VLIZ

ANNUAL REPORT 2021

2021 ANNUAL REPORT

The Flanders Marine Institute (VLIZ) promotes accumulation of marine knowledge and excellence in marine research in Flanders. The marine research areas are the ocean and seas, the coast and the tidal systems. The target groups for knowledge accumulation are the marine research community as well as educational institutions, the general public, policymakers and the industry (within the scope of the blue economy).

Vlaanderen
verbeelding werkt

west-vlaanderen
de gedreven provincie

RICHTING MORGEN
MET WETENSCHAP, TECHNOLOGIE, CREATIVITEIT & INNOVATIE

Dear reader,

At the end of 2021, the Flemish government made a decision on the future of VLIZ within the scope of a new management agreement to be concluded between both parties. After a year of evaluation by a consultancy firm and an international expert panel, the Flemish government approved a new agreement for the period from 2022 to 2026 on 17 December 2021. The mission, the research areas and the target audience of VLIZ remain unchanged. In the coming management period, VLIZ will continue and reinforce its current activities while focusing on research at the interface between climate, oceans and biodiversity.

In addition to the approval of the new management agreement, 2021 also marked numerous other achievements. The United Nations Decade of Ocean Science for Sustainable Development officially began on 1 January. Until the end of 2030, we are joining forces worldwide to achieve the 14th sustainable development goal (SDG 14: *'Conserve and sustainably use the ocean, seas and marine resources for sustainable development'*) and other ocean-related SDGs. The World Register of Marine Species (WoRMS) is the first VLIZ initiative to have been formally recognised as an 'Ocean Decade' action. VLIZ has demonstrated its ambition to help turn this Ocean Decade into a success by supporting numerous other initiatives.

In addition, VLIZ intensified the interactions within the Flemish marine science and innovation ecosystem over the past year. This ecosystem includes actors from both the Flemish knowledge institutions and the business world. Just like VLIZ itself, the entire marine scientific community has experienced strong growth and visibility in the past few years. Published by the Department of Economy, Science and Innovation (EWI), VLIZ and Blue Cluster, *'Gearing up our blue knowledge'* demonstrates the strength, diversity and potential of the Flemish innovation landscape and documents how Flanders makes use of the sea to meet its sustainability targets. In the near future, VLIZ will further expand the bilateral collaborations with marine research groups and other marine actors in Ostend and Flanders as well as explore new opportunities for cooperation with non-marine research groups.

Other achievements of the past year include: (1) the Integrated Carbon Observation System (ICOS) and the activities carried out by VLIZ within this scope which entered the mature operational phase, (2) the considerable number of policy-informing briefs aimed at the targeted dissemination of research results in marine and coastal policy issues (e.g. with regard to climate, recreational fisheries and plastic litter), (3) the innovative research into the link between the ocean and human health whereby VLIZ involves a new interdisciplinary group of scientists into its activities, (4) the development of the VLIZ Marine Robotics Centre into a knowledge hub for marine autonomous systems, (5) the pioneering role played by VLIZ in marine citizen science, both locally and internationally, (6) the visits by several prominent figures to VLIZ and the Marine Station Ostend, (7) the digital 20th anniversary edition of the VLIZ Marine Science Day, and (8) the importance attached by VLIZ to human capital and diversity as the basis for its scientific successes. In the section 'Highlights' of this annual report, we put a spotlight on a few of these achievements. Please bear in mind that this is only a fraction of our activities.

A lot has been planned for 2022 as well. First and foremost, the VLIZ employees, our international partners and our colleagues from the Flanders Research Institute for Agriculture, Fisheries and Food (ILVO) will move into the new offices at the InnovOcean Campus. The first stage of the expansion of the Marine Station Ostend will also be completed in 2022. In short, the start of the new management period 2022-2026 will see a number of milestones we are looking forward to as an institute.

JAN MEES
General Director of VLIZ

Ostend, March 2022

PROF. DR. JAN MEES
General Director of VLIZ

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SUPPORT TO INTERNATIONAL ORGANISATIONS

By order of the Flemish government, VLIZ supports several international organisations. This capitalises on VLIZ's international experience and reputation, and makes it possible to embed important European initiatives in Flanders. This chapter briefly explains the specific partnerships in which VLIZ participated in 2021.

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KEY PERFORMANCE INDICATORS

The Key Performance Indicators (KPIs) refer to important services provided by VLIZ to marine scientific researchers, policymakers, educators and the general public. These are criteria to evaluate the operation of VLIZ. As stated in the covenant for the period 2017-2021, VLIZ has to deliver on at least twelve KPIs every year.

ANNEXES

Only available in digital format: downloadable from the VLIZ website www.vliz.be/en/vliz-annual-report

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ORGANISATION VLIZ

VLIZ is administered by the Board of Directors and consults the Scientific Committee for its scientific support tasks. The General Assembly provides assistance in managerial and administrative decisions.

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MANAGEMENT INDICATORS

The Management Indicators refer to important services provided by VLIZ to marine scientific researchers, policymakers, educators and the general public. They complement the Key Performance Indicators (KPIs), which are criteria to evaluate the operation of VLIZ.

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An overview of the national and international networks in which VLIZ participates, projects for which VLIZ receives external funding, the scientific equipment and infrastructure made available by VLIZ, the events (co-)organised by VLIZ and the publications published by VLIZ.

HIGHLIGHTS

The highlights are the special events, achievements, activities or projects of VLIZ that took place in 2021. They are often the result of intensive cooperation between various departments and divisions.

A NEW COVENANT

The convenant for 2022-2026: www.vliz.be/en/administrative-documents

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» On the basis of the work carried out in the past years, VLIZ was evaluated positively as an institute able to adapt quickly to societal needs, new challenges and emerging scientific topics. Over the coming five years, VLIZ will continue to invest in the three pillars of scientific support, collaborative research and valorisation in policy making and the blue economy. In addition, attention is increasingly paid to strengthening the 'blue ecosystem' in Flanders, and there is a new focus on ocean-related climate research. «

JAN MEES, GENERAL DIRECTOR OF VLIZ

The mission of VLIZ is defined in a five-year covenant between the Flemish government and VLIZ. After an intensive preliminary stage of internal self-evaluation, external evaluation and negotiations, the Flemish government approved the new covenant for the 2022-2026 period on 17 December 2021.

The covenant defines the mission, the strategic and operational objectives, the funding of the institute and the key performance indicators (KPIs). VLIZ's mission remains unchanged: to promote the accumulation of marine knowledge and excellence in marine research in Flanders. The marine research areas are the ocean and seas, the coast and the tidal systems. The target groups for knowledge accumulation are the marine research community, educational institutions, the general public, policymakers and the industry (within the scope of the blue economy).

As far as its research mandate is concerned, VLIZ will primarily focus on collaborative research with its own contributions promoting interactions between actors and disciplines, research contributing to the accumulation of knowledge in the climate-ocean-biodiversity nexus, and research that adds value to the research infrastructure (including databases). In this research, VLIZ will always consider whether and how to best imbed the newly acquired expertise into the Flemish marine research landscape (or exploited economically). Within this scope, VLIZ already takes the strengthening of external marine research groups (MRGs) into account to promote the Flemish research landscape.

In addition, the Flemish government removed the non-compete clause form the research programme. This allows VLIZ to fully leverage its knowledge and expertise, and opens the way for more intensive cooperation between VLIZ and university research groups, with the development of the marine ecosystem as the collective higher purpose.

Finally, the number of KPIs has been decreased and linked to the strategic objectives within the 3-pillar model of VLIZ (research, valorisation and services) to monitor the value of these activities in a more result-oriented manner.

VLIZ not only renewed its covenant with the Flemish government, but also those with the province of West Flanders and the UNESCO-IOC Project Office for IODE. Within the scope of the blue economy, VLIZ and the province of West Flanders involved the Provincial Development Agency (POM) of West Flanders in their new covenant. The UNESCO-IOC Project Office for IODE and VLIZ reoriented their covenant with a view to reinforcing the activities from Flanders and Belgium in support of the Decade of Ocean Science for Sustainable Development (see Highlight on page 12-13).

LAUNCH OF THE DECADE OF OCEAN SCIENCE FOR SUSTAINABLE DEVELOPMENT

www.oceandecade.org/

The United Nations Decade of Ocean Science for Sustainable Development (UNDOSSD) officially began on 1 January 2021. Until the end of 2030, we are joining forces worldwide to achieve the 14th sustainable development goal (SDG 14: *'Conserve and sustainably use the ocean, seas and marine resources for sustainable development'*). UNDOSSD is also aimed at achieving other ocean-related SDGs such as combating climate change and preventing the loss of biodiversity. In the past two years, VLIZ actively worked behind the scenes to help prepare for this unique decade in Flanders as well as internationally and raise awareness about it among various stakeholders.

In early 2021, institutions could register their activities as 'Ocean Decade' actions. In 2021, it was also possible for the first time to submit a programme, project or contribution via the annual calls for 'Ocean Decade' (OD) actions. These OD actions provide some degree of quality assurance, greater visibility and a positive impact on the ocean community. In mid-October, the World Register of Marine Species (WoRMS) was officially recognised, together with 93 other actions, as an OD action. In addition, WoRMS was formally integrated into the globally coordinated action programme *'Marine Life 2030: A Global Integrated Marine Biodiversity Information Management and Forecasting System for Sustainable Development and Conservation.'* VLIZ prepared or submitted five other initiatives as OD actions that are currently going through the evaluation process. In addition, VLIZ compiled a dossier in 2021 to have its philanthropic project 'The sea as a good cause' recognised as an Ocean Decade Grant-Making Facility. In case of approval, 'The sea as a good cause' will mobilise its resources to support OD actions and serve as a hub attracting financial contributions from other donors. We expect a decision to be made in the spring of 2022.

In addition to carrying out OD actions itself, VLIZ is involved in and contributes to other formally recognised OD actions via (co) funding from Flanders. These actions include Ocean Teacher Global Academy (OTGA) and the OTGA Training Centre in Ostend; the Ocean Information Hub (OIH); the Ocean Biodiversity Information System (OBIS) with its European component EurOBIS; and the eDNA expeditions project.

At the end of 2021, VLIZ started its preparations for setting up a secretariat that will coordinate the Flemish and Belgian contribution to the Decade of Ocean Science. Ann-Katrien Lescrauwaet, Director of International Relations at VLIZ, will guide this process in close contact with the secretariat of the Intergovernmental Oceanographic Commission of UNESCO (IOC-UNESCO) in Paris, which has been mandated to implement the Decade of Ocean Science. With the establishment of the secretariat, Flanders and VLIZ demonstrate their ambition to help turn the Decade of Ocean Science for Sustainable Development into a success.

In light of the future role of VLIZ in the coordination of the Flemish and Belgian contribution to the Decade of Ocean Science, VLIZ and the UNESCO-IOC Project Office for IODE, located in Ostend, will reorient their five-year covenant with a view to joint Ocean Decade actions.

The *United Nations Decade of Ocean Science for Sustainable Development* was officially launched in 2021 (Shutterstock).

» In 2018 and 2019, VLIZ consulted the Flemish marine research groups to prepare for the Decade of Ocean Science and raise awareness among various stakeholders. Central to VLIZ's contribution to the Decade is our expertise in 'Open Science' and working in a multidisciplinary environment as well as the provision of marine research infrastructure and data and the support of capacity development. This way, VLIZ endorses the Decade's inclusivity principle according to which anyone is entitled to access science, technology and knowledge about the oceans.«

ANN-KATRIEN LESCRAUWAET, DIRECTOR OF INTERNATIONAL RELATIONS AT VLIZ

2021 2030 United Nations Decade of Ocean Science for Sustainable Development

WoRMS World Register of Marine Species

In 2021, the World Register of Marine Species (WoRMS) was formally recognised as an Ocean Decade action and integrated as a partner into the globally coordinated action programme *'Marine Life 2030'*.

The marine scientific community in Flanders and Belgium is growing. This is demonstrated annually by the inventory developed by VLIZ. © VLIZ (Decombel)

EXPANSION OF THE FLEMISH MARINE ECOSYSTEM

The continued growth of the Belgian marine research: www.vliz.be/en/news?p=show&id=8935
The Compendium for Coast and Sea: www.compendiumkustenzee.be/en/home

Over the past few years, VLIZ has experienced considerable growth. The Flemish government has granted additional mandates to VLIZ to initiate and conduct scientific research at the service of, in collaboration with or complementary to Flemish and international marine research groups, and to further develop the interface between marine research and the blue economy. As a result, the number of VLIZ employees increased from 80 in 2017 to 129 at the end of December 2021.

Strong growth has not only been noticeable in VLIZ but also in the entire marine scientific community. This is evident from the yearly counts of marine research in Flanders and Belgium which VLIZ has conducted since 2008. VLIZ has published the results in a policy-informing brief (PIB) within the framework of the Compendium for Coast and Sea. This PIB provides an overview of the research capacity and the scientific output, and takes an in-depth look at international partnerships, the geographical focus of research and the deployment of research vessels. The most recent inventory (Pirlet et al. 2021) demonstrates that Belgium boasts no fewer than 123 marine research groups (MRGs) which, in 2020, collectively produced 750 marine peer-reviewed publications, establishing a double record. Over a period of 12 years (2008-2020), these research groups published articles in nearly 1,400 different scientific journals, and the share of open-access journals increased to over 67%, compared to only 40% in 2008.

In the past few years, a very fruitful collaboration has emerged between the Flemish knowledge institutions and the business world. Both actors have reinforced each other to the extent that they can now be considered as a Flemish marine science and innovation ecosystem. VLIZ has the ambition and has been granted a mandate by the Flemish government to be a 'spider in the web' of this Flemish marine science & innovation ecosystem. In this context, VLIZ adopts a quadruple helix approach based on interactions between research, industry, policy and the general public. The covenant that was renegotiated with the Flemish government in 2021 states that VLIZ will further intensify the interactions within the marine research and innovation system. In addition to continuing current VLIZ initiatives, the institute also focuses on its own reinforcement with the recruitment of a National Liaison Officer. This enables VLIZ to take the bilateral collaborations with marine research groups and other marine actors in Ostend and Flanders to a higher level as well as explore new opportunities for cooperation with non-marine research groups.

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MARINE RESEARCH GROUPS

The number of marine research groups (MRGs) in Belgium in 2020.

Since 2021, Research Vessel (RV) *Simon Stevin* has been certified as an ICOS Class 1 ocean station. © ICOS ERIC (Konsta Punkka)

ICOS ACTIVITIES HAVE REACHED MATURITY

In 2021, the Integrated Carbon Observation System (ICOS) entered a more mature stage. ICOS is a European research infrastructure which monitors the greenhouse gas balance of the European continent and adjacent regions. Accurate measurement of the greenhouse gas balance will contribute to a better understanding of global climate change and its possible impact on ecosystems. The Flemish government supports ICOS Belgium by means of six measuring stations. VLIZ and the Operational Directorate Natural Environment take care of the oceanic component of ICOS Belgium. Measurements are performed by means of the ICOS buoy near the Thornton bank as well as the research vessels Simon Stevin and Belgica. The VLIZ buoy near the Thornton bank was officially recognised as an ICOS monitoring station in 2018. In 2021, RV Simon Stevin also received this ICOS quality label for standardised greenhouse gas measurements. Managed and operated by VLIZ, the 36-metre long research vessel is deployed in the Southern Bight of the North Sea, the English Channel and neighbouring areas. It is equipped to continuously measure the partial pressure of carbon dioxide (pCO_2) and to collect samples for dissolved inorganic carbon (DIC), pH and total alkalinity. The ICOS measurement equipment on board makes it is possible to determine how much carbon dioxide the sea has absorbed. The research areas where RV Simon Stevin is deployed are challenging yet very interesting, given the proximity of highly urbanised areas and local estuaries of rivers such as the Scheldt, the Seine and the Thames.

It is estimated that the ocean absorb approximately 25% of human generated carbon dioxide from the atmosphere. However, this estimate appears to be highly inaccurate and lacks the required nuances of time and space. The ICOS community is leading the way in the attempt to reduce the uncertainties in global observations and thus support the decision-making and policy-making process. Within this scope, the Ocean Thematic Centre (OTC) of ICOS brought together the community of marine pCO_2 observers and the developers of relevant measurement systems and sensors in the Marine Station Ostend of VLIZ for a major intercalibration workshop.

During this intercalibration workshop, the participants investigated how different sensors and systems that measure pCO_2 dissolved in surface seawater behave under controlled circumstances. This acquired knowledge makes it possible to improve the sensors and systems, and use them in a more targeted manner.

The international ICOS OTC *'pCO_2 intercomparison workshop'* took place at the Marine Station Ostend of VLIZ in June 2021 © VLIZ (Bart De Smet).

The COVID-19 pandemic forced the organisers to organise a hybrid event with a core team operating the sensors at VLIZ and with the other users participating virtually. During the daily webinars, all participants discussed the progress made in the experiment. The outcome of the intercalibration workshop helps the community of marine pCO_2 observers determine the most suitable system/sensor for their specific application. In addition, this community works closely together with developers to improve their products and meet the needs of the user community.

In the longer term, this readily available and reliable information and data supplied by VLIZ-operated stations and other ICOS measuring stations will be crucial to support science and society in their effort to become climate neutral. Thanks to the excellent cooperation within the scientific community and the established, standardised production of ICOS data, high-quality data are made freely available to the public within a few months after the observation. For instance, the CO_2 measurements which VLIZ has conducted since 2015 with the research vessel Simon Stevin and the measurement buoy near the Thornton bank contribute to the Surface Ocean CO_2 (SOCAT) Atlas. SOCAT is one of the principal tools for assessing CO_2 uptake by the oceans. Data products based on SOCAT are fundamentally important to synthesis and analysis projects such as the 'Global Carbon Budget' as well as biogeochemical models. The above has proven essential for policymakers in the climate negotiations regarding the uptake of CO_2 by the oceans.

On the basis of the previous year's achievements, we can conclude that ICOS and its activities at VLIZ have reached a mature operational stage. In addition, the ICOS research infrastructure has recently started to combine its traditional monitoring role – according to high standards – with high-quality scientific research. In the near future, VLIZ will look for additional opportunities to maintain and even expand the existing capacity.

» ICOS has entered the mature operational stage and is currently combining its traditional monitoring role – according to high standards – with high-level scientific research.«

THANOS GKRITZALIS (VLIZ MARINE TECHNICIAN EMPLOYED AT ICOS)

POLICY-INFORMING BRIEFS

An overview of the policy-informing briefs: www.vliz.be/en/beleidsinformerende-nota-s-bins

Policy-informing briefs (PIBs) are an effective tool for VLIZ to disseminate research results in marine and coastal policy issues in a targeted manner, after translation. They also provide an insight into the various complex (research) projects in which VLIZ is actively involved. In 2021, VLIZ published PIBs with regard to several topics.

Marine climate mitigation

Since the 2015 United Nations Climate Change Conference (COP21), increasing attention has been paid to the oceans' mitigation potential so-called oceanic or marine climate mitigation. With the PIB *'Mariene klimaatmitigatie: een wetenschappelijke synthese van de meest pertinente oplossingsrichtingen voor het Noordzeegebied'* (Marine climate mitigation: a scientific synthesis of the most pertinent solution paths for the North Sea area), VLIZ has bundled the current scientific insights within the marine context to facilitate the debate on the transformation towards a climate-neutral Europe. This PIB investigates several approaches to climate mitigation while focusing on five techniques / methods that are relevant within the North Sea context: offshore renewable energy, carbon capture and storage (CCS), marine geo-engineering, blue carbon and marine reserves. The selection of mitigation options was based on their feasibility, the knowledge available, and their usability in temperate and shallow sea basins such as the North Sea. Although the different options each carry their own promises, there also appear to be significant ecological and societal concerns. The content of this unique document can provide support in the review of national climate strategies and the progress towards the United Nations' Sustainable Development Goals. It can also be a source of inspiration for the Flemish blue innovation landscape.

Phasing out of the use of lead by anglers

Lead is a heavy metal and because of its practical properties (malleability, low melting point), high specific weight and low cost, it is used in a wide variety of applications, e.g. as a fishing weight by anglers. However, exposure to lead also poses health risks. By means of a PIB, VLIZ has provided the required scientific basis for a national approach to measures for the phasing out of the use and sale of lead weights. This approach forms part of an ongoing project with the Federal Public Service (FPS) Health, Food Chain Safety and Environment. Over the past year, the PIB resulted in three parliamentary questions, which illustrates the importance of and the interest in this topic. An English version of the PIB has also been released.

Plastic catchers

Plastic litter at sea is one of the major societal challenges of our time. The principal and most effective solution is reducing the amount of plastic that ends up in the environment and taking the required precautionary measures. However, the collection and clean-up of plastic that has accumulated in inland waters and in the ocean can also contribute to solving the worldwide litter problem. Within the scope of the Cluster-SBO project PLUXIN, financed by Flanders Innovation & Entrepreneurship (VLAIO) via Blue

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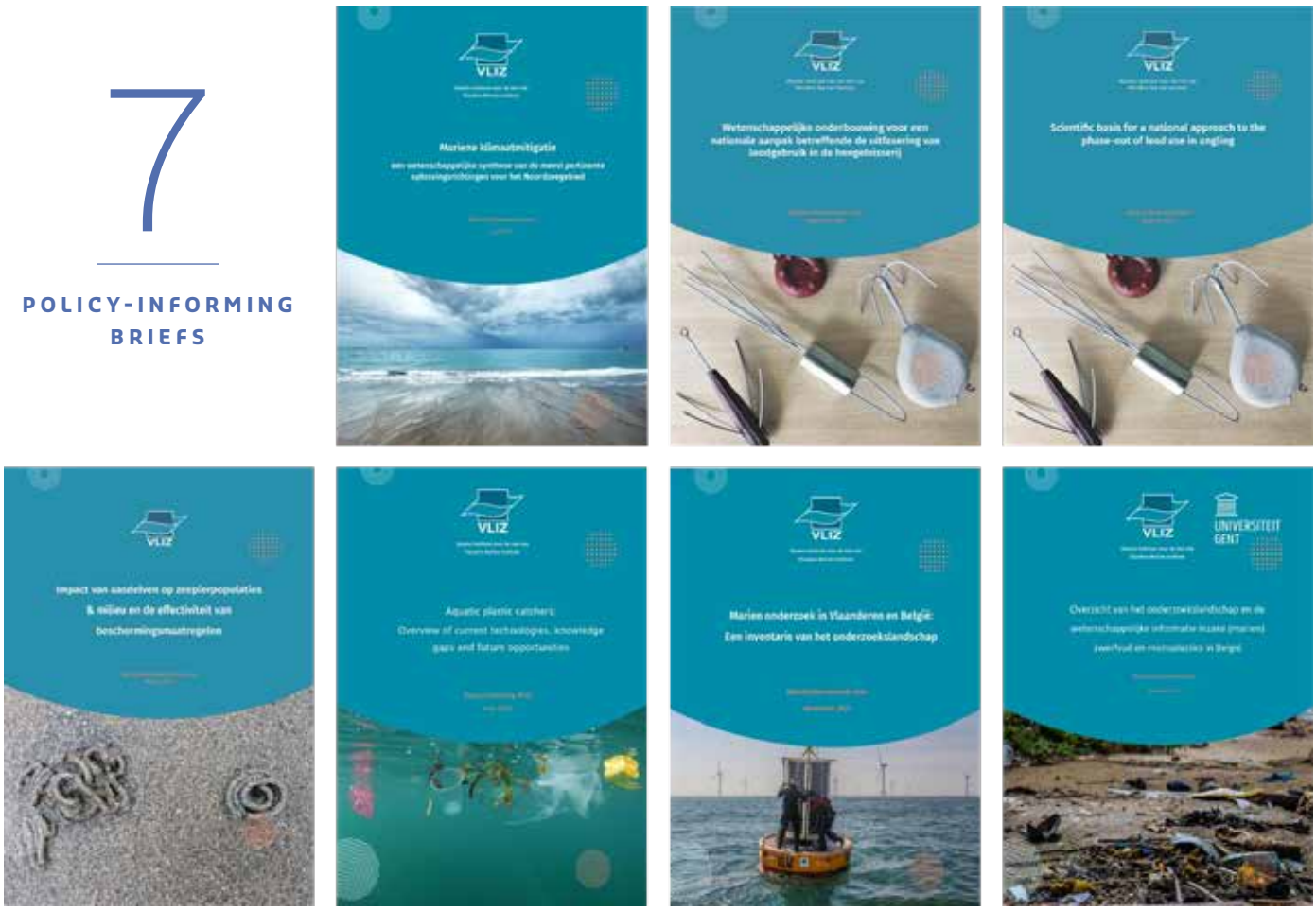
POLICY-INFORMING BRIEFS



In 2021, VLIZ published 7 new policy-informing briefs (PIBs). © VLIZ

Cluster, VLIZ has launched a valorisation project which bundles the existing systems for plastic collection and removal in aquatic environments. The resulting English-language PIB titled *'Plastic catchers: Overview of current technologies, knowledge gaps and future opportunities'* provides a comprehensive overview of the systems available worldwide. These include technologies that prevent more litter from ending up in the oceans as well as technologies that remove the accumulated litter from rivers and the ocean. By providing an insight into the state of affairs, the knowledge base and the potential of plastic catchers, interested companies, policymakers and water managers are able to make informed decisions about future installations

Marine litter and microplastics in Belgium

At the request of the national working group on marine litter coordinated by the Marine Environment Division (FPS Environment), VLIZ annually publishes an update of the available scientific information and expertise on marine litter and microplastics in Belgium.

Impact of bait digging on lugworm populations and the environment

How sustainable is the exploitation of lugworms for fishing bait (bait digging) and what is the impact on lugworm populations along the Belgian coast? This request for advice was the basis for a PIB titled *'Impact van aasdelven op zeepierpopulaties & milieu en de effectiviteit van beschermingsmaatregelen'* (Impact of bait digging on lugworm populations and the environment, and the effectiveness of protective measures). With this PIB, VLIZ has informed municipal policymakers on the sustainable management options for bait digging along the Belgian coast.

Marine research in Flanders and Belgium

With this annual PIB, VLIZ intends to inform marine and maritime (scientific) policymakers, the marine research community as well as other stakeholders and parties involved about the nature and evolution of marine research in Belgium.

