AZTI

MEMBER OF
BASQUE RESEARCH
& TECHNOLOGY ALLIANCE

**www.**azti.es

# 2022

Maite Erauskin-Extramiana

## AZTI REPORT

THE ANSWER LIES IN SCIENCE

# CONTENT

Nagore Luengo

# 1.1.
# LETTER FROM THE PRESIDENT AND THE CEO OF AZTI

*Bittor Oroz and Rogelio Pozo*

In a setting characterised by uncertainty and rapid changes, organisations are focusing on short-term planning. However, the trends and implications driven by major changes in society such as global warming, population growth and the polarisation of the economy between Asia and America will continue to mould the future, leading to structural changes that will shape society and determine the competitiveness of countries and companies. In this scenario, at AZTI we have conducted a long-term strategic analysis with a view to the future and **taking as a compass our 2023-2025 technology plan**, in order to guide our short-term decisions, to help us to stay on course and achieve our strategic vision and targets.

Population, climate change and the depletion of natural resources are inter-connected and closely-related issues. How human societies develop and grow, what use they make of natural resources and their environmental impact are factors that have a direct effect on climate change and therefore in the planet's capacity to sustain us. **Food production systems as we know them are not sustainable**. We are wasting and depleting the natural resources we need to produce food in the future. In short, we are placing at risk the future of the coming generations.

**Population plays a fundamental role** in the link between climate change and the depletion of natural resources. World population has grown exponentially in recent decades, which has given rise to increased demand for resources like energy, water and food.

The population is growing, and with it demand for energy and transport, so increasing emissions of greenhouse gases. The +1.5ºC scenario will be difficult not to exceed if our environmental footprint per capita continues as it is today, as it is forecast to involve an increase in greenhouse gas emissions from 41 Gt a year to 60 Gt a

**Bittor Oroz.** President of AZTI.

# 1.1.
# LETTER FROM THE PRESIDENT AND THE CEO OF AZTI

year. A grim scenario in which to **combat climate change**.

Moreover, the **over-exploitation of natural resources**, such as deforestation and overfishing, is leading to a loss of biodiversity and environmental deterioration. This may cause a chain reaction in the economy and in society as a whole, as the loss of healthy ecosystems affects air quality, the availability of clean water and our capacity to produce food.

In conclusion, population, climate change and the depletion of natural resources are inter-connected and must be approached in a holistic way. **It is essential for us to find sustainable solutions to ensure that the planet can meet the needs of its current and future population**. This includes fostering efficient use of natural resources, the adoption of clean, renewable technologies and the implementation of policies to promote sustainability and fairness in access to resources. By taking steps to meet these inter-related challenges we can ensure a sustainable future for our society and our planet.

All **these structural challenges call for transformational projects** to be carried out in a setting of uncertainty and high inflation. The fishing and food industries face major challenges in terms of costs, competitiveness and profitability. Uncertainty can make it hard to predict future demand, which in turn can impede strategic planning and decision-making. Inflation increases raw material and production costs and makes the prices of products less competitive on the market. In this context, but without losing sight of the medium and long term, AZTI **has prioritised the efficiency of processes by developing solutions for digitalisation, energy saving and automation, all through an approach of overall sustainability**.

Efficient processes can help

**Rogelio Pozo.** CEO of AZTI.

# 1.1.
# LETTER FROM THE PRESIDENT AND THE CEO OF AZTI

to cut production costs, helping a company to respond more quickly to changes in demand on the market and in the prices of inputs, which can be especially important in an uncertain, inflationary environment. Furthermore, efficient processes can also help a company to boost its productivity, cut production times and improve the quality of its products. All this helps to boost the company's position on the market and increase its profitability.

Climate change is an issue that must concern us, as we are all part of the problem but also part of the solution. Every gesture counts. Public policy, the strategies and commitments of private companies and the behaviour of consumers, are the three levers to develop solutions to transform production processes and models of consumption, and so minimise the effects of climate change. Reforms are needed in food production, industrial processes need redesigning and fuels need decarbonising, and we need to make the circular economy work, manage carbon capture and change models of consumption. Science has to play a leading role and deliver the knowledge necessary to devise policies and provide solutions with a positive impact on society and its sustainable, healthy development.

In short, science is playing a key role in developing sustainable, healthy food systems, from production to distribution and consumption of foods. Science does not have all the answers, but it does have the best answers available. **The answer is in science**.

Nagore Luengo

# 2.1.
# THE VALUE OF COLLABORATION

Science can be defined, seen, experienced and understood in different ways. However, almost all definitions point to knowledge generation as their main objective. Knowledge that must respond to a purpose that is, after all, the backbone that guides our path

The road to excellence is, of course, also the road to demanding standards. As you progress along this path, you discover that there are more and more opportunities for improvement, and the demands, both personally and collectively, also become greater.

Learning from the past, but looking to the future. Looking back on the progress we have made to discover the road we have travelled as a team, where once we dreamt of goals that seemed impossible and that we have managed to make a reality. This has been the starting point for a **new long-term strategic approach, AZTI2030**, which we have built as a team and which has enabled us to grasp the needs and trends of the market, in order to organise effective responses and develop new capabilities and ecosystems. This is the strategic plan that will allow us to stay the course to keep moving towards achieving our vision and strategic goals.

**THE VALUE OF COLLABORATION**

Faced with the new challenges that we must face, whether economic, business or social, at AZTI we are committed to exploring new perspectives and partnerships that allow us to join forces in the search for solutions that have an impact. Whether through participation in important international forums or in research projects of various kinds, we collaborate with leading European organisations in various fields. For example, we continue to coordinate a team of European scientific institutions that advise the **European Commission on fisheries management** and act as representatives of distant water RFMOs.

We are also committed to an important and strategic **international presence in those forums and scientific committees that are key** to the sustainable management of the fishing resources of the main species of interest to the Basque fishing sector, such as the STECF scientific committee, an organisation that directly advises the European Commission on the sustainable management of European fisheries.

We coordinate and participate in major European projects on issues related to the health and sustainability of the planet, from the seas to the production processes of the food industry, including the


Asier Nieto

development of products that are key to the diets of the future.

And because we believe that collaboration goes hand in hand with knowledge sharing, we openly share several tools that we have developed that help to better manage our planet's resources.

# 2.2.
# SCIENCE AND TECHNOLOGY OUTREACH

A scientific project, no matter how spectacular its results, is not complete until those results are published and shared with the academic community. In this way, the cornerstone of science is based on the idea that original research has to be published. Only in this way can new scientific knowledge be verified, with engagement in scientific conversations with peers, and the replication of new discoveries.

Under this premise, AZTI continues to commit to publishing the advances developed in scientific media. The number of scientific publications in 2022 is above **130 indexed publications per year** (>75% in Q1), with more than 6000 citations to AZTI papers this year. In terms of quality, the number of citations continues to increase steadily, with more than 30 citations per publication. Notably, an article was published in the journal Science (Seventy years of tunas, billfishes, and sharks as sentinels of global ocean health) and another in the journal Nature (Enviroscore: normalization, weighting, and categorization algorithm to evaluate the relative environmental impact of food and drink products).

But beyond scientific publications, AZTI'scommitment to the **dissemination and promotion of science** also stands out. Since 2016, more than 12 AZTI mentors have participated in the Inspira STEAM project to encourage the interest of young people, especially girls, in science and technology. On the other hand, efforts have been made to produce scientific dissemination materials (such as videos and infographics) and to participate in dissemination actions in different formats, such as radio and television programmes, workshops for families or conferences for the general public.


Nagore Luengo

# 2.3.
# INTERNATIONAL BENCHMARK: SCIENTIFIC EXCELLENCE

**“The people who make up AZTI are our greatest asset in achieving the goals we have set ourselves.”**

The more than 290 professionals that make up our team make the upward development of the organisation possible and are the main source of our strength. For this reason, during 2022, in a firm commitment to excellence and the search for scientific results, we have been able to incorporate new talent into our organisation with proven research experience.

We believe in the transformative power of teams, and that the sum of all people, individually and collectively, allows us to move forward together as an organisation.

