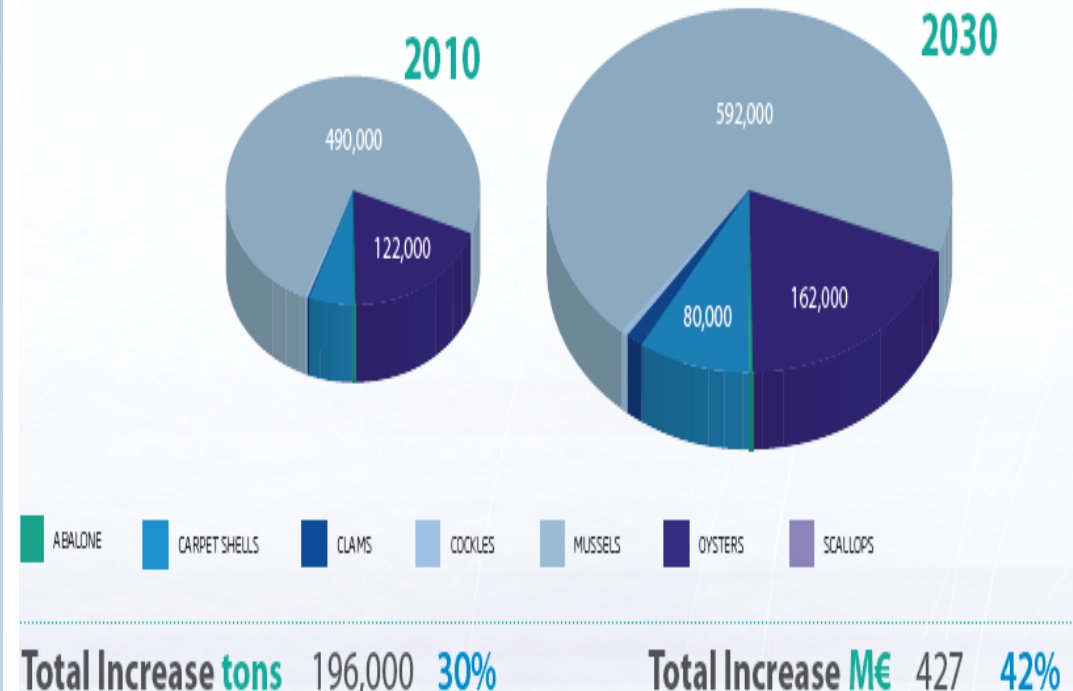


- Higher hatchery production of spat for on-growing



Vision 2030

- Production growth 30% = 1.3%/year, initially for mussels and minor species
- Shellfish demand will increase
- Natural, safe and sustainable sector
- Activity diversification on-farm
- Integrated multifunctional farms
- Higher levels of offshore production



Source: The Future of European Aquaculture –EATIP 2012

To achieve objectives~

European Aquaculture Priorities with eight Thematic areas were formulated



European
Commission

MARITIME AFFAIRS
AND FISHERIES

Economic advice in fisheries management

A trilogue between science,
administration and stakeholders

#EUFishEcon @EU_MARE



UNIVERSITY OF MALTA
Faculty of Science
Department of Biology



The European Association
of Fisheries Economists

Aquaculture & the Consumer

Product Quality,
Consumer
Safety & Health

Sustainable
Feed Production

Assuring a Sustainable Industry

Technology &
Systems

Managing the
Biological Life
Cycle

Aquatic Animal
Health & Welfare

Aquaculture in Society

Integration with
the Environment

Knowledge
Management

Socio-Economics,
Management &
Governance

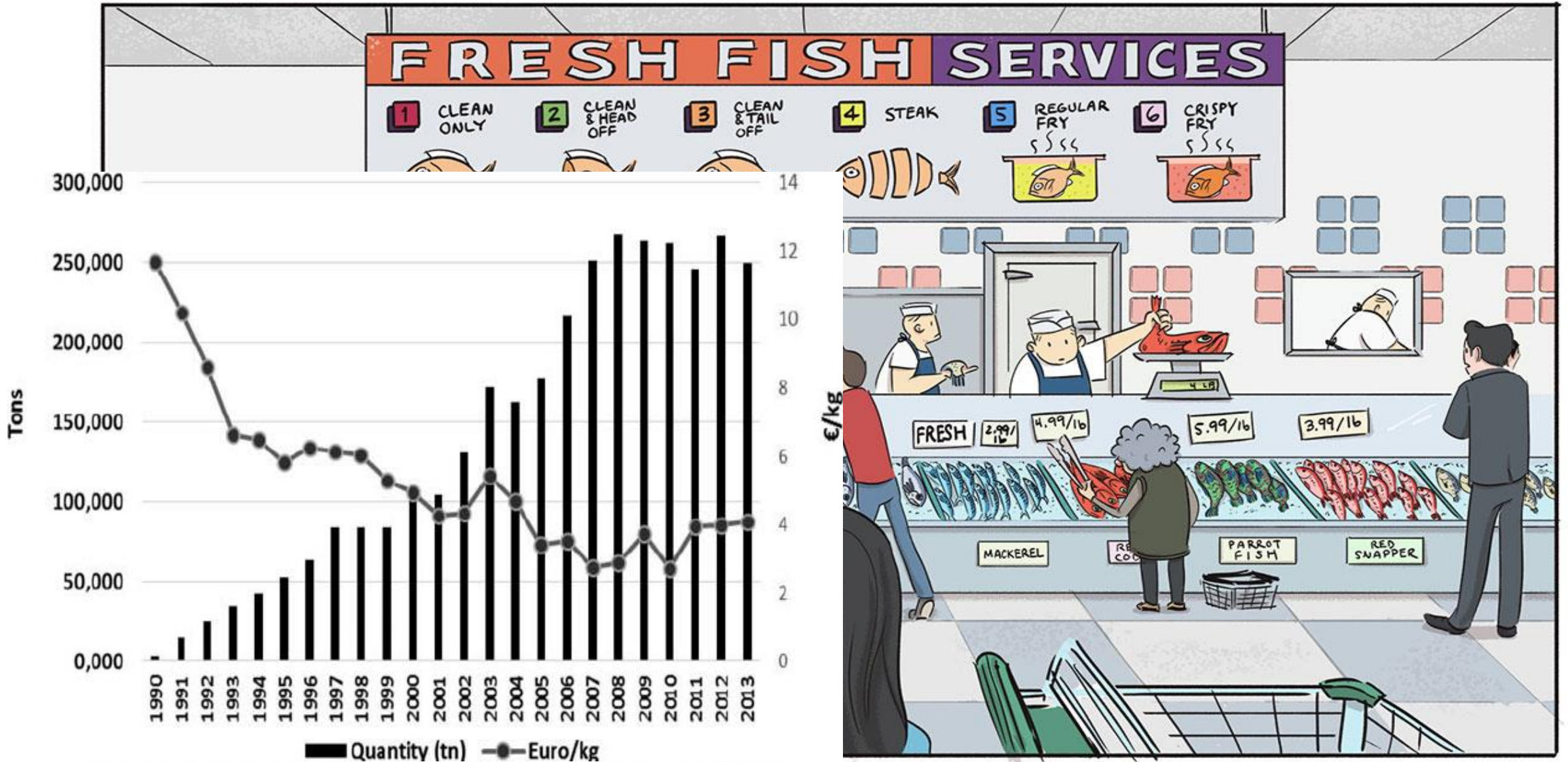
The Vision for European Aquaculture

- ❑ EU aquaculture will be sustainable and globally competitive
- ❑ Aquaculture production will grow and diversify by providing market and consumer range of new products
- ❑ EU Aquaculture production will adapt to climatic and geographic circumstances
- ❑ Aquaculture will be in harmony with nature and society
- ❑ EU aquaculture industry, by the year 2030 will provide annually 4.5 million tons food products, worth 14 billion euro
- **ALL above will be achieved by enhancing husbandry, welfare, technology and knowledge management ensuring the sustainability of aquaculture and its global role in technological leadership**