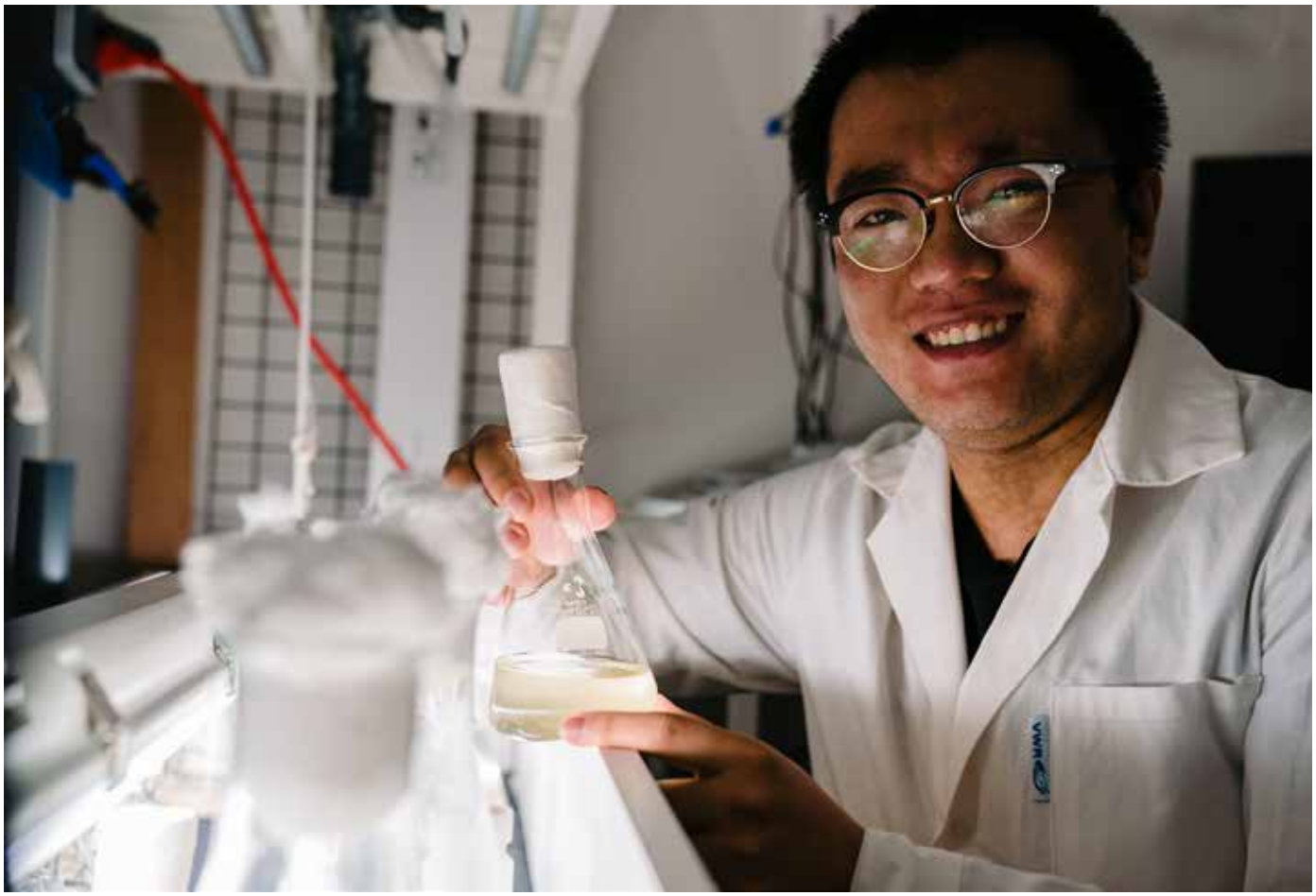
By means of an innovative virtual reality experiment, Alexander Hooyberg has investigated the effect of various coastal landscapes on our general wellbeing, mental health and cognitive functioning. © VLIZ (Decombel)

RESEARCH INTO THE RELATIONSHIP BETWEEN THE OCEAN AND HUMAN HEALTH

Life on our planet is inextricably linked to the ocean. The ocean regulates the climate, provides food and drinking water, and contributes to clean air. Exposure to a marine environment can have a positive effect on our health and wellbeing (the so-called *Blue Gym hypothesis*). However, the ocean is under pressure from economic activities and pollution from plastics and other chemicals. Generally, separate research is conducted into the impact of anthropogenic stressors on the marine environment's health on the one hand, and the importance of the ocean for human health on the other hand. The Strategic Research Agenda for Oceans and Human Health in Europe (SOPHIE) recommends a more multidisciplinary approach.

VLIZ analyses, quantifies and predicts the relations between humans and the marine environment in a multidisciplinary and interdisciplinary manner. The knowledge acquired should promote the protection and the sustainable use of the ocean as well as its benefits for human wellbeing and health. Over the past few years – and especially in 2021 – this resulted in research into (1) the psychological and physiological effects of coastal landscapes on human health and wellbeing, including the role of sensory perceptions and human behaviour (e.g. Hooyberg *et al.* 2020), (2) the occurrence and the role of marine micro-organisms (including viruses, bacteria and algae) in Belgian coastal waters and in aerosols in the sea air, which can have a negative or positive impact on human health (e.g. Van Acker *et al.* 2021), (3) the quantification and ecological assessment of pollutants in the marine environment (including macro- and microplastics as well as undersea munitions) (e.g. Catarino *et al.* 2021).

To study the environmental effects on mental health, a multidisciplinary team of scientists from VLIZ, Ghent University, KU Leuven and Hasselt University launched the 'Uitzicht'. project in 2021. The project brings together a number of studies on mental wellbeing for which scientists rely on the cooperation of citizens. In one study, researchers from VLIZ and Ghent University conducted an experiment involving virtual reality (VR), questionnaires and



PhD student Zhiyue Niu has conducted research into the amount of microplastics derived from plastic polymers and biocomposites, and has assessed to what extent these substances are harmful to the marine environment. © VLIZ (Decombel)

Ocean & Human Health at VLIZ: www.vliz.be/en/research-topic-ocean-human-health
About project 'Uitzicht': www.uitzicht.org/nl

physiological measurements to assess the environmental effects on our emotions, cognitive functioning and nervous system. No fewer than 164 test subjects aged between 18 and 65 took part in the VR experiment in July, August and September 2021. Scholarship PhD student Alexander Hooyberg, who set up this innovative experiment, was awarded a Brilliant Marine Research Idea (BMRI) grant worth € 5,000 in 2021. This grant enabled Alexander to purchase a device (NeXus-10 MKII) to measure the nervous system activity of the participants in the experiment who were exposed to various (coastal) landscapes by means of virtual reality headsets. In 2022, we expect to see the results of this first successful study.

Also within the scope of the Uitzicht project, clinical psychologists and biologists from VLIZ, Ghent University and KU Leuven studied the psychological impact of the COVID-19 pandemic and the remedial character of the Flemish coast. By means of an online questionnaire, they examined how the restrictions on outdoor activities affected our feelings and wellbeing during the first coronavirus lockdown. In 2021, the researchers published the study results in the A1 journal *Psychologica Belgica* (Severin *et al.* 2021).

In 2021, researchers from VLIZ and Ghent University conducted more coronavirus-related studies. One such study enabled them to confirm the suspicion that coronaviruses are not active for long in (North Sea) water. They published the results in the A1 journal *PLoS One* (De Rijcke *et al.* 2021).

By studying the link between the ocean and human health, VLIZ is a pioneer in Flanders, particularly in terms of research into mental health. In the short term, this research topic has become firmly established in the VLIZ research strategy. In the near future, VLIZ will increase its focus on this topic, e.g. by continuing to integrate and reinforce research into the ocean's health. In addition, VLIZ involves a new interdisciplinary group of scientists (including sociologists, medical experts and psychologists) in marine research by initiating the innovative research topic *'Ocean and Human Health'*.

BLUE ECONOMY AND SCIENCE ADDRESS OCEANIC CHALLENGES TOGETHER

The brochure *'Gearing up our blue knowledge'*: www.vliz.be/imisdocs/publications/358933.pdf

» The new blue industrial revolution should contribute to sustainable development and rely on sound scientific evidence and support. «

HILDE CREVITS, FLEMISH MINISTER FOR ECONOMY, INNOVATION AND AGRICULTURE

2021 was the year of the launch of the United Nations Decade of Ocean Science for Sustainable Development (UNDOSSD) (see Highlight on p. 12-13). On this occasion, VLIZ, Blue Cluster and the department of Economy, Science and Innovation (EWI) launched a brochure titled *'Gearing up our blue knowledge – Tackling ocean challenges in the UN Decade of Ocean Science'*. The brochure demonstrates the strength, diversity and potential of the Flemish innovation landscape and documents how Flanders makes use of the sea to meet its sustainability targets. Hilde Crevits, Vice Minister-President of the Flemish Government and Flemish Minister of Economy, Innovation, Work, Social Economy and Agriculture, officially presented the brochure at the VLIZ Marine Science Day of 3 March 2021 (see Highlight on p. 30-31).

Also in 2021, VLIZ once again played an important part in research and innovation projects involving the blue economy. This way, VLIZ acts as a facilitator for an efficient transfer of scientific knowledge from marine knowledge institutions to the maritime business world.

In this context, VLIZ presides the Blue Cluster scientific advisory board and is a member of the steering committee on behalf of the Flemish marine research landscape. In addition, VLIZ is actively investing in innovation projects through its own research and development in collaboration with partners from the blue economy. This concerns a wide variety of concrete topics, ranging from PROspection for BIOactive compounds in the North Sea (PROBIO) and nature-based solutions for coastal defence (Coastbusters 2.0) to the development of innovative observation methods (e.g. the use of robotics in AMUC2.0 or of eDNA in GEANS) and social as well as societal research into public support for new developments on the coast (BLUE BALANCE).

In addition, VLIZ and Blue Cluster cooperate closely in terms of internationalisation, communication and the organisation of joint events. For instance, about a hundred representatives from knowledge institutions, government authorities and the industry met in Ostend to participate in the *'Blue Economy Science Summit'* (BESS) (formerly known as *'Marine Science Meets Marine Industry'*) on 10 September 2021. With this annual event, VLIZ and Blue Cluster aim to bridge the gap between researchers and companies. The event puts a spotlight on the principal blue innovation activities and demonstrates that the cross-pollination between science and industry can result in new insights and developments (see KPI2 on p. 43). During the plenary session, attention was paid to the legal and operational aspects of intellectual property (IP) rights and what this implies for innovation and cooperation projects. Nathalie Balcaen, head of the Agency for Maritime and Coastal Services, explained the government's approach to and investment in innovation. Finally, an interactive innovation fair highlighted several innovation projects linked to the blue economy.

Resulting from cooperation between the department of Economy, Science and Innovation, VLIZ and Blue Cluster, the brochure titled *'Gearing up our blue knowledge'* demonstrates the innovative strength of the blue economy in Flanders.

Jan Mees, general director of VLIZ, addresses participants in the *'Blue Economy Science Summit'* of 10 September 2021. © VLIZ & Blue Cluster vzw (Verhaeghe)

Employees of the VLIZ *Marine Robotics Centre* (MRC) on mission in Greenland to install autonomous real-time observation nodes on the seabed. © VLIZ (Wieter Boone)

The transfer of the glider *'SeaExplorer'* by VUB to VLIZ was attended by (left to right) general director of VLIZ Jan Mees, governor of West Flanders Carl Decaluwé, professor Yue Gao (VUB), professor Willy Baeyens (VUB) and professor Colin Janssen (chairman of the VLIZ Scientific Board).

4

SEA-GOING ROBOTS

The number of sea-going robots in the VLIZ Marine Robotics Centre's fleet that can perform a wide range of measurements autonomously or remotely.

» The VLIZ Marine Robotics Centre invests in modular robots with a small logistical footprint. SeaExplorer is such a robot that plays a unique role in our ocean observing capacity. The glider makes it possible to study seasonal processes with an unprecedented level of detail. «

WIETER BOONE, MANAGER OF THE MARINE ROBOTICS CENTRE

MARINE ROBOTICS CENTRE HAS PICKED UP STEAM

The VLIZ Marine Robotics Centre (MRC): www.vliz.be/en/marine-robotics-centre

In 2018, VLIZ founded the Marine Robotics Centre (MRC) with the support of the Flemish government. While the first years of the MRC were characterised by investment in infrastructure, the building of human capital and the testing of equipment and robotics, the centre's activities picked up steam in 2021.

This increase in operational capacity translates into various national and international research projects in which sea-going robots actively participate. Despite the restrictions caused by the coronavirus pandemic, the VLIZ MRC team took part in two missions to Greenland in 2021. Autonomous real-time observation nodes on the seabed provide a better insight into the interactions between the ice sheet, the fjords and the adjacent sea. An engineer from the VLIZ MRC took part in two Remotely Operated Vehicle (ROV) campaigns in the Norwegian Sea and the Denmark Strait. The MRC extensively deployed its robots closer to home too. Within the scope of the innovation project Coastbusters 2.0, which tests the capacity and added value of certain biobuilder species for coastal protection, Uncrewed Surface Vehicle (USV) Adhemar served as a 'mobile measurement buoy' to measure the test site's essential environmental parameters. Autonomous Underwater Vehicle (AUV) Barabas proved its usefulness for Coastbusters 2.0, for instance by mapping the soil characteristics and monitoring the test setup situation below the water's surface. Tests were also carried out with innovative underwater communication techniques in order to connect observation nodes on the seabed to the sea-going robots.

In addition to the many project missions, USV Adhemar and AUV Barabas were present at the Technology Weekend organised by the Ministry of Defence at the naval base in Zeebrugge in early October. The general public was able to become acquainted with the VLIZ robots. The MRC also organised a demonstration with USV Adhemar which attracted considerable attention at a thematic afternoon dedicated to surface and underwater drones for companies, government authorities and academic partners.

Together with leading European players, the VLIZ MRC contributed to a few project proposals in 2021, including the MIRICLE (Mine Risk Clearance for Europe) proposal within the scope of the European Defence Industrial Development Programme (EDIDP). Recently approved, the project is aimed at improving the detection and neutralisation of (buried) mines. To this end, the consortium will utilise the expertise and the robotics of the MRC while also making use of the scientific knowledge of geologists and geophysicists who work on the VLIZ research topic *'Seascapes Past and Future'*. The MRC also successfully applied for other projects with Horizon Europe, FWO, VLAIO and MarTERA funding.

On 10 November 2021, the VLIZ MRC commissioned the glider 'SeaExplorer' which had been transferred to VLIZ by Vrije Universiteit Brussel (VUB). SeaExplorer is ideally suited for studying climate change in the ocean and conducting research into micronutrients in the oceans. After getting a substantial upgrade and additional sensors, the glider was subjected to acceptance tests at sea in southern France in the autumn.

Finally, the VLIZ MRC was actively involved in a study group providing input for the development of a legislative framework for unmanned surface vehicles in the Belgian part of the North Sea. This law came into effect on 1 July 2021.

In short, three years after its foundation, the VLIZ MRC has developed into a knowledge hub for *'marine autonomous systems'* with five VLIZ employees and four sea-going robots deployed for scientific purposes. It has been involved in various national and international research and innovation projects.

CITIZEN SCIENCE, AN IMPORTANT PILLAR OF 'OPEN SCIENCE'

Citizen science has become more widely known as part of the 'Open Science' movement. VLIZ may be considered a pioneer of marine citizen science, both on a local and on an international level.

On the Belgian coast, VLIZ is the initiator or co-organiser of four projects. Within the scope of SeaWatch-B about twenty specially trained volunteers have carried out standardised monitoring of the Belgian North Sea beaches since 2014. So far, this has resulted in over 250 surveys yielding information about beach shape, human presence, litter, seawater temperature, shells, lugworms, catches with towed nets, limpets, beached jellyfish and archaeological finds – spread over twenty fixed beach sections. In 2018, a report was published with the data gathered over the first four years. Since 2018, the general public has annually counted shells on the Flemish beaches during one day in March, and these shells are identified on the basis of the SeaWatch method. So far, the four editions of the Big Shell Counting Day (organised in cooperation with EOS Wetenschap, Natuurpunt, the province of West Flanders, Kusterfgoed, Strandwerkgroep and the coastal municipalities) have involved 2,500 participants and have yielded 142,000 identified shells belonging to over 60 species and a great deal of information.

In a third initiative concerning recreational sea fisheries, VLIZ and the Flanders Research Institute for Agriculture, Fisheries and Food (ILVO) convinced hundreds of sea fishing amateurs to keep a log and share data about fishing trips and catches. Finally, VLIZ has been involved in the installation of two poles on the Belgian coast (on the East Bank of Ostend and in Koksijde) within the scope of the international CoastSnap programme. Having been started in Australia, this project is aimed at encouraging citizens to take pictures on the beach with their smartphones from a holder fixed to a pole. The resulting data will then be used by VLIZ to monitor coastline changes, for instance.

In addition, VLIZ is a member of the steering committee of **Scivil**, the Flemish knowledge centre for citizen science, and is the initiator of the Scivil study group for biodiversity and a member of the data study group. VLIZ is frequently asked to give lectures on this topic and contributes to the '**Iedereen Wetenschapper**' digital platform for citizen science which has been developed by EOS Wetenschap.

Internationally, VLIZ has actively co-written numerous **publications** regarding Citizen Science. In 2020, VLIZ performed an analysis of 127 coastal citizen-science projects in the North Sea area, translated into a VLIZ policy-informing brief. It also co-wrote an A1 publication about marine citizen science in Europe and a chapter about citizen science in the BANOS CSA report. In 2017, the institute has co-written a policy brief of the European Marine Board about this topic.

In 2021, VLIZ, together with POGO and an American sponsor, joined in the international project COLLECT (*Citizen Observation of Local Litter in Coastal ECosysTems*) which conducts research into macro- and microplastics on African beaches. Students from 10 secondary schools in Ghana, Nigeria, Benin, Ivory Coast, Cape Verde and Morocco have contributed to this research project as citizen scientists. The project has thus resulted in the promotion of knowledge about the spread of plastic pollution on African beaches, and in raising awareness of plastic waste among local communities.

Throughout the four editions of the Big Shell Counting Day, 2,500 participants collected no fewer than 142,000 shells belonging to over 60 species © VLIZ

142,000

SHELLS

The number of shells collected by volunteers on Flemish beaches and identified with the help of experts during four editions of the Big Shell Counting Day.

» Since long, VLIZ has been a pioneer in the field of citizen science and has thus built a great deal of expertise. Large-scale citizen science events such as the Big Shell Counting Day or long-term intensive collaborations with a smaller group of volunteers within the scope of Seawatch-B uniquely combine ground-breaking scientific research with intensive citizen participation. VLIZ's extensive experience and insights in the field of citizen science and its willingness to share them are strongly appreciated by the citizen science community in Flanders and beyond. «

ANNELIES DUERINCKX, COORDINATOR OF SCIVIL, THE FLEMISH KNOWLEDGE CENTRE FOR CITIZEN SCIENCE

Hilde Crevits, Flemish Minister of Economy, Innovation and Agriculture, opens the seawater pipe (above) and unveils a plaque for the expansion of the Marine Station Ostend (below; left to right: Carl Claeys and Tom Haelvoet (Claeys-Haelvoet architecten), Johan Vrijghem (CFO Stadsbader), governor of West Flanders Carl Decaluwé, Flemish Minister of Economy, Innovation and Agriculture Hilde Crevits, Mayor of Ostend Bart Tommelein, general director of VLIZ Jan Mees and chairman of the VLIZ Scientific Board professor Colin Janssen). © VLIZ (Verhaeghe)

Minister Vincent Van Quickenborne visits the VLIZ Marine Robotics Centre accompanied by Jan Mees, general director of VLIZ, and Marc Nuytemans, CEO of Blue Cluster © VLIZ & Blue Cluster (Verhaeghe).

European Commissioner Virginijus Sinkevičius in the VLIZ Marine Robotics Centre © VLIZ (Jan Mees)

VISITS BY PROMINENT FIGURES TO THE MARINE STATION OSTEND

Press release inauguration seawater pipeline:
www.vliz.be/en/press-release/flemish-minister-hilde-crevits-inaugurates-seawater-pipeline-expansion-marine-station-oostende

In 2021, numerous prominent figures visited VLIZ and the Marine Station Ostend (MSO).

On 15 June, Hilde Crevits, Flemish Minister of Economy, Innovation and Agriculture, opened a pipe that provides the research station with fresh seawater. The pipe conducts seawater from the beach to the water tanks and aquariums in the current and future laboratories. The new seawater pipe is part of the expansion of the MSO, for which Minister Crevits also unveiled an inauguration plaque. In a first stage, the station will be expanded with a new building that will accommodate an innovative robotics and research centre. With this expansion, VLIZ will increase its research capacity and meet the demands of the institute's fast growth. The first stage of the masterplan for the site should be completed by the spring of 2022.

Minister of Justice and of the North Sea and Deputy Prime Minister Vincent Van Quickenborne visited the Marine Station Ostend on 22 June. At the invitation of Blue Cluster, the minister came to Ostend to learn more about several fascinating initiatives within the blue economy. The programme included a visit to the VLIZ Marine Robotics Centre and a demonstration of the unmanned surface vehicle 'Adhemar'. Later that morning, there was a boat trip to the test platform 'Blue Accelerator' and a lunch with prominent players in the blue economy. In the afternoon, Minister Van Quickenborne went to Brussels to explain the new legislative framework for autonomous vehicles during a webinar about autonomous vessels.

Virginijus Sinkevi ius, European Commissioner for the Environment, Oceans and Fisheries, visited Ostend on 6 September to get acquainted with several lŏcal initiatives within the sustainable blue economy in Belgium. Accompanied by Hilde Crevits, Flemish Minister of Economy, Innovation and Agriculture, and Mayor of Ostend Bart Tommelein, the EU Commissioner made a tour of the Marine Station Ostend and learnt about the citizen-science initiative CoastSnap. The programme of the day was drawn up by Bluebridge, Blue Cluster, Marine@UGent, Ostend Science Park and VLIZ.

DIGITAL 20TH ANNIVERSARY EDITION OF THE VLIZ MARINE SCIENCE DAY

Watch the recording of the VMSD21 livestream: www.youtube.com/watch?v=J2wEhvtL9GM&feature=youtu.be
Download the book of abstracts of VMSD21: www.vliz.be/imisdocs/publications/358823.pdf

The VLIZ Marine Science Day (VMSD), VLIZ's networking event aimed at scientists from the marine research community, would have celebrated its 20th edition in 2020. However, the coronavirus pandemic forced VLIZ to postpone this anniversary edition by one year and rethink the concept. In 2021, the first entirely digital version of the VMSD consisted of a three-hour programme with presentations, interviews, an online poster session and prize-giving ceremonies, interspersed with surprise elements. The event was hosted by science watcher Hetty Helsmoortel. The new digital concept did not put a damper on the enthusiasm of the participants. No fewer than 350 viewers (from 24 countries) followed the livestream via the VLIZ YouTube channel on 3 March 2021. The recording remained available after the event, and 1,955 people had watched the video at the end of 2021. We may conclude that after 20 years, the interest in this festival of marine sciences in Belgium has not waned. The research community reached by VLIZ is getting bigger, more diverse and more international every year. This underscores the increasing attention paid to the oceans, which are central to the United Nations Decade of Ocean Science for Sustainable Development launched in 2021 (also see Highlight p.12-13).

1,955

VIEWS

The number of views of the recording of the VMSD21 livestream on the VLIZ YouTube channel on 31 December 2021.

On the occasion of the 20th anniversary of the VMSD, graffiti artist Jamz Jamezon bridged the gap between marine science and art by creating a temporary mural at the site of the Marine Station Ostend.

VLIZ General Director Jan Mees and moderator Hetty Helsmoortel during the recording of the VLIZ Marine Science Day 2021 in KAAP Oostende © VLIZ

On the occasion of the 20th edition of the VLIZ Marine Science Day, graffiti artist Jamz Jamezon bridged the gap between marine science and art by creating a temporary mural at the site of the Marine Station Ostend. © VLIZ (Decombel)

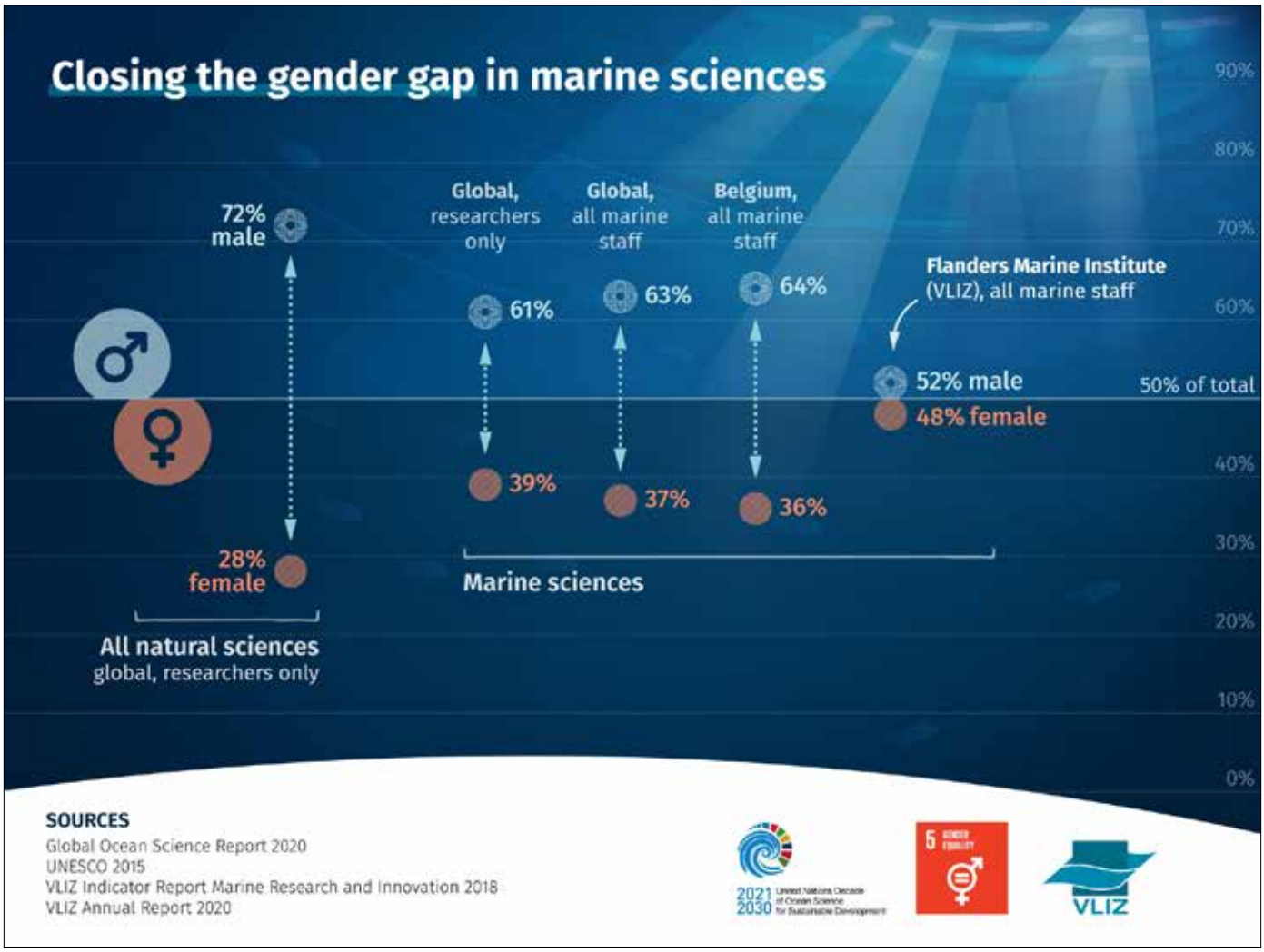
VLIZ fosters its human capital and attaches great value to diversity in all its facets © VLIZ (Decombel)

HUMAN CAPITAL AND DIVERSITY AS THE BASIS FOR ITS SCIENTIFIC SUCCESSES

VLIZ' Gender Equality Plan: www.vliz.be/en/diversity-inclusion

The interest, the trust and the belief in science and scientists among the Flemish population is generally very high (see the 2021 Science Barometer of the Flemish government). That is a good thing, because science is relevant to everyone. Behind the objectivity and neutrality of science, the theories and hypotheses, the experiments and analyses, there are people of flesh and blood. VLIZ is well aware of this fact and fosters its human capital. The VLIZ employees embody a set of competences, knowledge as well as social and personal skills indispensable for the day-to-day operation and further development of the institute. We owe our success to our talented and motivated staff who have a wide range of expertise and who closely collaborate and interact.

Science is not just objective and neutral, but by definition also diverse. VLIZ has always considered equality and diversity of paramount importance. Within this context, VLIZ recruits new employees on the basis of capacities and qualities, regardless of gender, belief, skin colour, age, sexual preference or disability. Since the establishment of the Research Department, the character of VLIZ has become increasingly international; together with the changing zeitgeist, this has resulted in a need for further professionalisation and consolidation of the institute's diversity policy. To this end, VLIZ created an internal study group in 2021 that is to draw up a clear and transparent diversity plan. The diversity plan should further facilitate the achievement of inclusivity and diversity



The gender gap is much less of an issue in marine sciences than in all other natural sciences. Yet there is always room for improvement. With 48% women and 52% men, VLIZ does comparatively well in comparison with the national and global level. © VLIZ

ambitions, closely monitor the evolution of diversity figures and indicators, and make adjustments where necessary. In addition, VLIZ aims to increase the motivation of its employees and their involvement in the day-to-day operation as well as improve their work-life balance by means of this dynamic plan. This will not only benefit the effectiveness and efficiency of their work, but also reinforce the creative and innovative objectives of VLIZ. In 2022, a benchmarking of the diversity figures and indicators is planned, which will be the reference for a biennial evaluation of progress.