- One AZTI scientist, Ángel **Borja**, is on the list of **Highly Cited Researchers**, i.e. he is in the top 1% most cited in his field worldwide and is also the most cited scientist in Spain in his field. Two AZTI researchers (Ángel Borja and Xabier Irigoien) are in the top 2% of the most cited researchers in the world across all fields.
- Three AZTI scientists **(Leire Ibaibarriaga, Raúl Prellezo and Andrés Uriarte**) are **members of the Scientific, Technical and Economic Committee for Fisheries** (STECF). This committee is responsible for providing direct advice to the EU (European Union) and is composed of highly qualified scientific staff, particularly in the fields of marine biology, marine ecology, fisheries science, fisheries technology and fisheries economics. Eight percent of this group is made up of AZTI scientists, which has made us the research centre in Europe with the largest representation on such an important committee.
- An AZTI scientist, **Dorleta García,** has been appointed **vice-president of the Advisory Committee of the International Council for the Exploration of the Sea** (ICES). This is the committee that gives fishing recommendations to the European Commission for all fish stocks.
- An AZTI scientist, **Haritz Arrizabalaga, has vice-chaired the Standing Committee on Research and Statistics of the International Commission for the Conservation of Atlantic Tunas** (ICCAT)
- Market Manager **Marina Santurtún** participated in the **United Nations Forum** on Ecosystem-based Fisheries Management
- AZTI has been accepted as a member of the **European Platform Food Losses and Food Waste** for the next five years 2022-2026, and is represented on the Platform by **Jaime Zufia** and **David San Martin**. We are one of the 7 European research institutes that are part

# 2.3.
# INTERNATIONAL BENCHMARK: SCIENTIFIC EXCELLENCE

of this platform. Promoted by the European Commission, it provides food waste prevention recommendations and sets targets to be included in the binding regulatory framework to reduce food waste in the EU.

- AZTI scientific staff **participate in or lead different scientific committees,** including the scientific vice-presidency of the ICCAT, participation in the scientific committee of the European Environmental Agency, participation on the board of the Scientific Association of Economists in the field of Economics of Natural and Environmental Resources (AERNA), in the European Society of Sensory Sciences and in the European Association for Food Safety, as well as occupying relevant positions in the Scientific Committees of the Regional Environmental and Fisheries Management Bodies, especially those dealing with the most important fisheries for the Basque fleets. An AZTI researcher is the president of the European Commission's Economic Committee for Fisheries (EAR).
- The Banco Sabadell Foundation has recognised the excellent professional career of AZTI researcher **Oihane Cabezas Basurko** with the **marine sustainability award**.

As a result of this scientific excellence and the applicability of the results, the successful **recruitment from EU programmes** deserves to be mentioned. In the first Horizon Europe WP2021-2022 work programme, AZTI has been awarded 12 projects (3 of which we are coordinating), representing a contracting of more than 7.36 million euros. Also significant were the contracts won in **public tenders** with the Port Authority of Bilbao and Pasaia, with the Regional Government of Andalusia and with the EFSA, the European Food Safety Agency, for a total of 3 million euros.

# 2.4.
# RECOGNITION FOR GOOD WORK

To innovate is to improve what already exists, providing new options that respond to the needs of people and companies. This is the focus of the innovation that we carry out at AZTI and which has also been recognised in different forums this year:

- The ENVIROSCORE environmental labelling system created by AZTI and KU Leuven received the **Esker ON award from the Provincial Council of Bizkaia**. This award recognises initiatives that promote the circular economy and demonstrate how Bizkaia is making progress in the green transition.
- In the first edition of the **Lurra Bizkaia Sariak Awards, in the Ura - Water category**, the **Bilbao Bizkaia Water Consortium** wished to recognise the projects carried out by AZTI to improve water efficiency among companies, and the actions carried out so that they achieve eco-efficient savings and production.
- AZTI received the **Kofradia-Itsas Etxea innovation award** in 2022. These awards are recognition by the inshore fishing sector to those entities and people who have supported, disseminated or promoted inshore fishing in the Basque Country.
- The MARLIT (POCTEFA) project led by AZTI has been selected as the winner of the **Atlantic Project Award in the Healthy Oceans and Resilient Coasts category**, for its relevance to the pillars of the Atlantic Action Plan; for its innovation in terms of results and working methods planned or achieved; and for the sustainability of the project results and possible scalability in other Member States.
- One of the innovations developed in the LIFE ECOFFEED project entitle**d** *Technological solution for adequating coffee by-products as animal feed*, has been defined as a **'key innovator' by the European Commission's Innovation Radar.**
- Some of the **food products developed by AZTI received several awards** in 2022. Among others, the Ecolumber Group's Air Nuts hot chilli snacks have won the UK's Great Taste 2022 and the Grocer's New Product Awards 2022 (Savoury Snacks). Likewise, the nutritionally balanced powdered product of the company Yuit has received the first start-up award (Food and Agrotech category) from the newspaper Expansión.

Saioa Álvarez

# 3

## SUSTAINABILITY

AND ENVIRONMENT

# 3.1.
# CONSERVATION OF NATURAL HERITAGE, PROTECTION OF NATURE AND BIODIVERSITY

**In the face of rapidly advancing biodiversity degradation, knowledge and technology, i.e. science, becomes an ally to help curb the rapid disappearance of species.**

## *KNOWLEDGE TO HALT AND REVERSE THE LOSS OF MARINE BIODIVERSITY*

Knowledge is the basis for action and, along these lines, AZTI, in collaboration with Simon Fraser University (SFU) and the International Seafood Sustainability Foundation (ISSF), has developed a global indicator - the **Red List Index** (RLI) - that measures the state of marine biodiversity based on the changes recorded in the risk of extinction of oceanic predatory fish (tuna, billfish and sharks) over seven decades.

The results, published in the prestigious journal Science, show the overall recovery of tuna and billfish species of commercial interest, thanks to management measures adopted by regional fisheries organisations.

However, the study has uncovered a problem in the management of sharks caught as bycatch by the tuna fisheries themselves. The risk of extinction of these vulnerable species continues to increase, which shows the urgency of taking management measures to halt this trend and foster their recovery.

The Red List Index can also be applied to other marine fish and is a useful tool for policy makers to monitor global targets and commitments set by the Convention on Biological Diversity and the Sustainable Development Goals (SDGs) to halt and reverse the loss of marine biodiversity.

On the other hand, in collaboration with the National Association of Bluefin Tuna Aquaculture (ANATUN), AZTI has validated a genetic system that **optimises the identification of different tuna species**. It has thus been possible to make progress in resolving existing identification problems and to contribute to the improvement of fisheries inspections and the control of marine resources

## *TECHNOLOGY TO PROTECT MARINE SPECIES AND REDUCE BYCATCH*

Bycatch is one of the main problems generated by fisheries worldwide, and is particularly serious when it affects protected, endangered or threatened species (PET species).

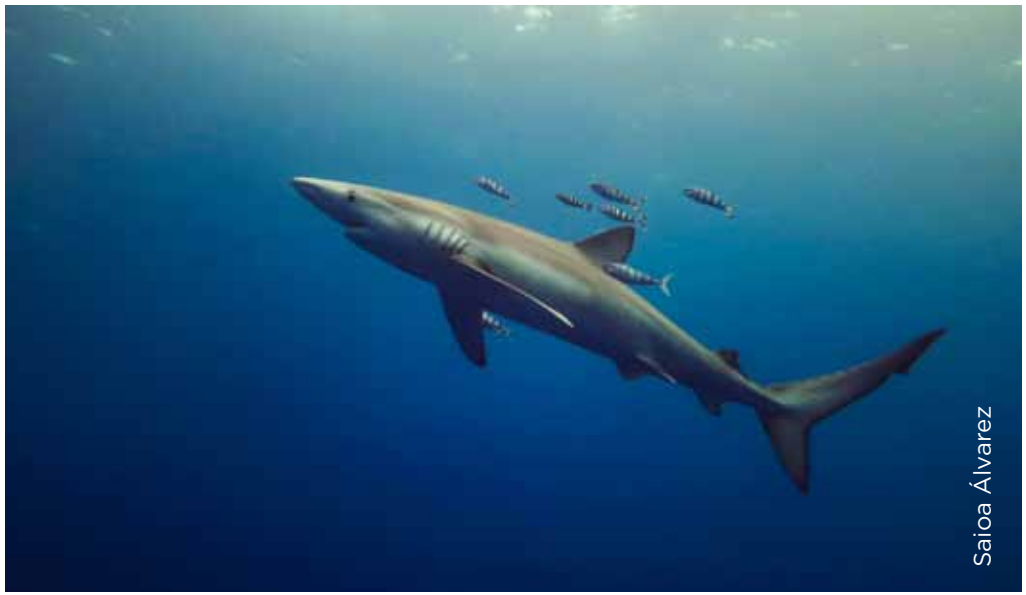
AZTI works with different fleets in various seas around the world to ensure that non-target fish are

not caught in fishing nets, thus making progress towards Sustainable Development Goal 14, which calls for the conservation and sustainable use of oceans, seas and marine resources.