EU finfish market ~

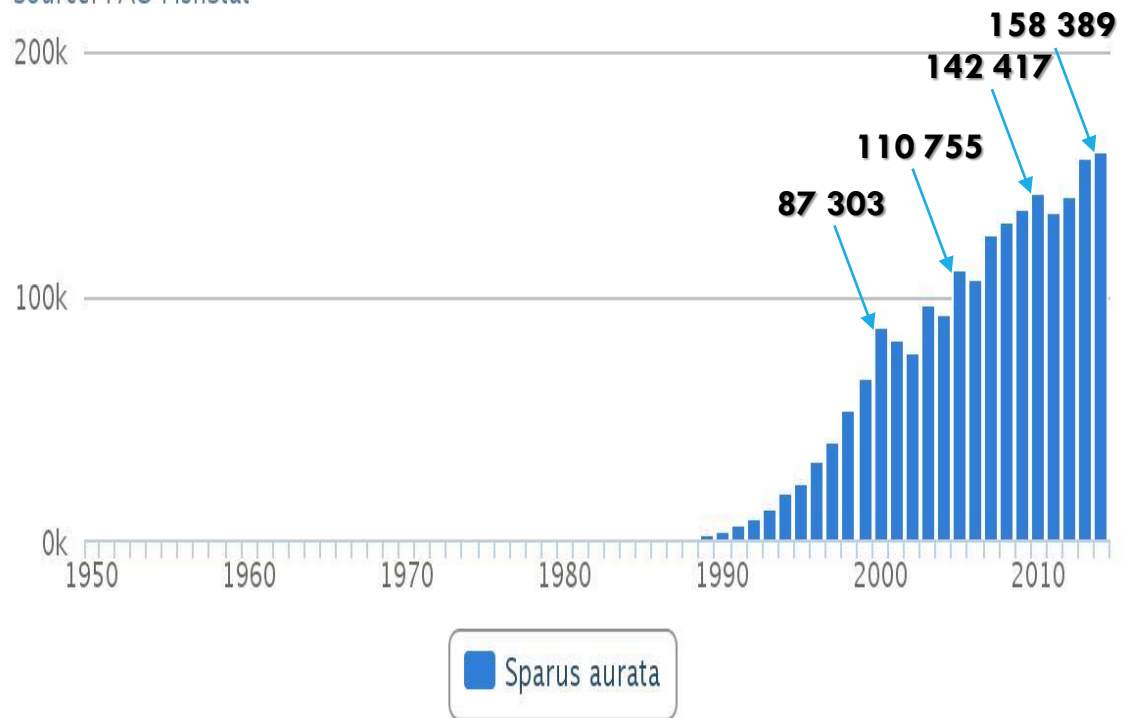
Production and annual average ex-prices (euro/kg) of european sea bass and gilthead seabream in Europe





Global Aquaculture Production for species (tonnes)

Source: FAO FishStat

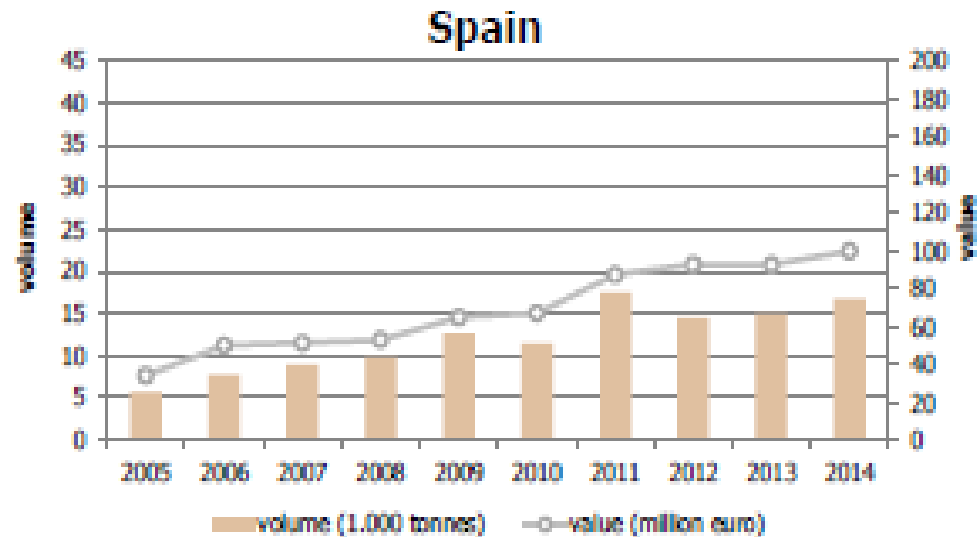
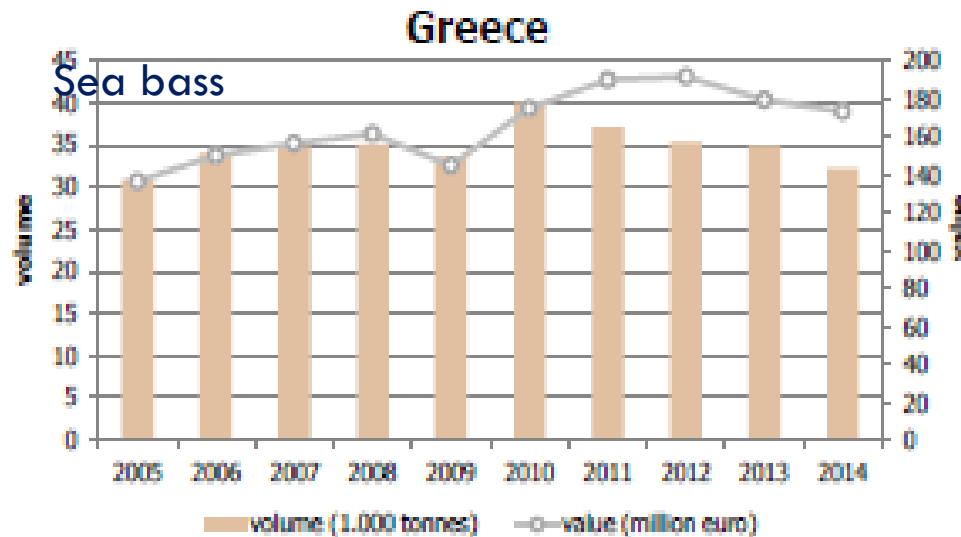
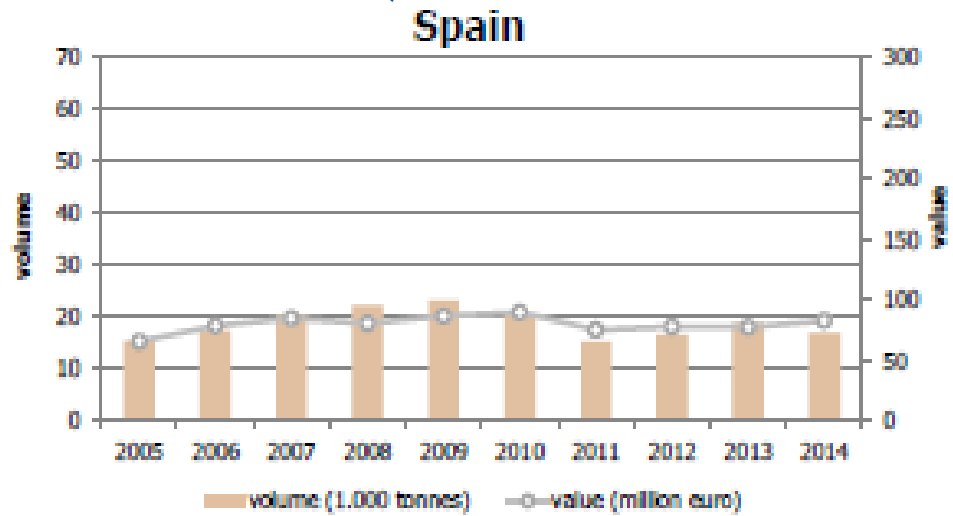
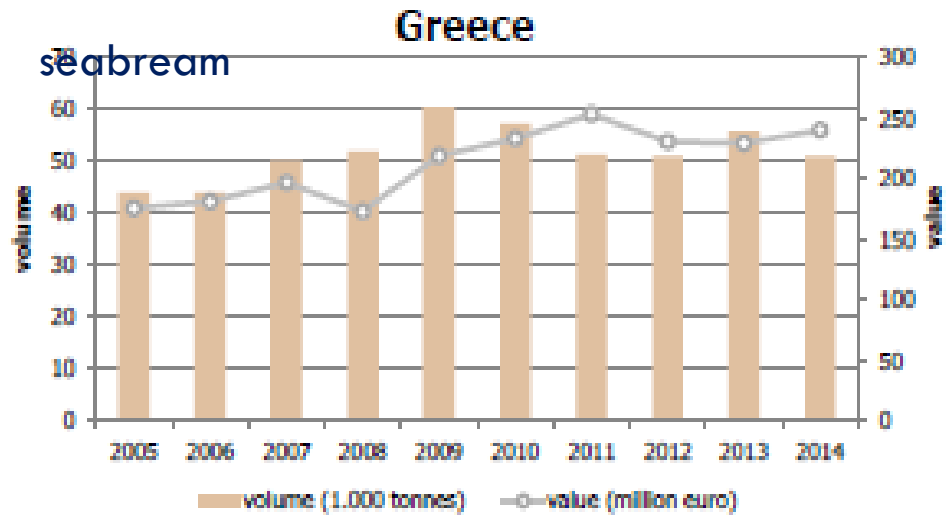