First, a gender equality plan was drawn up, which can now be consulted on the VLIZ website.

13

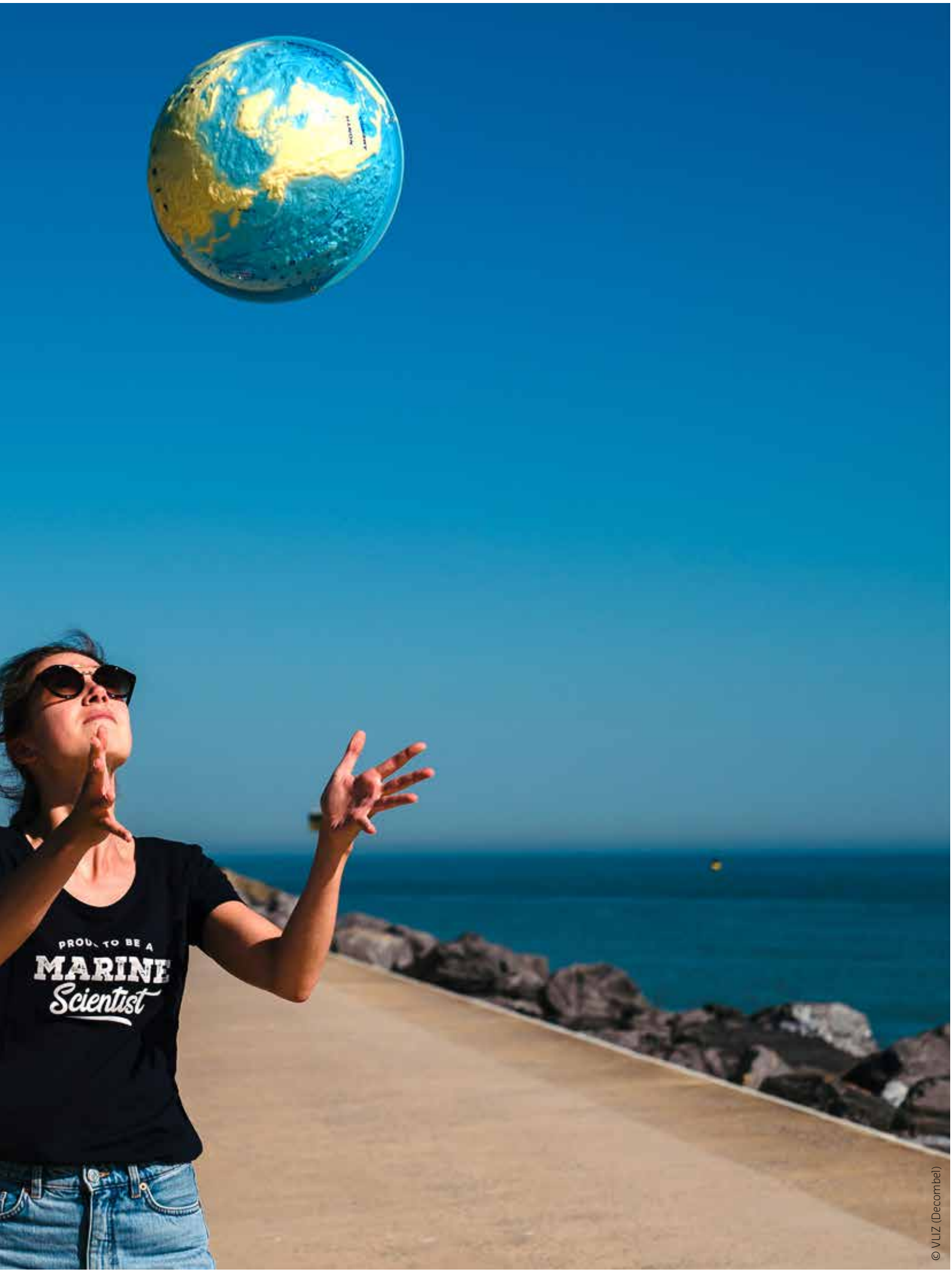
NATIONALITIES

The number of nationalities of VLIZ employees in 2021.

SUPPORT TO INTERNATIONAL ORGANISATIONS

By order of the Flemish government, VLIZ supports several international organisations. This capitalises on VLIZ's international experience and reputation, and makes it possible to embed important European initiatives in Flanders. This chapter briefly explains the specific partnerships in which VLIZ participated in 2021.

www.vliz.be/en/international-mandates



EUROPEAN MARINE BOARD

www.vliz.be/en/european-marine-board-emb
www.marineboard.eu

On the 1st of December 2021, the 8th EMB open forum brought together various stakeholders from the government, the academic world, NGOs and the business community during a hybrid event on the topic of 'Supporting the Ocean Decade in Europe'. The aim of the Forum was to reflect and facilitate discussion on what has been achieved during the first year of the Ocean Decade and what can be adapted and developed further as we progress through the Decade.

The European Marine Board (EMB) provides an independent Pan-European platform to its marine scientific member organisations to establish common research priorities, to promote marine research and to close the gap between science and policy. VLIZ represents FWO in the European Marine Board and was given the mandate by the Flemish government to accommodate and support the EMB secretariat.

The EMB secretariat, located at InnovOcean, benefits from VLIZ support through the use of the general VLIZ infrastructure, IT support, and one EMB staff member. Together with VLIZ, the EMB secretariat will also be moving to the new InnovOcean Campus in 2022.

Jan Mees, VLIZ General Director, served as the EMB chairman from 2014 until June 2019 and remained involved as the delegate of VLIZ within the EMB Board. The VLIZ head of Science Communications, Jan Seys, actively supports the EMB Communications Panel by serving on the Steering Group, and chairs the EMB supported Working Group on Marine Science Communication in Europe, for which a publication is foreseen to be launched early 2022.

In November 2021, EMB launched the Future Science Brief on Underwater Noise, for which VLIZ employee Elisabeth Debusschere was an active expert of the Working Group. Furthermore, VLIZ employee Michiel Vandegehuchte, co-author of EMB's flagship publication 'Navigating the Future V', was the speaker during EMB's Science Webinar series in August 2021, giving a presentation and participating in a Q&A session.

Throughout 2021, different VLIZ staff members attended and actively participated in the wide variety of EMB events, including the hybrid EMB 8th Forum on Supporting the Ocean Decade in Europe on 1 December 2021.

EMODNET SECRETARIAT

The European Marine Observation and Data Network (EMODnet) is a long-term European marine data service that unlocks the abundance of existing but often fragmented European marine data and observations and makes data and data products optimally accessible for use by government bodies, scientists and maritime companies. A Marine Knowledge initiative from the European Commission, EMODnet has become an essential tool for scientists, engineers, managers and policy-makers to generate the information necessary to improve our knowledge of the seas and to support sustainable economic growth and employment.

In practice, EMODnet consists of a network of more than 120 organisations supported by the EU's Integrated Maritime Policy which work together to observe the sea, process the data according to international standards and make that information freely available as interoperable data layers, data products and services.

Since 2013, the EMODnet Secretariat is hosted at the InnovOcean site in Ostend by VLIZ with the support from the Flemish Government. VLIZ provides office space for six EMODnet Secretariat staff members as well as IT support. VLIZ also hosts and leads the technical development and continuous updates of the EMODnet Central Portal data services (emodnet.ec.europa.eu) and has assisted in setting up the EMODnet Confluence and JIRA tools, used for the management of internal projects, day-to-day tasks and software developments. Moreover, as part of the repatriation of the Central Portal under the Europe domain, which was completed in summer 2021, VLIZ provided the EMODnet Secretariat with a development server for designing website layout.

The Central Portal gives users access to the different EMODnet thematic activities (bathymetry, geology, biology, chemistry, human activities, seabed habitats and physics), to the regional activities (EMODnet Sea-basin Checkpoints) and to data services (map viewer, query tool, catalogue, etc.). VLIZ coordinates the EMODnet Biology thematic node. Foreseen in 2022 is the web centralisation of EMODnet, so that all thematic data and products will be findable, accessible and downloadable via the Central Portal instead of through the individual thematic gateways. The work and collaboration between VLIZ and EMODnet to make this possible, started in 2021 and is well advancing.

In 2021, VLIZ continued supporting the EMODnet Secretariat with the content development and co-organisation of the EMODnet technical working group meetings, and provided support with the organisation of the hybrid EMODnet Open Conference 2021 (14 to 16 June). The latter three-day event gathered over 400 participants to discuss EMODnet achievements in the past 10 years, partnerships and vision for the coming decade.

- www.vliz.be/en/european-marine-observation-and-data-network-emodnet
- www.emodnet.eu/about-secretariat
- /emodnetconference2021.eu/

The second EMODnet Open Conference event, organised by the EMODnet Secretariat with support from VLIZ. © EMODnet (Dirk Leemans)

JPI OCEANS

Early 2021, JPI Oceans launched its new Strategy Framework which provides a coherent setting for the coming years for efficient and impactful pan-European research and innovation, in support of healthy and productive seas and ocean.

www.vliz.be/en/jpi-healthy-and-productive-seas-and-oceans-jpi-oceans
www. jpi-oceans.eu

The Joint Programming Initiative Healthy and Productive Seas and Oceans (JPI Oceans) is a pan-European intergovernmental platform that increases the efficiency and impact of research and innovation for sustainably healthy and productive seas and oceans. It is governed by a Management Board composed of national institutions such as ministries and funding agencies that develop, fund, and implement national research agendas. VLIZ is commissioned by the Flemish government to support the JPI Oceans Secretariat and does so by providing a full-time employee to the JPI Oceans secretariat in Brussels.

Early 2021, JPI Oceans launched its new Strategy Framework, which provides a coherent setting for the coming years for efficient and impactful pan-European research and innovation, in support of healthy and productive seas and ocean.

2021 also saw a healthy turnover of Joint Actions: the New Pollutants Knowledge Hub was successfully concluded with a policy brief and the European Marine Sensors Calibration Network transitioned into the Horizon 2020 metrology project MINKE. Further, JPI Oceans formally adopted two new Joint Actions on Cumulative Effects and on Ocean Carbon Capacities that picked up work towards creating new outcomes that help policies and people.

In addition, an unprecedentedly broad collaboration with the JPIs on Water and on Antimicrobial Resistance and with the European Commission resulted in selection of eighteen research and innovation projects on risks to human health and the environment by pollutants and pathogens in water resources.

Concluding a productive year, JPI Oceans launched a Joint Call on Underwater Noise among eight countries, worth eight million Euros, and with ties regionally (BANOS and BlueMed), globally (UN Decade) and internationally (US NOAA). Earlier in the year, the two ERA-NET Cofunds supported by JPI Oceans had already launched calls in the areas of Blue Bioeconomy and Marine Technology.

At the strategic level, JPI Oceans further contributed to the advancement of the new Horizon Europe partnership on Sustainable Blue Economy. In February the high-level draft of a Strategic Research and Innovation Agenda for the partnership, actively co-created by stakeholders around Europe, was released. Since then, JPI Oceans continues to support the process and is designated to lead the communication activities of the new partnership.

At global level JPI Oceans' role was formalised in the UN Ocean Decade. As one of the two European Decade Implementing Partners, JPI Oceans will facilitate and coordinate national, regional and programmatic contributions together with the European Marine Board.

UNESCO/ IOC PROJECT OFFICE FOR IODE

www.vliz.be/en/unescoioc-project-office-iode
www.iode.org

At the start of the monitoring within the PacMAN project (Pacific Islands Marine Bioinvasion Alert Network), settlement plates and signaling boards were placed at four locations in the Suva harbour (Fiji). © Mr. Puamau (Sky Productions Fiji)

Since 2005, VLIZ hosts and supports the Project Office for the International Oceanographic Data and Information Exchange (IODE PO) Programme of UNESCO's 'Intergovernmental Oceanographic Commission' (IOC). The 'UNESCO/IOC Project Office for IODE' is also the Secretariat of the IOC's Capacity Development section.

Despite the impact of the COVID19 pandemic, the OceanTeacher Global Academy (OTGA) organized 32 online training courses in 2021. In addition, OTGA has also hosted training courses of external partners. In 2021, four such training courses were hosted of which one for VLIZ-WoRMS. Altogether, OTGA enrolled 1,550 learners in 2021 and 3,250 people applied to a training course. OTGA's network of 16 Regional and Specialized Training Centres delivered the training courses. In 2021, the IOC Science and Communication Centre on Harmful Algae at University of Copenhagen was accepted as a new Specialized Training Centre. This brings the total number of OTGA Regional and Specialized Centres to 17. In September 2021, OTGA was endorsed as a UN Ocean Decade Project.

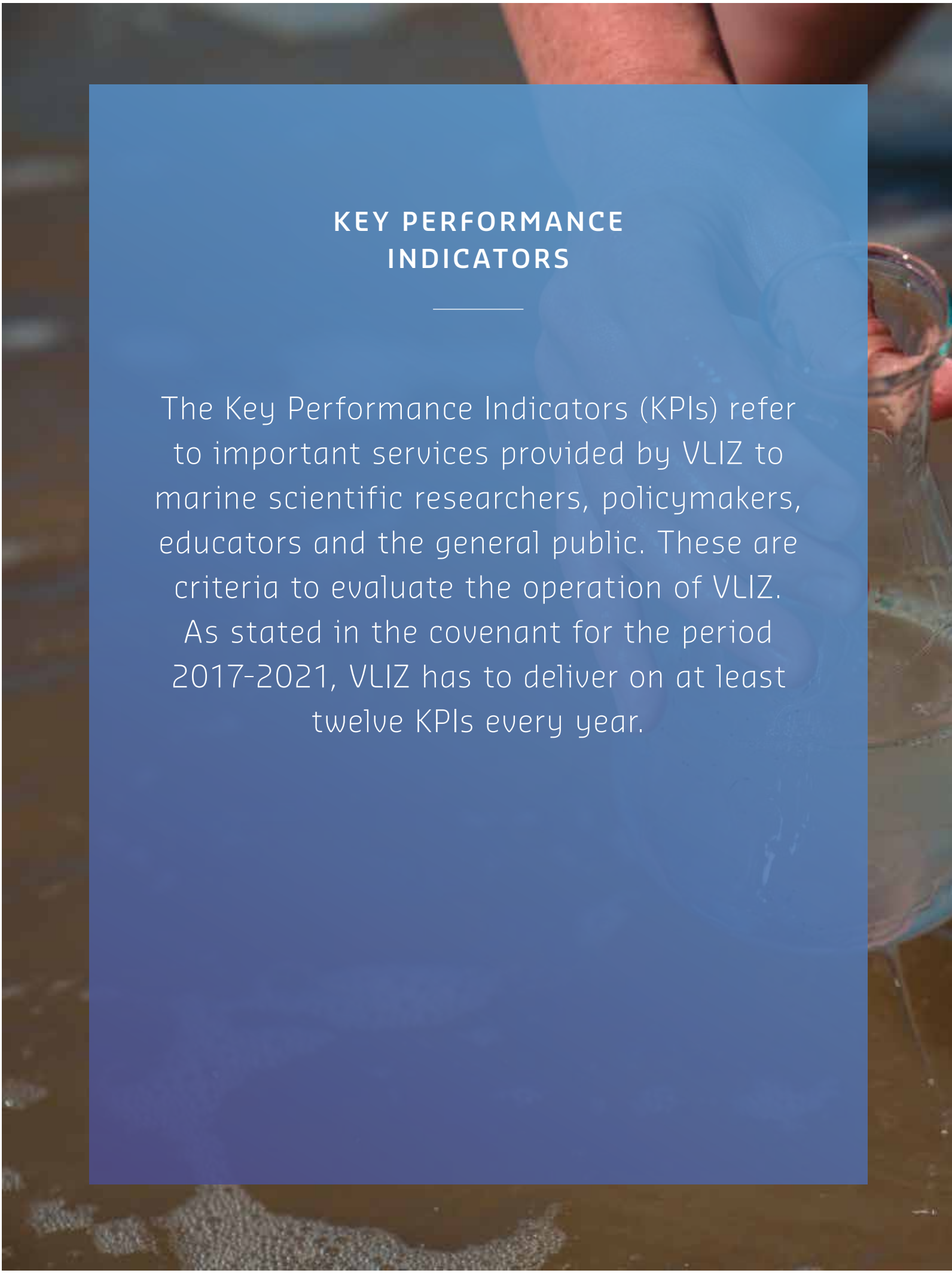
The Ocean Biodiversity Information System (OBIS), which manages a global database containing data on the distribution, abundance and diversity of all marine species, published in 2021 a record number of 16 million presence records from 662 new datasets. VLIZ manages the European OBIS node, EurOBIS, which contributed 139 new datasets to OBIS, serving 26 million records. The VLIZ data centre has been actively involved in OBIS activities such as vocabulary standardization and taxonomic quality control. OBIS contributed to the first UN led Global Harmful Algal Bloom Status report, published in June 2021, and co-authored by Maarten De Rijcke from the VLIZ Research Department.

In 2021, the Pacific Islands Marine Bioinvasions Alert Network (PacMAN) project, led by OBIS, delivered its monitoring plan. The plan was developed by involving both local Fijian authorities as well as an international scientific advisory board, which includes membership from the VLIZ Research department.

The OBIS team has also initiated the project 'eDNA expeditions in marine World Heritage sites'. This project will organize citizen science campaigns to estimate fish biodiversity and potential impacts of global warming at 25 Marine World Heritage sites across the globe. Both PacMAN and eDNA expeditions are endorsed UN Decade actions.

After a consultation period with different experts, the ODIS Catalogue of Sources (ODISCat) database and interface have been further developed and improved by a student who was sponsored and supervised by VLIZ. Being the host of 29 out of 3,000 entries, VLIZ is well represented in the ODISCat database.

Regarding the activities under the IOC's Capacity Development (CD) coordination unit, the third Session of the IOC Group of Experts on Capacity Development (GE-CD) was held as an online event on 1-2 December 2021. The GE-CD will develop a new IOC CD strategy (2023-2030) for adoption by the 32nd IOC Assembly in 2023, a CD chapter for the implementation plan of the UN Ocean Decade, and prepare a proposal to promote greater visibility and reach of its strategy. The IODE Project office will coordinate this effort.



KEY PERFORMANCE INDICATORS

The Key Performance Indicators (KPIs) refer to important services provided by VLIZ to marine scientific researchers, policymakers, educators and the general public. These are criteria to evaluate the operation of VLIZ. As stated in the covenant for the period 2017-2021, VLIZ has to deliver on at least twelve KPIs every year.

KPI 1

AT LEAST TWENTY-EIGHT A1 PUBLICATIONS (THE AVERAGE FIGURE FOR 2019-2021) WRITTEN BY A VLIZ EMPLOYEE IN 2021

60

A1 PUBLICATIONS [1]

written by VLIZ employees were published in 2021, including 17 A1 publications with a VLIZ employee as the first author and 43 A1 publications with a VLIZ employee as a co-author. An overview of the A1 publications is available on p. 59 of the annexes.

© VLIZ (Decombel)

[1] in 2020: 41

KPI 2

THE ORGANISATION OF AN ANNUAL EVENT BRINGING TOGETHER ACTORS FROM THE MARINE SCIENTIFIC COMMUNITY AND THE INDUSTRY

On 10 September 2021, VLIZ and Blue Cluster organised the Blue Economy Science Summit (BESS). It was the first edition of BESS (formerly known as 'Marine Science meets Maritime Industry') in its new form. © VLIZ & Blue Cluster (Verhaeghe)

95 representatives from knowledge institutions, government authorities and the industry met on the East Bank of Ostend to participate in the 'Blue Economy Science Summit' (BESS) (formerly known as 'Marine Science Meets Marine Industry') on 10 September 2021. With this successful annual event, VLIZ and Blue Cluster aim to bridge the gap between researchers and companies. The event puts a spotlight on the principal blue innovation activities and demonstrates that the cross-pollination between science and industry can result in new insights and developments. This year, the event was centred around intellectual property (IP) rights. During the plenary session, attention was paid to the legal and operational aspects of IP and what this implies for innovation and cooperation projects. Nathalie Balcaen, head of the Agency for Maritime and Coastal Services, explained the government's approach to and investment in innovation. Finally, an interactive innovation fair highlighted several innovation projects linked to the blue economy.

BLAUWE CLUSTER

95

REPRESENTATIVES

from knowledge institutions, government authorities and the industry came together at the *'Blue Economy Science Summit' (BESS)* in 2021. 48% of the attendants came from the industry, 38% from knowledge institutions and 14% from the government.

KPI 3

AT LEAST 180 SAILING DAYS SPENT ON SCIENTIFIC RESEARCH, MONITORING AND EDUCATION EACH YEAR

RV SIMON STEVIN 163

RIB ZEEKAT 73

OTHER VESSELS EQUIPPED WITH VLIZ EQUIPMENT 38

274

DAYS SPENT AT SEA [1]

This is the total number of days spent at sea with RV Simon Stevin, RIB Zeekat and other vessels equipped with VLIZ equipment.

RV Simon Stevin and the RIB 'Zeekat' in the port of Ostend.
© VLIZ (Bart De Smet)

VLIZ provides researchers with logistical support by ensuring the management, maintenance and operation of research infrastructure and equipment.

RV Simon Stevin is deployed for academic coastal oceanographic research in the Southern Bight of the North Sea and the eastern part of the English Channel. It also serves as a training platform for students from marine sciences as well as maritime training courses. In 2021, a total of 573 scientists boarded the ship, of which 553 scientists/divers and 20 students. Ten marine research groups made use of RV Simon Stevin within the scope of 31 different projects (see annex p. 56). On account of COVID-19, only three day trips for educational purposes took place. RIB Zeekat can be deployed from the research vessel Simon Stevin or from the shore, including for sampling in coastal waters, the Belgian ports and the Scheldt estuary. The reinforced keel is designed to run the vessel aground on tidal banks.

[1] in 2020: 243

KPI 4

SEVEN MISSIONS A YEAR CONDUCTED WITH THE EQUIPMENT OF THE MARINE ROBOTICS CENTRE. THIS NUMBER INCLUDES THE MULTIPLE-DAY DEPLOYMENT OF EQUIPMENT IN FOUR-DAY PERIODS

After having been transferred to VLIZ, the glider 'SeaExplorer' was subjected to acceptance tests at sea in southern France in the autumn of 2021 © VLIZ (Wieter Boone)

17

MISSIONS [1] [2]

included 8 short-term campaigns and 9 multiple-day campaigns with equipment from the Marine Robotics Centre, such as USV Adhemar, AUV Barabas, the glider and autonomous measuring devices.

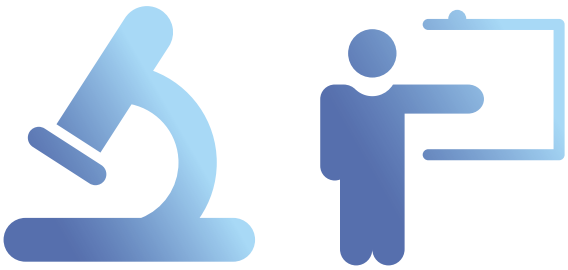
Remotely Operated Vehicle (ROV) Zonnebloem (formerly called 'Genesis') is deployed for national research in the Belgian part of the North Sea and for deep-sea research from international research vessels. The Autonomous Underwater Vehicle (AUV) Barabas is a torpedo-shaped robot which performs measurements of the water column, the seabed and the soil. It is capable of diving to a depth of 1,300 metres and can remain submerged for up to 7 hours. The robot is ideally suited for mapping the seabed and heritage shipwrecks. The Uncrewed Surface Vehicle (USV) Adhemar exploits wave power for its propulsion while solar panels provide electricity for its measuring instruments. Since the power supply is largely dependent on renewable energy, the USV can perform measurements of water and atmosphere over long periods of time. In 2021, the Marine Robtics Centre commissioned a new ocean robot which had been transferred to VLIZ by Vrije Universiteit Brussel (VUB). This glider is ideally suited for studying climate change in the oceans and conducting research into micronutrients in the ocean.

[1] in 2020: 10. From 2019 onwards, KPI 4 includes not only the number of missions with ROV Zonnebloem, but all missions with the measuring instruments of the Marine Robotics Centre.. [2] 2 planned missions were cancelled due to the COVID-19 restrictions.

KPI 5

EXTERNAL PARTIES USE THE MARINE STATION OSTEND FOR SCIENTIFIC OR EDUCATIONAL ACTIVITIES AT LEAST 120 CALENDAR DAYS A YEAR

© VLIZ (Bart De Smet)



173

DAYS [1]

The number of days when external parties used the Marine Station Ostend for scientific or educational activities. On these days, a total of 302 scientists, students and visitors* made use of the MSO infrastructure.[2]

© VLIZ (Decombel)

The Marine Station Ostend (MSO) is the satellite laboratory by the sea for all Flemish marine scientists and is used within the scope of the European infrastructure networks LifeWatch, ICOS and EMBRC. The MSO comprises multifunctional wet, dry and molecular laboratories, cold stores with water tanks for marine organisms, a storage and working space for data and research equipment, a core repository for cold storage of drill cores and a space for public activities.

[1] in 2020: 139

[2] An overview of marine scientific projects that made use of the MSO in 2021 can be found on page 57 of the annexes.

* Due to the COVID-19 pandemic, all visits by students to the MSO (except for one) were cancelled and no external parties made use of the laboratories for a certain period.

KPI 6

AT LEAST 30 DATA SETS A YEAR MADE AVAILABLE TO FLEMISH MARINE RESEARCHERS AND PUBLISHED IN 'OPEN ACCESS' AFTER HAVING BEEN ACQUIRED BY RV SIMON STEVIN OR THE FLEMISH ESFRI RESEARCH INFRASTRUCTURES, OR AFTER HAVING BEEN SUPPLIED WITHIN THE SCOPE OF INTERNATIONAL NETWORKS OR PROJECTS IN WHICH VLIZ IS INVOLVED

Source: Shutterstock

A great deal of data are collected within the scope of Flemish marine research. Data supplied to VLIZ are archived and – with permission of the data owner – integrated into data systems or processed into data products so that they can be efficiently disclosed. To facilitate the search for data, VLIZ provides a detailed description of the data in data sets and discloses them via an online information system. The data can be requested online via the VLIZ website: www.vliz.be/en/request-data.

187

DATA SETS [1]

were made available to Flemish marine researchers and published in 'Open Access' in 2021 after having been acquired by RV Simon Stevin or the Flemish ESFRI research infrastructures, or after having been supplied within the scope of international networks or projects in which VLIZ was involved.

[1] in 2020: 233

KPI 7

AT LEAST 3 DATA ANALYSIS AND TRAINING WORKSHOPS ORGANISED EVERY YEAR

4

DATA ANALYSIS AND TRAINING WORKSHOPS[1]

were organised, including 1 LifeWatch-WoRMS editor workshop, 1 ETN Training Webinar, 1 SUMES training workshop, and 1 Harmful Algal Bloom (HAB) editor workshop.

The participants of the online LifeWatch-WoRMS editor workshop, focusing on sponges (porifera), from 7 to 11 June 2021.

VLIZ manages several taxonomic, biogeographical and traits-related databases. Considerable investments were made in training experts who provide data to these databases in 2021.

[1] in 2020: 5

KPI 8

ANNUAL GROWTH OF THE NUMBER OF NEW REFERENCES IN THE OPEN MARINE ARCHIVE OF AT LEAST 2,500 UNITS A YEAR (BROKEN DOWN BY NUMBER OF ARTICLES, THESES, BOOKS AND REPORTS, CONFERENCE PROCEEDINGS [INCL. ABSTRACTS], ETC.)