The Indian Ocean is the main fishing ground, in terms of catches, for the **Spanish tuna freezer fleet**, so it is not surprising that guaranteeing the sustainability of tuna and fishing activity in these seas has become a priority for the fleets that operate there.

One of the priorities is to reduce their impacts

# 3.1.
# CONSERVATION OF NATURAL HERITAGE, PROTECTION OF NATURE AND BIODIVERSITY


Saioa Álvarez

on the marine environment and especially on the most vulnerable species, such as sharks and manta rays. Tuna purse seine fishing is estimated to generate a low percentage of bycatch (1-2%), but nevertheless, it all adds up. Therefore, in order to **reduce bycatch in tuna fishing**, the tuna freezer sector and AZTI have been working on the development of various selective devices for the release of these vulnerable species, so that they can be returned alive to the sea and continue their life cycle.

In this regard, 8 *hoppers* (selective trays with a ramp) were installed on OPAGAC tuna freezer vessels in 2022. In addition, a survey has been carried out in the Pacific where 16 silky sharks were tagged to assess their survival rate based on the use of these technologies.

In the same vein, ramps and grids have been installed on board vessels of the OPAGAC and ANABAC fleets to **facilitate the release of sharks and manta rays**. The survival of sharks on vessels with discard belts has also been assessed with the tagging of 60 silky sharks on two trips in the Indian Ocean during 2020 and 2021, on board Echebastar vessels.

The results obtained are very encouraging: the survival rate of sharks, in cases where the Code of Good Practice is applied and release tools are used, can be as high as 50% of the total number of sharks caught on the fishing trip. The estimated survival rate is the highest found worldwide in freezer tuna vessels, and at least double that of previous estimates.

In addition, through satellite tags, data have been collected to provide information on the vertical and horizontal migrations of silky sharks and their habitat, which will allow the definition of alternative mitigation measures. These data can help to define alternative mitigation measures.

As far as the **Basque coast** is concerned, one species that could be negatively affected by fishing activities is the **European Shag** *(Gulosus aristotelis)*, a resident and nesting seabird species, which generally feeds in shallow areas, close to the coast. The shag has the category of “vulnerable” in both the National Catalogue of Threatened Species and the Basque Catalogue of Threatened Species. It is therefore important to know the areas where this species is at the greatest risk of accidental capture. To this end, AZTI is gathering information on the

# 3.1.
# CONSERVATION OF NATURAL HERITAGE, PROTECTION OF NATURE AND BIODIVERSITY


Guillem Chust

species on the Basque coast (location of colonies, movements, etc.) and, in addition, information on the spatial and temporal distribution of the fishing effort involved in the fishing gear that could have the greatest impact on the species (trammel nets, longlines, etc.). This will help to propose measures to ensure that bycatch does not compromise the future of the species.

It has also been proven through remote electronic monitoring that appropriate use of an active acoustic cetacean deterrent device *(pinger)* in commercial trawl fisheries **reduces common dolphin** *(Delphinus delphis*) **bycatch** by more than 90% (reduction in both frequency of occurrence and catch-per-set rate). This study has also made it possible to determine the importance of operational factors in bycatch, such as fishing area and depth.

Similarly, in 2022, the **selectivity of trawling** for certain species has been **improved** through innovations in the load lines that support the cod-end.

## *TO UNDERSTAND THE EFFECT OF DIFFERENT IMPACTS ON MARINE ECOSYSTEMS*

Nowhere is the importance of biodiversity for sustainable development more essential than in the oceans. Marine biodiversity, i.e. the variety of life in the oceans and seas, is a fundamental aspect of the three pillars of sustainable development - economic, social and environmental - maintaining the healthy functioning of the planet and providing services that underpin human health, well-being and prosperity.

The increasing pressure on the seas of different countries around the world caused by urbanisation and industrialisation of coastal areas has, in recent years, prompted different programmes and strategies aimed at minimising pollution and waste discharge into the waters. However, agricultural, urban and industrial discharges are still a major threat to marine ecosystems, making it essential for public administrations to know and understand the ecological and environmental status of these communities.

In this context, AZTI developed the **AMBI** (AZTI's Marine Biotic Index) **software** which evaluates the environmental impact on the seas produced by different human activities. This technology, a world reference, already covers all the continents of the world and many countries such as New Zealand, China, Mexico, Canada, Chile, Morocco, Algeria, Iran, Arabia, India and the whole of Europe. In 2022, the tool has been adopted by the US Environmental Protection Agency (EPA) **as the official measurement system for the marine environment**. The adoption of AMBI by the EPA is a further boost to the use of this tool, and represents a great opportunity to generate more data and increase the catalogue of species included in the system.

In a broader sense, information on the ecosystem effects of fishing gears in contact with the seabed is also of great interest for the management of sustainable fisheries, because only the conservation of habitats that are in a good state can ensure the

# 3.1.
# CONSERVATION OF NATURAL HERITAGE, PROTECTION OF NATURE AND BIODIVERSITY

productivity of these habitats from the point of view of biological resources (including species of commercial interest). Thus, in 2022, AZTI began a new campaign on board the oceanographic vessels of the Secretariat-General for Fisheries to assess the **impact that trawling gear has on the seabed**, both in the physical environment and in its biota.

## *NEW ADVANCES IN UNDERSTANDING MARINE HABITATS*

Humans have done a great job exploring our planet over the last two millennia, but somehow, we seem to have forgotten 70% of our planet, that part covered by brackish water that still holds many secrets.

We know that we still have a long way to go to understand the true nature of the oceans, and that perhaps the answer to many of our present and future needs lies at the bottom of the sea. At AZTI we continue to unravel some of its secrets:

- In the context of the MER-CLUB project a screening of bacterial strains isolated from marine sediments with **mercury detoxification capacity** has been carried out. Two strains isolated from sediments taken from off the Cantabrian coast have been shown to volatilise inorganic mercury from highly contaminated culture media.
- Marine bacteria form biofilms in which they secrete a variety of bioactive compounds. In a *screening* process aimed at identifying compounds of biotechnological interest from marine bacteria, we have discovered an **exopolysaccharide with bioactive properties** that is currently in the patent process.
- As part of the SUMMER project, we have carried out a bioprospecting based on genomic sequences of marine microorganisms, and we have identified a group of marine bacteria potentially producing polyunsaturated fatty acids (PUFAs), such as omega-3s, that have not previously been associated with this process in the ocean.

# 3.2.
# SUSTAINABLE EXPLOITATION OF NATURAL RESOURCES: TOWARDS ECOSYSTEM-BASED FISHERIES MANAGEMENT

**Sustainable development of fisheries management involves balancing, in an integrated way, different societal objectives (e.g. ecological and economic objectives). This is called ecosystem-based fisheries management, which seeks to sustain the resources of fisheries for present and future generations, meeting the needs of the present without compromising the ability of future generations to meet their own needs.**

## *SCIENTIFIC ADVICE FOR DECISION-MAKING*

Research and the best available scientific knowledge on how stocks are constituted, how they affect both fishing activity and the whole value chain... are the basis for decision-making in fisheries management.

In this sense, our research has found clear evidence indicating that **the reduction in anchovy sizes** found in recent years in the Bay of Biscay, is not due to aspects related to increased fishing pressure on large sizes of greater economic interest. According to the data collected, the reduction in size is already visible from the juvenile stages and evidence has been found linking it to intense transport processes towards the open ocean in spring-summer. These processes could reduce the access by predators to smaller anchovies, which would survive in greater numbers than in previous years.

