ANNUAL REPORT 2017

Kotka Maritime Research Association
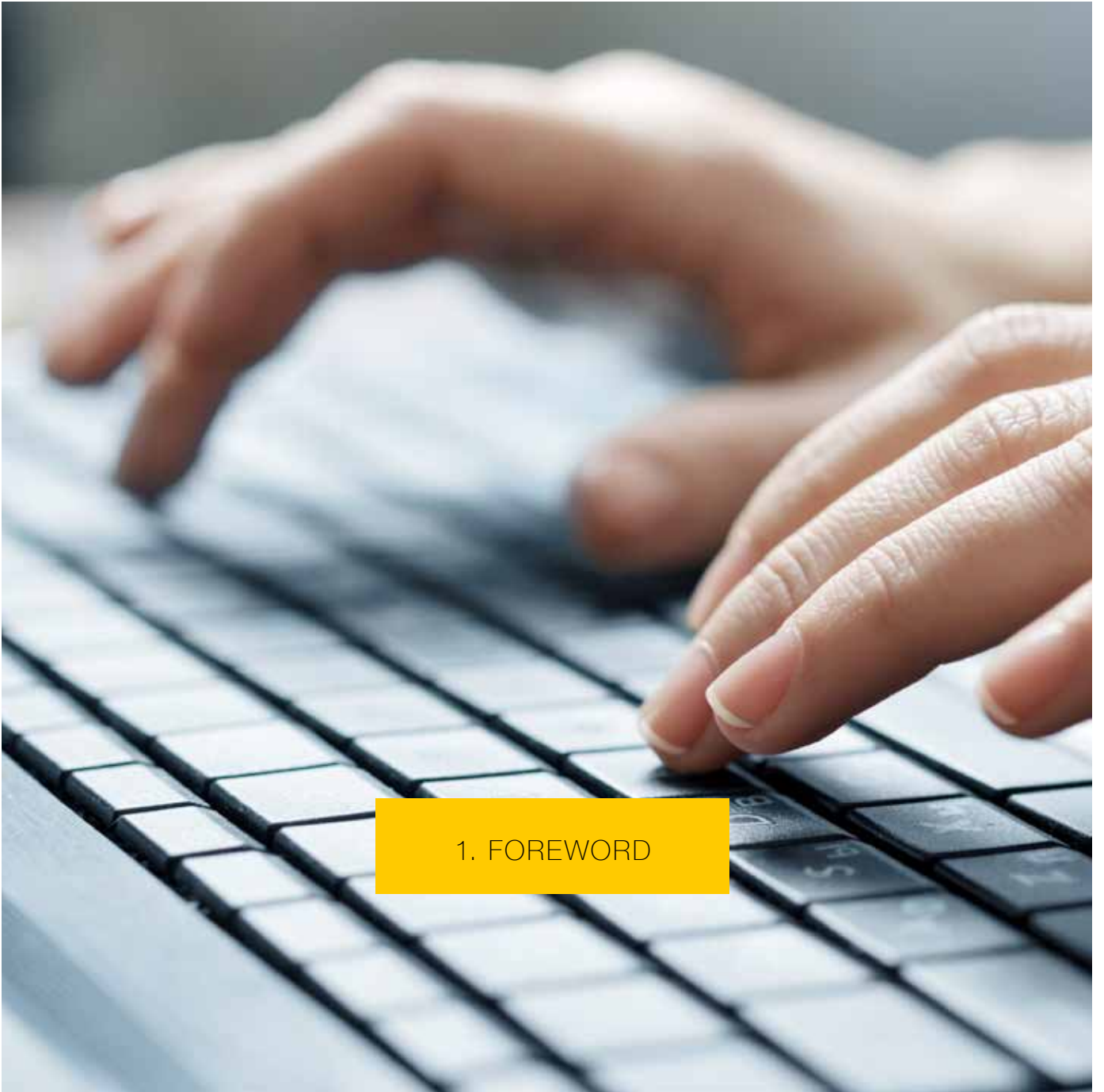
CONTENTS

1. FOREWORD

We had a successful year of 2017. Kotka Maritime Research Centre was awarded EU funding for three new projects. In total, we secured funding worth over five million Euros. We are proud of our wide and diverse network of international experts. In 2017, in addition to the neighboring Russia and Estonia, our project work expanded to the other Baltic Sea Region countries, too.
All this speaks volumes of our ability to produce relevant and competitive project applications.

Over ten years ago, we came up with an idea for a project then called MOBILE PORT. It was quite an ambitious idea. We wanted to find solutions to improve information streams in port operations. We believed that with modern information and communication technologies, the traffic flows would be improved, hence the number of accidents would be reduced. In 2011, MOBILE PORT was awarded a prize in national INNOFINLAND competition. However, no matter how inspiring the concept, it was too early for digitalization of ports.

Last October, however, a brand-new project DigiPort was launched. DigiPort concept is not too different from MOBILE PORT – and one could even say it is a continuum to the MOBILEPORT. DigiPort aims to find out how ports can develop their existing businesses and create new opportunities through digitalization and open data.