Global Aquaculture Production for species (tonnes)

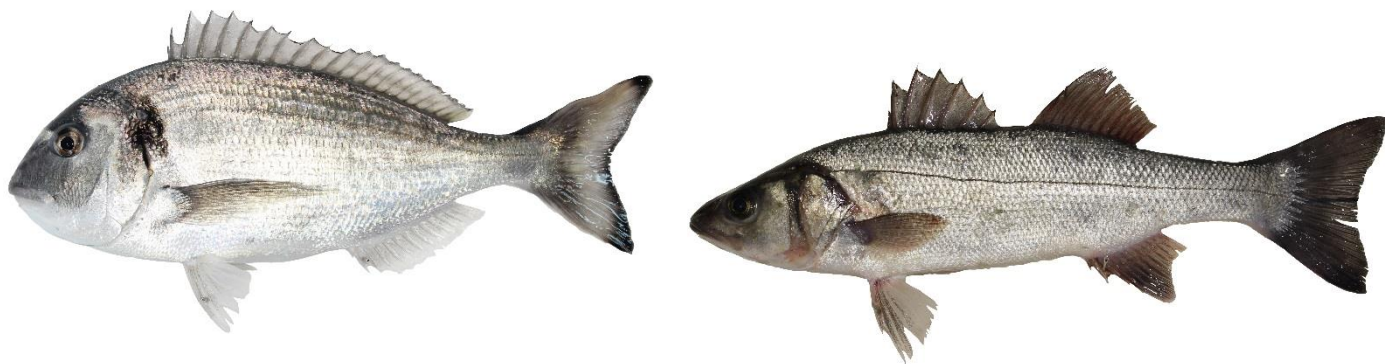
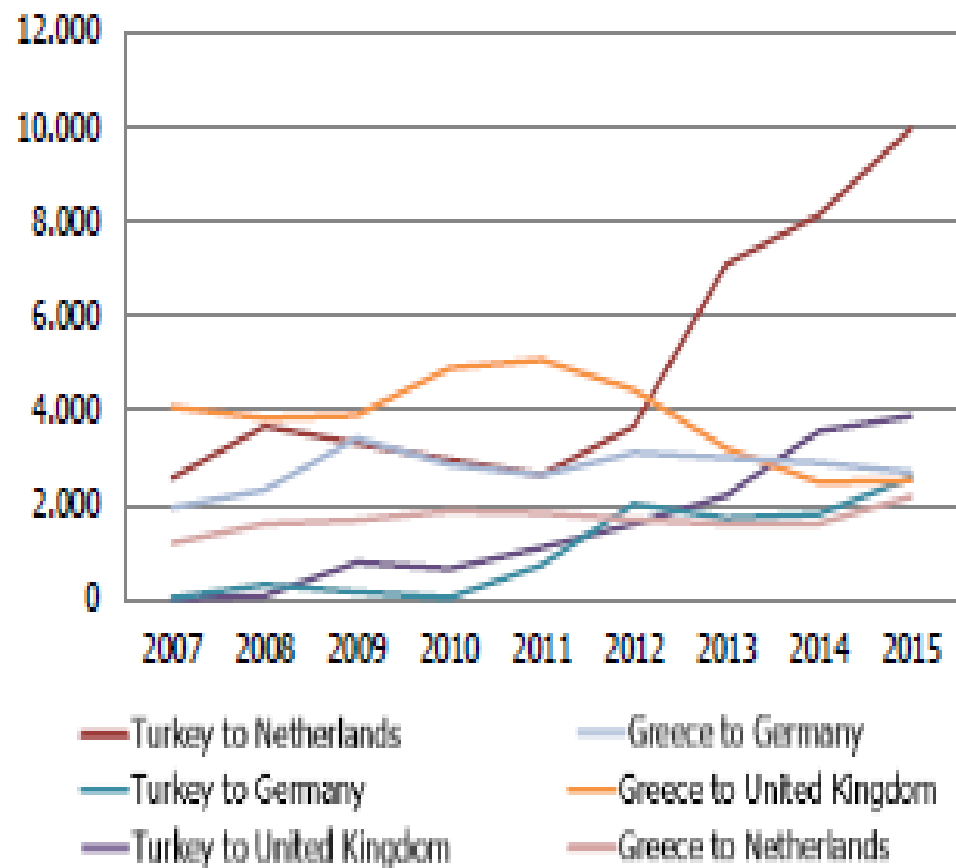
Source: FAO FishStat