We have also been able to confirm **the presence of hybrids between black anglerfish and white anglerfish,** with hybrids accounting for up to 30% of white anglerfish catches in some areas. Furthermore, it has been shown that hybrids can breed with white or black monkfish, but not with each other. To better understand the impact of hybrids on species conservation, the monkfish genome has been sequenced and further genomic studies will be carried out. To learn more about the impact of hybrids on spawning stock biomass estimates and possible influences on the total allowable catch, simulations will be carried out assuming different scenarios. Finally, a misidentification between the two species of monkfish has also been observed, with black monkfish being found with white peritoneum (the peritoneum is the fabric covering the stomach whose colour is used to identify the species); preliminary studies indicate that **correcting this misidentification would lead to an increase in annual income in the Basque Country**.


Irati Velez

Also, thanks to AZTI's research, **new sardine catch rules** have been established taking into account variable reproductive productivities, in scenarios based on maximum sustainable yield.

We have developed a tool, **INFOTACS**, which allows us to take into account the impact of Total Allowable Catches (TACs) and annual quotas on each of the fleet segments. This allows administrations to **determine which fleet segments are more or less affected by TAC decisions**, so that

# 3.2.
# SUSTAINABLE EXPLOITATION OF NATURAL RESOURCES: TOWARDS ECOSYSTEM-BASED FISHERIES MANAGEMENT

these decisions can be accompanied by measures to reduce or mitigate this impact on allocations.

In the same vein, a multi-species and multi-fleet tool has also been developed to assess **the socio-economic impact on the Spanish trawl fleet in relation to the TACs and Quotas advice** and the implementation of the Fish Landings Obligation. This tool is very useful for the development of fleet management and activity strategies.

In addition, together with OPPAO, a Production and Marketing Plan has been drawn up in which the **entire trawl value chain** has been **evaluated**, focusing on the added value of certain species based on their possible transformation for commercialisation.

In this chapter, the **collaboration agreement with the Secretariat-General for Fisheries**, financed with Next Generation funds, for an amount of 3 million euros for the development of projects related to the sustainable management of fisheries, deserves special mention.

## *CAMPAIGNS THAT HAVE AN IMPACT*

Multidisciplinary oceanographic campaigns are a key activity to improve knowledge on the functioning and state of marine ecosystems.

In the Bay of Biscay, AZTI has been carrying out this type of campaign on a regular basis for more than 25 years, the best known being **BIOMAN and JUVENA**, dedicated to the study of anchovy biomass.

Once again, this year, the results of these two campaigns confirm the good state of the species' stock in the Bay of Biscay, with the number of anchovies under one year old standing at 481,000 tonnes, more than double that of the previous year. This is excellent news that highlights the commitment of both the administration and the sector itself, the main stakeholder in the sustainability of anchovies, in the scrupulous monitoring of this more scientific management of the species.

These campaigns are also a **full commitment to the sustainability of the seas** where, in addition to the biomass of fish, the environmental factors that affect their survival are evaluated: their diet (study of zooplankton and ichthyoplankton); or their habitat, in terms of predators (including cetaceans and birds), oceanographic variables (essential physical properties of seawater such as temperature, salinity, etc.). This information is essential to improve the sustainability of fishing activity and to satisfy current needs, without compromising those of future generations or altering an essential driving force of the Basque economy.


Iñigo Onandia

## *TOOLS TO IMPROVE THE MANAGEMENT OF SMALL-SCALE FISHING ACTIVITY*

Artisanal fishing, also known as small-scale fishing, comprises the majority of the European fleet in terms of number of vessels (75% of active vessels) and is a fundamental socio-economic and cultural activity for the coastal communities of the European Union.

# 3.2.
# SUSTAINABLE EXPLOITATION OF NATURAL RESOURCES: TOWARDS ECOSYSTEM-BASED FISHERIES MANAGEMENT


Javi Amezaga

Under the slogan "Small Scale, Big Value", the UN declared 2022 as the International Year of Small-scale Fisheries and Aquaculture, a fact that will help draw attention to small-scale fishers, who account for 90% of the world's fishing workforce.

In order to improve the management of the activity of this important fleet, AZTI has developed a set of tools (Ebartesa Toolbox) that will enable progress to be made towards the ecosystemic management of this subsector, thus contributing to the improvement of both its management and its sustainability. These tools are aimed at digitising fisheries data, measuring impacts and mapping the potential distribution of fish biomass.

## *DIGITALISATION TO IMPROVE THE EFFICIENCY OF THE FISHERIES SECTOR*

### Saving energy without losing profitability

The current energy situation and rising fuel prices have meant that the fishing industry has had to pay greater attention to energy saving strategies. One fact, although it varies according to fishing methods and operations, is that up to 50% of the vessels' operating costs are energy costs.

The viability of the fishing sector necessarily involves **optimising productivity and competitiveness through strategies and tools such as digitalisation**, with a special focus on fuel savings and reducing its carbon footprint. In this sense, there are two main focuses of AZTI's research work: saving energy without losing profitability, and the implementation of tools that contribute to the economic and environmental sustainability of the sector. During the year 2022, a series of actions were carried out to improve the sustainability of the inshore fleet, and which pursue three objectives:

- **Optimising the route to the fishing grounds** on the basis of updated information on the forecast of ocean weather conditions to enable the skipper to improve decision making. In addition, progress is being made in the development of predictive models of commercial species distribution, in terms of probability to improve efficiency.
- **Improving efficiency** on-board the boats. To this end, the data obtained by the Vessel Monitoring System (VMS) has been analysed and the operational pattern of the tuna trolling and bait boat fleet segment is being evaluated

# 3.2.
# SUSTAINABLE EXPLOITATION OF NATURAL RESOURCES: TOWARDS ECOSYSTEM-BASED FISHERIES MANAGEMENT

in order to estimate, as a starting point, the consumption and carbon footprint of this activity and its operation.

- Data analysis (operating patterns and estimated consumption) for the **electrification** (or electric hybridisation) of the propulsion system and electric generation of the small-scale artisanal fishing fleet segment, as well as its possible extension to a larger segment of the Basque Country fleet.

*Artificial intelligence on-board to make fishing more sustainable and profitable*

Artificial intelligence (AI) has a daily impact on the lives and activities of people, businesses and public administrations. This relatively new scientific discipline has opened up a world of possibilities for small and medium-sized enterprises in the food value chain, and is already being used to predict harvests, improve animal welfare and ensure sustainable fisheries, among many other applications in the chain.

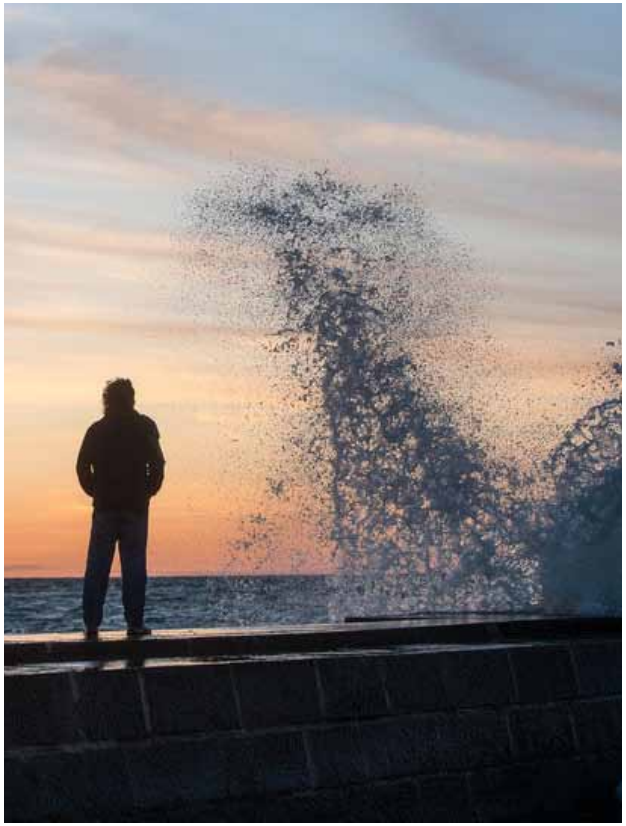
However, there are concerns that its use may not only be beneficial, but also invasive. For this reason, in 2021, the European Commission proposed the Artificial Intelligence Act (AIA), a pioneering new legislative framework that seeks to regulate the use of these technologies in EU Member States in order to pave the way for their safe and efficient application.