24.3%

983
ARTICLES

65.3%

642
A1 ARTICLES

75.3%

3054
REPORTS,
BOOKS A.O.

0.4%

17

PHD-THESES

The VLIZ Library manages a very extensive collection of (inter)national marine scientific literature. The collection contains books, maps, periodicals, reports and theses, and can be searched via the online catalogue. VLIZ strives for open communication. The VLIZ Library aims to make as many publications as possible freely available in digital form. A great deal of Belgian marine literature is digitally available via the Open Marine Archive (OMA), the principal collection component of the VLIZ library. In addition, search engines such as Google Scholar give publications included in OMA a prominent ranking.

4,054

NEW REFERENCES[1]

were added to the Open Marine Archive in 2021, of which 24.3% (=983) articles, of which 65.3% (=642) A1-articles; 0.4% (=17) PhD-theses; and 75.3% (=3,054) reports, books and other works. This brings the total number of digital publications in OMA to 43,344.

[1] in 2020: 4,306

KPI 9

AT LEAST 90% OF LITERATURE REQUESTS PROCESSED BY THE LIBRARY RESULT IN DOCUMENT DELIVERY WITHIN ONE WORKDAY AFTER THE REQUEST

© VLIZ (Decombel)

92%

OF DOCUMENT DELIVERIES WERE MADE WITHIN ONE WORKDAY

In 2021, the VLIZ library processed 1,523 literature requests.[1]

[1] in 2020: 1,986 requests (94%)

KPI 10

PARTICIPATION IN AT LEAST TEN CONSULTATIONS AT FORMAL CONSULTATION FORUMS (IN ACCORDANCE WITH THE ANNUALLY UPDATED WORK PLAN OR STRATEGIC PLAN) AND THREE POLICY RECOMMENDATIONS WITH REGARD TO RESEARCH INTO THE BLUE ECONOMY, PROVIDED WITHIN TWENTY WORKDAYS AFTER THEY HAVE BEEN REQUESTED, WITHIN THE SCOPE OF AN ANNUALLY UPDATED STRATEGIC PLAN CONCERNING 'POLICY ADVICE ON THE BLUE ECONOMY'

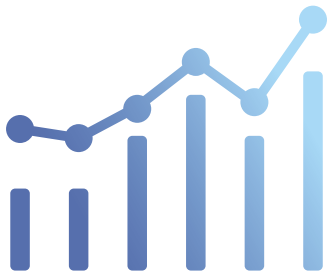
56

PARTICIPATIONS IN CONSULTATIONS[1]

56 participations in consultations at formal consultation forums, including 13 consultations with Blue Cluster, 5 consultations within the scope of the Complex Project Coastal Vision, 4 consultations of the Flemish Aquaculture Platform with the Strategic Aquaculture Steering Group (SSAQ), 6 consultations with Port Oostende, 10 consultations concerning marine litter and 18 sectoral consultations.

24

POLICY RECOMMENDATIONS[2]



with regard to research into the blue economy. The majority of policy advice requests came from the Flemish policy areas, in particular the Department of Economy, Science and Innovation (1), the Department of Agriculture and Fisheries (1), Blue Cluster (2), the cabinet of Minister Crevits (1), the Flemish Parliament (1), and the Public Waste Agency of Flanders (OVAM) (1). Federal requests came from the Federal Public Service Environment (5) and the Federal Public Service Product Policy (1); there were provincial requests from the Governor of West Flanders (1) and municipal requests from the municipality of Koksijde (2). Finally, VLIZ made 1 policy recommendation on its own initiative and there were 7 other policy recommendations

The industry was added to the target groups to be served in the recently concluded management agreement between the Flemish government and VLIZ (2017-2021). VLIZ was also given the task of representing the scientific community in initiatives to support the blue economy. To perform this task, VLIZ makes a valuable contribution to the implementation of the policy with regard to economic development at sea through participation in consultations at formal consultation forums and the provision of policy recommendations with regard to research into the blue economy.

KPI 10BIS

VLIZ ACTIVELY PARTICIPATES IN 4 INITIATED OR ONGOING RESEARCH AND INNOVATION INITIATIVES WITHIN THE SCOPE OF THE BLUE ECONOMY ANNUALLY

45

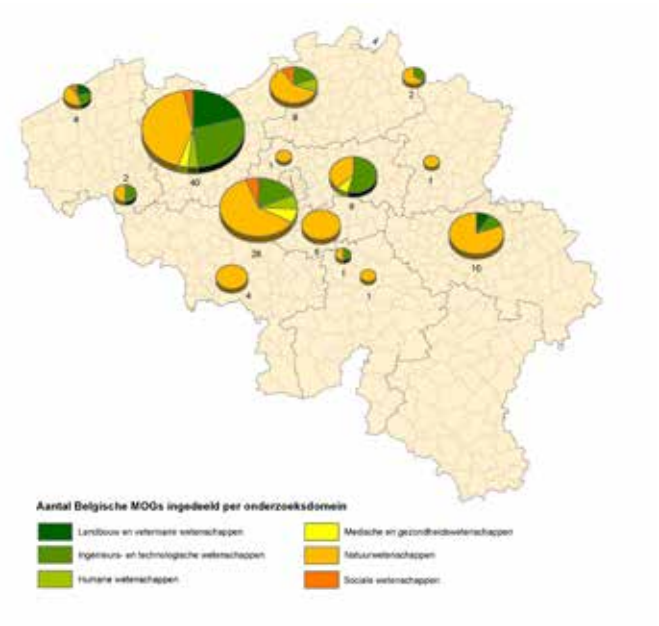
RESEARCH AND INNOVATION INITIATIVES[3]

initiated and ongoing innovation initiatives within the scope of the blue economy, including 20 ongoing projects relating to the blue economy, 20 project proposals linked to the blue economy and 5 other ongoing initiatives linked to the blue economy.

[1] in 2020: 58; [2] in 2020: 20; [3] in 2020: 36

KPI 11

ANNUAL UPDATE OF THE INVENTORY OF THE MARINE RESEARCH LANDSCAPE IN FLANDERS (COMPENDIUM FOR COAST AND SEA)



Left: With the policy informing brief 'Inventory of the marine research landscape in Flanders and Belgium' VLIZ tries to inform stakeholders and other persons concerned about the character and evolution of marine research in Belgium. Right: Marine research groups in Flanders and Belgium presented by location and research area (Pirlet *et al.* 2021).

Compendium for Coast and Sea: www.compendiumkustenzee.be/en
Download the full report here: www.vliz.be/en/imis?module=ref&refid=347434

Every year, the marine research landscape in Flanders and Belgium is surveyed by means of a fixed methodology. In November 2021, the current situation was reported in a policy informing brief by the VLIZ Policy Information division within the context of the Compendium for Coast and Sea.

The 2021 inventory demonstrated that Belgium boasted 123 marine research groups (MRGs) which collectively produced 750 marine peer-reviewed publications in 2020 – both figures are a significant increase compared to 2019. Although 2020 was dominated by the coronavirus, it was still a productive year for marine researchers. On an international level, the scientific output of the MRGs is comparable to that of the major marine institutes in the neighbouring countries.

Over the past 12 years (2008-2020), these research groups published articles in nearly 1,400 different journals, and the share of open-access journals increased to 67%, compared to only 40%[1] in 2008.

Belgian marine research also has a strong international orientation. In nearly 80% of the publications, the research was conducted outside the Belgian part of the North Sea and 74% were the result of international collaboration (so-called international co-publications). This international collaboration mostly takes place with the neighbouring countries and the US, but the network of our marine researchers covers no less than 157 countries. In approximately 26% of cases (2008-2020), a (research) vessel was deployed for data collection, with a total of 293 different (research) vessels from 43 countries.

With this annual update and inventory of the marine research landscape, VLIZ intends to inform marine and maritime (scientific) policymakers, the marine research community and other stakeholders.

[1] This figure is updated annually as more and more scientific journals retrospectively make their publications available online.

KPI 12

AT LEAST 8 EVENTS ORGANISED AND COMMUNICATION PRODUCTS CREATED A YEAR IN COLLABORATION WITH SCIENTISTS, WITH MARINE INFORMATION BEING TRANSFERRED TO RESEARCHERS, THE GENERAL PUBLIC AND/OR EDUCATORS

In the weekend of 13 and 14 March 2021, citizen scientists could collect 100 shells on the beach in their family bubble for the 4th edition of the Big Shell Counting Day. With the online tool ScHELPdesk, experts remotely provided assistance. © VLIZ

Via the six-part video series 'Visit VLIZ virtually', a selection of novelties and VLIZ facilities that were inaccessible or difficult to access due to the coronavirus were spotlighted in 2021. It is available in English with Dutch subtitles on the VLIZ YouTube channel.

13
EVENEMENTS

9
COMMUNICATION PRODUCTS

One of the strategic objectives of VLIZ is to promote ocean literacy in Flanders and the visibility of marine research to the public at large. VLIZ tries to achieve this objective by disclosing high-quality marine information to very diverse target groups (young and old, professionals and the general public, local and international, education and research) through events, communication products and publications as well as the information desk and social media.

25

EVENEMENTS, PRODUCTS, A.O. [1]

A total of 13 events (page 58 of the annexes), 9 communication products and publications (page 59 of the annexes) and 3 other activities. Other activities include (1) the information desk (page 23 of the annexes), where various target groups can ask questions, (2) VLIZ's presence and activities on social media (page 25 of the annexes) and (3) the VLIZ press briefings (page 65 of the annexes).

[1] in 2020: 21 georganiseerde evenementen en communicatieproducten

COLOPHON

This 2021 Annual Report of the Flanders Marine Institute (VLIZ) has been presented for approval to the Board of Directors and the General Assembly on 23 March 2022.

COORDINATION AND FINAL EDITING

- **Jan Mees** - General Director of VLIZ
- **Tina Mertens** - VLIZ Assistant Director
- **Jan Seys** - Head of the VLIZ Communication division
- **Bart De Smet** - Senior Science Officer Communications VLIZ

Many thanks to all who contributed to the completion of this document.

COVER PHOTO

The InnovOcean Campus, the new headquarters of VLIZ, its national and international partners, and the marine research department of ILVO © VLIZ (Bart De Smet)

DESIGN

Zoe©k - Marc Roets & Yves Moerman

AVAILABILITY

This document is available as a PDF file on the VLIZ website (www.vliz.be/en/vliz-annual-report).

TO BE QUOTED AS FOLLOWS

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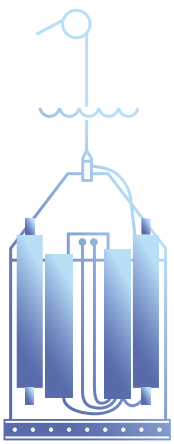
VLIZ

ANNEXES

ANNUAL REPORT 2021

ANNEXES ANNUAL REPORT 2021

ONLY AVAILABLE IN DIGITAL VERSION



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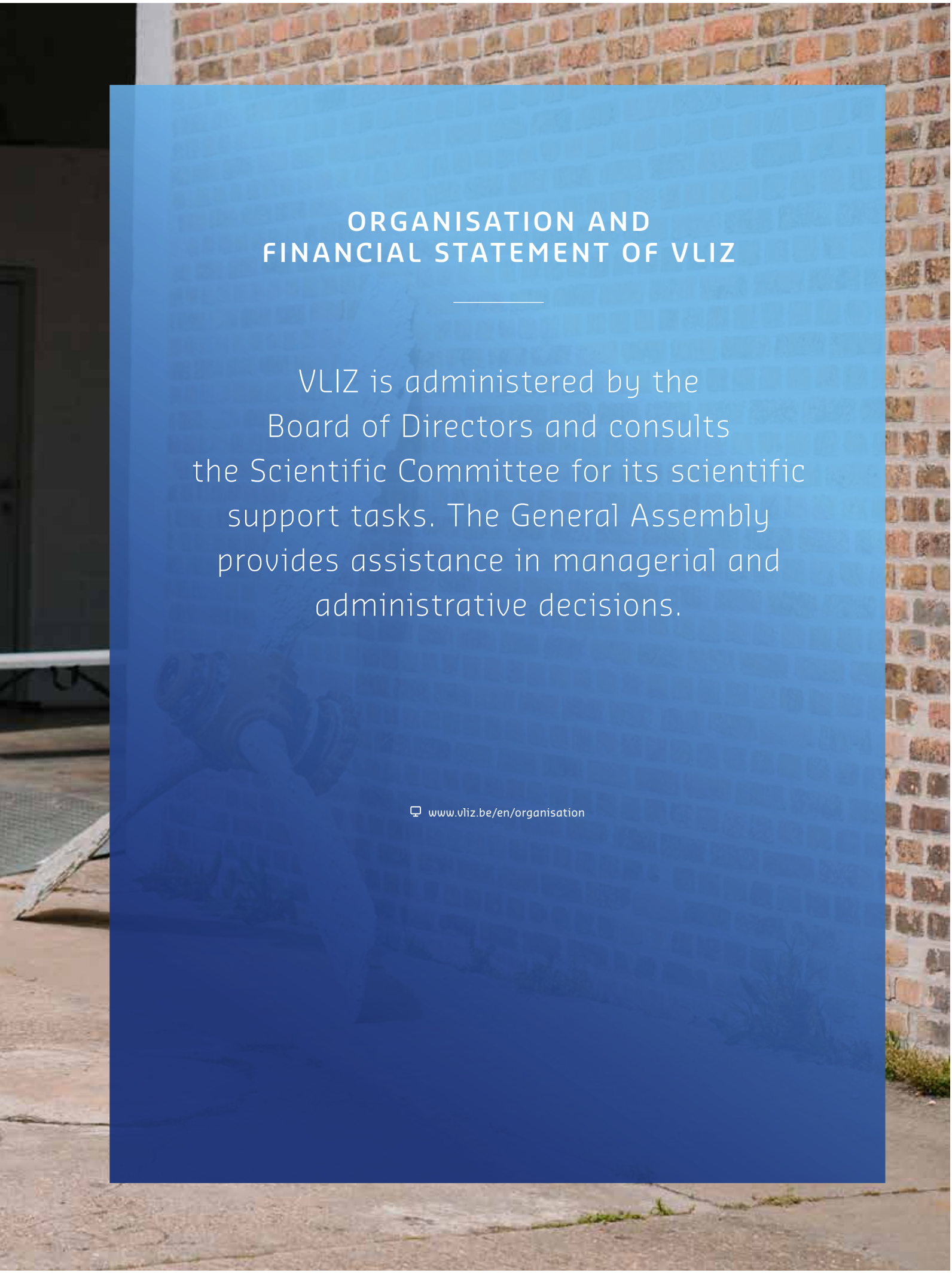


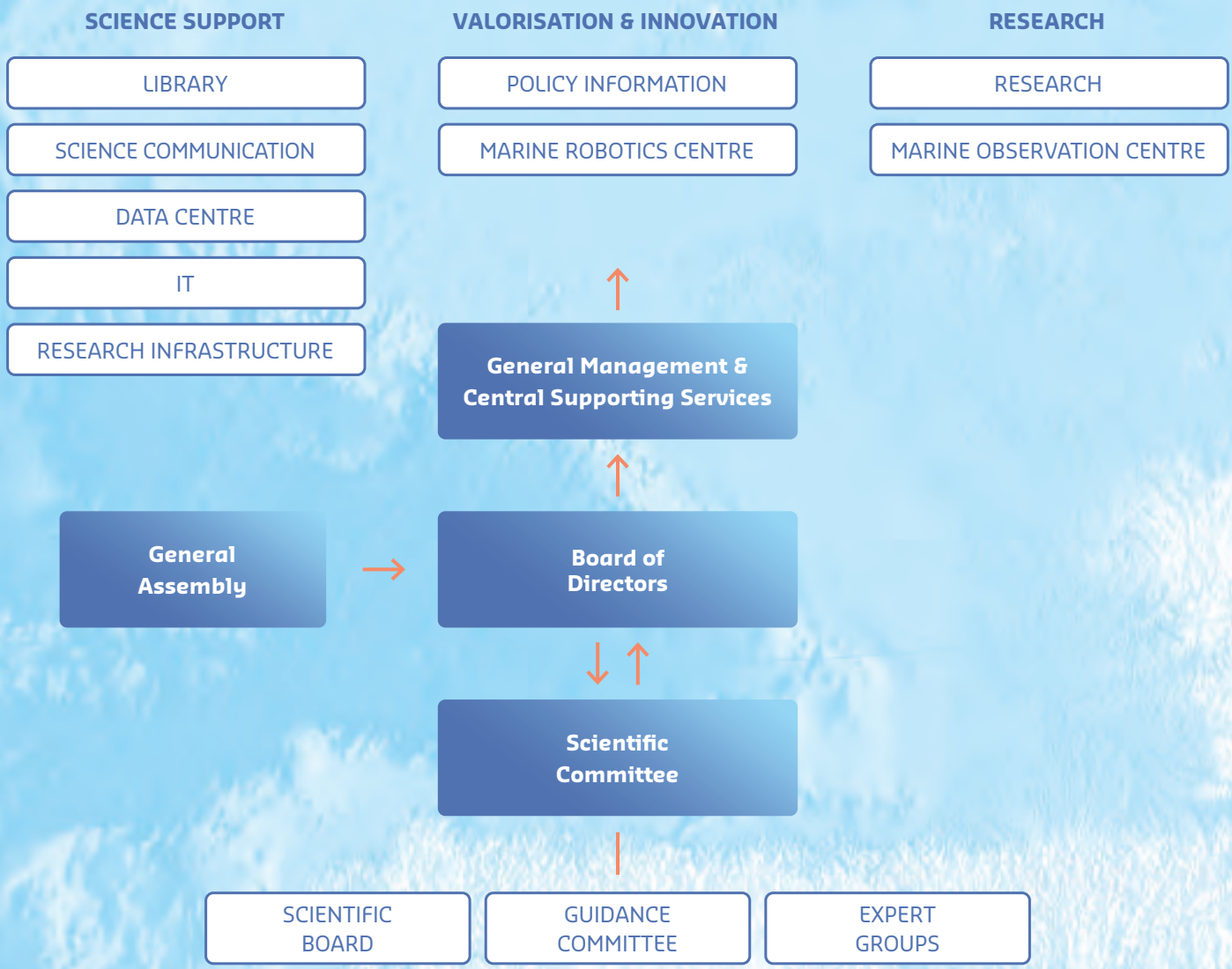
ORGANISATION AND FINANCIAL STATEMENT OF VLIZ

VLIZ is administered by the Board of Directors and consults the Scientific Committee for its scientific support tasks. The General Assembly provides assistance in managerial and administrative decisions.

www.vliz.be/en/organisation

VLIZ ORGANISATION

For more information about the organisation of VLIZ, visit:
www.vliz.be/en/organisation



The Flanders Marine Institute (VLIZ) is an autonomous institute with the legal status of a non-profit organisation under Belgian law that receives an annual allowance from the Flemish government, in particular from the department of Economy, Science and Innovation (EWI), and from the province of West Flanders. The highest ruling organ of VLIZ is the General Assembly. The organisation is administered by a Board of Directors, and its daily operations are overseen by the General Director, assisted by the Coordination division. VLIZ strongly focuses on three pillars: scientific support, valorisation & innovation, and research. These three pillars are reflected into the three eponymous departments, each including several divisions. A permanent team of scientists in the Scientific Committee, which advises the Board of Directors on all scientific aspects of the VLIZ operations, is consulted several times a year to define and adjust its scientific support tasks. This committee consists of three interconnected and mutually reinforcing components. The Scientific Board is a compact steering committee giving high-quality and scientifically sound advice to the Board of Directors. The Guidance Committee is convened annually for a plenary meeting open to a wide group of marine scientists to discuss important new and planned activities. Expert groups are thematic working groups composed of the most relevant experts from Belgium and abroad and are established for a limited or longer period of time.

COMPOSITION OF THE BOARD OF DIRECTORS

AT THE END OF 2021

VLIZ is administered by the Board of Directors, consisting of 12 members.

THE SIX MEMBERS NOMINATED BY THE FLEMISH GOVERNMENT ARE:

- **Carl Decaluwé**, governor of West Flanders, chairman
- **Mark Andries**, administrator-general VLAIO
- **Daphné Dumery**, mayor Blankenberge
- **Romina Vanhooren**, deputy head of the Gatz cabinet - general policy and Executive Councillor in Oudenburg
- **Wouter Vanlouwe**, councillor Veurne
- **Charlotte Verkeyn**, general policy and Executive Councillor in Ostend

THE TWO MEMBERS NOMINATED BY THE PROVINCE OF WEST FLANDERS ARE:

- **Claude Croes**, member of the Provincial Council
- **Patrick De Klerck**, member of the Provincial Council

THE FOUR INDEPENDENT MEMBERS ARE:

- **Colin Janssen**, Ghent University, vice-chairman
- **Jean Berlamont**, Katholieke Universiteit Leuven
- **Noémie Wouters**, CEO Bluebridge
- **Willy Versluys**, fishing vessel owner

THE GOVERNMENT COMMISSIONERS ARE:

- **Annie Cool**, councillor Cabinet Hilde Crevits
- **Danielle Raspoet**, secretary-director VARIO

ATTEND THE MEETINGS:

- **Gert Verreet**, Flemish Government Department of Economy, Science and Innovation
- **Patrick Braet**, province of West Flanders, financial manager
- **Jan Mees**, General Director of VLIZ
- **Tina Mertens**, VLIZ Assistant Director
- **Heidi Coussens,** VLIZ executive secretary and rapporteur

The **tasks and operation** of the Board of Directors as well as the appointment and qualifications of its members can be found in the VLIZ Good Governance Charter.

COMPOSITION OF THE GENERAL ASSEMBLY

AT THE END OF 2021

Mr **Carl Decaluwé**, governor of West Flanders, is THE CHAIRMAN.

THE TEN VOTING MEMBERS APPOINTED BY THE FLEMISH GOVERNMENT ARE:

- **Patric Jacobs**, Ghent University
- **Willy Baeyens**, Vrije Universiteit Brussel
- **Jean Berlamont**, Katholieke Universiteit Leuven
- **Ernest Schockaert**, Hasselt University
- **René Van Grieken**, University of Antwerp
- **Magda Vincx,** Ghent University
- **Philip Van Avermaet**, Flemish Government Department of Economy, Science and Innovation
- **Ulrike Vanhessche**, Coast Guard secretariat (MDK)
- **Ilse Hoet**, head policy division (MOW)
- **Jan Strubbe**, honorary director-general of the Waterways and Marine Affairs Administration

THE FOUR VOTING MEMBERS APPOINTED BY THE PROVINCE OF WEST FLANDERS ARE:

- **Claude Croes**, member of the Provincial Council
- **Patrick De Klerck**, member of the Provincial Council
- **Anthony Dumarey**, member of the Provincial Council
- **Patrick Braet,** Provincial Treasurer
- **Jan Denys**, principal of the Mercator Maritime Institute

THE MEMBER APPOINTED BY THE RESEARCH FOUNDATION – FLANDERS (FWO) IS:

- **Hans Willems**, secretary general of the Research Foundation – Flanders

The members of the Board of Directors of VLIZ have the right to attend the General Assembly with an advisory vote. Sympathising members have the right to participate in the discussions of the General Assembly.

The **competences** of the General Assembly as well as information on the meetings and voting procedure can be found in the VLIZ Good Governance Charter.

SCIENTIFIC BOARD

AT THE END OF 2021

The Scientific Board consists of **16 members** and the composition reflects the **inter-university and interdisciplinary character** of VLIZ.

THE CHAIRMAN is the vice-chair of the Board of Directors, **Mr Colin Janssen** (Ghent University).

TWO DELEGATES FROM GHENT UNIVERSITY (UGENT):

- **Marleen De Troch** (substitute: David Van Rooij)
- **Gilbert Van Stappen** (substitute: Peter Troch)

TWO DELEGATES FROM KATHOLIEKE UNIVERSITEIT LEUVEN (KULEUVEN):

- **Filip Volckaert** (substitute: Gert Jan Weltje)
- **Jaak Monbaliu** (substitute: Erik Toorman)

TWO DELEGATES FROM VRIJE UNIVERSITEIT BRUSSEL (VUB):

- **Margaret Chen** (substitute: Marc Kochzius)
- **Marc Kochzius** (substitute: Karolien Van Puyvelde)

TWO DELEGATES FROM THE UNIVERSITY OF ANTWERP (UA):

- **Ronny Blust** (substitute: Gudrun De Boeck)
- **Filip Meysman** (substitute: Patrick Meire)

ONE DELEGATE FROM HASSELT UNIVERSITY (UHASSELT):

- **Tom Artois** (substitute: Natalie Beenaerts)

ONE DELEGATE FROM THE INSTITUTE FOR AGRICULTURAL AND FISHERIES RESEARCH (ILVO):

- **Hans Polet** (substitute: Bart Sonck)

ONE DELEGATE FROM THE RESEARCH INSTITUTE FOR NATURE AND FOREST (INBO):

- **Maurice Hoffmann** (substitute: Eric Stienen)

ONE DELEGATE FROM THE FLEMISH INSTITUTE FOR TECHNOLOGICAL RESEARCH (VITO):

- **Roger Dijkmans** (substitute: Bart Deronde)

ONE DELEGATE FROM THE FLEMISH ENVIRONMENT AGENCY (VMM):

- **Didier D'hondt** (substitute: Marleen Van Steertegem)

ONE DELEGATE FROM THE FLANDERS HERITAGE AGENCY:

- **Marnix Pieters** (substitute: Tom Lenaerts)

ONE DELEGATE FROM FLANDERS HYDRAULICS RESEARCH (FHR):

- **Frank Mostaert** (substitute: Toon Verwaest)

ATTEND THE MEETINGS:

- **Jan Mees**, General Director of VLIZ
- **Tina Mertens**, VLIZ Assistant Director
- **Jan Seys**, rapporteur (substitute: Nancy Fockedey)

A DELEGATE FROM THE DEPARTMENT OF ECONOMY, SCIENCE AND INNOVATION (EWI):

- **Gert Verreet**

On 18 June 2021, the Scientific Committee visited the VLIZ Marine Robotics Centre at the Marine Station Ostend © VLIZ (Tina Mertens)

BALANCE SHEET AND INCOME STATEMENT

DECEMBER 2021

BALANCE ON 31 DECEMBER 2021

ASSETS

(kEUR)	31-12-2020	31-12-2021
Intangible fixed assets	0.33	2.29
Tangible fixed assets	6,292.64	6,121.62
Financial fixed assets	17.93	17.93
Stocks	18.61	22.27
Amounts receivable within one year	3,388.49	5,584.42
Cash investments	0	0
Liquid assets	5,953.56	188.25
Deferred charges and accrued income	54.49	112.67
TOTAL	**15,726.05**	**12,049.45**

LIABILITIES

(kEUR)	31-12-2020	31-12-2021
Allocated funds	775.00	924.00
Profit and losses brought forward	2578.07	3,175.74
Capital grants	7,167.95	7,004.35
Provisions for liabilities and charges	0	0
Amounts payable after one year	0	0
Amounts payable within one year	5,205.03	945.36
Deferred charges and accrued income	0	0
TOTAL	**15,726.05**	**12,049.45**

The figures of the balance sheet and income statement include all subsidies received by VLIZ as stated in the management agreement or the covenant.

No surplus of the allocated subsidy was brought forward as a reserve in 2021 (art. 12 § 3 of the covenant).

Budgetary deviations from the 2021 budget (art. 12 § 3 of the covenant): none.