Ports are important hubs in the rapidly digitalizing traffic system. Thus the DigiPort is an opportunity to support participating ports in their efforts into digitalization. We are proud to be part of this work – thus we nominate DigiPort as our top project of the year 2017.

COMPLETE, our second new project, focusses on one of the major threats to the world's oceans and biodiversity, the invasive species. Among new projects is also INFUTURE, aiming to produce new knowledge-based innovations to foster inland waterway transportation.

Anna Kiiski
Executive Director

2. KOTKA MARITIME
RESEARCH CENTRE IN BRIEF

Kotka Maritime Research Centre brings together world-leading scientists on maritime transport, maritime safety and marine environment.

The international research centre was established in Kotka in 2005. The centre was founded as a response to a need for scientific research in the fields of maritime transport, maritime safety and marine environment.

Kotka was an ideal location for the research centre. Kotka is a home for the biggest universal export port in Finland, the Port of HaminaKotka. The local university, the South-Eastern Finland University of Applied Sciences, is known for maritime education. The sea city of the Maritime Centre Vellamo and the aquarium Maretarium is a go-to destination for various maritime events.

A wide cooperation

Researchers from the University of Helsinki, the University of Turku, the Aalto University and the South-Eastern Finland University of Applied Sciences form the core of the centre.

Beyond academia, the research centre works closely with a great number of experts in the fields that our research focusses on. A few examples could be the Finnish Environmental Institute, Natural Resources Institute, Finnish Transport Safety Agency, Finnish Transport Agency and Metsähallitus, development companies Cursor Ltd and Posintra Ltd and the Etelä-Kymenlaakso Vocational College.
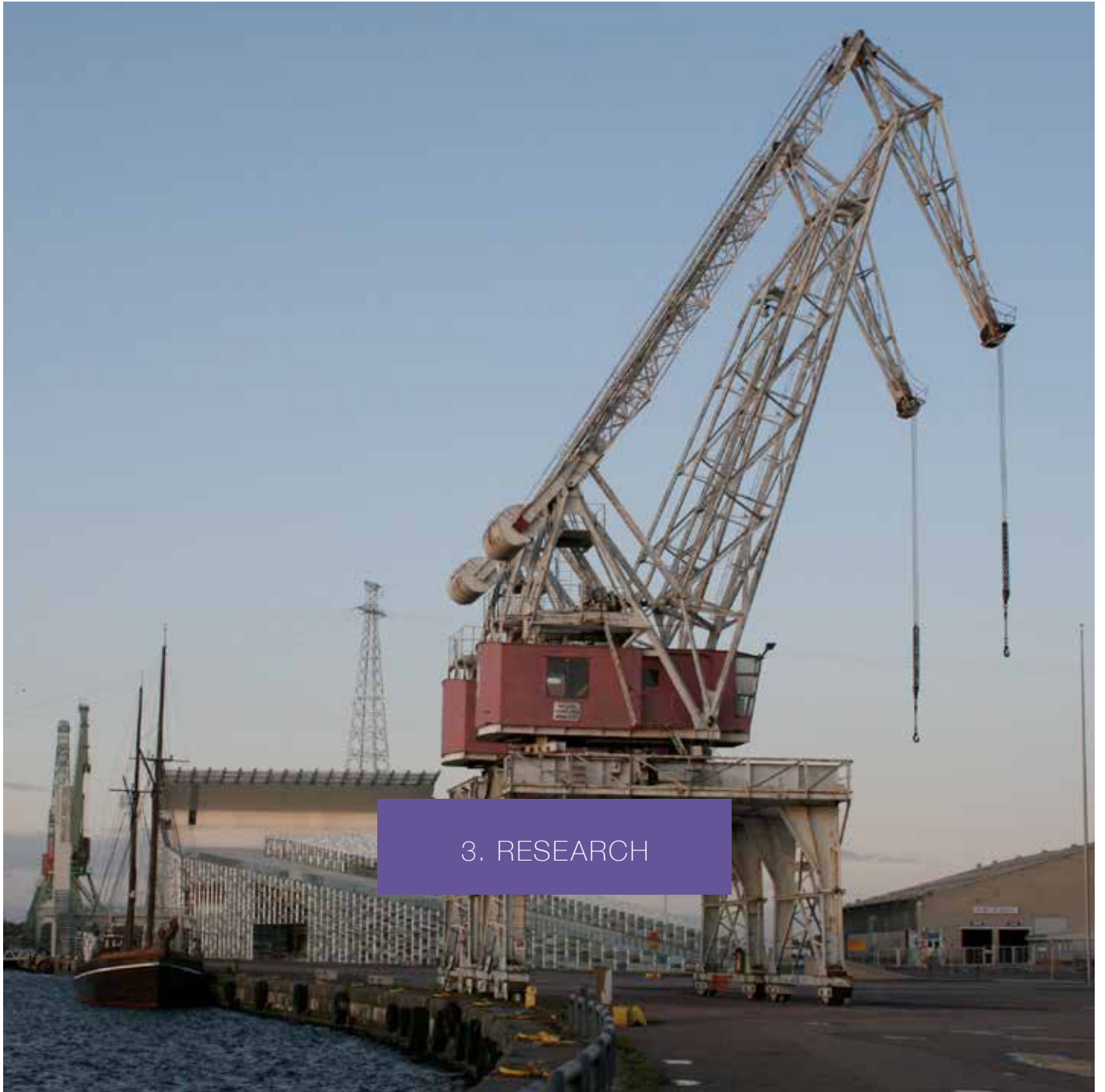
3. RESEARCH