One of the sectors that will have to take this new regulation into consideration is the fisheries sector. In order to provide its main actors with information on this new legal ecosystem, the AZTI technology centre and the IUEE, at the request of the European Parliament, have drawn up a report that will serve as a guide to good practices for the correct application of these technological solutions within the fishing industry.

# 3.3.
# ACHIEVING A SUSTAINABLE ENERGY MODEL



However, it is essential not to forget that the viable development of marine energy sources, in addition to resolving the technical and economic difficulties inherent to their development, must provide a solution starting from the most preliminary stages of the project, to the potential environmental impacts that may arise from the installation, operation and dismantling of the associated structures, and the implementation of marine spatial planning for the selection of the most suitable areas for the development of marine energies.



*Tools for environmental risk analysis, open source*

AZTI has developed **two specific tools for the environmental risk analysis of wave energy converters**, WEC-ERA (Wave Energy Converters Ecological Risk Assessment Tool) and WIND-ERA (Ecological risk assessment of offshore wind turbines). Subsequently, by means of the VAPEM tool (ecological assessments and maritime spatial planning tool) we have made all the information and models developed freely available.

# 3.4.
# CLIMATE CHANGE MITIGATION AND ADAPTATION STRATEGIES

**Observation and monitoring of the coastline is essential to study the effects of climate change on the Basque coast. We cannot lose sight of the impacts that are being caused, anticipating the possible consequences of climate change and working to define the criteria for how to adapt to these impacts.**


Nagore Luengo

This is an objective that AZTI has been pursuing since 1986, when it began installing different platforms to monitor the effects of climate change in the sea and which, in recent years, has made substantial progress thanks to initiatives such as the **Marine Observatory of Climate Change in the Bay of Biscay and the Basque coast**. This project, which has the collaboration of the Naturklima Foundation and the LIFE Urban Klima 2050 project, and which is aligned with the Basque Climate Change Strategy 2050, has enabled the implementation of an integrated system for monitoring and predicting climate change and its effects on the sea and the coast, its biodiversity and its resources. This is key to assessing potential impacts and anticipating the consequences of climate change and setting out the adaptation approaches to be implemented.

Some of the results obtained and published in 2022 that warn of changes in the climate regime are the following:

*CLIMATE REGIME SHIFTS AND THE REDISTRIBUTION OF BIODIVERSITY IN THE BAY OF BISCAY*

- There has been a gradual change associated with climate change since the 1980s, with s**ea surface warming** up to 100 m in depth in the bay (0.10-0.25 °C per decade), as well as increases in air temperature and insolation. This warming may have had repercussions on the redistribution of the benthic community along the Basque coast, favouring warm-water species over cold-water species. In addition, the weight-at-age of anchovy and sardine has decreased over the last two decades.
- An **increased depth of the winter mixed layer** in the southeastern gulf has probably led to an increase in nutrients, surface oxygen and chlorophyll concentration.
- A **rise in sea level** (1.5-3.5 cm per decade since the 1990s), associated with climate change.

# 3.4. CLIMATE CHANGE MITIGATION AND ADAPTATION STRATEGIES

- An **increase in extreme wave height events** of 16.8 cm per decade in the southeast gulf, probably related to the storms of the last decade, and impacts on beach erosion.

## *ACIDIFICATION OF THE SEA*

Another direct consequence of climate change is the acidification of the sea: the more carbon dioxide the oceans absorb, the more acidified they become. The more acidification, the greater the impact on the growth of marine organisms such as coralline algae, molluscs, crustaceans, marine snails, corals and some plankton communities, and consequently on fish species.

Knowledge of climate effects in the ocean is essential for establishing adaptation strategies and establishing mitigation measures. The latest action in this sense has been the **installation of a new pH sensor** (within the framework of the LIFE IP Urban Klima 2050 project) to monitor ocean acidification along the Basque coastline, which will provide regular data, that will allow reliable and accurate estimates of the degree of ocean acidification.

## *BASQUE COASTLINE VULNERABILITY AND ADAPTATION ANALYSIS*

The accompanying effects of global warming, such as rising average sea levels and adverse weather events, can have significant consequences for coastal populations. For this reason, climate risk management in these areas has become a major challenge for public administrations.

In response to this scenario, AZTI has led the cross-border MARLIT project (POCTEFA), which has managed to improve and automate the mechanisms for predicting storm risk (and their impact) on the Basque, French and Catalan coasts.

The study has compiled detailed local information on the impact of storms on the coastline, and has generated a catalogue of measures (with an assessment of the feasibility of their application and a simulation of the economic cost they may entail) and solutions that will make it possible to evaluate, in a pioneering way, how coastal risk will evolve on a local scale. This information will help the public administrations of each territory to advance in the design of measures aimed at mitigating the effects of storms on the coast, both in the short and in the medium and long term.

It has also analysed and sought solutions to deal with the **effects of the rise in average sea level**, and the impact of waves on the Basque coast caused by climate change. Within the framework of the 'KOSTAEGOKI' project, the results of which

# 3.4.
# CLIMATE CHANGE MITIGATION AND ADAPTATION STRATEGIES


Agata Basañez

AZTI Report 2022

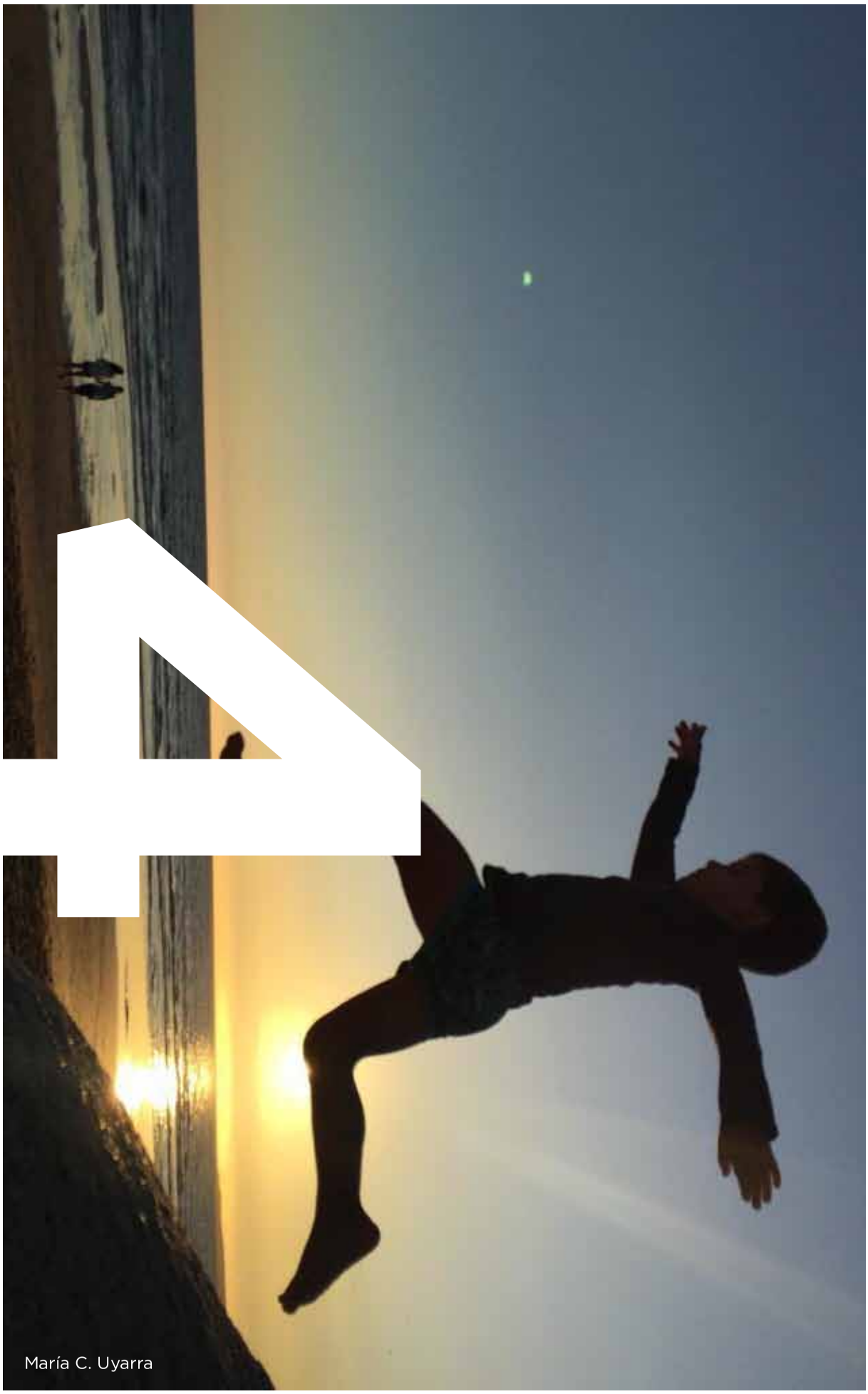
were made public in 2022, AZTI has worked to provide relevant information and tools to improve the planning and management of coastal areas, as well as to provide adaptation measures that help the competent administrations to face the challenges of this global phenomenon. Thus, based on the analysis of historical tide and wave data sets, future conditions have been modelled under different scenarios of sea level rise due to climate change, with studies of the risk to the affected population, industrial and residential land, affected GDP, capital stock, beaches and the natural environment and critical infrastructures, among others.