INCOME STATEMENT ON 31 DECEMBER 2021

INCOME

(kEUR)	31-12-2020	31-12-2021
Operating income	14,255.93	15,535.19
Financial income	1,101.13	1,080.20
Exceptional income	3.77	0.03
TOTAL	**15,360.83**	**16,615.42**

COSTS

(kEUR)	31-12-2020	31-12-2021
Stocks	2.37	0.58
Remuneration and social security	9,658.30	10,430.19
Services and other goods	1,962.06	1,679.43
Provisions for liabilities and charges	0	0
Depreciation	1,536.84	1,564.88
Financial expenses	11.39	19.09
Other operating expenses	1,572.33	2,174.29
Exceptional expenses	0.39	0.28
TOTAL	**14,743.68**	**15,868.74**

RESULT

(kEUR)	2020	2021
Result for the financial year	617.15	746.68
Transfer to allocated funds	123.00	149.00
Profit brought forward as of 31/12	2,578.05	3,175.73

MANAGEMENT INDICATORS

The Management Indicators refer to important services provided by VLIZ to marine scientific researchers, policymakers, educators and the general public. They complement the Key Performance Indicators (KPIs), which are criteria to evaluate the operation of VLIZ.

SOCIAL INDICATORS

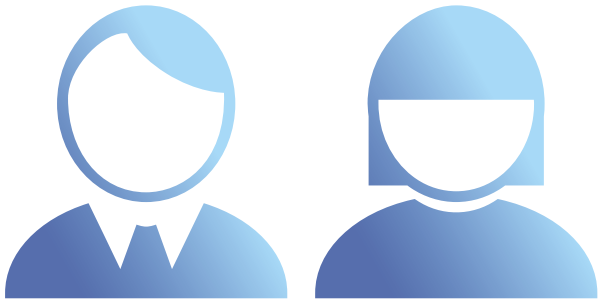
2021

129

EMPLOYEES [1]

Number of people of foreign origin: 17.

Number of people with an employment disability: 1.

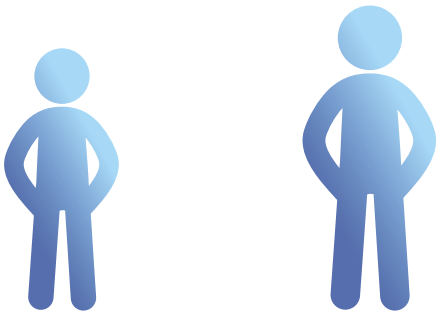


MEN

68

WOMEN

61



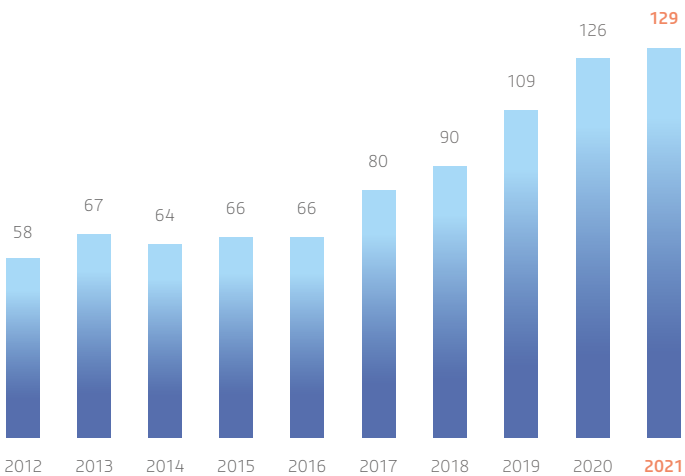
PERMANENT

54

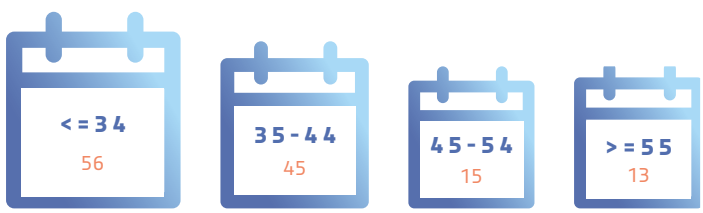
TEMPORARY

75

NUMBER OF EMPLOYEES



AGE OF THE EMPLOYEES



[1] Source: Wikipedia (Flemish perspective): any person living in the Flemish or Brussels Region, of whom at least one grandparent was born outside the European Union – excluding other Western and Northern European states, the USA and Canada.

STAFF TURNOVER

IN

10

OUT

14

21.3%

LEAVE ETC.[1]

The total number of days of absence as a result of maternity leave, parental leave, time credit, leave, sickness, etc. versus the total number of days to be performed.

2.37%

SICKNESS ABSENCE[2]

2.37% of the total number of days to be performed.

153

DAYS OF TRAINING[3]

received by 107 employees.

118

PERFORMANCE INTERVIEWS[4]

119

HIGHER-EDUCATED EMPLOYEES[5]

and 10 persons who completed secondary education at most (ESF definition).

A	B	C	D
96	23	8	2

[1] in 2020: 19.6%
[2] in 2020: 2.2%
[3] in 2020: 139 days of training received by 105 employees
[4] in 2020: 111; [5] in 2020: 116

RESEARCH PROJECTS

2021

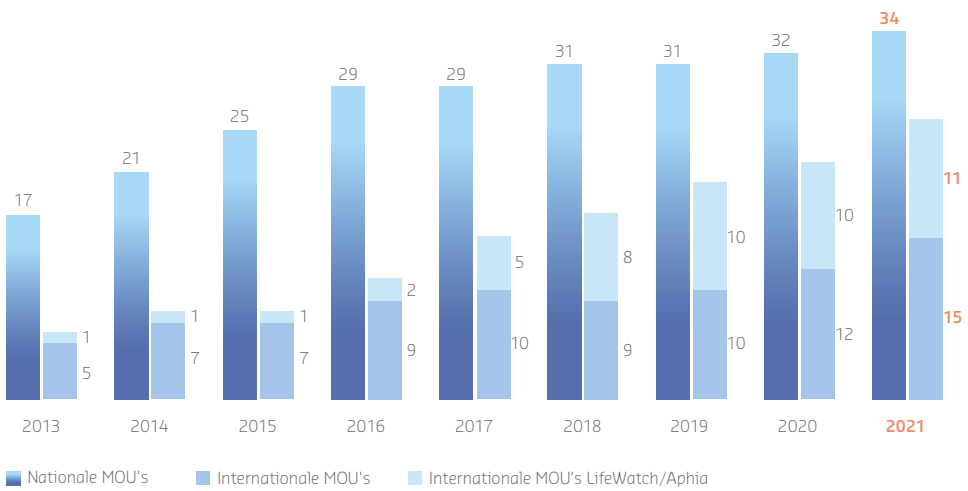
12 RESEARCH PROJECTS WITH EXTERNAL FUNDING INITIATED [2]

PROJECT	TOTAL PROJECT BUDGET	VLIZ BUDGET	NUMBER OF PARTNERS [1]
NOZ Borssele	€ 154,753.20	€ 154,753.20	2 (2)
Fish Intel	€ 4,061,748.85	€ 358,432.55	10 (1)
DISSco Flanders	€ 3,382,496.00	€ 45,016.00	10 (10)
Apelafico	€ 749,705.00	€ 120,000.00	8 (2)
EMODnet Physics IV	€ 1,050,000.00	€ 30,000.00	15 (1)
EMODnet Biology IV	€ 1,500,633.00	€ 393,166.00	21 (3)
Ovam Fostplus baseline study plastic flux 2021	€ 149,744.00	€ 56,466.00	4 (4)
BG-Part	€ 906,418.00	€ 264,073.00	3 (3)
Princes Elisabeth Zone	€ 9,696.00	€ 9,696.00	1 (1)
EMODnet Chemistry Lot 5	€ 2,234,000.00	€ 50,000.00	14 (1)
Testerep	€ 2,062,154.00	€ 623,296.00	4 (4)
Phasing out of the use of lead by anglers	€ 20,655.80	€20,655.80	1 (1)

0 RESEARCH PROJECTS WITH INTERNAL FUNDING INITIATED

NATIONAL AND INTERNATIONAL COOPERATION AGREEMENTS

2021



The number of cooperation agreements in force per year for the 2013–2021 period, divided into national MOUs, international MOUs and international MOUs within the framework of LifeWatch/Aphia.

A list of all agreements is available on www.vliz.be/en/cooperation-agreements.

[1] number of Belgian/Flemish projects (figure between brackets)

[2] in 2020: 20 research projects with external funding and 2 research projects with internal funding initiated

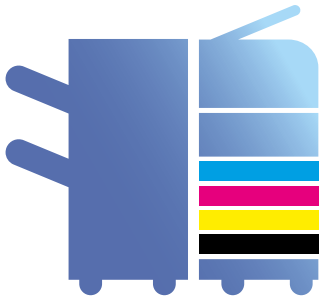
ENVIRONMENTAL INDICATORS

2021

42,367

NUMBER OF PRINTS AND COPIES [1]

One print/copy corresponds to one page.



0.01

TONER CONSUMPTION [2]

used for printers and photocopiers per staff member.

GAS, WATER & ELECTRICITY CONSUMPTION [3]

39,466 m³

266,230 kWh

305 m³

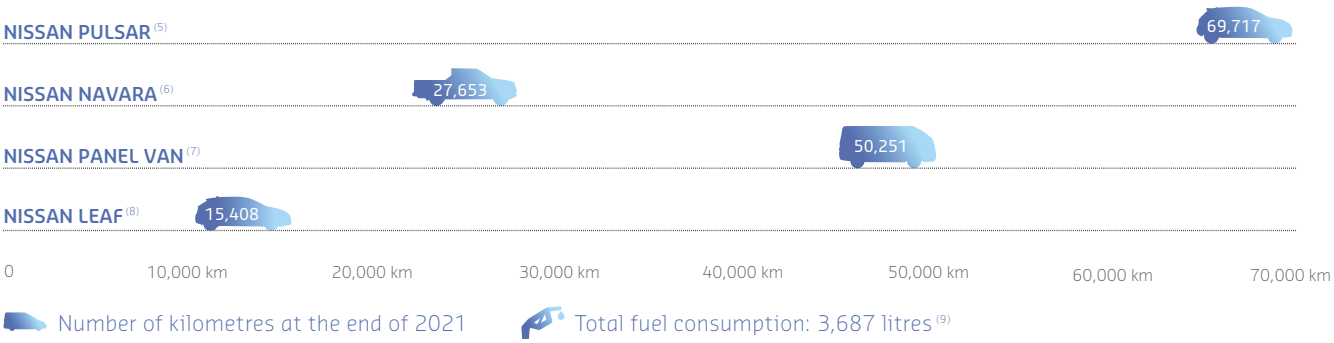
COMMUTING [4]

€ 92,269

TRAIN, TRAM & BICYCLE ALLOWANCES

refunded to employees.

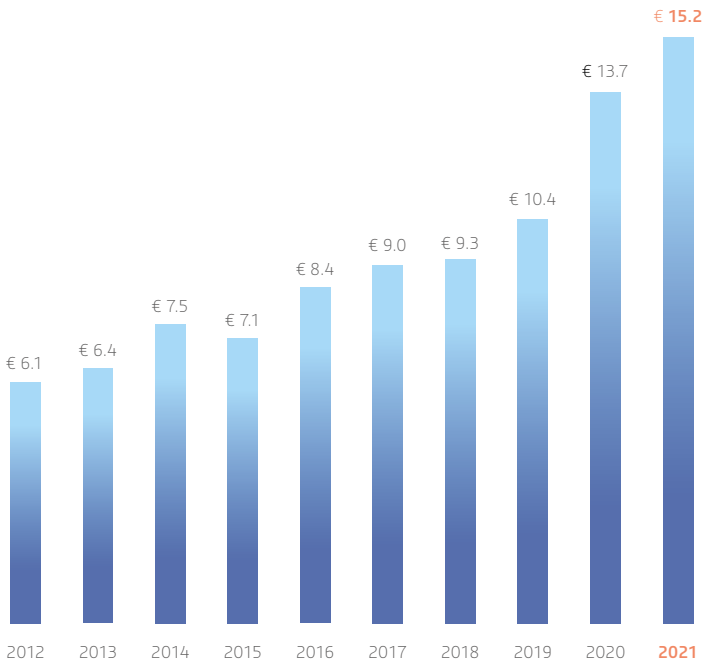
NUMBER OF KILOMETRES AND FUEL CONSUMPTION OF VLIZ CARS AT THE END OF 2021



[1] in 2020: 62,480 prints and copies
[2] in 2020: 0.11 toner consumption
[3] in 2020: gas: 33,394 m³, electricity: 239,280 kWh, water: 261 m³
[4] in 2020: € 88,589 train, tram and bicycle allowances
[5] in 2020: 58,598 km
[6] in 2020: 18,770 km
[7] in 2020: 32,072 km
[8] in 2020: 12,698 km
[9] in 2020: 3,190 liter

VLIZ TURNOVER

IN MILLION EURO

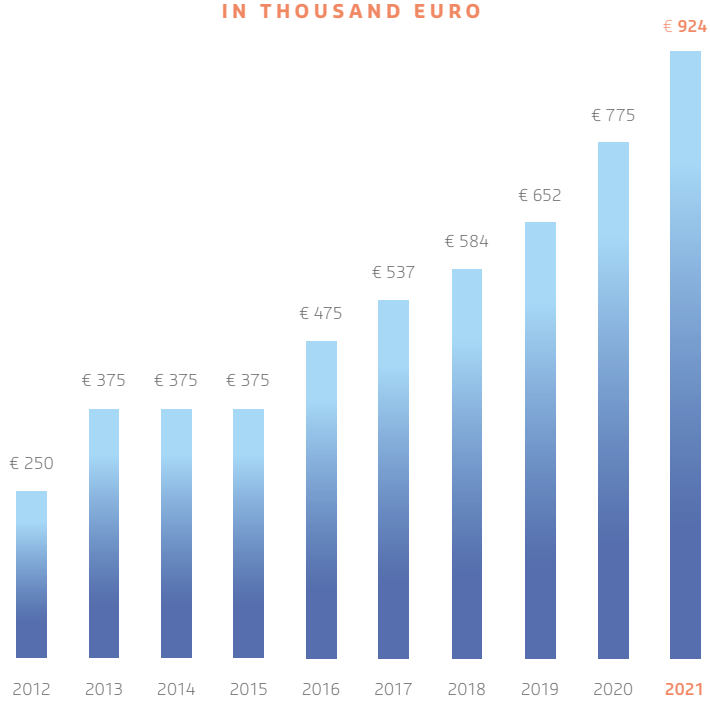


2021: €15,207,195

Membership fees, donations, legacies and subsidies

SOCIAL LIABILITIES

IN THOUSAND EURO



2021: € 924,000

TURNOVER OF INNOVOCEAN SITE PARTNERS

IN EURO

€ 992,838

TOTAL

IOC PROJECT OFFICE FOR IODE

€ 576,706

EUROPEAN MARINE BOARD SECRETARIAT

€ 136,784

EMODNET-SECRETARIAT

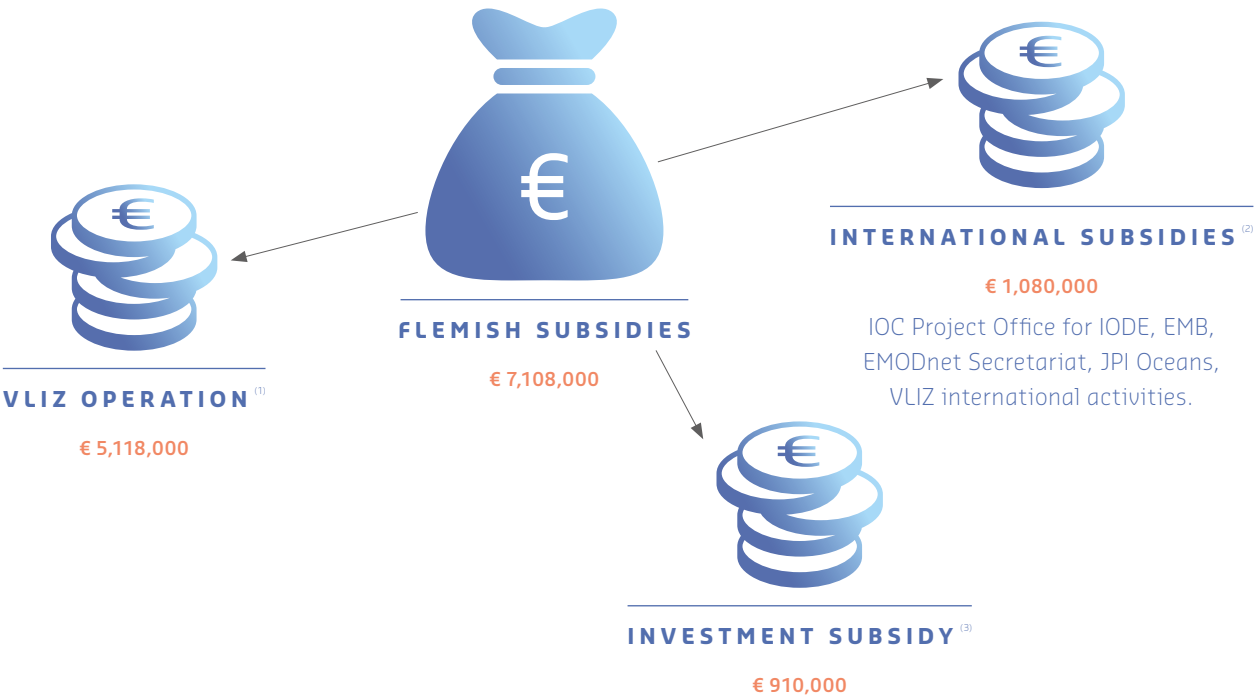
€ 180,044

JPI OCEANS

€ 99,304

OVERVIEW OF SUBSIDIES

IN EURO



VLIZ OPERATION [1]

€ 5,118,000

FLEMISH SUBSIDIES

€ 7,108,000

INTERNATIONAL SUBSIDIES [2]

€ 1,080,000

IOC Project Office for IODE, EMB, EMODnet Secretariat, JPI Oceans, VLIZ international activities.

INVESTMENT SUBSIDY [3]

€ 910,000

PROVINCE OF WEST FLANDERS [4]

€ 163,713

EXTERNAL FUNDING

€ 5,371,751

ESFRIs [5]

€ 1,596,077

LifeWatch, ICOS, EMBRC

NATIONAL AND INTERNATIONAL PROJECTS [6]

€ 3,611,961

76%

The external funding amounts to 76% of the Flemish subsidies [7].

[1] in 2020: € 5,118,000, in 2015: € 1,938,000, in 2010: € 1,145,434
[2] in 2020: € 1,080 000, in 2015: € 1,080,000, in 2010: € 688,000
[3] in 2020: € 910,000, in 2015: € 1,090,000, in 2010: € 1,100,000
[4] in 2020: € 163,713; in 2015: € 153,330; in 2010: € 142,248
[5] in 2020: € 1,290 ,000; in 2015: € 2,191,150; in 2010: not applicable
[6] in 2020: € 3,521,418; in 2015: € 1,101,495; in 2010: € 1,522,702
[7] in 2020: 70%

EVENTS

2021

70

OVERNIGHT STAYS [1]

The number of overnight stays in Ostend by people visiting the InnovOcean site or attending events organised by the InnovOcean partners in Ostend.

4

INTERNATIONAL VISITS [2]

The number of meetings and events with an international character that took place in Ostend, attended by 90 participants in total.

4,004

NUMBER OF PARTICIPANTS IN ORGANISED EVENTS [3]

The number of participants in 32 events (co)organised by VLIZ.

41

MISSIONS [4]

The number of missions to 8 countries.

[1] in 2020: 218
[2] in 2020: 15 visits with 320 participants
[3] in 2020: 1,101 participants in 22 events
[4] in 2020: 53 missions to 14 countries

927

VLIZ MEMBERS [1]

The total number of VLIZ members, including 593 individual members, 219 partner members, 34 institutional members, 14 students, 15 honorary members, 17 members of the Board of Directors, 8 members of the General Assembly and 27 members of the Scientific Committee.
In 2021, VLIZ was joined by 228 new members and 57 members resigned their membership.

9

VLIZ AWARDS [2]

Awards were granted by VLIZ, including 2 for master students, 5 for PhD students, 1 for post-doctoral researchers and 1 for master students, PhD students and post-doctoral researchers.

REQUESTS FOR INFORMATION

2021

232

QUESTIONS ANSWERED [3]

Total number of requests for information granted across all VLIZ divisions via info@vliz.be.

1,523

LITERATURE REQUESTS [4]

Total number of literature requests (incl. requests for information) to the library via library@VLIZ.be

22

QUESTIONS COMPENDIUM [5]

Total number of requests for information with regard to the Compendium.

[1] total number of members in 2020: 753; 2019: 684; 2018: 573; 2017: 517; 2016: 430; 2015: 328
[2] in 2020: 9 awards
[3] in 2020: 245
[4] in 2020: 1,986
[5] in 2020: 17

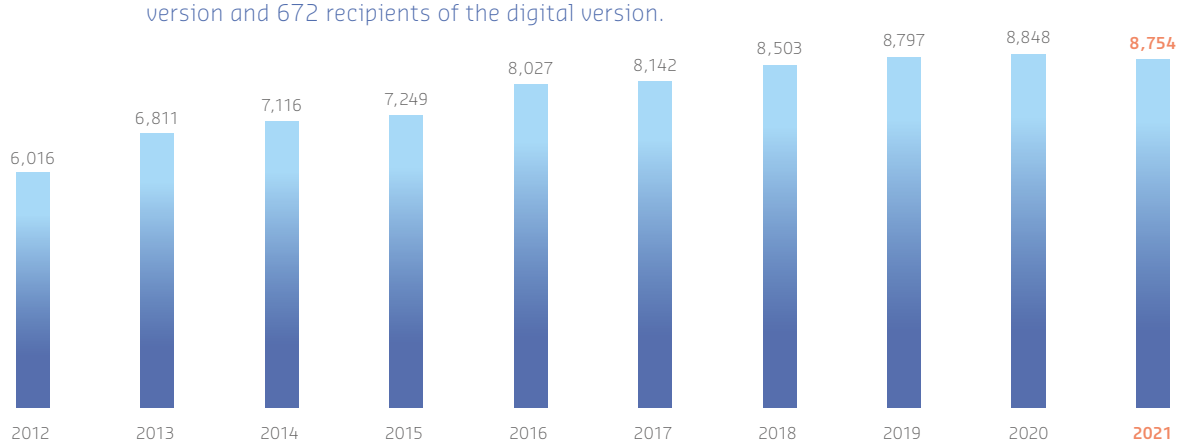
SUBSCRIBERS

2021

8,754

SUBSCRIBERS TO DE GROTE REDE

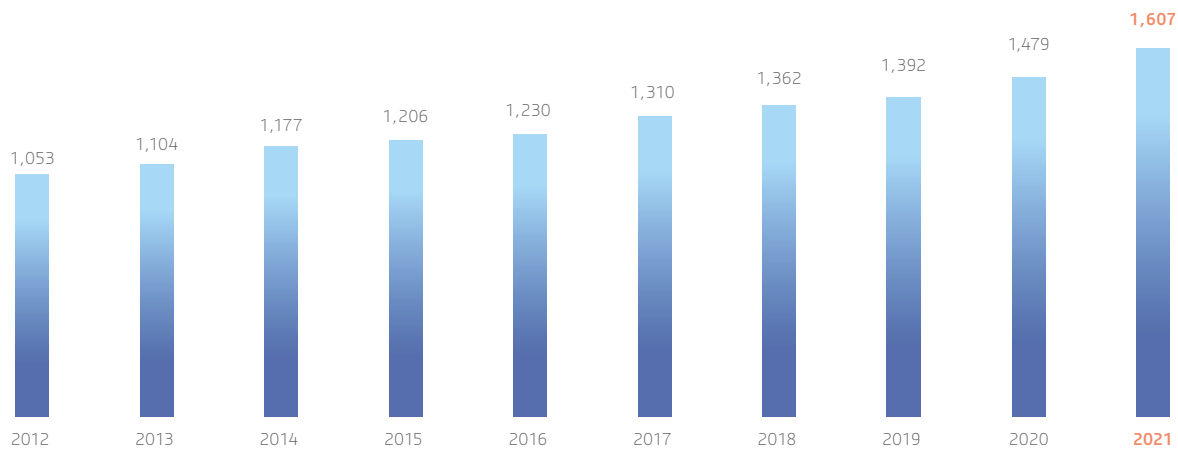
The number of subscribers to De Grote Rede (since 1999), including 8,082 recipients of the paper version and 672 recipients of the digital version.



1,607

SUBSCRIBERS TO TESTEREP MAGAZINE[1]

The number of subscribers to Testerep Magazine (since 1999).



[1] Since September 2020 'Testerep Magazine' replaces the newsletter VLIZINE.

LECTURES

2021

1,100

GENERAL PUBLIC REACHED BY INFORMATIVE LECTURES[1]

Members of the general public reached by means of 28 informative lectures on the VLIZ premises and elsewhere.

SOCIAL MEDIA REACH

2021

TWITTER[2] (@jmeesvliz)

FOLLOWERS	TWEETS
5,359	11,405

YOUTUBE[3]

FOLLOWERS	POSTS
467	534

FACEBOOK

VLIZ (@VLIZnieuws)[4]		RV Simon Stevin[5] (@rvsimonstevin)	
FOLLOWERS	POSTS	FOLLOWERS	POSTS
2,677	802	1,848	803

LINKEDIN[6]

FOLLOWERS	POSTS
3,306	374

INSTAGRAM[7]

FOLLOWERS	POSTS
1,028	105

[1] in 2020: 3,242 members of the general public reached by means of 25 informative lectures

[2] in 2020: 4 ,496 followers; 10, 264 tweets
[3] in 2020: 298 followers; 497 posts
[4] In 2020: 2,471 followers; 658 posts

[5] in 2020: 1,841 followers; 790 posts
[6] in 2020: 2,531 followers; 236 posts
[7] in 2020: 797 followers; 69 posts

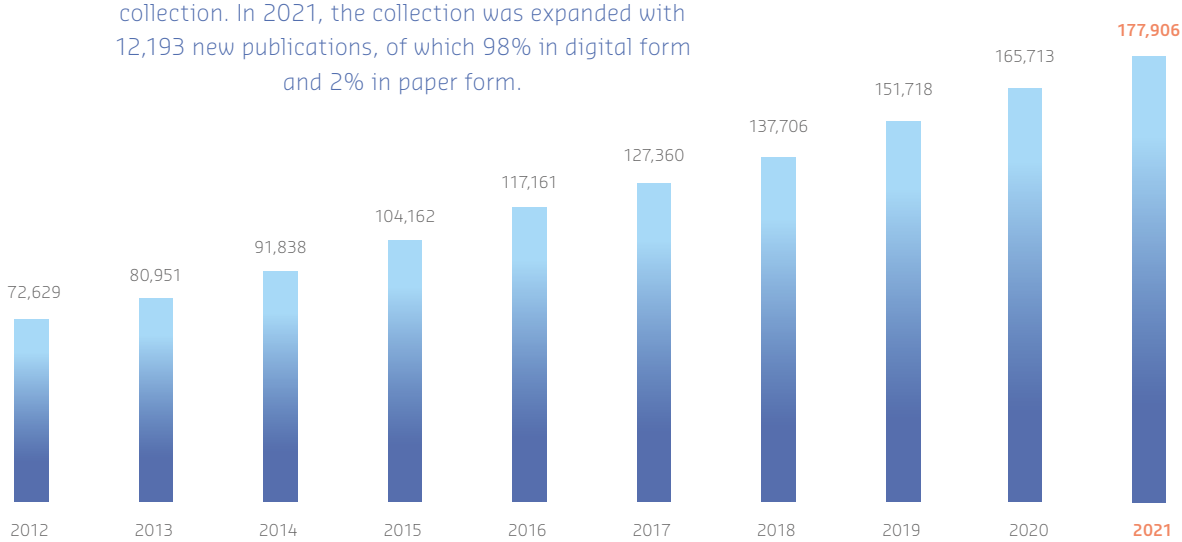
GROWTH OF THE LIBRARY COLLECTION

2021

177,906

PUBLICATIONS

The total number of (paper and digital) publications in the library, i.e. the cumulative growth of the paper and digital collection. In 2021, the collection was expanded with 12,193 new publications, of which 98% in digital form and 2% in paper form.