Pentti Kujala

MARINE SAFETY
Aalto University

Marine safety research develops concepts, methods and frameworks for safer maritime operations. The Risk Analysis and Safety Science are applied to specific MARITIME problems. Doing this we know how maritime risks can be effectively managed.

Safety is a multidisciplinary science, which requires systems-theoretic accident models, a critical but constructive attitude to improve state-of-the-art both in terms of foundations and applications, cross-disciplinary interaction, statistical techniques (Bayesian Networks, Generalized Linear Models), data analysis and modelling, as well as expert elicitation procedures.

The key personnel are professor Pentti Kujala, Post Docs Floris Goerlandt, Otto Sormunen, Osiris Valdez Banda, Martin Bergström and doctoral students Mikko Suominen, Mikko Kotilainen, Roman Repin, Lu Liangliang, Fi Lang

No 39 in the Shanghai ranking of Marine/Ocean Engineering

Tommi Inkinen

MARITIME INDUSTRIES AND LOGISTICS
University of Turku

The research in the University of Turku, Center for Maritime Studies offers diverse research agenda in the fields of maritime industries and logistics. It combines business studies, economics together with environmental and social sciences. The centre has specialists in traffic and ports in the Baltic Sea, logistics chains and infrastructure and in marine industry sector. We coordinate the interdisciplinary environmental research supporting marine spatial planning and integrated coastal zone management.

The research has three main spearheads

1) Shipping and maritime logistics including: Maritime transport and infrastructure; Port networks and port operations; Maritime safety studies; pilotage operations; National security of supply
2) Maritime cluster including: Development of marine industries; Cluster dynamics and economic impacts; Corporate social responsibility in shipping operations together with studies focusing on Blue Growth
3) Marine environment and spatial planning including: Efficiency and impacts of environmental regulations in shipping; Environmental status of ports; Marine spatial planning; Shipping and offshore activities in the Arctic; Performance and impact of the European ports system; Integrated knowledge base and management system for ports.

The key personnel are professor Tommi Inkinen and senior researcher Reima Helminen.

MARINE ENVIRONMENT
University of Helsinki

The Fisheries and Environmental Management Group focuses on the interaction between ecosystems and human society.

The research interests
1) Decision and risk analysis of renewable resources and biodiversity
2) Identification and quantification of risks in the use of natural resources and in the various maritime activities
3) Integrating different sources of data and knowledge: Bayesian analysis
4) Cross disciplinary modelling of exploitation processes of natural resources in the face of risks and uncertainty in the information.

All previous applications focused either on the fisheries science or on oil spill risk analysis. Smartsea and Wise projects focus on more generic risks.

In the aquatic ecosystems it is people who cause the main risks. Therefore, we need human sciences to solve the problem. Our research projects combine biology, limnology, fisheries management, geography and sociology. Mathematical science produces risk models that have foundation in these sciences.

Bayesian analysis forms the backbone of our environmental modelling approach. It provides an effective tool to learn from various information sources. These sources include data, models and their theoretical background, and expert knowledge. For example, we have estimated the effectiveness of an oil combating fleet to collect oil from an oil spill.

In the oil spill impact analysis, it is important to develop a methodology, which allows learning from previous accidents. It is important that uncertainties in impact predictions are high. By creating Bayesian models that can learn from previous accidents, it is possible to have less uncertainties about future accidents.

The key personnel are professor Sakari Kuikka, Post Docs Annukka Lehikoinen, Inari Helle and doctoral students Suvi Ignatius, Emilia Luoma and Tuuli Parviainen.

Sakari Kuikka

Justiina Halonen

Olli-Pekka Brunila

MARITIME SAFETY AND MANAGEMENT OF ENVIRONMENTAL RISKS
South-Eastern Finland University of Applied Sciences Xamk

Xamk's applied research focuses on logistics and maritime. In maritime the focus is on maritime safety and managing environmental risks related to the maritime operations. The main research topics include pollution prevention and spill response management as well as maritime emergency response and distress operations.

In logistics, the focus is on green transportation, innovative business concepts and ways to connect hubs and clusters.

Digitalisation and environmental issues are cross-cutting themes, both in logistics and in maritime.