Trends in seabream (above) and sea bass (down) production in two main EU countries (Greece & Spain) by value (million euro) and by volume (1000 tonnes) from 2005 to 2014



Exports of gilthead seabream and European seabass from Turkey and Greece to main European market (volume in tonnes)



Fact findings:

1. EU seabass and seabream hardly compete with expanded Turkey export

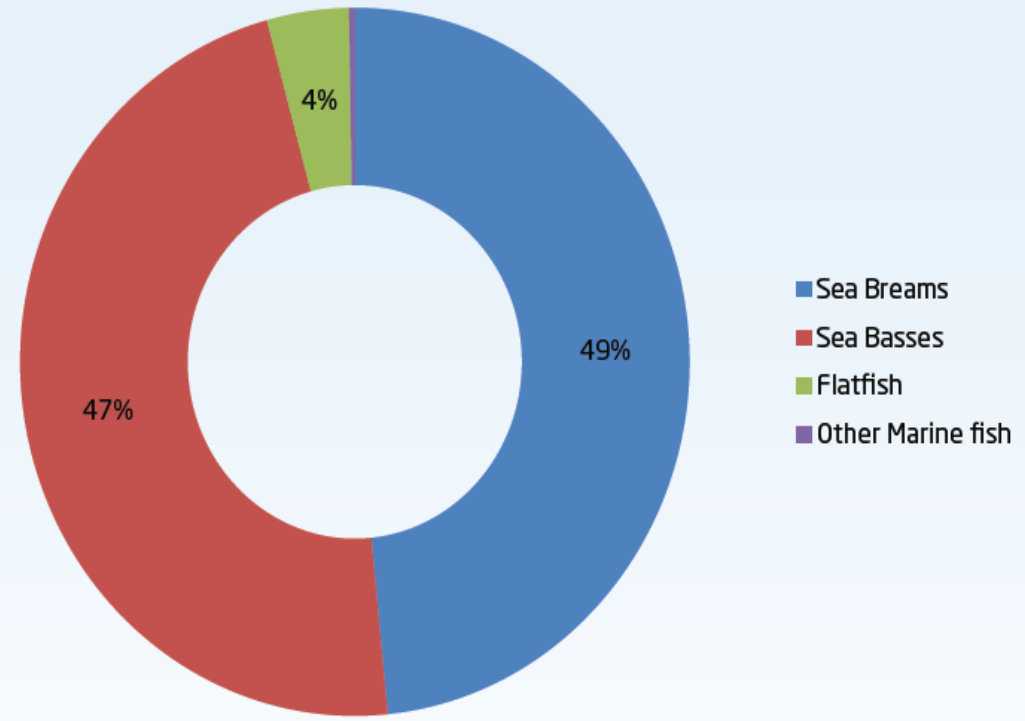
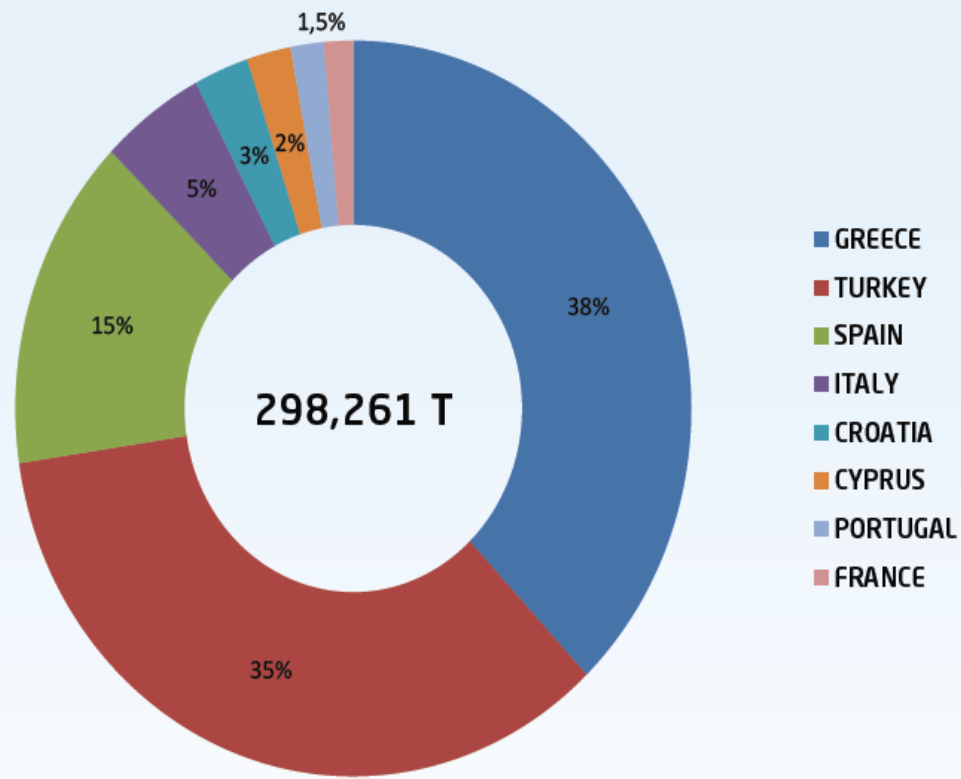
2. Northern European markets is mainly supplied by Turkey which export has increased 236% from 2010 (2964 tonnes) to 2015 (9965 tonnes)

AQUACULTURE SITES IN THE MEDITERRANEAN SEA. MEDITERRANEAN FISH CAGES AND SHELLFISH FARMS ARE MAPPED USING SATELLITE IMAGES FROM GOOGLE EARTH (P. TRUJILLO ETAL. 2012).



MARINE MEDITERRANEAN PRODUCTION IN 2014 PER COUNTRY & PER SPECIES

(FEAP ANNUAL REPORT, 2015, 36 PP)



= +2,1 % compared to 2013



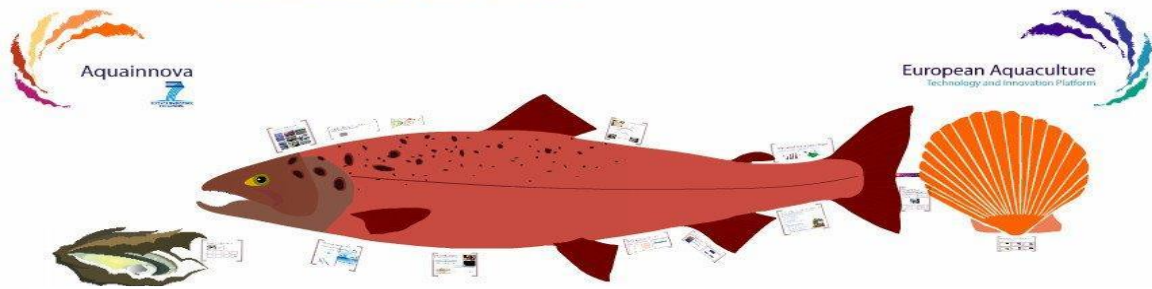
Main challenges for the increase of sustainable aquaculture production in Mediterranean countries