VLIZ PUBLICATIONS

2021

126

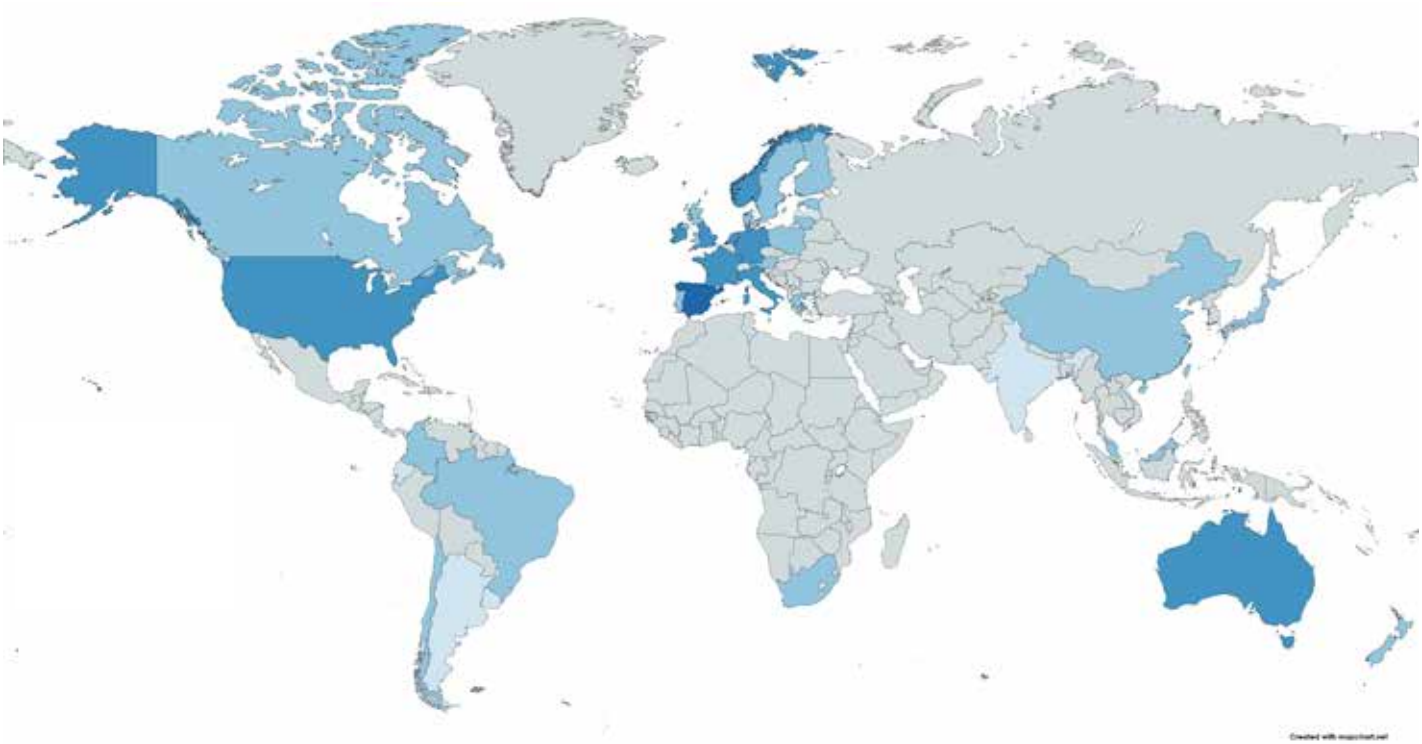
PUBLICATIONS [1]

with at least one author affiliated to VLIZ or published by VLIZ.

[1] in 2020: 86

RESEARCHERS AND RESEARCH GROUPS IN A1 PUBLICATIONS

2021



Distribution of the 358 international researchers across all A1 publications authored by a VLIZ employee from 2021 (KPI1 p. 42) per country.

>20
10-20
2-9
1

451

RESEARCHERS IN A1 PUBLICATIONS [1]

The number of researchers in all A1 publications authored by a VLIZ employee (KPI 1 p.42), including 93 Belgian and 358 international researchers (see world map).

300

RESEARCH GROUPS IN A1 PUBLICATIONS [2]

The number of research groups in A1 publications authored by a VLIZ employee, including 41 Belgian and 259 international research groups.

[1] in 2020: 436 researchers incl. 80 Belgian and 356 international researchers
[2] in 2020: 294 research groups, incl. 35 Belgian and 259 international research groups

CITATIONS

2021

2,367

CITATIONS [1]

The number of citations of A1 publications authored by a VLIZ employee.

PUBLICATIONS ON VLIZ RESEARCH FACILITIES

SINCE 2001

834

PUBLICATIONS ON VLIZ RESEARCH FACILITIES [2]

A total of 54 new publications on VLIZ research facilities appeared in 2021, including 34 on RV Simon Stevin, 11 on the VLIZ equipment, 2 on the Marine Station Ostend, 3 on the ROV Zonnebloem, 2 on the ICOS research infrastructure and 2 on the EMBRC research infrastructure.

RV SIMON STEVIN

369

RV ZEE-LEEUW

307

VLIZ EQUIPMENT

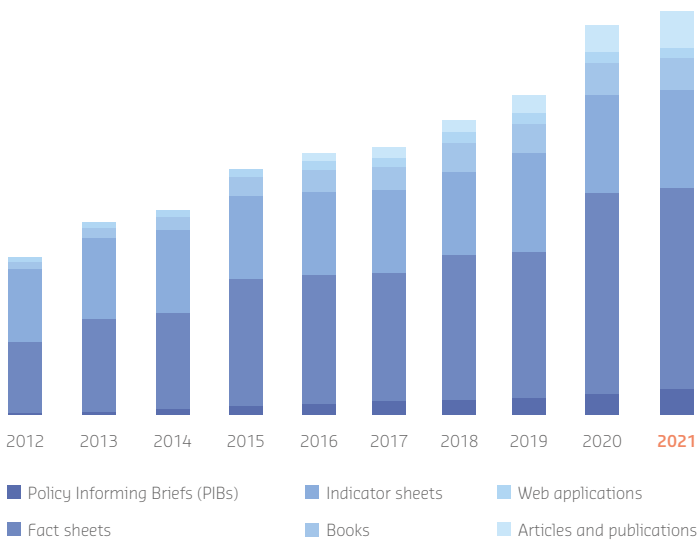
65

[1] in 2020: 1,552 citations

[2] the number of publications on VLIZ research facilities that have appeared since 2001 includes 369 publications on RV Simon Stevin, 307 publications on RV Zeeleeuw, 65 publications on VLIZ equipment, 34 publications on the greenhouses at De Haan, 30 publications on ROV Zonnebloem, 9 publications on the Marine Station Ostend, 7 publications on the ICOS research infrastructure and 13 publications on the EMBRC research infrastructure.

INFORMATION PRODUCTS

SINCE 1999



In 2021, there were 27 new information products, including 8 policy informing briefs (PIBs), 18 articles and publications, and 1 web application.

713

INFORMATION PRODUCTS

The number of information products since 1999.

NEW COMPENDIUM FOR COAST AND SEA INFORMATION PRODUCTS

2021

0

COMPENDIUM FOR COAST AND SEA [1]

New Compendium for Coast and Sea information products in 2021.

[1] in 2020: 18 new information products.

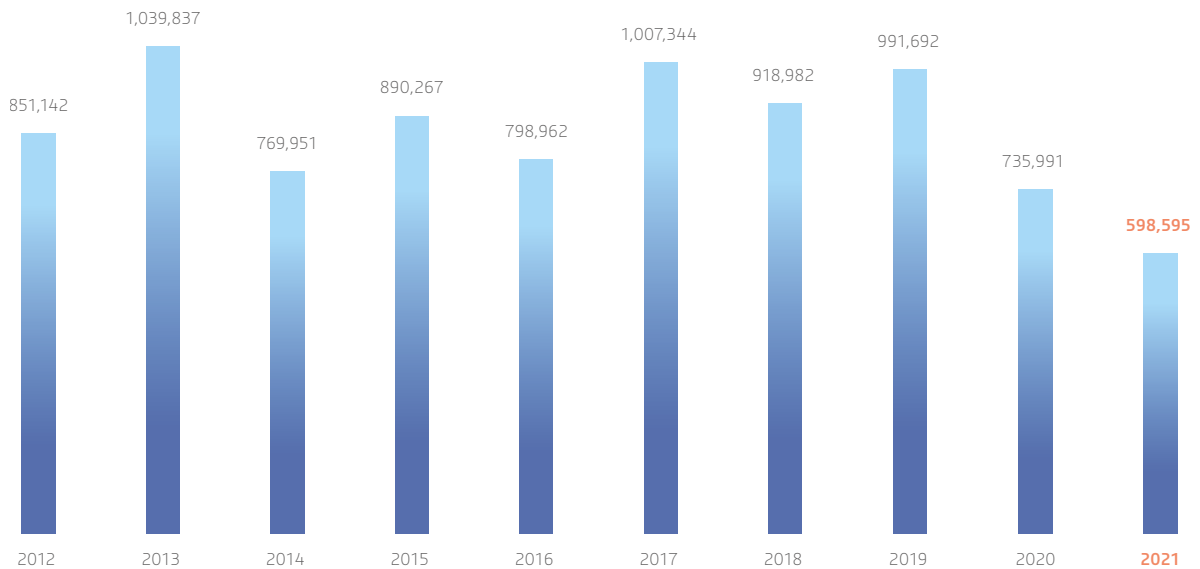
VISITORS TO THE VLIZ WEBSITES

2021

598,595

UNIQUE VISITORS

The number of unique visitors to the informative websites managed by VLIZ (url: www.vliz.be).



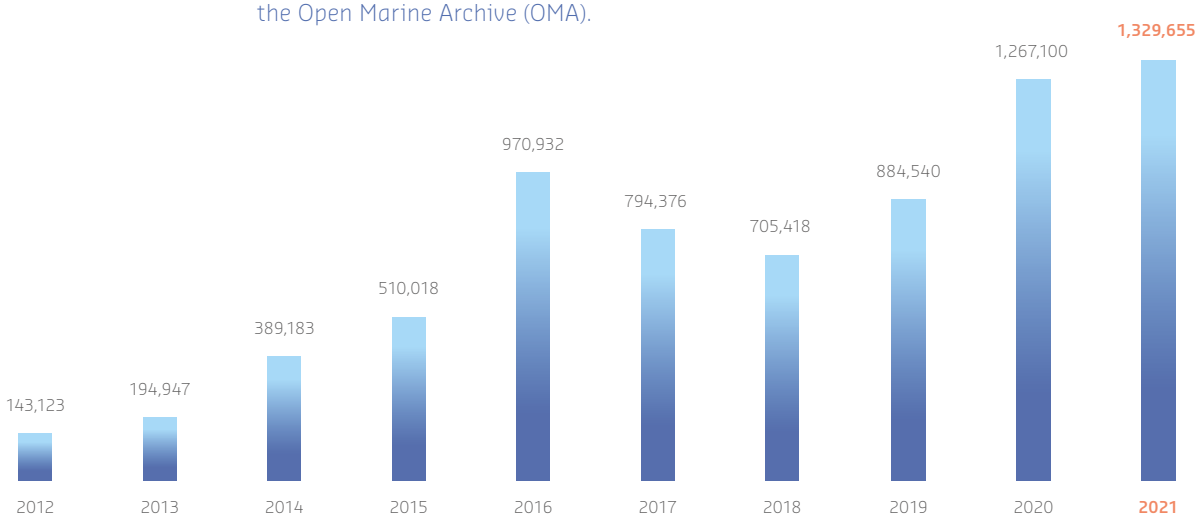
DOWNLOADS

2021

1,329,655

DOWNLOADS OPEN MARINE ARCHIVE

Total number of downloads from the Open Marine Archive (OMA).



37,049

UNIQUE TITLES DOWNLOADED [1]

Unique titles downloaded from the Open Marine Archive.

58,230

UNIQUE OPEN ACCESS TITLES [2]

Number of unique Open Access titles downloaded from the library collection.

2,150,213

OPEN ACCESS TITELS [3]

Total number of Open Access titles downloaded from the library collection.

[1] in 2020: 30,099; [2] in 2020: 46,685; [3] in 2020: 1,989,131

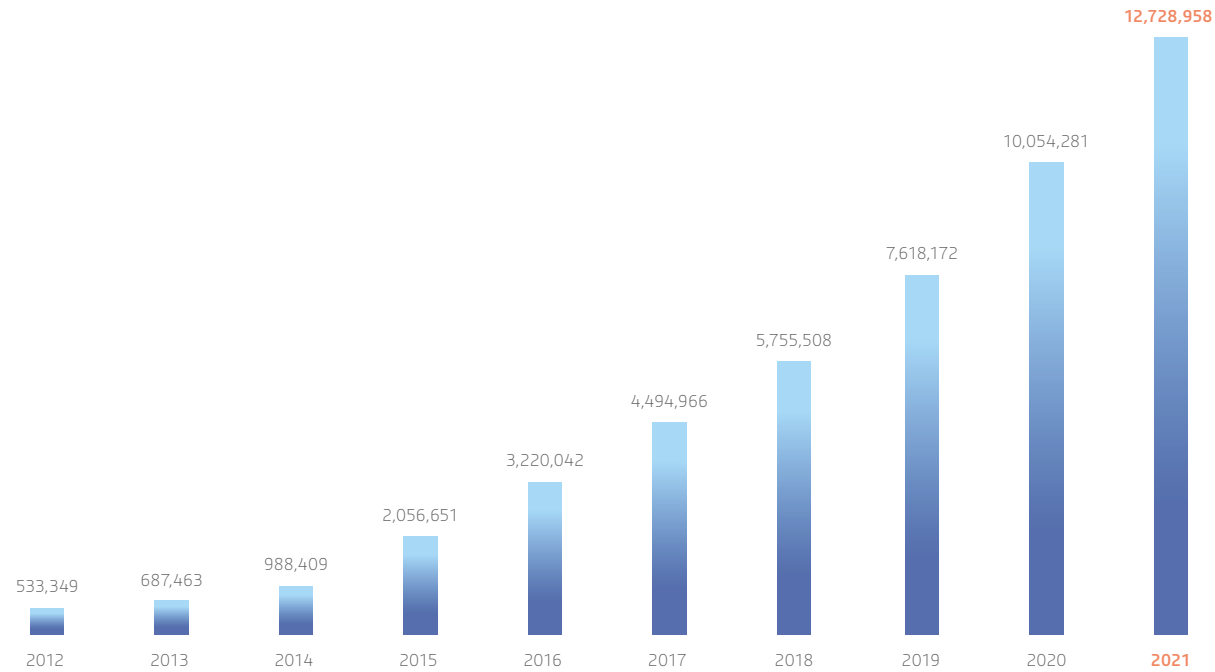
DATA DOWNLOADS

2021

12,728,958

NUMBER OF DATA DOWNLOADS SINCE 2006

In 2021, the number of data downloads was 2,675,887.



Cumulative figures

DATA DOWNLOADS

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Flemish Banks Monitoring Network	-18,858	-12,820	-1,623	262	230	220	73	43	40	24
Sluice Dock	9,381	-12,550	4,240	4,414	3,979	5,336	5,014	1,676	1,011	1,267
IOC Sealevel monitoring facility	-92,516	119,348	284,518	-1,052,948	-1,145,428	-1,248,812	-1,237,284	-1,839,158	-2,222,396	-2,642,936
Marine Regions	6,291	7,944	9,087	9,628	12,743	16,633	19,715	20,706	24,100	21,704
WoRMS	121	183	224	53	118	129	106	230	222	227
EMODnet	373	700	780	797	776	831	1,052	644	1,309	1,002
ScheldeMonitor	209	569	474	140	159	87	174	165	603	208
MIDAS	NA	NA	NA	NA	NA	54,533	39,580	10,709	81,606	8,519
TOTAL	**127,749**	**154,114**	**300,946**	**1,068,242**	**1,163,433**	**1,326,581**	**1,302,998**	**1,873,331**	**2,331,287**	**2,675,887**

DOWNLOADS OF INFORMATIVE PRODUCTS

2021

TEACHING PACKAGES

840
downloads in 2021 [1]

DE GROTE REDE

54,820
downloads in 2021 [2]

ZEEKRANT

1,988
downloads in 2021 [3]

VIDEOS

939,296
downloads since 2005

PHOTOGRAPHS

42,486,710
downloads since 2005

COMPENDIUM PRODUCTS

4,528
downloads in 2021

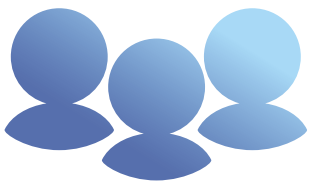
[1] in 2020: 221; 2015: 5,848; 2010: NA
Since mid-2018, visitors have no longer been required to log in so as to download educational packages, which may explain the decrease in the number of downloads since 2019.

[2] in 2020: 76,396; 2015: 117,124; 2010: 36,995

[3] in 2020: 1,736; 2015: 2,179; 2010: 815

REGISTERED USERS OF VLIZ DATABASES

2021



5,145

REGISTERED USERS[1]

The number of registered users of databases managed by VLIZ.

SUPPLIED DATA

2021

275

DATA REQUESTS[2]

The number of data requests (via data@vliz.be) in 2021.

SCIENTIFIC PROJECTS

SINCE 1999

201

SCIENTIFIC PROJECTS[3]

which have made use of RV Simon Stevin / RV Zeeleeuw since 1999.

See page 56 for a list of the research projects which made use of RV Simon Stevin in 2021.

(1) in 2020: 4,759
(2) in 2020: 352
(3) in 2020: 187

MASTER THESES, PHDs AND INTERNSHIPS

2021

52

MASTER THESES, PHDs AND WORK PLACEMENTS [1]

The number of bachelor students (1), master theses (13), PhDs (18) and internships (20) of which VLIZ is the (co-)supervisor.

See p. 53 for an overview of the master theses and internships in 2021.

ABSTRACTS AND LECTURES BY INVITATION

2021

33

ABSTRACTS AND LECTURES BY INVITATION [2]

The number of abstracts and lectures by invitation on research.

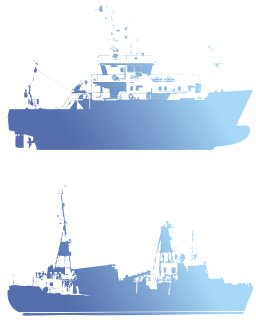
[1] in 2020: 45 incl. 8 master theses, 16 PhDs and 21 work placements
[2] in 2020: 27

NUMBER OF DAYS SPENT AT SEA

2021

274

SAILING DAYS



NUMBER OF DAYS SPENT AT SEA

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
RV Simon Stevin	100	147	183	176	184	168	169	182	137	163
RV Zeeleeuw	57	NVT	NVT	NVT	NVT	NVT	NVT	NVT	NVT	NVT
RIB Zeekat	37	5	17	21	18	12	28	28	64	73
ROV Zonnebloem (ex. Genesis)	6	26	20	4	3	11	10	11	0	NVT
Third-party vessels	110	42	48	50	36	43	63	34	42	38
TOTAL	**310**	**220**	**268**	**251**	**241**	**234**	**270**	**255**	**243**	**274**

SAILING DAYS WITH INTERNATIONAL PARTICIPATION

2021

0

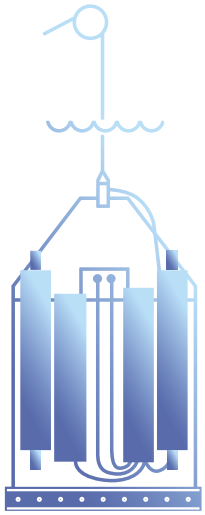
SAILING DAYS[1]

The number of days spent at sea in foreign waters and/or with the participation of international research groups.

[1] in 2020: 0

BORROWING OF VLIZ EQUIPMENT

2021



16

BORROWS [1]

The number of times that VLIZ equipment was borrowed.

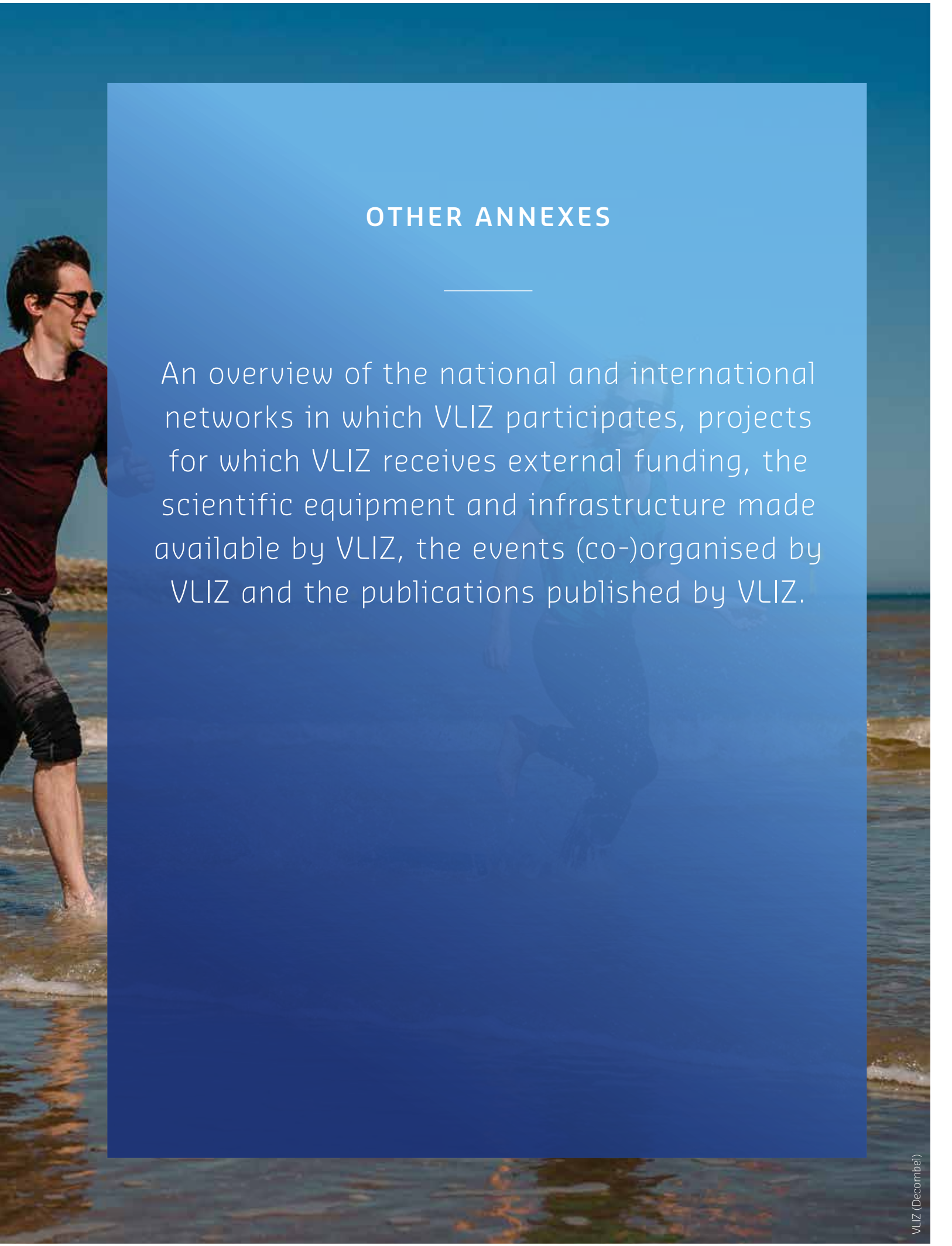
The workboat deployed from the RV Simon Stevin. © VLIZ (Decombel)

[1] in 2020: 17


Wrangler

OTHER ANNEXES

An overview of the national and international networks in which VLIZ participates, projects for which VLIZ receives external funding, the scientific equipment and infrastructure made available by VLIZ, the events (co-)organised by VLIZ and the publications published by VLIZ.



VLIZ (Decombel)

NETWORKS

2021

NATIONAL NETWORKS AND ADVISORY AND CONSULTATIVE COMMITTEES

This list of national networks and (temporary or project-related) advisory and consultative committees in which VLIZ participates is not exhaustive.

- Advisory Committee PIO Paardenmarkt
- Advisory Committee of VNR Knokke-Heist & Westkust (ANB)
- Belgian division of the 'Scientific Committee on Oceanic Research' (SCOR)
- Complex Project Coastal Vision: member of the Policy Committee and reporter of the Technical-Scientific Committee (TWC)
- Covenant for Sustainable Fisheries – WG Coast – SWG Education and Training
- The Blue Cluster: acting member of the Board of Directors, member of the steering committee and chairman of the scientific advisory board (WAR)
- Blue Energy expert group (Provincial Development Agency)
- Federal Council for Sustainable Development Belgium (FRDO-FCSS)
- Flanders Environmental Library Network (FELNET)
- Port of Ostend: Board of Directors
- KULeuven Industrial Advisory Board (KULeuven)
- IkHebEenVraag.be consortium (RBINS)
- KVAB science communication awards (KVAB) and ad-hoc working groups
- MCM-lab (mine counter measures)
- Monumentenwacht
- National and Flemish working group on Marine Litter
- NAVIGO scientific advisory group (NAVIGO)
- Network of the Liaison Agency Flanders-Europe (VLEVA)
- North Sea and Oceans Steering Committee (MNZ)
- Steering Group PIO: collecting and removing floating litters in the marinas along the coast
- Surveillance, early warning and rapid response – Invasive Alien Species steering committee
- Flemish Bioeconomy Policy Plan Steering Group
- Strategic steering committee of the Flemish Aquaculture Platform (SSAQ)
- Think Tank North Sea (TTNS)
- Flemish Europe Platform (VEP) including Working Groups on Horizon Europe (WG1), Pan-European initiatives and collaborations (WG2), Open Science (WG4), Digitalisation (WG5) and Knowledge Network on China (KNOC)
- Association of Geography Teachers (VLA)
- Association for Education in Biology (VOB)
- Flemish FWO-NCP: European Liaison Officers network (ELO)
- Flemish Supercomputer Centrum - User Committee (VSC)
- Flemish Knowledge Center for Citizen Science (SCIVIL)
- Flemish Unesco Commission (VUC)
- Flemish Association for Libraries, Archives and Documentation Centres (VVBAD)
- VLIR Learning network
- International strategy Working Group (Provincial Development Agency)
- Coastal Working Group
- Program of measures for the Marine Strategy Framework Directive of the Marine Environment Service
- Science Information Network of the Flemish government (WIN)
- ZEEBteam Province of West Flanders

INTERNATIONAL NETWORKS AND ADVISORY AND CONSULTATIVE COMMITTEES

This list of international networks and advisory and consultative committees in which VLIZ participates is non-exhaustive and alphabetically ordered and does not include any steering committees and working groups linked to the implementation and management of project activities.