Research projects are need-based and carried out in close cooperation with end-users providing practical, ready-to-use research results. Maritime and logistics RDI activities were conducted in a working closely with authorities, companies, and public sector organisations.

The key personnel are research director Mervi Nurminen, research manager Justiina Halonen (maritime safety and oil spill response) and research manager Olli-Pekka Brunila (logistics) and RDI personnel Elias Altarriba, Emmi Rantavuo, Antti Lanki, Mikko Pitkäaho, Krista Surakka, Joel Kauppinen, Tommy Ulmanen and Tomi Oravasaari.

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4. DOCTORAL DISSERTATIONS

Safety and risk management in the planning and executing of winter navigation operations should be improved and simplified.

Osiris Valdez Banda, Aalto University

Maritime transport is commonly categorized as one of the riskiest industry sectors. In Finnish sea areas, the risks increase during winter navigation when ships have to navigate in sea ice conditions. To support and ensure the integrity of people, ships, and environment during winter navigation, different safety and risk management strategies are developed.

This thesis provides a review of the current safety performance of winter navigation in Finnish sea areas and proposes alternatives to control and improve it. To this end, the thesis first provides understanding and evidence of the risks threatening the safety of the winter navigation system. Ship collisions during ship independent navigation and ship collisions in convoy operations in medium and severe ice conditions are identified as the accidents with highest risk.

These identified contexts are the basis for developing a model that analyses the risk of collision during winter navigation. The model combines the analysis of the role of humans in the execution of the operations and operational aspects of the performance of ships in ice conditions. It is used as a risk management tool that proposes risk control options and assesses their potential efficiency for supporting and improving the safety performance of winter navigation. The assessment of the risk control options points out the need for improving and simplifying safety and risk management in the planning and executing of winter navigation operations.

Based on this, the thesis offers a method for executing a systematic application and performance measurement of the requirements contained in maritime safety management regulations. Moreover, the thesis introduces a process for designing maritime safety management systems based on a system engineering approach and proposes a tool for reviewing safety performance. Through a case study, these proposed alternatives are combined for designing a safety management system for one of the main responsible actors controlling and ensuring the safety of ship navigation. This case study makes a representation of the advantages in the management of maritime risk and safety, with a special focus on winter navigation.

Utilizing embedded knowledge in maritime transportation system to manage the risk of ship grounding.

Arsham Mazaheri, Aalto University

Most of the risk models for ship-grounding accidents do not fully utilize available evidence. They are merely based on accident statistics and expert opinions. The main issue with such models is that they do not necessarily reflect the reality to the extent required.

This thesis proposes an evidence-based framework for building evidence-based risk models for probabilistic assessment of ship grounding. In order to build the evidence required for creating the evidence-based risk model, traffic characteristics as primary source of data are extracted from AIS data and accident statistics of the Gulf of Finland. Additionally, using expert knowledge of the local pilots in the Gulf of Finland, a location dependent and semi-quantitative index as Waterway Complexity Index is defined to assess the dependency of ship grounding and navigational difficulty of a waterway to handle a ship. Moreover, ship grounding incident and accident reports from Finnish, Swedish, and British maritime authorities are utilized as primary and secondary sources of data respectively to build the required evidence for constructing the risk model.