The results are available both in an informative report available on the Ihobe website ( and through the Geoeuskadi viewer (where you can download geo-referenced layers of flood zones, coastline retreat on beaches, risks to the socio-economic and environmental system).

In addition, as part of the URBANKLIMA project, coastal videometry has been used to carry out an in-depth analysis that relates flooding with the hydrodynamic and geomorphological parameters of 14 beaches in the Basque Country. The results have allowed the simplification of measurements from 14 to 3 (one representative of each group), which points to the improvement of integrated coastal management.

# 4

## VALUE CREATION



María C. Uyarra

# 4.1.
# REGIONAL VISION, JOB CREATION AND ATTRACTING INVESTMENT

## *IMPROVING THE VISION OF THE BASQUE COUNTRY*

At AZTI we continue to promote initiatives that seek to **improve the vision of the Basque Country** as a leader in the food value chain. In this sense, for the second consecutive year, we have co-organised **Food4Future World Summit,** an international event that has already established itself as an unmissable technological event. At the summit, you can discover the latest innovations and solutions that are transforming the food sector. In this edition, the event was attended by 7,217 participants from 25 countries and from the 5 continents, positioning the Basque Country as the epicentre and world benchmark for FoodTech, having an economic impact of 14 million euros on the city of Bilbao.

## *ATTRACTING INVESTMENT*

Investment is one of the most important variables for ensuring economic growth and job creation. Without investment, the productive capacity of a company, country or region does not increase, and when capacity increases, employment is generated.

Within the framework of the Basque Government's Strategic Aquaculture Plan, in which aquaculture is highlighted as one of the areas to be developed in the field of new sustainable food production systems, we have collaborated in the development of the **future Basordas aquaculture park**. The initiative is expected to create 560 jobs: 200 jobs directly involved in the aquaculture park and another 360 workers indirectly linked to the Basordas surface activity. In this sense, we have carried out studies on the design of future facilities, collaborating with institutions to adapt the regulations to enable the development of private projects and we have carried out a national and international search for projects to be implemented in this aquaculture park.

We have also promoted the creation of **two new technology-based companies**:

- **Saretu Recycling**: which has a strong emphasis on promoting the circular economy, it will focus on the recovery of discarded fishing nets, recycling them and transforming them into different products.
- **Itsas Balfego:** within the framework of the Oarsoaldea Urdina initiative, Itsas Balfego promotes research and development of extractive fishing, production, fattening

# 4.1.
# REGIONAL VISION, JOB CREATION AND ATTRACTING INVESTMENT

and marketing of fish through aquaculture processes both at sea and on land.

*DEVELOPMENT AND ACCELERATION OF ECONOMIC SECTORS*

The future of food lies in a new wave of innovation that is already underway and is here to stay. It has spawned thousands of **foodtech** startups that are causing a revolution in the food and beverage industry, a key pillar of the global economy. According to the annual study by accelerator Eatable Adventures entitled The State of Foodtech in Spain 2022, the segment has attracted 268 million euros in investment in 2022.

For its part, the **blue economy** - which relates to the sea and its resources - represents a great opportunity for economic growth and development in Europe.

A significant number of **innovation projects** are being carried out to generate new understanding, new products and new services in areas such as ocean protection, sustainable fisheries management, new food preservation technologies, healthy and convenience foods, of which more specific examples will be given in this document. The economic and social impact of this investment in R&D for both public administrations and companies is highly significant in terms of generating economic activity and new jobs.

In order to accelerate innovation in the foodtech and blue economy sectors, in 2022 we launched the following technology initiatives:

- Maintaining the transfer and entrepreneurship activity in the field of EIT FOOD by continuing the **incubation and acceleration programmes for start-ups,** with the participation of 10 new start-ups in the Bilbao operations centre.
- We have supported the Basque-French cheese company Agour in the creation of **Agour Hazitegia**, an entrepreneurship hub that aims to connect start-ups and entrepreneurs to promote new innovative ideas in the

*Commitment to innovation.*

A significant number of **innovation projects** are being carried out to generate new knowledge, products and services in areas such as ocean protection, sustainable fisheries management, new food preservation technologies, healthy and convenience foods, of which more specific examples will be given in this document. The economic and social impact of this investment in R&D, both for public administrations and companies, is very significant in terms of generating economic activity and new jobs.

# 4.1.
# REGIONAL VISION, JOB CREATION AND ATTRACTING INVESTMENT



FoodTech sector in the Basque Country and The French Basque Country. This new form of entrepreneurship will allow companies to capture talent, new business models and technology by connecting with entrepreneurs and startups. Through this alliance with Agour, initially signed for 4 years, the aim is to transform knowledge into business opportunities and then transfer the results to the industrial fabric.

- We are working to extend and diversify the activities arising from the development of the so-called **Blue Economy,** as well as to attract start-ups with disruptive innovations for the challenges of this sector of the economy. In this regard, within the framework of the Preferential Action Zones (ZAPS) plan, approved by the Basque Government in the **Oarsoaldea** area (Gipuzkoa), we have worked to collaborate in the creation of a competitive technological space, defining products and target markets, particularly those aimed at tackling climate change, as well as the challenges and opportunities of a more circular economy, which promotes the protection and greater knowledge of our seas through an economy linked to their sustainable exploitation.
Thus, we have proposed, and it has been included in this plan, the development of a blue economy pole in the Bay of Pasaia, **this will be based on the companies in the area, but will also** have a view to other companies in the Basque Country that may see, in this initiative and in the space generated, an opportunity to extend and diversify their activity in view of the opportunities that are opening up in the development of the blue economy, as well as attracting the entrepreneurial world (start-ups,...) with disruptive innovations for the challenges of this sector of the economy.
In 2022, 8 industrial projects were initiated in the development of monitoring technologies that facilitate the sustainable exploitation of oceans and marine ecosystems, development of marine aquaculture, electrification of vessels, development of autonomous vessels, as well as the application of state-of-the-art gene technologies and biotechnologies for obtaining ingredients of marine origin and their application in food, cosmetics, biomaterials and health.

# 4.2.
# DESIGNING AND GUIDING R&D&I STRATEGIES

The **Fisheries Secretariat of the Ministry of Agriculture, Fisheries and Food and AZTI has signed an agreement** (which runs until 2023) with the aim of promoting the sustainable management of fisheries resources, in the economic, social and environmental spheres, and for the benefit of the sector's long-term viability. The partnership focuses on 4 main lines of action: Governance, value and communication; Knowledge (collection of new data from the fisheries sector and the marine ecosystem); new methodologies and tools (fleets, stocks and the marine ecosystem); and sustainable production (mitigation and adaptation).

*Fisheries Science Board*

AZTI has joined the recently created **Fisheries Science Board**, which will be responsible for presenting the main results of the evaluations and scientific work coordinated by the Ministry of Agriculture, Fisheries and Food, on which decisions on fisheries' policy are based, especially in terms of total allowable catches (TACs) and quotas.

# 4.3.
# CREATING VALUE FROM KNOWLEDGE

AZTI, which has been playing a key role in the observation of the Bay of Biscay, the coastal area of the Basque Country and the marine ecosystem for years, is promoting the creation of a super observatory in the southeast of the Bay of Biscay and has developed, with funding from the Basque Government, **a new online technological application that includes interesting details on the campaigns carried out and existing measurement systems in the area**, in order to display the information available, which is key for the actors involved in the management of the marine environment.  This online application is also a first step towards identifying additional measurement requirements and integration opportunities in order to build an optimised observatory for integrated and multidisciplinary observation of the marine environment and its ecosystem.