- Catalogue of Life Global Team, Editorial Board, Board of Directors (Catalogue of Life)
- Coastal Wiki Editorial Board (Coastal Wiki)
- Editorial board of Global Ocean Science Report van IOC-UNESCO (GOSR)
- EuroGOOS Task Team on FerryBox
- EuroGOOS Task Team on Marine Gliders
- EuroGOOS Working Group on Biological Observations
- European Association of Aquatic Sciences Libraries and Information Centres (EURASLIC)
- European Census of Marine Life (EuroCoML)
- European Centre for Information on Marine Science and Technology (EurOcean)
- European Marine Biodiversity Observatory System (EMBOS)
- European Marine Board (representative of the Research Foundation – Flanders) (EMB)
- European Marine Board Communications Panel (EMBCP)
- European Marine Science Educators Association (EMSEA)
- EU MSP network, Ocean Governance network
- European network of Marine Biodiversity and Ecosystem Functioning (MARBEF+)
- European Network of Marine Research Institutes and Stations (MARS)
- European Parliament InterGroup on Climate Change and Biodiversity (CCBD)
- European Parliament InterGroup on Seas and Ocean (SEARICA)
- European Regions Research and Innovation Network (ERRIN): active member in WG Blue Growth and WG BioEconomy
- European Research Vessel Organisation (ERVO)
- Executive Committee of the European Register of Marine Species (ERMS)
- Executive Council and General Assembly of the Intergovernmental Oceanographic Commission (IOC) of UNESCO
- Global Ocean Science Report-II: co-author, reviewer and member of the editorial board
- Global Sea Level Observing System Network (GLOSS)
- Group of European Data Experts in Research Data Alliance (GEDE-RDA)
- ICES Data and Information Group (ICES - DIG)
- ICES Working Group on Biodiversity Science (ICES - WGBIODIV)
- ICES working group on Marine Litter & Microplastics (WGML)
- ICES Working Group on Recreational Fisheries Surveys (ICES – WGRFS)
- ICES Working Group on the History of Fish and Fisheries (ICES - WGHIST)
- INSPIRE Thematic Working Group on Biogeographical Regions, Habitats and Biotopes and Species Distributions (INSPIRE)
- Integrated Carbon Observation System Marine Station Assembly (ICOS)
- Integrated Carbon Observation System Oceanographic Thematic Centre meeting (ICOS)
- International Coastal Atlas Network (ICAN)
- International Hydrographic Organization (IHO) and IHO S-130 Project team (Chair)
- International Research Ship Operators (IRSO)
- IOC Expert Group on Ocean Capacity Development: and chair of Task Team on Clearinghouse Mechanism for the Transfer of Marine Knowledge
- IODE Group of Experts on Biological and Chemical Data Management and Exchange Practices (IODE - GE-BICH)
- IODE Network of National Oceanographic Data Centres (IODE NODC)
- Joint IAMSLIC/IODE Group of Experts on Marine Information Management (IAMSLIC/ IODE GE-MIM)
- Joint Programming Initiative Healthy and Productive Seas and Oceans (JPI Oceans)
- JPI Oceans Knowledge Hub on sea Level Rise
- LifeWatch National Centers netwerk (LifeWatch - LiNC)
- Marine Knowledge Expert Group within the European Marine Observation and Data Network (EMODnet)
- National Marine Educators Association US (NMEA)

- News & Information Group of the Partnership for Observation of the Global Oceans (POGO - News & Information Group)
- Ocean Biogeographic Information System (OBIS)
- Ocean Communicators United (OCU)
- Ocean Economy Working Group events and network (OECD)
- Ocean InfoHub - Steering Group
- Ocean Teacher Global Academy – Steering Group
- Ocean Tracking Network (OTN)
- Oceans Past Initiative (OPI)
- Partnership for Observation of the Global Oceans (POGO)
- Scientific Committee on Oceanic Research (SCOR) (representing Belgian membership)
- Sea Data Network (SeaDataNet II)
- SeaWeb Europe – Jury concours Olivier Roelinger (SeaWeb)
- Species 2000 (Species 2000)
- Steering Committee of the European Marine Biological Resource Centre (EMBRC)
- Steering Committee of the Flemish UNESCO Trust Fund (FUST)
- Steering Committee of the World Register of Marine Species (WoRMS)
- UN Decade of Ocean Science for Sustainable Development: global planning meeting, implementation plan, science plan
- Vlaams-Nederlandse Scheldecommissie m.e.r. (VNSC)
- Working Group on Invasive Alien Species (WGIAS)
- World Data System of the International Council for Science (ICSU - WDS)

VLIZ participates in steering committees of (research) projects in interface with the blue economy, such as SARCC – Sustainable and Resilient Coastal Cities (pilot sites for development of dunes as seawalls on the Flemish coast, Interreg V 2 Seas, 2019-2022), Socorro project (offshore corrosion, Interreg V 2 Seas, 2020-2022) and Internet of Water Flanders (VLAIO, 2019-2023).

PROJECTS EXTERNAL FINANCING

VLIZ RECEIVED EXTERNAL FINANCING FOR COORDINATION, COMMUNICATION AND/OR DATA MANAGEMENT WITHIN THE SCOPE OF 60 PROJECTS IN 2021. MOST OF THESE PROJECTS WERE CARRIED OUT IN COOPERATION WITH RESEARCH GROUPS.

EU

ASSEMBLE Plus – *Association of European Marine Biological Laboratories Expanded*
Duration: 01.09.2017 – 30.09.2021
www.assembleplus.eu/
ASSEMBLE Plus operates under the umbrella of the European Marine Biological Resource Centre (EMBRC) and integrates 32 marine biological research stations worldwide. It provides scientists from academia, industry and policy with a high-quality programme of transnational and virtual access to marine biological research facilities, historical observation data and advanced training opportunities. VLIZ provides transnational access to the infrastructure offered within EMBRC and manages a work package concerning the improvement of virtual access to marine biological data, information and knowledge. UGent acts as a subcontractor of VLIZ for specific activities.

BANOS CSA – *'Towards a Baltic and North Sea research and innovation programme'*
Duration: 01.11.2018 – 30.04.2021
The general aim of BANOS CSA is to develop the necessary conditions for long-term coordination of joint research and innovation efforts in the countries surrounding the Baltic Sea and the North Sea through the setup of a joint research and innovation framework programme. BANOS CSA is coordinated by BONUS EEIG (TFEU Art 185) and represents the leading research and innovation funders of the states surrounding the Baltic Sea and the North Sea.

BASTA – *Boost Applied munition detection through Smart data inTegration and AI workflows*
Duration: 01.12.2019 – 30.11.2022
The focus of this proposal is on cost-efficient detection and identification of sea-dumped munition (whether buried below the seabed or not), both for regional scale reconnaissance (typical size of several km2) and for local scale surveys of known dump sites (verification of munition). The project is a collaboration between 2 research institutes and 2 industrial partners with a view to maximising the value of the research results.

Blue-Cloud – *Piloting innovative services for Marine Research & the Blue Economy*
Duration: 01.10.2019 – 30.09.2022
The project implements a practical approach to address the potential of cloud based open science to develop a set of services that demonstrate the potential of the Pilot Blue Cloud as a thematic EOSC cloud to support ocean research through a set of five pilot Blue-Cloud demonstrators.

COASTAL – *Collaborative land sea integration platform*
Duration: 01.05.2018 – 30.04.2022
https://h2020-coastal.eu/
COASTAL is a multi-actor project involving stakeholders in the development of business roadmaps and policy solutions for enhancing coastal and rural collaboration and synergies by combining local knowledge and scientific expertise in a co-creation process.

COST-ETN – *The European Aquatic Animal Tracking Network*
Duration: 22.03.2019 – 21.03.2021
This COST Action is aimed at integrating all independent regional telemetry initiatives into a pan-European biotelemetry network embedded in the international context of existing initiatives.

EMODnet – *European Marine Observation and Data Network*
Duration: continually since 2014
www.emodnet.eu
The European Marine Observation and Data Network (EMODnet) develops a data infrastructure to make marine data available so as to support scientists, policy makers and other end users within the scope of the new European maritime policy. VLIZ is responsible for the biological pilot project (www.emodnet-biology.eu). It will use the existing European atlas with distribution data of marine species (EurOBIS) as a basis and complete it. VLIZ is also involved in the chemical project of EMODnet and the Data Ingestion initiative. In addition, VLIZ is expanding the EMODnet Central Portal (www.emodnet.eu), which is intended to provide access to the data products and data collected within the EMODnet thematic networks. The EMODnet Secretariat is located at the InnovOcean site in Ostend.

EMOD-PACE – *EMODnet China – EMODnet PArtnership for China and Europe*
Duration: 19.02.2020 - 30.06.2022
Strengthening international ocean data through the EU's ocean diplomacy with China.

ENVRI FAIR – *ENVironmental Research Infrastructures building Fair services Accessible for society, Innovation and Research*
Duration: 01.01.2019 – 31.12.2022
http://envri.eu/envri-fair/
ENVRI-FAIR is the connection of the Cluster of Environmental Research Infrastructures (ENVRI) to the European Open Science Cloud (EOSC). Participating research infrastructures (RI) cover the subdomains Atmosphere, Marine, Solid Earth and Biodiversity/Ecosystems. The overarching goal is that at the end of the proposed project, all participating RIs have built a set of FAIR data services which enhances the efficiency and productivity of researchers, supports innovation and enables data- and knowledge-based decisions.

EOSC-LIFE – *Providing an open collaborative space for digital biology in Europe*
Duration: 01.03.2019 – 28.02.2023
EOSC-Life brings together the 13 Biological and Medical ESFRI research infrastructures (BMS RIs) to create an open collaborative space for digital biology. The projects aims to respond to the challenge of analysing and reusing the prodigious amounts of data produced by life-science. By publishing data and tools in a Europe-wide cloud, EOSC-Life aims to bring the capabilities of big science projects to the wider research community.

Eurofleets+
Duration: 01.02.2019 – 31.01.2023
Coordinated by IM (Ireland), the Eurofleets+ project brings together over 20 scientific institutions to take the first steps towards a coordinated European research fleet and associated infrastructure. Through the Eurofleets+ call we hope to get funding for a two week campaign on board of the RV Sanna in Nuuk, Greenland. We would like to use the VPR in two fjord systems (Godhabsfjord and Ameralik) and the shelf connecting these areas, to research the zooplankton distribution. This project would fit within the PhD of Anouk Ollevier (Understanding and optimizing zooplankton imaging observations).

FISH_INTEL – *Fisheries Innovation for sustainable SHared INTerchannEL resources*
Duration: 01.02.2021 – 30.06.2023
The project's main objective is the provision of evidence to statutory and fisheries enforcement bodies on the identification of essential fish habitats and successful implementation of ecosystem based fisheries management.

GEANS – *Genetic tool for Ecosystem health Assessment in the North Sea region*
Duration: 01.03.2019 – 28.02.2022
GEANS is aimed at harmonising and consolidating existing DNA-based methods to ensure their application for assessing ecosystem health in the North Sea environment. A DNA sequence reference library will be compiled, current methods will be optimised and standardised, genetic indicators will be developed and a roadmap for management implementation will be provided.

IJI – *Common Facility and Distributed Notes Internal Joint Initiative*
Duration: 01.03.2020 – 28.02.2021
With this project LifeWatch ERIC aims to boost its construction and engages users in developing their research activities into the Virtual Research Environments of the e-Science Infrastructures. This demonstration project will work on the topic of non-indigenous and invasive species (NIS).

IP Booster *(service pack 1 & 5)*
Intellectual Property Booster (IP Booster) is a specialised professional IP service for public research organisations looking to realise value from their research results.
VLIZ has submitted a grant request for service pack 1 (initial ip audit) & service pack 5 (negotiating technology transfer).

JERICO-S3 – *Joint European Research Infrastructure of Coastal Observatories: Science, Service, Sustainability*
Duration: 01.02.2020 – 31.01.2024
JERICO-S3 will provide a state-of-the-art, fit-for-purpose and visionary observational RI, expertise and highquality data on European coastal and shelf seas, supporting world-class research, high-impact innovation and a window of European excellence worldwide.

Marine Regions – *Towards a standard for georeferenced marine names*
Duration: since 2011
www.marineregions.org
Marine Regions is a standardised geographic data system which makes geographic information on marine place names and maps freely available. It integrates geographic information on seas, oceans and undersea features, and indicates the boundaries of various marine areas throughout the world. 'Marine Regions' integrates the data and information from the VLIMAR Gazetteer (place name register) and the MARBOUND database (EEZ boundaries). Both global data systems have been developed by the Flanders Marine Institute and have demonstrated their added value for many users over the past few years. The combination of both databases is intended to benefit the different target groups.

Mission Atlantic
Duration: 01.09.2020 – 31.08.2025
The 'mission' of Mission Atlantic is to investigate how multiple pressures within and across important sub-areas affect the resilience of the Atlantic Ocean to future climate and societal changes. The project will tackle this question by advancing knowledge on ecosystem processes as well as applying new observation technology and state-of-the-art predictive capacity to develop an operational regional and basin-scale Integrated Ecosystem Assessment (IEA).

North Sea Wrecks – *an opportunity for blue growth (NSW)*
Duration: 01.11.2018 – 31.10.2022
The project will provide the tools required by planners, response organisations, economic actors and other stakeholders to assess the risks posed by shipwrecks and ammunition in the North Sea and propose risk mitigation solutions.

SeaBioComp – *Development and demonstrators of durable biobased composites for a marine environment*
Duration: 01.05.2019 – 01.08.2022
SeaBioComp will develop demonstrators using innovative bio-based thermoplastic composite materials with the following characteristics: (1) mechanical properties that are at least equivalent to the ones of conventional oil-based composites, (2) tailored durability according to the specific application (2 to >20 years), (3) reduced CO2 emission (30%) and reduced ecotoxic impact (due to microplastics).

SEA(A)BASS – *Data gathering of habitat specific biological and socio-economic information for the management of seabass*
Duration: 01.03.2020 – 31.12.2022
Data collection of habitat specific biological and socio-economic data for informed seabass management.

SeaDataCloud – *Further developing the pan-European infrastructure for marine and ocean data management*
Duration: 01.11.2016 - 30.04.2021
SeaDataCloud is a continuation of SeaDataNet, where professional data centres from 35 countries collaborate to make the data sets collected by the pan-European oceanographic research fleet and the new automated observation systems available within one efficiently distributed data system. SeaDataCloud aims at considerably advancing SeaDataNet services and increasing their usage, adopting cloud and HPC technology for better performance. SeaDataCloud is developing a Virtual Research Environment (VRE) to provide researchers with various functionalities to calculate oceanographic data products on the basis of in situ observations and remote sensing data.

WECANET – *A pan-European Network for Marine Renewable Energy*
Duration: 12.09.2018 – 11.09.2022
www.wecanet.eu
This pan-European network focuses on an interdisciplinary approach to marine wave energy that will contribute to large-scale WEC Array deployment by addressing the current bottlenecks.

FLEMISH GOVERNMENT, WATERWEGEN EN ZEEKANAAL (W&Z)

OMES – *Research on the environmental effects of the SIGMA plan*

Phase III: 16.07.2008-15.10.2009	Phase VIII: 01.02.2014 -30.04.2015
Phase IV: 01.10.2009-01.10.2010	Phase IX: 01.02.2016-30.04.2017
Phase V: 01.02.2011-30.04.2012	Phase X: 01.02.2017-30.04.2018
Phase VI: 01.02.2012-30.04.2013	Phase XI: 01.02.2018-30.04.2019
Phase VII: 01.02.2013-30.04.2014	Phase XII: 01.02.2020-30.04.2021

www.omes-monitoring.be/en
The OMES consortium has implemented this multidisciplinary monitoring programme, which was commissioned by Waterwegen en Zeekanaal, since 1995. Various components of the ecosystem are sampled: water quality, carbon cycle, phytoplankton, zooplankton, microphytobenthos, primary productivity and sediment characteristics. VLIZ is responsible for the integrated OMES database and ensures its dissemination through the OMES website (www.vliz.be/projects/omes).

FLEMISH GOVERNMENT, MARITIME ACCESS DIVISION

ScheldeMonitor – *Flemish-Dutch knowledge platform for research and monitoring of the Scheldt estuary*
Duration of current phase: 01.01.2021 - 31.12.2024; started in 2010
www.scheldemonitor.org
ScheldeMonitor is a Flemish-Dutch knowledge and information system for research and monitoring of the Scheldt estuary. This portal provides an overview of publications, institutions, projects, datasets, etc. related to research and monitoring in the Scheldt estuary as well as access to measurements and data products such as maps, charts and indicators.

ERDF FLANDERS

Blue Accelerator
Duration: 01.05.2018 – 30.40.2021
The Blue Accelerator project is aimed at creating so-called living labs where testing is possible under real marine conditions. The principal focus is on the development of an offshore test location (incl. platform) off the coast of Ostend.

FEDERAL GOVERNMENT, BELSPO

ANDROMEDA – *Analysis techniques for quantifying nano-and microplastic particles and their degradation in the marine environment*
Duration: 01.04.2020 – 31.03.2023
Within ANDROMEDA, in situ detection, efficient sampling and cost-effective laboratory methods will be developed and optimized to analyze microplastics. Approaches will be based on hyperspectral imaging, chemical markers and fluorometric detection techniques. Advanced analysis techniques making use of μFTIR, Raman imaging and SEM-EDX (amongst others) will be applied to quantify and characterize micro and nanoplastics.

AQUALOOKS – *Improving atmospheric correction and aquatic particle retrieval with bidirectional remote sensing data*
Duration: 01.07.2019 – 31.12.2021
This project mainly has remote sensing objectives (development of algorithms and validation of in situ data for multi-look satellite missions), but is also aimed at refining and further developing the autonomous radiometry platform PANTHYR, which was developed by VLIZ in the course of the HYEPRMAQ project.

BG-PART – *BioGeochemical PARTicle interactions and feedback loops on the Belgian Continental Shelf*
Duration: 01.06.2021 – 01.06.2024
Interactions between biological and mineral particles may underlie phytoplankton and sediment dynamics in our North Sea. Phytoplankton produces sticky marine gels that influence flocculation, floc size and settling velocity of mineral particles. In turn, higher settling velocities decrease turbidity, changing the underwater light conditions and fostering photosynthesis. BG-PART aims to obtain an integrated understanding of biotic and abiotic interactions that drive particle dynamics in the BCS.

PERSUADE – *ExPERimental approaches towards Future Sustainable Use of North Sea Artificial HarD SubstratEs*
Duration: 01.01.2018 – 31.12.2021
The project is aimed at the construction of an in-situ underwater hard-substrate garden where organisms will be collected for mesocosm experiments. The marine food chain near offshore artificial hard substrates will be imitated in the seawater tanks of the Marine Station Ostend (MSO). VLIZ supports the development of the underwater garden and provides technical assistance for the setup of the experiments.

STURMAPS – *Towards 3D SPM and turbidity mapping in the water column using multibeam sonar*
Duration: 01.12.2021 – 31.05.2022
This project builds on the TIMBERS projects and aims to finish what was foreseen in the 2 years the project ran. Additional (statistical) analyses will be executed to better understand the relationship between multibeam water column data and in-situ SPM data. Additionally, a paper will be drafted regarding the potential of multibeam sonars to map SPM/turbidity in 3D.

TIMBERS – *3D Turbidity assessment through Integration of MultiBeam Echo-sounding and optical Remote Sensing*
Duration: 01.04.2019 – 30.06.2022
The goal of this project is to produce 3D turbidity profiles for seawater by combining remote sensing with multi-beam echo-sounding (MBES). A method will be developed to deduce vertical turbidity profiles from measured MBES backscatter values and combine them with turbidity data from the top layer of the water column on the basis of satellite observations.

TrIAS – *Tracking Invasive Alien Species: Building a data-driven framework to inform policy*
Duration: 01.01.2017 – 01.09.2021
www.belspo.be/belspo/brain-be/projects/TrIAS_en.pdf
TrIAS is primarily aimed at the establishment of a data mobilisation framework for alien species on the basis of different data sources. The combination of these data with a Belgian checklist of alien species will feed indicators for the identification of emerging species, their level of invasion in Belgium, changes in their invasion status and the identification of areas and species of concern that could be negatively impacted. The second objective is to develop data-driven procedures for risk evaluation based on risk modelling, risk mapping and risk assessment.

FEDERAL GOVERNMENT, ENVIRONMENTAL DIVISION

RecVis – *Marine recreational fisheries monitoring*
Duration: 01.05.2016 – 31.12.2021
www.recreatievezeevisserij.be
Development and implementation of a protocol for systematic monitoring of the recreational fishing sector (fishing effort, location, catches, etc.).

Phase out of lead fishing sinkers
Duration: 08.04.2021 – 08.04.2022
The aim is to elaborate a draft cooperation agreement on the phasing out of fishing lead between the governmental bodies involved and the sector organisations and federations.

PROVINCE

STEM4sea – *The sea as context for STEM in primary education*
Duration: 01.09.2019 – 30.06.2021
In partnership with the St.Lodewijkscollege primary school in Bruges, VLIZ is developing a set of STEM activities on ocean topics for teachers in primary education. With the support of the province of West Flanders.

Zeekrant
Duration: Since June 2007
Annual publication of VLIZ in partnership with the province of West Flanders with all sorts of facts on the sea and beach.

FWO (FORMER HERCULES FOUNDATION)

DiSSCo Flanders – *Towards a collection management infrastructure for Flanders*
Duration: 01.01.2021 tot 31.12.2024
DiSSCo Flanders will address biological, anthropological and geological collections. The whole workflow from specimen sampling in the field to their digitization and online publication enabling re-use of the data and media will be addressed.

LifeWatch – *Flemish contribution to LifeWatch.eu*
Duration: continually since 01.04.2012
www.lifewatch.be
The Flemish contributions to the LifeWatch infrastructure are coordinated by the Research Institute for Nature and Forest (INBO) and, as far as the marine component is concerned, by the Flanders Marine Institute (VLIZ). Flanders contributes to the central LifeWatch infrastructure with a taxonomic backbone which is developed through various projects, including the World Register of Marine Species or WoRMS (www.marinespecies.org) and EurOBIS (www.eurobis.org). WoRMS aims to provide an authoritative and comprehensive list of names of marine organisms, including information on synonyms. EurOBIS is a distributed system which makes it possible to simultaneously search for biogeographic information on marine organisms in various data sets. EurOBIS has been developed within the MarBEF network and serves as the European node of OBIS. As part of LifeWatch, Marine Regions is a standardised geographic data system which makes geographic information on marine place names and maps freely available. It integrates geographic information on seas, oceans and undersea features, and indicates the boundaries of various marine areas throughout the world. Marine, freshwater and terrestrial observatories are developed regionally within LifeWatch, as are different biodiversity data systems, web services and models.

DISARM – *Dumpsites of Munitions: Integrated Science Approach for Risk and Management*
Duration: 01.01.2020 – 31.12.2023
www.disarm.be
The Paardenmarkt is one of the many munition dumpsites in our oceans. A few m below the seafloor, ca. 35.000 tons of WW1 chemical munition are buried. The present scientific knowledge is insufficient to make any reliable judgement on the state of the site. The DISARM project aims to address the knowledge gaps, but will go an important step further to develop an integrated scientific approach to support risk assessment and management of marine chemical munition dumpsites worldwide.

EMBRC – *European Marine Biological Resource Centre*
Duration: 01.01.2021 – 31.12.2024
www.embrc.eu
EMBRC will be a distributed infrastructure for research and training at leading marine research stations in Europe. It constitutes a virtual network of marine stations for the study of marine species, biodiversity and ecosystem functioning, developmental biology and evolution, biogeochemistry, global change, biomedical sciences and marine products. EMBRC will provide end users from SMEs, academia and industry with access to marine biodiversity, associated metadata and extractable products. Services include access to marine species (model species), biobanks, dedicated 'omics' platforms, structural biological facilities and imaging (microscopy, cytometry, etc.). The Flemish contribution is coordinated by the Marine Biology Laboratory (Ghent University) and VLIZ, with VLIZ making seagoing and land-based facilities available and providing technical support.

FOSB – *Flemish Open Science Board*
Duration: 01.09.2020 – 30.06.2021
The Flemish Open Science Board (FOSB) holds the mandate to outline the Open Science Policy in Flanders. This board unites all Flemish stakeholders in a shared vision for the future with regard to Open Science and EOSC, and, supported by technical working groups, advises the policy on steps to be taken to fully integrate Flanders into the international Open Science landscape.

ICOS – *Integrated Carbon Observing System*
Duration: 01.01.2012 – 31.01.2025
www.icos-infrastructure.eu
ICOS provides the long-term observations required to understand the present state and predict future behaviour of the global carbon cycle and greenhouse gas emissions. VLIZ performs the oceanographic measurements which Flanders will transfer to ICOS through the University of Antwerp. VLIZ performs measurements aboard RV Simon Stevin to this end. Within the scope of ICOS, VLIZ collaborates with NIOZ-Yerseke and the University of Liège (Alberto Borges).

Creating negative CO_2 emissions via enhanced silicate weathering (ESW)
Duration: 01.02.2019 – 31.12.2022
This SBO project will tackle the problem of climate stabilisation by examining the feasibility of an innovative negative emission technology called 'Enhanced Silicate Weathering' (ESW) integrated into coastal zone management. The goal is to perform fundamental research into efficiency, mutual benefits and environmental impact of the technique in order to examine if and how it can be developed into a sustainable and cost-effective approach to the evaluation of negative emissions.

Decision support framework for plastic clean-up technologies in rivers and estuaries: minimizing unintentional bycatch while maintaining efficient plastic removal under realistic environmental conditions
Duration: 01.11.2021 – 31.10.2025
The aim is to develop a mathematical model to quantify the bycatch of plastic removal technologies. This model will support water managers in their choice of a suitable technology to remove plastic and limit ecological collateral damage.

Testerep – *Evolution of the Flemish seascape 5000 BP - present*
Duration: 01.10.2021 – 31.09.2025
The project's aim is to extend our spatio-temporal understanding of Flanders' coastal landscape over the last 5000 years by studying the former Testerep peninsula at sea and on land. This will provide new detailed insights into the relative impact of natural changes (e.g. sealevel rise) versus anthropogenic interventions (e.g. constructing embankments) on the morphological dynamics of the coast.

UNESCO

GLOSS – *Sea Level Station Monitoring Facility*
Duration: continually since 2008
www.ioc-sealevelmonitoring.org
A worldwide service for real-time sea level monitoring by means of measuring stations in cooperation with GLOSS (Global Sea Level Observing System) and IOC (Intergovernmental Oceanographic Commission).

VLAIO (FORMER IWT – STRATEGIC BASIC RESEARCH)

Coastbusters 2.0
Duration: 01.02.2020 – 31.01.2023
An innovative collaboration between public and private parties, Coastbusters 2.0 will implement various reef facilitating systems to induce the formation of a biogenic mussel bed in an early stage and to achieve a nature inspired design (NID) for coastal defence.

PLUXIN – *Plastic Flux for Innovation and Business Opportunities in Flanders*
Duration: 01.09.2020 – 31.08.2023
A first prerequisite to take effective plastic remediation measures is to know where and when action should be taken. A central objective in this project is to develop a two-dimensional-horizontal (2DH) plastic dispersal model. The model will be calibrated and validated with experiments and field sampling data. Plastics will be identified from remote sensing reflectance data through image recognition algorithms ('Machine Learning'), hence resulting in an automated plastic detection method.

PROBIO – *PROspection for BIOactive compounds in the North Sea*
Duration: 01.11.2019 – 30.04.2022
Marine environments offer a wide variety of bioresources containing potential bioactive compounds. This project wants to unravel the underexplored potential of a selection of local organisms by screening their bioactive compounds. This project will generate an essential knowledge base to identify possible uses in commercial applications, which will trigger further research to foster new commercial developments in various sectors.

SUMES – *Sustainable Marine Ecosystem Services*
Duration: 01.09.2020 – 31.08.2023
The SUMES project aims to develop a model to assess the impact of human-induced changes on the ecosystem, its structure (e.g. biodiversity) and function (e.g. food chains, biogeochemistry), its capacity to provide marine ecosystems goods and services (e.g. sequestration of carbon) and subsequent consequences.

TOERISME VLAANDEREN

Operation North Sea 1944-45 exhibition
Duration: 20.09.2018 – 03.01.2021
This exhibition, held at Seafront Zeebrugge, deals with the liberation of Walcheren on 1 November 1944 by Canadian, Polish, British, French, Norwegian, Dutch and Belgian troops. This project is conducted in collaboration with the War Heritage Institute, Westtoer, the Flemish government and Nationale Loterij/Loterie Nationale.