In this thesis, two frameworks are introduced to review and extract information from the reports. A new version of Human Factors Analysis and Classification System is introduced as a framework to review the grounding accident reports. A new positive taxonomy as Safety Factors, based on high-level positive functions that are prerequisite for safe transport operations, is introduced to review the grounding incident reports. Utilizing the proposed framework for evidence-based risk modeling as well as the built evidence from primary and secondary sources of data and expert knowledge, a Bayesian Network risk model is developed in this thesis for assessing the probability of ship grounding accidents.
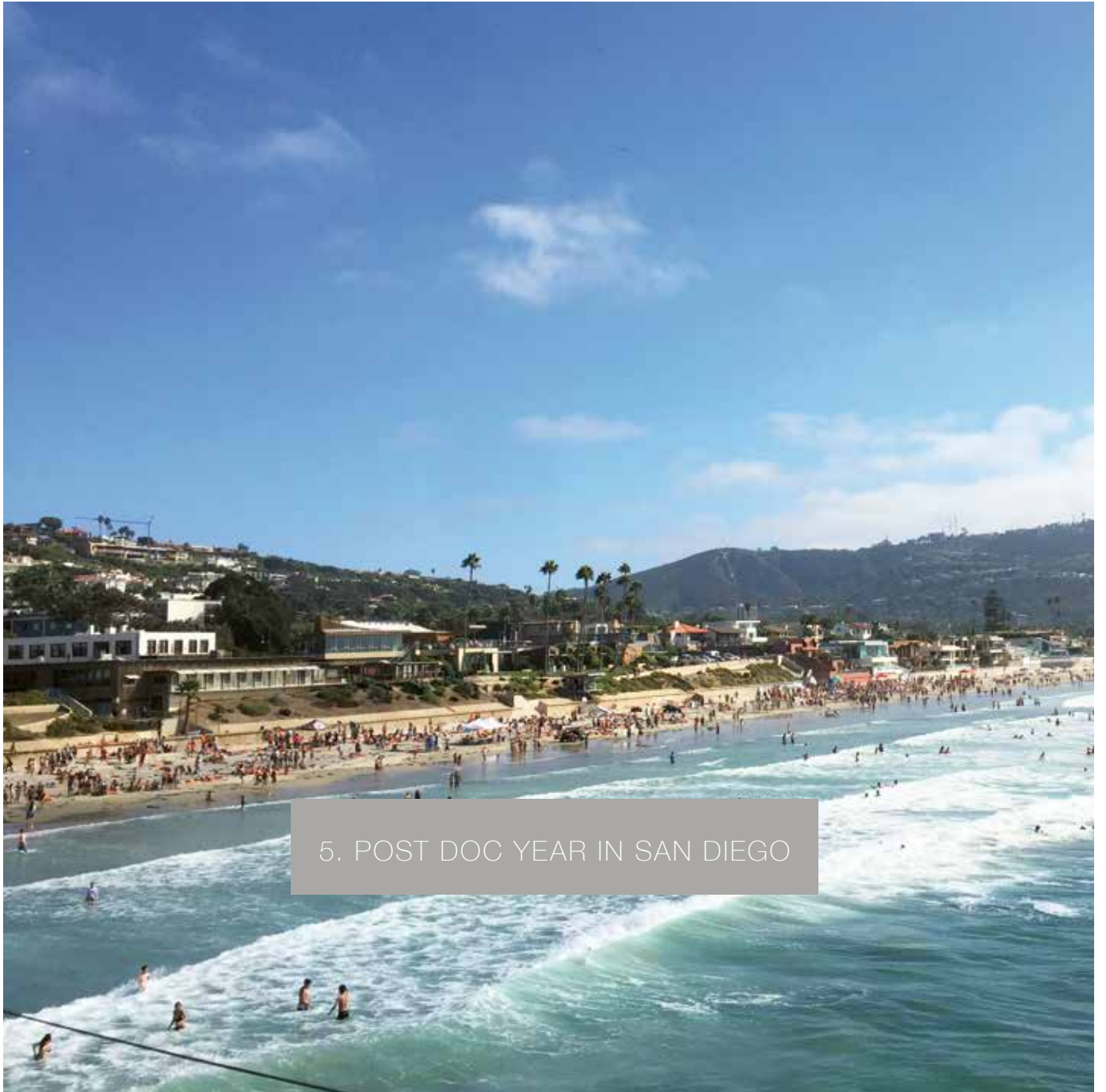
5. POST DOC YEAR IN SAN DIEGO

Riikka Venesjärvi

In 2017, Riikka Venesjärvi (University of Helsinki) visited the University of California San Diego as a postdoctoral researcher. The aim of her visit was to evaluate the current economic methods to value coastal and marine ecosystem services. Riikka defended her doctoral thesis in 2016 and in her research, she studied how the resources in oil spill risk management should be allocated to improve the marine conservation.

The University of California San Diego is a public research university located in the La Jolla neighborhood of San Diego in the United States. It is recognized as one of the top 15 research universities worldwide. In the university Riikka collaborated with Richard Carson, a professor in Environmental Economics and a principal investigator on the economic damage assessments for the Exxon Valdez and Deepwater Horizon oil spills. The professor Carson taught Riikka valuation techniques that drive policy decisions.

San Diego is a major city in California and it is the eighth-largest city in the United States. The city is known for its mild year-round climate, natural deep-water port, extensive beaches, long association with the United States Navy, and recent emergence as a healthcare and biology development centre.

The visit was a part of the mobility plan in the SmartSea project funded by the Strategic Research Council of Academy of Finland. Riikka received additional travel funding from the Finnish Maritime Foundation.

6. TOP PROJECT: DIGIPORT

DigiPort examines the current state of digitalisation in the Finnish ports and identifies the best ways to support the ports in their digitalisation efforts.

Reima Helminen, University of Turku
Janne Saarikoski, Kotka Maritime Research Association
Tommy Ulmanen, South-Eastern Finland
University of Applied Sciences

Successful digitalisation will enhance cost-efficiency as well as improve efficiency and sustainability of the ports.

"We are determined that Finnish ports can profit from digitalisation and the use of open data. The ports are important traffic hubs. Thus it's vital that the ports are not left behind while the others in the system elsewhere are going digital", states project manager Janne Saarikoski.

The current state of digitalisation in the ports will be examined through interviews, surveys and literature reviews. Workshops will give port communities a platform to share operational issues that could be improved through digitalisation.

Then project will create a new kind of operating model based on open data. The focus will be on the infrastructure – such as traffic routes, technical systems, buildings, cranes, piers.

Open data could benefit the whole port community. Thus we will organise training courses for port data owners to discuss opening of data. The data will then be gathered to a server and published as a port infrastructure Data Catalogue.