- **Address negative perception of aquaculture**
- **Conductive policy and adequate governance**
- **Land and water availability**
- **Minimizing ecosystem negative impacts**
- **Fed aquaculture: Availability of Fishmeal, Fish Oil and other ingredients**
- **Biosecurity and health management implementation**
- **Technology and knowledge adequate to requirements**
- **Adequate finance and investment specially for small farmers**
- **Improve equity and social impact**
- **Diversify the sector**
- **Address/prepare for external forcing factors (e.g. climate change)**

Mediterranean - Growth Forecasts

Aquaculture in 2030

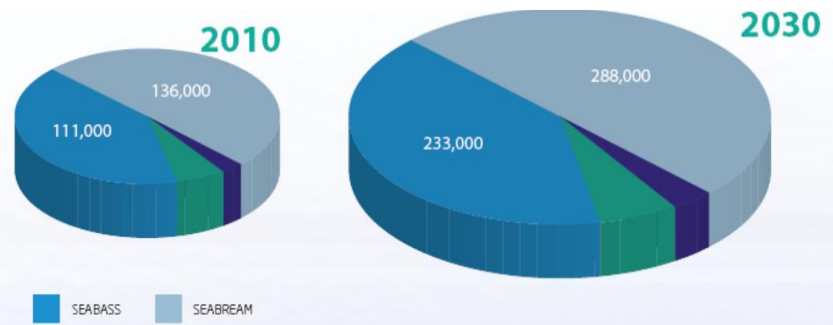
Our vision for the future.



Vision 2030

- Production growth >100% = minimum 4%/year
- Higher expansion rates for meagre and sole
- FCR decreases to 1.2 (35% improvement)
- Aquaculture will diversify – functional additives, bio-energy (algae)
- Main species: seabass, seabream, sole, meagre, turbot
- Productivity/employee increases by 20%
- Juvenile survival increases by 20%

(a) Finfish



Total Increase tons 305,000 112% Total Increase M€ 1,449 113%

Challenges

- Understand consumer perceptions
- Effective marine & coastal spatial planning
- Obtain robust fish, selected broodstock
- Disease control & prevention
- Overcome climatic challenges, severe weather
- Ensure innovation and best knowledge management

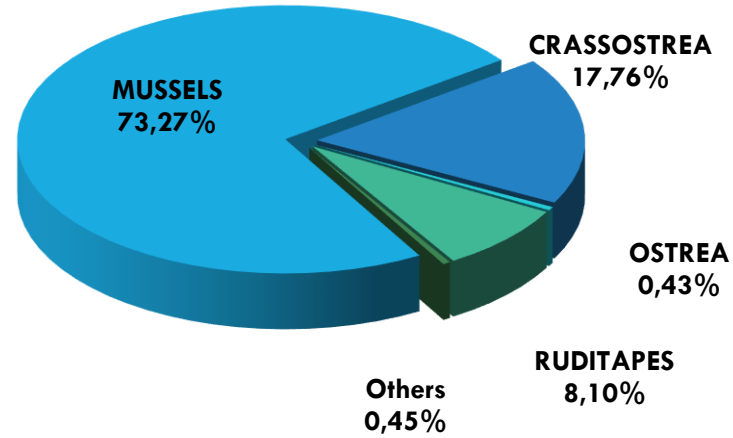
Action Plan

- Access to new production sites, licences
- Understand consumer choice
- Diversify species profile
- Communicate quality aspects of Mediterranean products
- Simplification of legislation
- Incorporate technological developments
- Assure environmental sustainability
- Encourage diversification and integration
- Integrated spatial planning for aquaculture development

Effects

- Production >600,000 tons of fish
- €2.7 billion ex-farm but €5 billion increase in total value
- 10,000 more jobs
- Total sea farm space of 2,100 hectares
- Hatcheries to supply nearly 3 billion juveniles
- Feed demand increases by 200,000 tons

Mediterranean shellfish production (Source:FAO)

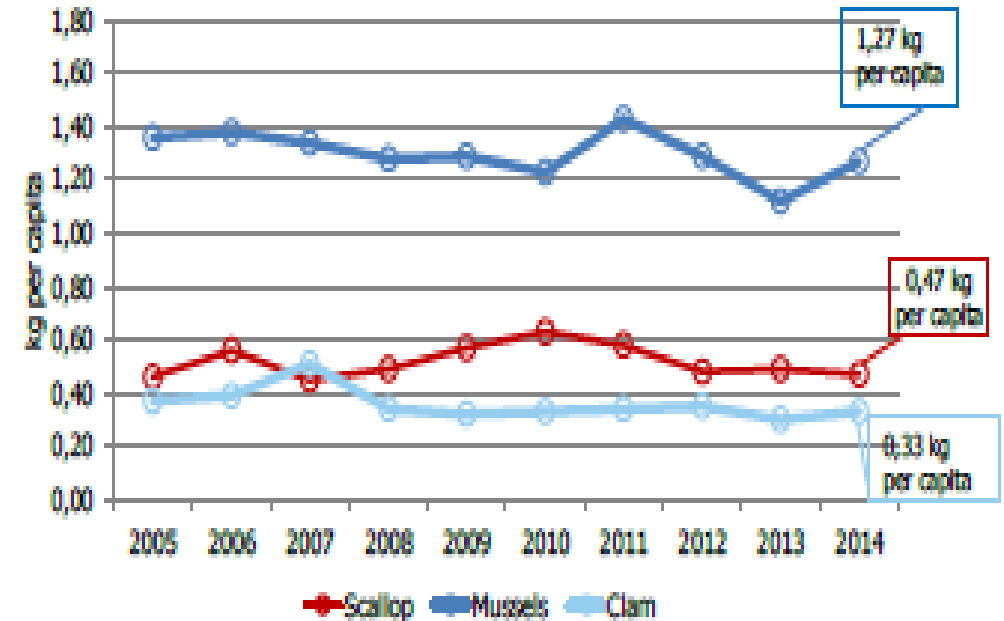
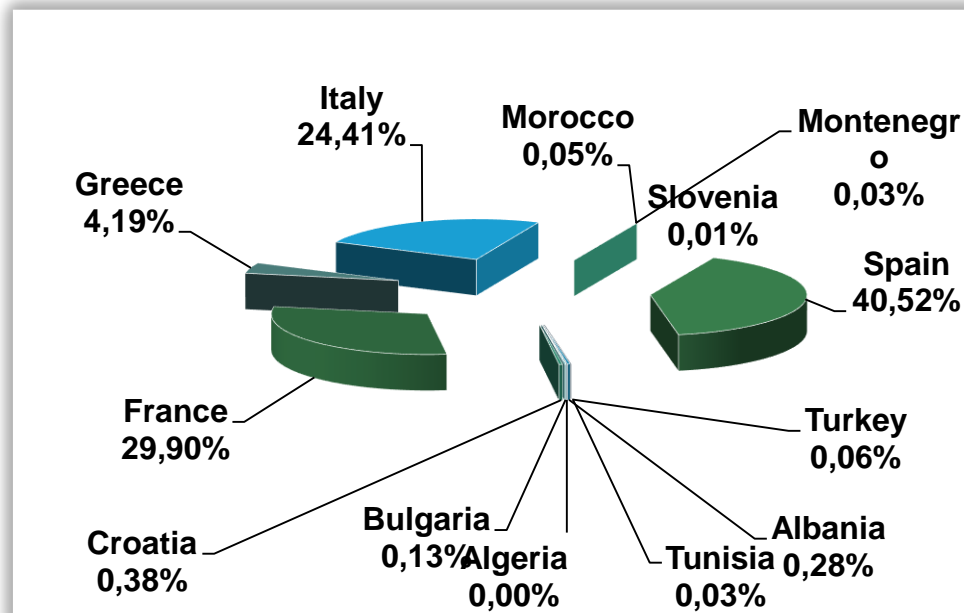