FUST – FLANDERS UNESCO TRUST FUND FOR SCIENCE

Ocean InfoHub – Ocean Teacher Global Academy
Duration: 01.05.2020 – 01.05.2022
The IOC Ocean InfoHub Project (OIH) aims to streamline access to ocean science data and information for management and sustainable development.

OTGA – *Ocean Teacher Global Academy*
Duration: since 2005
The OceanTeacher Global Academy (OTGA) project aims at building equitable capacity related to ocean research, observations and services in all IOC Member States. UNESCO/IOC's International Oceanographic Data and Information Exchange (IODE) programme has built a comprehensive Learning Management System (OceanTeacher) that, in combination with classroom training, has trained nearly 2000 students from 120 countries since 2005. This success demonstrates the expertise within IODE and its potential to expand the use of this methodology to other IOC programmes. The OTGA project will complement other existing training programmes of the IOC.

PacMAN – *Pacific Islands Marine bioinvasions Alert Network*
Duration: 01.05.2020 – 01.05.2022
The project will develop a national invasive species monitoring system as well as an early-warning decision-support tool for Pacific SIDS, offering a user-friendly dashboard indicating the potential presence of invasive species (including pathogens and pest species) or risk of invasions to support local management.

OTHERS

APELAFICO – *Acoustic ecology of pelagic fish communities: a study into the effects of construction and exploitation of wind farms.*
Duration: 01.01.2021 – 31.12.2023
Financing: NWO
This project concerns an interdisciplinary study with fundamental and applied aspects fitting the targets of the Dutch National Research Agenda (NWA). The project will collect data, using a set of echosounders, on density and diversity of pelagic fish in and around offshore windfarms in association with acoustic conditions during the construction and exploitation of windfarms.

Microfish – *Microplastic biomonitoring in fish: Assessing the feasibility and conducting a pilot field study*
Duration: 01.08.2020 – 31.05.2021
Financing: CEFIC-ICCA (the European Chemical Industry Council & the International Council of Chemical Associations).
In this project microplastics in the digestive system of commercial fish species will be identified and quantified. VLIZ supports by performing a statistical power analysis and characterizing the plastics (μFTIR).

Net op Zee Borssele (NOZ Borssele) – *Monitorings- en evaluatieplan elektromagnetische velden*
Duration: 01.09.2021 – 31.12.2022
The plan consists of five sub-studies, namely [1] EMF strength and scope, effects on [2] marine mammals; [3] cartilaginous fish; [4] diadromous fish; and [5] benthic fish. In addition, it is set out how this plan contributes to the broader monitoring of the ecological effects of electromagnetic fields (EMF).

Baseline meadurement plastic flux
Duration: 01.01.2021 – 31.12.2021
Financing: OVAM/Fostplus.
On behalf of OVAM/FostPlus, VLIZ will coordinate and report a plastic baseline measurement in the context of the Flemish Integrated Marine Litter Action Plan. UGent, KULeuven, UAntwerpen perform tasks as a subcontractor of VLIZ.

The Rich North Sea

Duration: 15.10.2020 – 30.06.2021

Financing: programme 'The Rich North Sea' - TRNS (The Netherlands).

A TRNS project set up in collaboration with Cefas wants to investigate the influence of windmill parks at sea on the marine biodiversity, by creating biotope and habitat maps of the North Sea. The focus is on macrobenthic data. They do not limit themselves to data from within windmill parks, but also data collected in the wider North Sea area, including those regions from before the windmill parks were actually there. From EurOBIS, we will provide relevant data and information for this project.

TRAINEES, MASTER STUDENTS AND STUDENT EMPLOYEES

2021

TRAINEES AND MASTER STUDENTS SUPERVISED BY VLIZ IN 2021

NAME	DIVISION	SCHOOL/UNIVERSITY
Aagje Droohenbroodt	Trainee Science Communication	VIVES Hogeschool
Amber Thienpont	Trainee Science Communication	Artevelde hogeschool, Ghent
Anton Bilsen	MSc student Research	KU Leuven
Axel Jünger	Trainee Research Infrastructure	Ghent University
Bob Van de Poll	Trainee Science Communication	Van Hall Larenstein Hogeschool, The Netherlands
Charlotte Beerten	Trainee Science Communication	VIVES Hogeschool
Clemence Pretat	MSc student Research	Cnam-Intechmer, France
Clemence Pretat	Trainee Research	Cnam-Intechmer, France
Elien Geeraerts	MSc student Research	Ghent University
Elke Lycke	MSc student Data Centre	Ghent University
Elke Lycke	Trainee Marine Observation Centre	Ghent University
Els de Vreede	Trainee Research	Hogeschool Zeeland, Nederland
Emerson de Oliviera	Trainee Science Communication	Howest Kortrijk
Fien Seras	Trainee Data Centre	Marine Regions
Harsim Brar	Trainee Research	University of Antwerp
Ilke Koster	Trainee Science Communication	Ghent University
Jade Timperman	MSc student Research	Ghent University
Josephine Njeru	MSc student Research	Ghent University
Kyran Raes	Trainee Science Communication	VIVES Hogeschool
Lasse Cornillie	MSc student Marine Robotics Centre	Ghent University
Line Debaveye	Trainee Science Communication	VUB, University of Antwerp, Ghent
Louisa Schoutteten	MSc student Research	Ghent University
Lucille Plijnaar	Trainee Research	University of Utrecht, The Netherlands
Magali Robbe	MSc student Research	Ghent University
Maria Camila Leon	MSc student Research	Vrije Universiteit Brussel
Marie Heyndrickx	Trainee Data Centre	University of Antwerp
Michiel Seurynck	Trainee Research	Howest Kortrijk
Paulien Philippe	MSc student Research	KU Leuven
Robyn Sahota	Trainee Marine Observation Centre	Ghent University
Sol Anglada Segura	MSc student Research	Vrije Universiteit Brussel
Sophie Wouters	MSc student Research	Ghent University
Vera Baron	Trainee Marine Observation Centre	Technical University Munchen, Germany
Warre Dekoninck	BSc student Research Infrastructure	Ghent University
Wout Decrop	Trainee Marine Robotics Centre	Ghent University

STUDENT EMPLOYEES ACTIVE AT VLIZ IN 2021

NAME			
Aoufi Sofya	Devos Eli	Ramaut Anouck	Tuytens Kimberly
Calonge Arienne	Florence Peter	Reyniers Piet	Van Valckenborg Brecht
d'Hondt Guillaume	Garcia Claudia	Sorigué Pol	Vandepitte Simon
Debaere Shamil	Huong Mai Nguyen	Stoffels Jethro	Vanherbergen Xander
Degroote Kevin	Porters Porters	Stubbe Liesje	Vansteene Istvan
			Wittoeck Karlien

SCIENTIFIC EQUIPMENT AND INFRASTRUCTURE

2021

OVERVIEW OF SCIENTIFIC EQUIPMENT AND INFRASTRUCTURE FOR SCIENTIFIC RESEARCH MADE AVAILABLE BY VLIZ

WATER SAMPLING AND CHARACTERISATION EQUIPMENT

- Acoustic current meter (ADCP) and speed log
- Dissolved inorganic carbon analysis system
- System for oxygen analysis by means of Winkler titration
- Seawater acidity analysis system
- Aquadopp current profiler (ADCP)
- Signature 1000 ADCP (profiling, wave measurements & turbulence)
- Acoustic node with 1 subseanode and one topside node
- Broadband acoustic recorders
- Carrousel 6 x 4 litre Niskin bottles
- CTD equipped with sensors for:
  - Photosynthetically active radiation (PAR)
  - Dissolved oxygen and redox potential (ORP)
  - Turbidity
  - Chlorophyll a
- Aeolian sand transport monitoring network
- Fluorometer
- 10 litre GO-FLO bottle
- Methane sensor
- Multibeam sonar
- 5 litre Niskin bottle
- Nutrient analysis system
- Underway data acquisition system on board RV Simon Stevin with:
  - Thermosalinograph
  - Fluorometer
  - Atmospheric pCO_2 analysis system
  - Oxygen sensor
  - Turbidity sensor
- Secchi disk
- Total alkalinity sensor
- LISST-100X and LISST-200X turbidity meter
- WISP

SOIL SAMPLING AND SOIL MAPPING EQUIPMENT

- Bowers & Connelly multi-corer
- Cohesive Strength Meter (CSM)
- Hamon grab
- Multibeam sonar
- Multibeam sonar system for shallow areas
- Multi-transducer sub-bottom echosounder
- Reineck Box Corer
- Sediment Profile Imaging (SPI)
- Singlebeam sonar
- Van Veen grab
- Sparker
- Gilson dredge
- Vibrocorer

BIOLOGICAL SAMPLING EQUIPMENT

- Bat recorder
- Bongo net
- Beam trawl
- Otter trawl
- Pelagic otter trawl
- Bowers and Connelly multi-corer
- Porpoise detectors – C-PODs
- Fast repetition rate Fluorometer (FrrF)
- FlowCam
- Flow cytometer
- Fluorometer
- Gilson dredge
- Hamon grab
- Hydrophone
- Hyperbenthic sledge
- Neuston net
- Sieving table
- Apstein plankton net
- CalCoFi plankton net
- Vertical plankton net – WP2
- Reineck Box Corer
- Sediment Profile Imaging (SPI) system
- Sensor network for large birds
- Van Veen grab
- VEMCO fish acoustic receiver network in the Western Scheldt and coastal waters
- Video plankton recorder
- Wilson auto-siever
- Zooscan

MISCELLANEA

- Augmented reality sandbox
- Biological laboratory
- Bird tracking camera
- Chemical laboratory
- Compressor for filling diving cylinders
- Core repository – cold store for drill cores
- DGPS hand-held unit
- Freezers
- Weather station on board RV Simon Stevin:
  - Atmospheric pCO_2
  - Wind speed
  - Wind direction
  - Temperature
  - Atmospheric pressure
- Microscopes
- Mini ROV
- Molecular laboratory
- Multi-sensor mooring with acoustic release
- Underwater camera
- RIB Zeekat
- ROV 'Zonnebloem' (former 'Genesis')
- AUV 'Barabas'
- USV 'Adhemar'
- Glider 'SeaExplorer'
- Video frame
- Water tanks for marine organisms
- Web cameras

RESEARCH PROJECTS

2021

RESEARCH PROJECTS WHICH MADE USE OF RV SIMON STEVIN IN 2021

MARINE RESEARCH GROUP	PROJECT
FPS Economy – Continental Shelf Service	Monitoring of sand and gravel extraction
FPS Economy – Continental Shelf Service	Mapping gradients in seafloor characteristics
ILVO -Fisheries	Combituig
ILVO -Fisheries	Demersal Young Fish Survey (DYFS)
ILVO -Fisheries	Flatfish in windmill farms
ILVO -Fisheries	Acute effects of dredging
INBO	Monitoring of seabirds
RBINS	Habitat protecting installing offshore windfarms
OD Nature & Ugent - Marine biology	OUTFLOW
Ugent - GhEnToxLab	Temora metabolism
Ugent - Marine biology	Sea bass
Ugent - Marine biology	HOTMIC
Ugent - ARC	UNITED
University of Antwerp	Electrified sediment ecosystems
VLIZ	DISARM
VLIZ	North Sea Wracks
VLIZ	Metatranscriptomics of plankton
VLIZ	ICOS
VLIZ	LifeWatch measurement campaigns
VLIZ	PROBIO
VLIZ	PLUXIN
VLIZ	TIMBERS
VLIZ	Assemble+
VLIZ	JERICO-Next
VLIZ	Paleolandscapes of the Southern North Sea
VLIZ	APELAFICO
VLIZ	Coastbusters 2.0
VLIZ	Plastiflux
VLIZ	Unmanned Data Harvesting
VLIZ	FishIntel
VLIZ - Ugent	EMOBON

In 2021, RV Simon Stevin was used for 31 projects (including 11 new ones), amounting to a total of 163 days at sea.
A total of 201 unique projects have made use of RV Simon Stevin since 2000.

RESEARCH PROJECTS WHICH MADE USE OF THE MARINE STATION OSTEND IN 2021

MSO INFRASTRUCTURE USED	REASON	MARINE RESEARCH GROUP
Courtyard	Investigate weather impact on concrete	Ghent University - Lab Magnel-Vandepitte
Courtyard	North Sea Wrecks -setup of corrosion experiments	Antwerp Maritime Academy
Mesocosms	Enhanced Silicate Weathering	VLIZ, Antwerp University
Lab infrastructure	ICOS	VLIZ
Lab infrastructure	LifeWatch	VLIZ

The Marine Station Ostend was used for marine scientific projects, educational purposes, visits, meetings and open house days for 173 days in 2021.

EVENTS

IN 2021

EVENTS (CO)ORGANISED BY VLIZ IN 2021

DATE	TITLE	LOCATION	ROLE OF VLIZ	NUMBER OF PARTICIPANTS	KPI12 EVENT
03.02.2021	Zeebad: an ocean full of plastic - Ugent	Online	co-organiser	20	✔
24.02.2021	Zeebad: an ocean full of plastic - UAntwerpen	Online	co-organiser	49	✔
24.02.2021	Masterclass Big Shell Counting Day	Online	co-organiser	49	✔
03.03.2021	VLIZ Marine Science Day	Kaap Oostende + online	organiser	538	✔
04.03.2021	Webinar: introduction to shells for beginners	Online	co-organiser	145	✔
12.03.2021	Pluxin - Thematic Session Plastic Catchers	Online	organiser	35	
14.03.2021	Big Shell Counting Day	10 Flemish coastal municipalities + online	co-organiser	1 100	✔
31.03.2021	VLIZ-webinar: Virtual North Sea dive - Waves	Online	organiser	85	✔
19.04.2021	Multibeam water column data: State-of-the-art & perspectives	Online	co-organiser	73	
22.04.2021	SUMES workshop	Online	organiser	17	
27.05.2021	Help! How do you spark interest in science in the classroom?	UGent - S8 Sterre complex, Ghent	co-organiser	6	
07-11.06.2021	WoRMS Porifera workshop	Online	organiser	19	
09.06.2021	VLIZ-webinar: Virtual North Sea dive - Sharks	Online	organiser	109	✔
14-18.06.2021	EMODnet Open Conference and Jamboree	Online	co-organiser	639	
15.06.2021	Foundation-stone laying ceremony Ocean Innovation Space & inauguration seawater pipeline	MSO, Ostend	co-organiser	19	
22.06.2021	Demo Port of Ostend - Visit Vincent Van Quickenborne	MSO - Warehouse 4 + Port of Ostend	co-organiser	22	
29.06.2021	May tree celebration InnovOcean Campus	InnovOcean Campus, Ostend	co-organiser	48	
28.06-11.07.2021	ICOS pCO_2 instrument intercomparison workshop	MSO - Warehouse 1, Ostend	co-organiser	70	
07.07.2021	PlaneetZee workshop for children: build and pilote your own underwater robot!	MSO, Ostend	organiser	10	✔
05.09.2021	Open door InnovOcean Campus	InnovOcean Campus, Ostend	co-organiser	102	
06.09.2021	Visit EU Commissioner Sinkevicius & Minister Crevits to Ostend	MSO, Ostend	co-organiser	49	
10.09.2021	Blue Economy Science Summit (BESS)	De Cierk, Ostend	co-organiser	88	
17.09.2021	VLIZ members' day	MSO, InnovOcean site & InnovOcean Campus, Ostend	organiser	203	
14.10.2021	UNESCO meeting day VUC	Herman Teirlinck building, Brussels	co-organiser	100	
18.10.2021	Think Tank North Sea - Kick-off Environmentally sustainable blue growth	InnovOcean site, Ostend	organiser	41	
21.10.2021	Info session public and private datasets Flemish coast	VAC Bruges	co-organiser	30	
27.10.2021	PlaneetZee workshop for children: ecosystem services	MSO, Ostend	organiser	8	✔
28.10.2021	Lifewatch Biodiversity Day	VAC Ghent	organiser	87	✔
29.10.2021	Flemisch Aquaculture Symposium	BlueBridge, Ostend	co-organiser	100	
10.11.2021	SeaExplorer transfer ceremony from VUB to VLIZ	MSO - Warehouse 4, Ostend	organiser	22	
18.11.2021	Training SeaWatch-B: gekruide vis	InnovOcean site, Ostend	organiser	20	✔
08.12.2021	VLIZ-webinar: Virtual North Sea dive - Underwater heritage	Online	organiser	101	✔

VLIZ (co)organised 32 events with a total of 4,004 participants.

PUBLICATIONS

2021

DE GROTE REDE

- Issue 53 (May 2021) with leading articles on: Seals at the coast; the twilight zone; Revolution in robots at sea. Number of copies: 9,000 **(KPI12 publication)**
- Issue 54 (November 2021) with leading articles on: Seaweed, hype or emerging trend? The sense and nonsense of omega 3 supplements. Shark teeth from the Ostend Eastern Bank. Number of copies: 9,000 **(KPI12 publication)**

TESTEREP MAGAZINE

A total of 12 issues of the e-newsletter Testerep magazine appeared in 2021, including a total of 176 articles. **(KPI12 publication)**

VLIZ LIBRARY ACQUISITIONS

A total of 44 Library Acquisitions lists were forwarded by e-mail in 2021.

ZEEKRANT

Seys, J.; Bogaert, K.; Maelfait, H.; Tavernier, I., De Smet, B.; Fockedey, N.; Theuninck, S.; Verbeke, P.; Bauwens, S. (Ed.) (2021). Zeekrant 2021**:** annual publication of the Flanders Marine Institute and the province of West Flanders, Ostend. 8 p. Number of copies: 50,000 **(KPI12 publication)**

VLIZ SPECIAL PUBLICATIONS

- Nr. 87: Mees, J.; Seys, J. (Ed.) (2021). Book of abstracts – VLIZ Marine Science Day. Ostend, Belgium, 3 March 2021. VLIZ Special Publication, 87. Flanders Marine Institute (VLIZ): Ostend. 91 pp. https://dx.doi.org/10.48470/24

VIDEO AND AUDIO

- De Smet, B.; Seys, J. (2021). Video series 'VLIZ boekentip'. Series of book reviews by VLIZ employees. Flanders Marine Institute (VLIZ): Ostend. https://youtube.com/playlist?list=PLIFvvLeEE2QRVdp7vTYJDXRN3I7OykiUX **(KPI12 publication)**
- Waegemaeker, B.; Fockedey, N.; De Smet, B.; Seys, J. (2021). Video series 'Visit VLIZ virtually'. Series of 6 English spoken videos (with English and Dutch subtitles) focusing on a selection of VLIZ facilities that are not accessible due to Corona. Flanders Marine Institute (VLIZ): Ostend https://www.vliz.be/en/imis?module=ref&refid=338849 **(KPI12 publication)**
- De Smet, B.; Fockedey, N.; Wittoeck, J.; Seys, J. (2021). Video series 'VLIZ Achter de Schermen'. Flanders Marine Institute (VLIZ): Ostend https://youtube.com/playlist?list=PLIFvvLeEE2QQ0hDVwWuCcRtQLOfIzMGvw **(KPI12 publication)**

A1 PUBLICATIONS BY VLIZ EMPLOYEES (KPI1)

- Alonso, B.; Juan, C.; Ercilla, G.; Cacho, I.; López-González, N.; Rodríquez-Tovar, F.J.; Dorador, J.; Francés, G.; Casas, D.; **Vandorpe, T.**; Vázquez, J.T. (2021). Paleoceanographic and paleoclimatic variability in the Western Mediterranean during the last 25 cal. kyr BP. New insights from contourite drifts. *Mar. Geol. 437*: 106488. https://dx.doi.org/10.1016/j.margeo.2021.106488. https://dx.doi.org/10.1016/j.margeo.2021.106488
- Beerten, K.; Meylemans, E.; Kasse, C.; **Mestdagh, T.**; Van Rooij, D.; Bastiaens, J. (2021). Networks of unusually large fossil periglacial polygons, Campine area, northern Belgium. *Geomorphology (Amst.) 377*: 107582. https://dx.doi.org/10.1016/j.geomorph.2020.107582 https://dx.doi.org/10.1016/j.geomorph.2020.107582

PUBLICATIONS

2021 (CONTINUATION)

- Bennetsen, E.; Gobeyn, S.; **Everaert, G.**; Goethals, P. (2021). Setting priorities in river management using habitat suitability models. *Water 13(7)*: 886. https://dx.doi.org/10.3390/w13070886. https://dx.doi.org/10.3390/w13070886
- Calboli, F.C.F.; Delahaut, V.; Deflem, I.; **Hablützel, P.I.**; Hellemans, B.; Kordas, A.; Raeymaekers, J.A.M.; Bervoets, L.; De Boeck, G.; Volckaert, F. (2021). Association between Chromosome 4 and mercury accumulation in muscle of the three spined stickleback (*Gasterosteus aculeatus*). *Evol. Appl. 14(10)*: 2553-2567. https://dx.doi.org/10.1111/eva.13298
- Castagna, A.; Dierssen, H.; Organelli, E.; Bogorad, M.; **Mortelmans, J.**; Vyverman, W.; Sabbe, K. (2021). Optical detection of harmful algal blooms in the Belgian coastal zone: A cautionary tale of Chlorophyll c_3. *Front. Mar. Sci. 8*: 770340. https://dx.doi.org/10.3389/fmars.2021.770340
- **Catarino, A.I.**; Kramm, J.; Völker, C.; Henry, T.B.; **Everaert, G.** (2021). Risk posed by microplastics: Scientific evidence and public perception. *Current Opinion in Green and Sustainable Chemistry 29:* 100467. https://dx.doi.org/10.1016/j.cogsc.2021.100467
- Chen, H.; Stow, D.A.V.; Xie, X.; Ren, J.; Mao, K.; Gao, Y.; Chen, B.; Zhang, W.; **Vandorpe, T.**; Van Rooij, D. (2021). Depositional architecture and evolution of basin-floor fan systems since the Late Miocene in the Northwest Sub-Basin, South China Sea. *Mar. Pet. Geol. 126:* 104803. https://dx.doi.org/10.1016/j.marpetgeo.2020.104803
- Costello, M.J.; **Dekeyzer, S.**; Galil, B.; Hutchings, P.; Katsanevakis, S.; Pagad, S.; Robinson, T.; Turon, X.; **Vandepitte, L.**; **Vanhoorne, B.**; Verfaille, K.; Willan, R.; Rius, M. (2021). Introducing the World Register of Introduced Marine Species (WRiMS). *Manag. Biol. Inv. 12(4)*: 792-811. https://dx.doi.org/10.3391/mbi.2021.12.4.02
- Coughlan, M.; Roy, S.; O'Sullivan, C.; Clements, A.; O'Toole, R.; **Plets, R.** (2021). Geological settings and controls of fluid migration and associated seafloor seepage features in the north Irish Sea. *Mar. Pet. Geol. 123:* 104762. https://dx.doi.org/10.1016/j.marpetgeo.2020.104762
- Curto, M.; Le Gall, M.; **Catarino, A.I.**; **Niu, Z.**; Davies, P.; **Everaert, G.**; Dhakal, H.N. (2021). Long-term durability and ecotoxicity of biocomposites in marine environments: a review. *Rsc Advances 11*: 32917–32941. https://dx.doi.org/10.1039/d1ra03023j
- Cusa, M.; Falcão, L.; De Jesus, J.; Biolatti, C.; Blondeel, L.; Bracken, F.S.A.; **Devriese, L.**; Garcés-Pastor, S.; Minoudi, S.; Gubili, C.; Acutis, P.L.; Mariani, S. (2021). Fish out of water: consumers' unfamiliarity with the appearance of commercial fish species. *Sustainability Science 16*: 1313-1322. https://dx.doi.org/10.1007/s11625-021-00932-z
- **Custódio, M.**; Cartaxana, P.; Villasante, S.; Calado, R.; Lillebø, A.I. (2021). LED lighting and high-density planting enhance the cost-efficiency of *Halimione portulacoides* extraction units for integrated aquaculture. *Applied Sciences-Basel 11(11)*: 4995. https://hdl.handle.net/10.3390/app11114995
- **Custódio, M.**; Lillebø, A.I.; Calado, R.; Villasante, S. (2021). Halophytes as novel marine products – A consumers' perspective in Portugal and policy implications. *Mar. Policy 133*: 104731. https://dx.doi.org/10.1016/j.marpol.2021.104731
- Czub, M.; Nawala, J.; Popiel, S.; Brzezi ski, T.; Maszczyk, P.; Sanderson, H.; Maser, E.; Gordon, D.; Dziedzic, D.; Dawidziuk, B.; Pijanowska, J.; Fabisiak, J.; Szubska, M.; Lang, T.; Vanninen, P.; Niemikoski, H.; **Missiaen, T.**; Lehtonen, K.K.; Beldowski, J.; Kotwicki, L. (2021). Acute aquatic toxicity of arsenic-based chemical warfare agents to Daphnia magna. *Aquat. Toxicol. 230*: 105693. https://hdl.handle.net/10.1016/j.aquatox.2020.105693
- De Baere, K.; **Van Haelst, S.**; Chaves, I.; Luyckx, D.; Van Den Bergh, K.; Verbeken, K.; De Meyer, E.; Verhasselt, K.; Meskens, R.; Potters, G.; Melchers, R. (2021). The influence of concretion on the long-term corrosion rate of steel shipwrecks in the Belgian North Sea. *Corrosion engineering, science and technology 56(1)*: 71-80. https://dx.doi.org/10.1080/1478422x.2020.1807163
- **De Rijcke, M.**; **Shaikh, H.M.**; **Mees, J.**; Nauwynck, H.J.; **Vandegehuchte, M.B.** (2021). Environmental stability of porcine respiratory coronavirus in aquatic environments. *PLoS One 16(7)*: e0254540. https://dx.doi.org/10.1371/journal.pone.0254540
- **De Smet, B.**; Simon-Lledó, E.; Mevenkamp, L.; Pape, E.; Pasotti, F.; Jones, D.O.B.; Vanreusel, A. (2021). The megafauna community from an abyssal area of interest for mining of polymetallic nodules. *Deep-Sea Res., Part 1, Oceanogr. Res. Pap. 172*: 103530. https://dx.doi.org/10.1016/j.dsr.2021.103530
- **Declercq, A.M.**; Tilleman, L.; Gansemans, Y.; De Witte, C.; Haesebrouck, F.; Van Nieuwerburgh, F.; Smet, A.; Decostere, A. (2021). Comparative genomics of Flavobacterium columnare unveils novel insights in virulence and antimicrobial resistance mechanisms. *Vet. Res. 52(1)*: 18. https://dx.doi.org/10.1186/s13567-021-00899-w

- Egger, M.; Quiros, L.; **Leone, G.**; Ferrari, F.; Boerger, C.M.; Tishler, M. (2021). Relative abundance of floating plastic debris and neuston in the eastern North Pacific Ocean. *Front. Mar. Sci. 8*: 626026. https://hdl.handle.net/10.3389/fmars.2021.626026
- Galparsoro, I.; Pinarbasi, K.; Gissi, E.; Culhane, F.; Gacutan, J.; Kotta, J.; Cabana, D.; Wanke, S.; Aps, R.; Bazzucchi, D.; Cozzolino, G.; **Custodio, M.**; Fetissov, M.; Inácio, M.; Jernberg, S.; Piazzi, A.; Paudel, K.P.; Ziemba, A.; Depellegrin, D. (2021). Operationalisation of ecosystem services in support of ecosystem-based marine spatial planning: insights into needs and recommendations. *Mar. Policy 131*: 104609. https://dx.doi.org/10.1016/j.marpol.2021.104609
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VLIZ ACKNOWLEDGED

VLIZ was mentioned in the acknowledgements of 1,405 publications, including 1,111 peer-reviewed publications and 294 non-peer-reviewed publications.

PRESS RELEASES

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Flanders Marine Institute
InnovOcean site
Wandelaarkaai 7
8400 Ostend, Belgium

Tel.: +32 (0)59 34 21 30
E-mail: info@vliz.be
www.vliz.be