Open data resources will enable development of port operations, support decision-making and create new kinds of value-added services.

The Finnish Transport Agency has opened data of other models of transport, and DigiPort ensures that open data of the ports will be compatible with the date of the other sources.

OPEN DATA

The main event, Hack the Port hackathon, will be organized in the spring of 2019 to inspire innovations on use of open data. The best teams will be rewarded and encouraged to participate in the Ship 2019 start-up festival.

The strategies of the Finnish Ministry of Transport and Communication on intelligent robotics and open automation ecosystems guide the work of DigiPort.

Consortium   Lead partner:
Kotka Maritime Research Association

Other partners:
South-Eastern Finland University
of Applied Sciences, University of Turku,
The Finnish Information Society Development
Centre (TIEKE)

Implementation period:
1.10.2017–30.9.2019

Total budget:
366 347 EUR

Funding: European Regional Development Fund ERDF,
Port of HaminaKotka Ltd., Port of Turku Ltd. and
City of Kotka
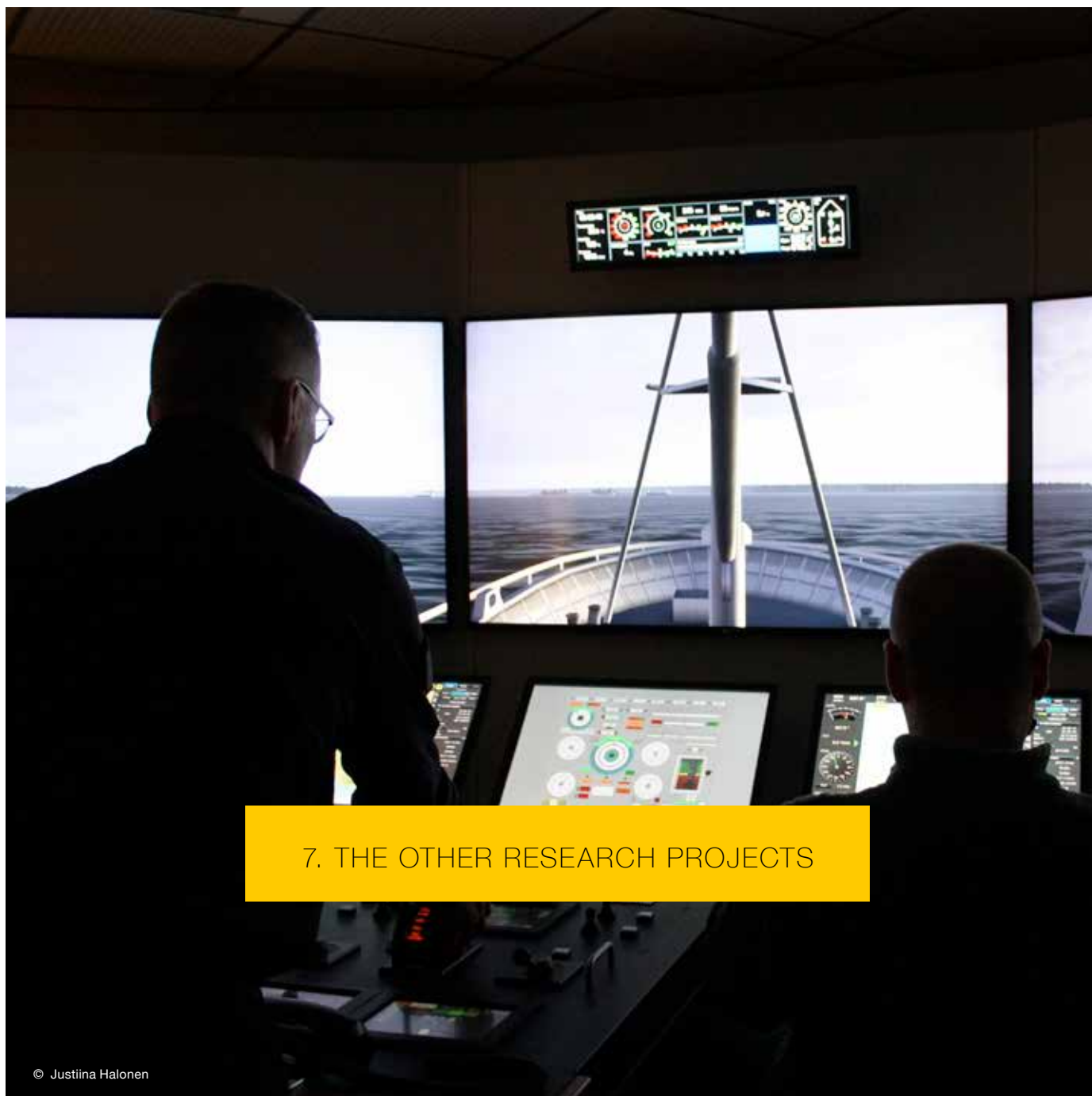
7. THE OTHER RESEARCH PROJECTS

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CEARCTIC
The Lloyd's register Foundation research center of excellence for Arctic shipping and operations
Pentti Kujala, Mihkel Körgesaar, Mikko Suominen, Mikko Kotilainen and Roman Repin, Aalto University

Aalto University is chairing the new centre to cover all the important topics crucial for the risk-based design of ships, shipping and other Arctic operations.