Apparent consumption of most important bivalves species (2005-2014)

Source: our elaboration based on EUMDFA data

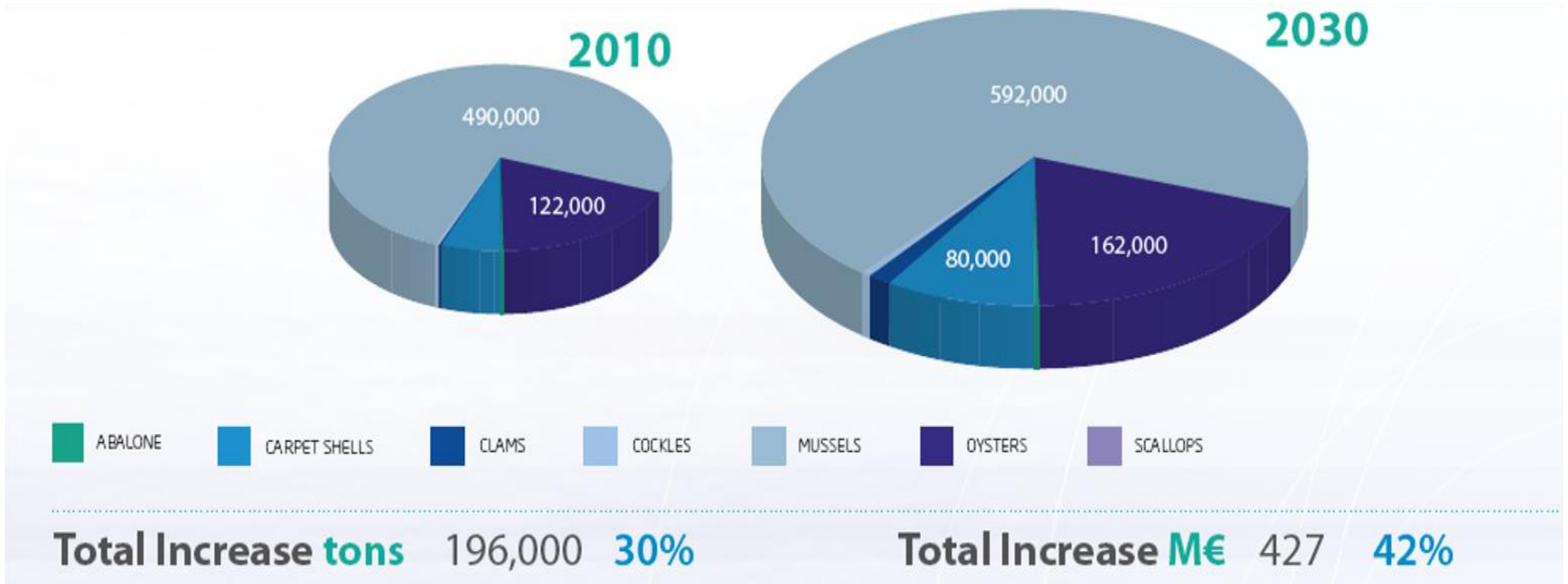
% Production of Mollusc in MED Countries in 2010, by country.

Source: FAO



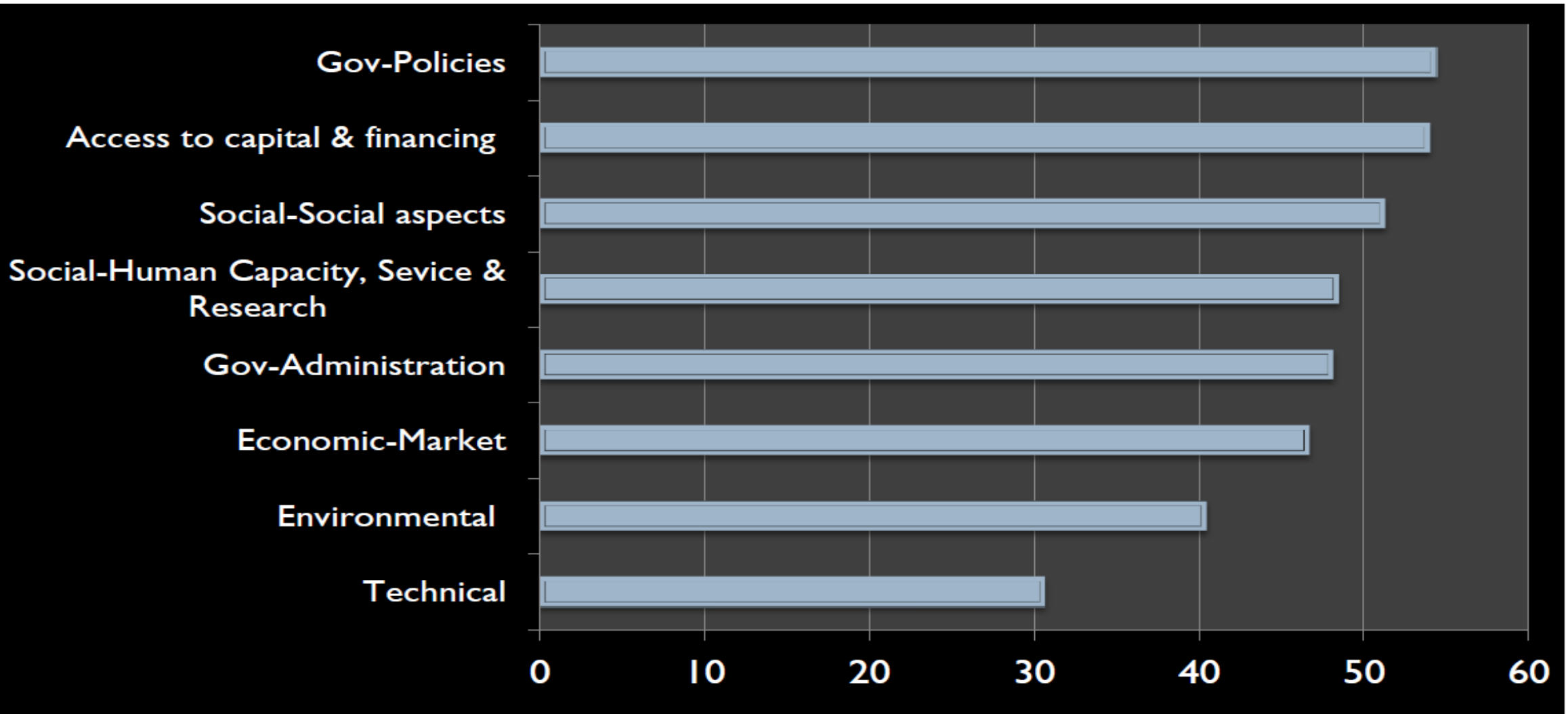
GROWTH FORECASTS IN VOLUME AND VALUE FOR MEDITERRANEAN SHELLFISH PRODUCTION

(b) Shellfish



AQUACULTURE: MAIN CONSTRAINTS BY 2030

(SOURCE: WWW.AQUAMEDPROJECT.NET)



NOT ENOUGH EXPLOITED EU AQUACULTURE POTENTIAL

- **Market opportunities**
- **Diversification by farmed species and farmed products**
- **New rearing sites by employing more robust offshore type technology**
- **Combined rearing systems – offshore - RAS; & IMTA**
- **Improvement of husbandry practices**
- **Fish feed technology and feeding technique**
- **Standards and procedures**
 - in optimizing site selection
 - improve welfare and fish health management
 - prevent pathogen dissemination via trade of aquatic animals
 - improve natural resources protection and environmental sustainability – monitoring
 - in social responsibility (compliance with labour legislation; health and safety condition on site...)