Thanks to the creation of this 'super observatory' called **ebegi**, public administrations, the scientific and research community, fishing and industrial stakeholders and society in general have an inventory in the cloud of the type of information available, both historical and updated in real time, thanks to the data collected by AZTI for decades in its oceanographic campaigns and observation activities. The novel **ebegi** integrated observing system can also be used to implement policies and directives that respond to ecosystem demands for the conservation and restoration of marine biodiversity and habitats, as well as the challenges associated with climate and global change.

Asier Nieto

In 2022, the data display of EuskOOS, the Coastal Operational Oceanography System operated by the Basque Meteorology Agency Euskalmet, has also been improved, with the scientific advice of AZTI, enabling it to facilitate access to high quality ocean-meteorological data for all users of the Basque coastline. This system provides an accurate description of the current state of the sea along the Basque coastline. In addition, it provides continuous forecasts of future sea conditions, which can help in the prevention of coastal marine hazard emergencies.

# 4.4. SUSTAINABILITY, PROCESS DEVELOPMENT AND OPTIMISATION

**In order to reduce environmental degradation and achieve the Sustainable Development Goals, it is imperative to promote more sustainable production and more responsible consumption of food and beverages.**

## *OPTIMISATION OF INDUSTRIAL PROCESSES*

Digitalisation is the key to transforming companies towards a more sustainable model and to ensuring their survival in an increasingly competitive market. Not only that, it is essential to increase resilience in the face of uncertain and volatile future scenarios.

Thanks to new technologies, the food industry is committed to greater automation, connectivity and globalisation in order to fully adapt to the so-called fourth industrial revolution, better known as Industry 4.0.

- Artificial Intelligence (AI) is the big opportunity to reduce the emissions that cause climate change. In fact, research claims that AI has the potential to reduce 9.7 times more carbon emissions than it emits. With this in mind, AZTI has worked on a pilot project (**iFishCan** testbed) to improve the performance of the canned fish sector through digitalisation and artificial intelligence. The pilot initiative, which ended in 2022, focused on improving the industry's traditional food losses and waste, preventing its generation (rather than simply limiting it) and mitigating the environmental impact of the fish processing chain, in line with the requirements of current circular economy policies. The results obtained, which are adaptable and scalable, have made it possible to increase the monitoring capacity of certain factors to a level that was hitherto not possible, improving sustainability and reducing costs.
- 2022 was also the year of the launch of the **automatic anchovy counter**, a system based on image techniques and artificial intelligence, which optimises and makes the anchovy (or other species) counting process more efficient, while at the same time obtaining objective data that are fundamental for defining the cost of the product. Aware of the difficulty involved in adopting this type of technology, several webinars have been held throughout the year for the sector, to learn first-hand about the advantages and applications of the solution.

# 4.4.
# SUSTAINABILITY, PROCESS DEVELOPMENT AND OPTIMISATION

- A **calibration system** has also been developed **to determine the quality of oils** instantaneously and non-destructively.

In terms of improving production processes, AZTI is one of the 25 organisations in Cantabria, Catalonia, the Basque Country and Navarre that have joined forces to improve the sustainability of family and cooperative dairy farms. Within the framework of this initiative, AZTI leads the sustainability component in the **Kaiku ecosystem**.

## *MORE SUSTAINABLE PRODUCTION (AND CONSUMPTION)*

Sustainable consumption and production (SDG 12) is about doing more and better with less, decoupling economic growth from environmental degradation, increasing resource efficiency and promoting sustainable lifestyles.

Given the enormous impact of the food system on the environment, it is essential to promote more sustainable production and more responsible consumption of food and beverages.

The response to this important challenge requires:

- **Incorporating new**, more efficient **food production technologies** that reduce water and energy consumption and generate less food waste.
- **Boosting the production of new sources of sustainable and healthy protein** and moving towards a dietary change that includes alternative proteins.
- **Circularity and efficiency** of natural resources.
- **Digitalisation of food systems**, from primary production, logistics and traceability to the consumer, in order to be more efficient and generate less waste throughout the chain.
- **Committing to sustainable packaging** while guaranteeing food quality and safety.
- **Involvement of consumers,** who need to be aware of the importance of prioritising the purchase of the most sustainable product.
- **Support from science,** which should provide

# 4.4.
# SUSTAINABILITY, PROCESS DEVELOPMENT AND OPTIMISATION

innovations that are accessible and easy to implement.

The improvement of production processes must have a solid foundation in order to quantify, in detail, the impacts associated with the company's activities so as to identify the main components and thus define options for improvement at the environmental level. To this end, the European Commission has opted for the Environmental Product Footprint (EuPF), an assessment method that establishes a common way of measuring environmental performance. AZTI collaborates with companies in facilitating the calculation of PEF, promoting systems to measure and communicate the ecological footprint of food production that facilitate consumer information so that food and drink purchases can be made with environmental criteria and scientific rigour.

- Throughout 2022, **ENVIROSCORE®,** the calculation, evaluation and communication system that promotes environmental improvement in agri-food companies, has been validated with 150 food products. This system, developed by AZTI and KU Leuven, based on the PEF methodology, has demonstrated its ability to capture the variability of environmental impact between

different foods and beverages, as well as to discriminate, within the same type of products, those products that have "worse" production techniques, excessive packaging or long transport distances. In addition, several companies have started to use the new system, which is also supported by the scientific community, as evidenced by the publication of a scientific paper on ENVIROSCORE in the journal Nature.

- Within the framework of the AQUAPEF project, led by AZTI and which ended in 2022, a solution has been developed to calculate, verify and communicate the **environmental impact of aquaculture products** in the Mediterranean in accordance with the European Product Environmental Footprint methodology. With the implementation of the tool, the Aquapef Software Tool also makes it possible to identify the causes and origins of the impact, thus facilitating decision-making based on environmental criteria.

# 4.4.
# SUSTAINABILITY, PROCESS DEVELOPMENT AND OPTIMISATION


*REDUCING FOOD WASTE*

In line with the United Nations Sustainable Development Goals # 2 and # 12, AZTI works hand in hand with companies in the food sector to optimise production processes in order to reduce waste and to develop new products from this underutilised food waste, to contribute to ensuring the sustainability of the food chain.

Developing more eco-efficient food processing technologies and processes, which on the one hand require fewer resources (water, energy, materials) and on the other hand minimise food losses, has become a necessity. Considering the eco-design of new foods and diets, i.e. predicting what environmental impacts a food product will have when it is in the process of being designed, in order to modify that design and reduce those impacts before starting to build the facilities required to produce it, and the circular economy processes will, in turn, add even more value to the resulting products.

The following are examples of technologies we have developed that allow the recovery of food by-products not only as a solution to reduce pollution but also as an economic opportunity (circular economy).

- **Filtration** technologies (nanofiltration and microfiltration), which allow the separation of high-value biomolecules in liquid effluents. In this regard, one of the success stories achieved in 2022 was the new technological solution developed for the Serrats canning company, which allows **brine** to be **recovered in the tuna cooking process**, optimising resources and reducing the environmental impact associated with this process, making canned food more sustainable. Thus, thanks to the brine regeneration technology, 90% of the brine can be reused in the process, allowing for an improvement in the use of raw materials, while recovering a new protein concentrate with various potential applications. This type of technology has also been used to filter mussel cooking water, for example.
- **Hydrolysis** techniques, which allow the release of high-value molecules (active peptides) and increase the digestibility of ingredients (pre-digestion of fibre). This technique has been used for the treatment of brewer's yeast or fish by-products, among others. More than 10 functionalised and bioactive products based on protein hydrolysates for food and feed have been developed from food by-products.
- **Drying** technologies (decanter - centrifuge - flash dryer) facilitating the stabilisation

# 4.4. SUSTAINABILITY, PROCESS DEVELOPMENT AND OPTIMISATION

over time of under-utilised food wastes (stabilisation of brewer's yeast, spent brewer's grain, grape stalks, coffee grounds)

- **Fermentation** technologies **with microorganisms** (microalgae and fungi) for the recovery of by-products from the food industry (fruit, vegetables, juices, wine pomace) to obtain ingredients that are rich in protein and other valuable compounds (bioactive or functional) such as proteins, polyphenols or pigments, which can be used both for animal feed (mainly ruminants or fish) and for human food or fertilisers. In 2022, both ingredients and additives derived from fungi are being validated and trials with aquaculture fish are underway.