CEARCTIC hired 12 doctoral students and 2 post docs. In total, 19 journal papers have been approved since 2013. In 2017, two doctoral students graduated, three master thesis were completed, five journal papers were accepted and eight were submitted for publication, 10 conference presentations were given, and 41 conference papers were prepared.

During SMM 2017 in Hamburg, a public seminar was held to present the main results of the project for an audience of seventy people.

www.cearctic.aalto.fi/en/

COMPLETE
Completing management options in the Baltic Sea Region to reduce risk of invasive species introduction by shipping
Miina Karjalainen, Kotka Maritime Research Association
Inari Helle and Annukka Lehikoinen, University of Helsinki
Elias Altarriba, Marko Piispa and Mikko Nykänen, South-Eastern Finland University of Applied Sciences

Invasive species are identified as a major threat to the world's oceans and biodiversity. One important vector introducing harmful aquatic organisms and pathogens in marine environment is shipping. There are two main ways ships spread alien species – through ballast water and hull fouling.

COMPLETE project will provide a comprehensive approach on this complex issue. Through delivering required management tools and practical guidelines, it will propose a harmonized way to comply with the requirements set by the IMO's Ballast Water Management Convention in the Baltic Sea region. Also, IMO biofouling guidelines provide useful information on practices to minimize the role of this pathway. The question is, to what extent these guidelines are followed by shipping industry, how the awareness is and how applicable these guidelines are for the Baltic Sea region.

The results from the project can be used for harmonizing biofouling management and planning a proposal for a biofouling strategy for the Baltic Sea region. In three years, COMPLETE will develop management strategies and tools specifically for the Baltic Sea. By addressing one of the key challenges in the region, the goal of the project is to develop operational frameworks and provide user-oriented tools, in close cooperation with relevant stakeholders, to make shipping more environmentally friendly.

projects.interreg-baltic.eu/projects/complete-113.html

GOHERR
Integrated governance of Baltic herring and salmon stocks involving stakeholders
Suvi Ignatius, University of Helsinki

The aim of GOHERR is to develop a regionalised governance framework involving stakeholders, and a related decision support tool for the ecosystem-based management of the Baltic herring and salmon stocks. The framework combines biological, public health and social scientific perspectives related to the use and management of these two interrelated keystone fisheries of the Baltic Sea. Thereby it contributes to developing the ecosystem approach to fisheries, which requires holistic thinking and comprehensive representations of the ecosystem, including social components.

Adaptive management and integrated management are seen as tools for responding to the challenge of implementing the ecosystem approach.

The following will be analysed:
1) what are the socio-cultural and political prerequisites for successful regionalised fisheries governance, and what kind

of institutional, organisational, structural and attitudinal flexibility is needed;

2) if and how integrated fisheries governance can benefit the sector-based management of Baltic herring and salmon stocks, the stakeholders, and eventually consumers; and

3) how governance at the regional level can be linked to governance at the national and international levels.

SCAROIL
Simulator Training for Cargo Handling and Oil Recovery
Emmi Rantavuo, Justiina Halonen, Antti Lanki, Perttu Juvonen, South-Eastern Finland University of Applied Sciences and Simo Knutas, Etelä-Kymenlaakso Vocational College Ekami

The project develops training on oil spill response for regional fire and rescue services and other response authorities. The oil spill training programme aims to utilize new educational methods; e-learning and simulator based training. In addition to fully exploiting the existing navigational bridge simulators, an entirely new oil recovery simulator has been developed. This simulator is designed to model the oil recovery process; recovery method, rate and volume.

The new simulator enables the creation of a comprehensive training programme covering training tasks from a distress call to the completion of an oil spill response operation. Integration of a navigational bridge simulator and the new oil recovery simulator creates a unique learning environment in which the marine oil spill response operations can be demonstrated and new response methods tested.

The structure of the training programme, as well as the training objectives, are based on competence and education surveys. The training programme has been piloted twice during the project. The shifts in competence levels of the participants were evaluated in order to demonstrate the actual efficiency of the training. The results convinced that the simulator training is a viable tool to improve the operational capability of the responders.