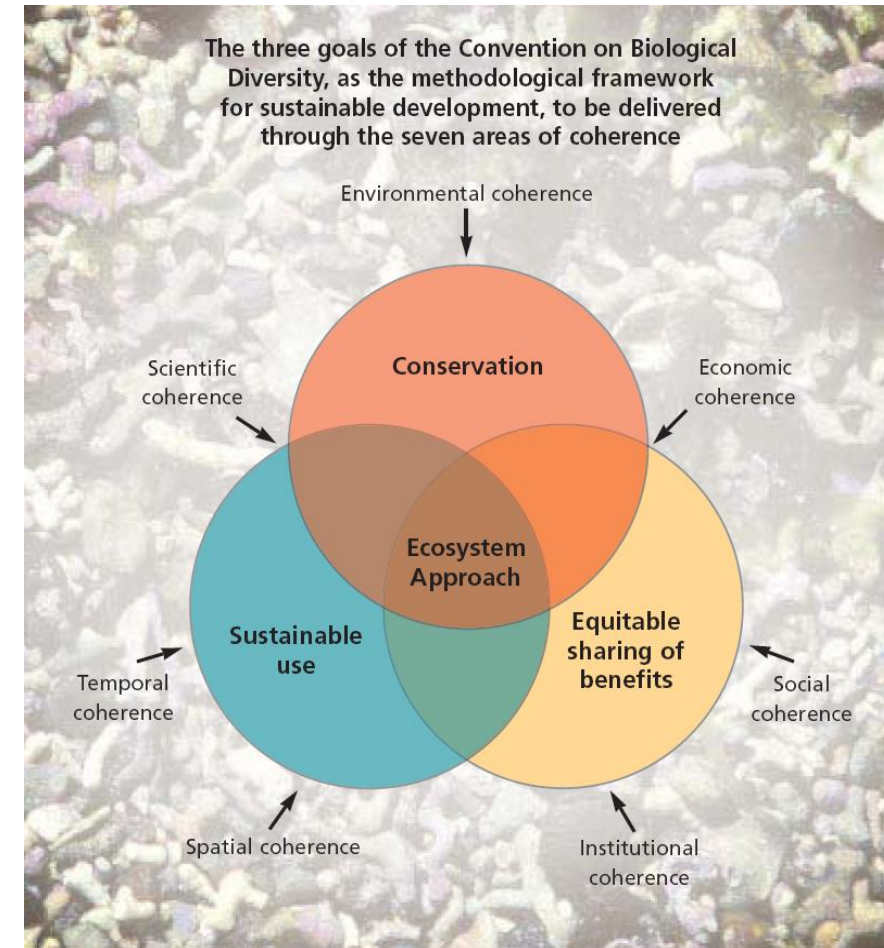
All above may

IMPROVE TRUST AMONG PRODUCERS AND CONSUMERS

KEY FORMULA IN A NEW ERA OF AQUACULTURE DEVELOPMENT

➤ Farms must operate by respecting both environmental and economic optimum, and also act in a socially and culturally responsible manner

- **Environmental consideration – sitting aquaculture following ICZM principles and Ecosystem Approach must be a common standard**
- **Competitiveness – a shift from quantity-oriented to quality and market-oriented approach**



COMPETITIVENESS & MARKET-ORIENTED APPROACH

Needs:

- » **Consolidate production** through sustainable farming while optimising profitability and minimizing environmental impact;
- » **Improve the image** of aquaculture products supported by market-oriented production;
- » **Develop strategic marketing plans** for the promotion, product development and commercialization, in both traditional and new markets;
- » **Certify** freshness, traceability and animal welfare, than ...
 - more people will choose the products, the more supermarkets will stock them and more fish farms animals will have a better life

„labelled food could increase by as much as 200% in the next five years due to an increase in consumer demand”

MEDITERRANEAN FOOD CONSUMPTION PATTERNS

The Mediterranean diet, in which seafood is one of important components is widely considered nutritious and healthy

Due to new lifestyles and socio-economic changes the dietary pattern is critically eroding the Mediterranean Cultural Heritage of Humanity, recognized by UNESCO 2013

It is a urgent need to preserve and transmit the Mediterranean diet as a common cultural heritage and lifestyle to future generations

Source: CIHEAM/FAO. 2015. Mediterranean food consumption patterns: diet, environment, society, economy and health. A White Paper Priority 5 of Feeding Knowledge Programme, Expo Milan 2015. CIHEAM-IAMB, Bari/FAO, Rome.

UNESCO
United Nations
Educational, Scientific and
Cultural Organization

Intangible
Cultural
Heritage

Intangible
cultural
heritage

NEWS EVENTS CONVENTION LISTS SAFEGUARDING

UNESCO > Culture > Intangible Heritage > Lists > Mediterranean diet

Mediterranean diet

Cyprus, Croatia, Spain, Greece, Italy, Morocco, Portugal

Inscribed in 2013 (8.COM) on the Representative List of the Intangible Cultural Heritage of Humanity

Mediterranean Food Pyramid

Meats and Sweets
Less often

Poultry, Eggs, Cheese, and Yogurt
Moderate portions,
daily to weekly

Fish and Seafood
Often, at least
two times per
week

Fruits, Vegetables, and Grains
(mostly whole)

Wine
In moderation

Drink Water

PROCESSING OF FARMED FINFISH – ADDING A NEW VALUE

- Processing is a strategic advantage in achieving the high quality and freshness of farmed fish
- By adding new value and satisfying consumer requirements new market is created
- Processing is running much behind actual needs;
 - +30 years of industrial production, but packaging and processing have started hardly a decade ago
- Product quality, branding and labeling to obtain consumer confidence



Photo: Cromaris, Croatia

KBBE-2013-07-GA 603121 DIVERSIFY



www.diversifyfish.eu Search



EUROPEAN UNION 7th FRAMEWORK PROGRAMME

HOME PARTNERS SPECIES RESEARCH AREA INTRANET DISSEMINATION BLOG

7FP-KBBE-7-DIVERSIFY


Enhancing the European aquaculture production by removing production bottlenecks of emerging species, producing new products and accessing new markets

Contact Project Coordinator



Summary - objectives

An efficient, sustainable and market-oriented expansion of the EU aquaculture sector based on new fish species and products will reduce the dependence of the EU on imports, reduce the pressure on over-exploited fisheries in the EU and explore new segments and tailor-made products for the EU market. This is the objective of a newly approved Collaborative project named DIVERSIFY, funded by the European Commission (FP7-KBBE-2013, GA 603121).
[\(read more\)](#)



Firm factors affecting profit in EU aquaculture

(source: Sanchez et al. 2016)