On the other hand, aware of the magnitude of the problem of food waste and with a broad and solid knowledge base, AZTI has been one of the organisations that has taken part in carrying out a diagnosis of food waste generation in the agri-food chain in the Basque Country, a pioneer in Europe, prepared by the Vice-Ministry of Agriculture, Fisheries and Food Policy of the Basque Government's Department of Economic Development, Sustainability and the Environment, through the Elika Foundation. AZTI has been


responsible for providing relevant information for the sectoral studies on primary production, processing and production, retail and HORECA.

# 4.5.
# DIVERSIFICATION OF THE PORTFOLIO OF PRODUCTS AND SERVICES

*FOOD INNOVATION*

Once again this year, at AZTI we have identified the **trends** that will have the greatest impact on the food sector. The new EATendencias 2022 report highlights new alternatives to animal protein, authenticity, mental health, personalised nutrition, hybrid experiences and hyper convenience, as some of the trends that will most impact the food sector this year. This information is helping food companies to understand what is happening in the field of food consumption in order to identify opportunities for innovation and adapt their innovations to new consumer needs. In this sense, and to better meet new consumer demands, AZTI has set up a panel of experts in plant-based and hybrid products, as well as a new service that, through eye tracker technology, analyses consumer purchase interaction.

And while trend awareness is an undeniable asset in the design of new products, the marketing of new products is often the peak moment. It is the exciting result of a process that goes from the generation of innovative ideas to their transformation into the foods of the future: the nutritionally balanced formulation to respond to health needs; the search for health care, ease of use, quality, environmental concern, preservation process and costs, among many other factors.

Some of the **product launches** undertaken by our customers this year that we are particularly proud of are:

- **Multi-layer reduced-sugar bars:** AZTI has developed, together with the Spanish multinational company NATRA,dedicated to the production and manufacture of chocolate and cocoa-derived products, 5 multilayer bars with a reduction in sugar of more than 30%, without the use of artificial sweeteners or polyalcohols. The sticks are marketed in the US market. This innovation, in line with market trends will allow NATRA to maintain its leading position in the national and European markets, creating value for its customers and, by extension, for the end consumer.
- **Ready-to-eat salmon and smoked cod tartar**: AZTI has developed, together with the company Vensy, two references of ready-to-eat smoked salmon and cod tartar products, in which the entire innovation process has been worked on from the idea to the design and development of the products, including the selection of the best preservation and packaging technologies, which allow the sensory characteristics of the products to be maintained while guaranteeing their stability.
- **Minimally processed local vegetable soups in sustainable packaging**: AZTI has developed

# 4.5.
# DIVERSIFICATION OF THE PORTFOLIO OF PRODUCTS AND SERVICES

3 references for vegetable soups and one for pasteurised snail, for the company Itsaslur. This initiative has helped to boost the agricultural diversification of local producers through the production of higher-value products, such as healthy creams with improved nutritional composition.

- **Yuit Solubles:** In collaboration with YUITAZTI has carried out a process of innovation during which it managed to design and develop 7 references of nutritionally balanced powdered product that can be consumed in drink format after regeneration with water. These products have been developed by innovating their formulation and, significantly, the design of their nutritional profile, as well as the expected sensory characteristics.

But we do not only work on the final product. We also study and research how to achieve the appropriate technology that opens up new avenues for food innovation. One example is the WaSeaBi project, where a **new technology** has been developed **that allows new fish cuts to be made** in order to develop innovative, healthy and tasty fish products all from fish waste, from head to tail. This technological improvement allows the product yield of these companies to be increased and, where previously only fish fillets were produced, five other products with valuable uses are now available. Thus, from fractions managed in food quality, a wide range of recovery options opens up, with applications in pharmaceutical, nutraceutical, human or animal foodstuffs.

And continuing with the mission to strengthen and improve our food system, in 2022 we have made numerous advances in methodologies related to **food identity**. Achieving solutions that improve people's confidence in our food system is fundamental, so, among other examples, the development of a new genetic method to guarantee the provenance of mussels, is an important example to highlight. The study aims to combat fraud and raise consumer awareness of the importance of labelling and traceability of fishery products.

In terms of **food safety**, we have made great advances in massive sequencing technologies to identify ingredients in processed foods, and we are participating in the most ambitious R&D&I project in the Spanish aquaculture industry, to innovate solutions for the control of infectious diseases in aquaculture.

# 4.5.
# DIVERSIFICATION OF THE PORTFOLIO OF PRODUCTS AND SERVICES

*COMMITMENT TO HEALTH*

Our involvement in health is also worth mentioning. We continue to research omics technologies through which we can facilitate business innovation in **effective**, safe and beneficial **functional foods and nutraceuticals**. In this sense, we have developed a tool for calculating products in relation to the nutritional needs of a specific population, which allows us to improve the nutrition, in a personalised way, of those people with specific needs.

Precision nutrition allows us to access a greater understanding of the complex relationship between an individual, their food intake and their phenotype (including health), in order to provide nutritional intervention or advice, which is known to be beneficial to the individual. This approach can be applied both as a preventive strategy in healthy individuals who may or may not have an increased susceptibility to specific diseases, and to patients who already have a disease.

During 2022, we deepened our positioning in **sports nutrition**, with collaboration agreements with leading sports clubs such as Real Sociedad and Athletic Club. With the latter team, we have developed a prototype of a nutritional calculator for the men's first team that provides personalised menu recommendations according to the needs of each athlete and which has already been implemented in their high performance centre in Lezama.

We also continue to work on the development of **solutions for cancer patients**. Preliminary results from the nutritional clinical trial with breast cancer survivors show that women who follow a diet based on their molecular characteristics (lipidomic and genetic) achieve better results in reducing inflammation and body weight, compared to the control group (generalist diet).

In addition, we have developed a nutritional programme for **overweight/obese people** tested in a work environment. The results were very positive, with an average weight reduction of 5kg (being fat loss) and a reduction of 2 body mass index (BMI) points. In addition, high adherence (70%) has been achieved after 4 months of participation and there has been high levels of confidence towards the programme (8/10).

# 4.6.
# BOOSTING BUSINESS COLLABORATION

*W APPLICATIONS FOR OCEANOGRAPHY*

At AZTI we have many successful examples of Operational Oceanography. For example, challenges such as the Prestige oil spills in 2002-2003, regarding which 2022 marks the 20th anniversary, search and rescue at sea, jellyfish on beaches, plastics and floating rubbish, regulation of beach occupation, etc. All this allows us to offer services related to this field beyond our borders.

**In the area of remote monitoring and modelling systems for the assessment of the vulnerability of the coastal zone**, in 2022 a new impetus has been given to the smart coastal management technology Kostasystem which, in addition to its presence in the Basque Country and France, is now adding new locations in the Canary Islands and Morocco. This system is designed to manage three main lines of action: bathing safety, beach services and morphological monitoring of bathing areas.

On the other hand, this year we have added a new service: providing oceanographic information (bathymetry, waves and sea currents) on the race courses of the trawler league during the television broadcasts. We have provided Basque radio-television with maps showing the speeds of the sea currents in the different lanes during the regatta schedule, forecasts of the swell conditions expected during the regattas and information of interest to the audience following the regattas both on TV and radio.


## Collaborative solutions from science to the challenges of the sector.

AZTI continues to add new partners to the AZTInnova platform, an exclusive virtual community to promote the creation of joint value through innovation and business collaboration, and to foster synergies in the food value chain. In 2022 AZTInnova has added 30 new members, bringing the total number of associated companies to 160. With the aim of responding to the challenges of the food sector, more than 60 companies and agents from the sector have taken part in more than a dozen collaborative sessions, seeking to develop joint solutions that promote innovative consortium projects.

*One more year at the service of a healthier and more sustainable society... because today, more than ever,*

***the answer lies in science.***.

Xabier Murgui


AZTI
MEMBER OF
BASQUE RESEARCH
& TECHNOLOGY ALLIANCE