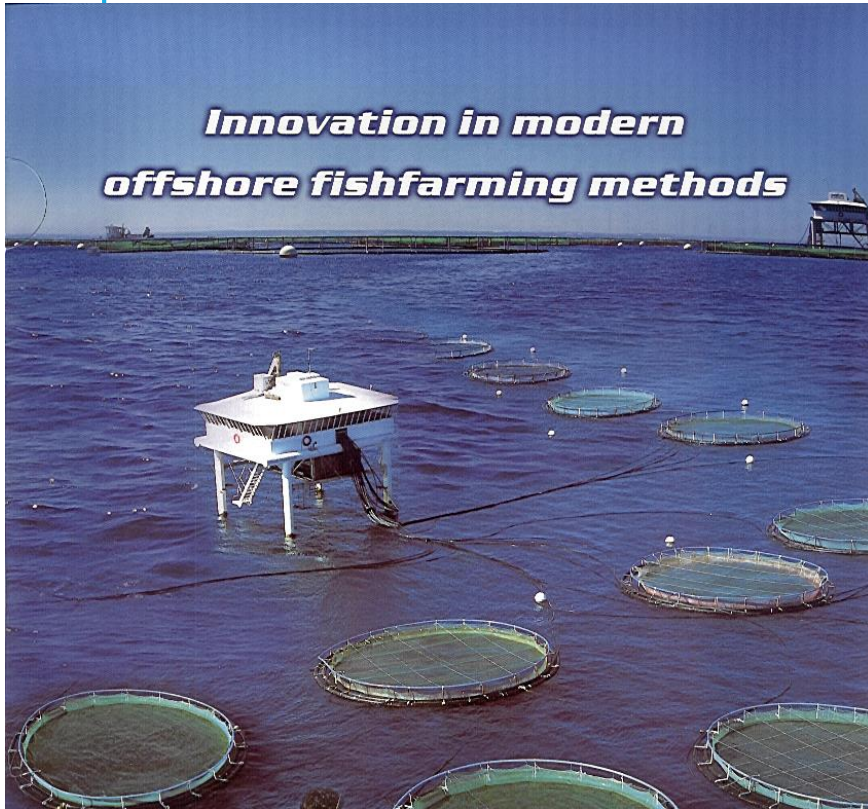
- **Diversification strategy has demonstrated the best economic performances in both marine and land-based aquaculture**
- **Product certification is also positively related with farms' economic performances**



Size does matter !!!

- **Size factor affecting differences in economic performances of firms belonging to EU aquaculture industry; size variable is positively related to profit margins**

FARMING ON EXPOSED LOCATION



- **Monitoring of farmed fish in real time**

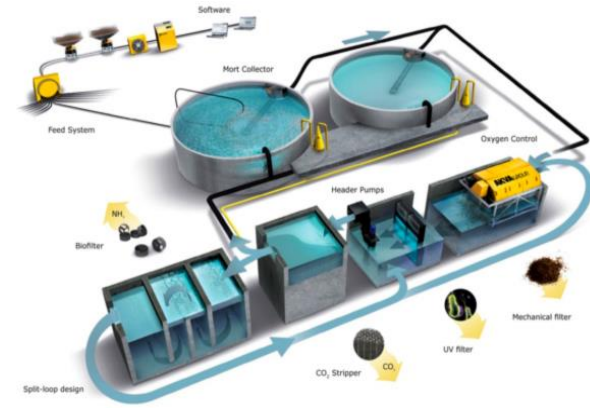
- **Full feeding control**

The collage illustrates various aspects of modern offshore fish farming technology:

- Hand holding feed:** A hand is shown holding a purple feed pellet, representing precise feeding control.
- Magnifying glass:** A magnifying glass is positioned over a fish, symbolizing real-time monitoring of the farmed fish.
- Sensor:** A white cylindrical sensor is shown, likely used for monitoring water quality or fish health.
- Computer interface:** A computer monitor displays a control interface with a bar chart showing data trends and various control buttons.

Exposed areas = potential fish species and production systems

Robust and fast growing species



ongrowing „seed” production



❖ Production economy may take advantage of combined and prolonged land-based RAS for growing robust „seed”, and shore technology for market



Potential of offshore tech should be investigated under Given environmental, economic, And social circumstances



- RAS : variety of environments
- Operational costs must be radically lowered if RAS will improve its competitiveness



market product

INTEGRATED-MULTITROPHIC AQUACULTURE (IMTA)



IMTA ?

The waste products from one food production process (i.e. fin-fish production) is assimilated by other food organisms and converted to valuable products

Economy & Environment = „Vin-Vin”

.....

- **Increase productivity**
- **Increase profitability**
- **Reduce environmental damage**
- **Increase space requirement** (extensive culture of eg. shellfish and aquatic plants are space consuming)
- **Increased the social licence of IMTA aquaculture**
- **Increased complexity to the system**

Photo: google

Source: Aquacult Environ Interact 8: 191–199, 2016

HOW SCIENCE CAN HELP INDUSTRY?

- **Spatial planning and farm location**

- Where and how big farms should be ? ICZMP, Spatial Multi-criteria Analysis and Ecosystem approach, as a science-based tools for site selection, and assessing carrying capacity of coastal areas

- Decision support system: AquaModeling, estimate of holding capacity of an ecosystem, MSP, SEA-EIA ?

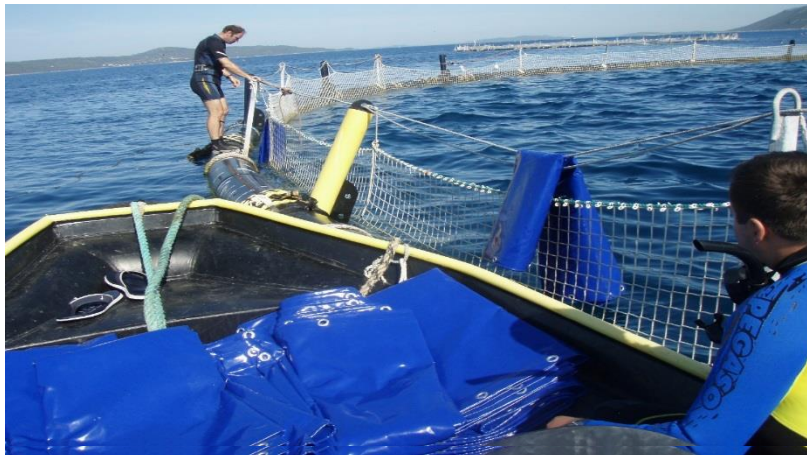
- **Health & biosecurity - prevention of disease and management of fish health**

- How to reduce veterinary drug use at farm level ? ,

- Some natural compounds (i.e. probiotics, sea weed, fish by product....) to be tested for their activity (*recent lit. overview demonstrated beneficial effect when use for human and animal medicine treatment*)



CONT.



- = Effects of a mixture supplement diet to be tested and monitored by measuring stress and immunity related markers
- = Feed enrichment with desired pigments as to improve consumer acceptance of mariculture product
- **Breed stock management**
 - = Sex manipulation (i.e. all female sea bass population have increased growth compared to males)
 - = Triploids to enhance growth and avoid impact on native populations
 - = Improve resistance to infective pathogens
 - = Phenotyp selection as to improve market value and diversification of mariculture product
- = **& many other fields**

Thank you very much for your attention



aquaculture
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