SEA-EFFECTS BC
Shipping Emissions in the Arctic (Black Carbon)
Olli-Pekka Brunila, Katariina Ala-Rämi and Tommi Inkinen, University of Turku

The project aims at more reliable and unequivocal basis of black carbon emission evaluation in shipping environment, and towards new options for on-line monitoring techniques. Definitions of sampling and sample treatment are essential for reliable measurements in ship environment, particularly when using new fuels and emission control technologies. This will also support generation of the reliable ship emission factors. In-depth analysis of other emissions in parallel to black carbon measurements increase understanding of the results obtained with different techniques, which is a prerequisite for development. Business opportunities in the field of emission measurements are evaluated, particularly as concerns sensor and information technology.

www.vtt.fi/sites/sea-effects

SMARTSEA
Sustainable Growth in Gulf of Bothnia
Riikka Venesjärvi, University of Helsinki

The project aims to provide science-based guidance and new innovations for the sustainable use of the Finland's marine resources. To meet this challenge, we have formed a team of leading experts in marine biodiversity, fisheries, marine geology, ocean physics and modeling, coastal engineering, maritime spatial planning and geography, and created a strong linkage to relevant stakeholders. The SmartSea project will create new potential for development and growth of the Gulf of Bothnia region by providing high quality data and efficient tools for marine spatial planning.

A part of the "Climate-Neutral and Resource-Scarce Finland" program funded by the Strategic Research Council of Academy of Finland.

www.smartsea.fmi.fi/

STORMWINDS
Strategic and operational risk management for wintertime maritime transportation systems
Floris Goerlandt, Osiris Valdez Banda, Otto Puolakka, Lu Liangliang, Aalto University

The STORMWINDS project aims to contribute science-based analyses and practice-oriented tool developments for enhancing maritime safety and accident response during winter in the Northern Baltic Sea.

Consequently, regional and sub-regional policies highlight the need for developing preventive measures to improve the safety of navigation in ice conditions. A key aspect is strengthening the cooperation between organizations facilitating safe navigation, and safety management tools available to these organizations, enhancing both accident preventive and response measures.

A first research theme builds on systems-theoretic accident theories to develop an indicators-based safety management model for Vessel Traffic Services.

A second theme focuses on e-Navigation, where various algorithms and testbed tools are developed for providing enhanced information about safe routes and operability of ships in ice conditions.

A third research theme addresses pollution response in winter conditions through a risk analysis and response effectiveness assessment of oil spills in the Northern Baltic Sea. Also, it develops tools for supporting operational (tactical) decision making. Thus, BONUS STORMWINDS aims to advance maritime risk analysis and management, taking an interdisciplinary approach to improve maritime safety.

Funded by Baltic Sea Research and Development Programme BONUS (2015-2017).

www.stormwinds.aalto.fi

SÖKÖSaimaa
Oil Spill Response Management Model for Saimaa Inland Waters
Emmi Rantavuo, Joel Kauppinen, Mikko Pitkäaho, Elias Altarriba, Justiina Halonen & Krista Surakka, South-Eastern Finland University of Applied Sciences

The Lake Saimaa is the largest lake in Finland and the fourth largest lake system in Europe. Inland waterways of Saimaa are considered as a part of the main transport corridor in the trans-European transport network and is also exposed to the risk of land-based oil-discharges.

Inland oil spill response management model is based on the results of risk analysis on transportation and storage of oils in Lake Saimaa district, and the oil drift calculation models produced for identified high-risk locations. Modelling enables creation of scenario-based, site-specific contingency plans crucial for inland waters where response strategy is to be selected in a very short space of time. In Saimaa waterways where shores are near, window of opportunity to conduct an effective on-water response is further reduced due to the fast currents. In order to facilitate identification of vulnerable areas and establishing protection priorities and response strategy, management model includes easy-to-use decision support tools for response managers and on-scene response teams. Risk assessments, planning spill response logistics including transportation and storage points, mapping sensitive areas and species are all carried out during this project to operate as a frame to preparedness planning. Project results are gathered in a web-based manual.

SÖKÖSaimaa project is initiated by the regional oil spill authorities. It is a joint effort of designated spill response specialists representing the the Rescue Services of South Karelia, North Karelia, South Savo and North Savo together with the Finnish Transport Agency, the Emergency Service College, the Finnish Environment Institute and the Centres for Economic Development, Transport and the Environment of South Savo, North Savo, North Karelia and Southeast Finland (ELY Centres).

30MILES
Development of services for lively water tourism in the Eastern Gulf of Finland
*Tarja Javanainen, Kotka Maritime Research Association*

The project 30MILES aims at improving the overall service level and safety in small ports and the waterfront. The Eastern Gulf of Finland has lacked a network of small ports with a good service level. As better small ports increase the attractiveness of the region, the project aims to organize small ports into a cooperating network in the distance of every 30 miles. The project establishes a ring of ports around the Eastern Gulf of Finland to focus on joint development of sustainable and safe port services and marketing activities. Joint efforts are made to improve the services offered in small ports and help them receive better visibility from the potential visitors. Effective marketing is implemented to inform the visitors and to create sustainability for the local businesses.
As a result, the service level increases in 12 small ports in the Eastern Gulf of Finland. The information about the services of the ports and accessibility is clearly presented. The improvements attract new businesses and investors, which in turn attract more visitors to the area.

www.merikotka.fi/30MILES
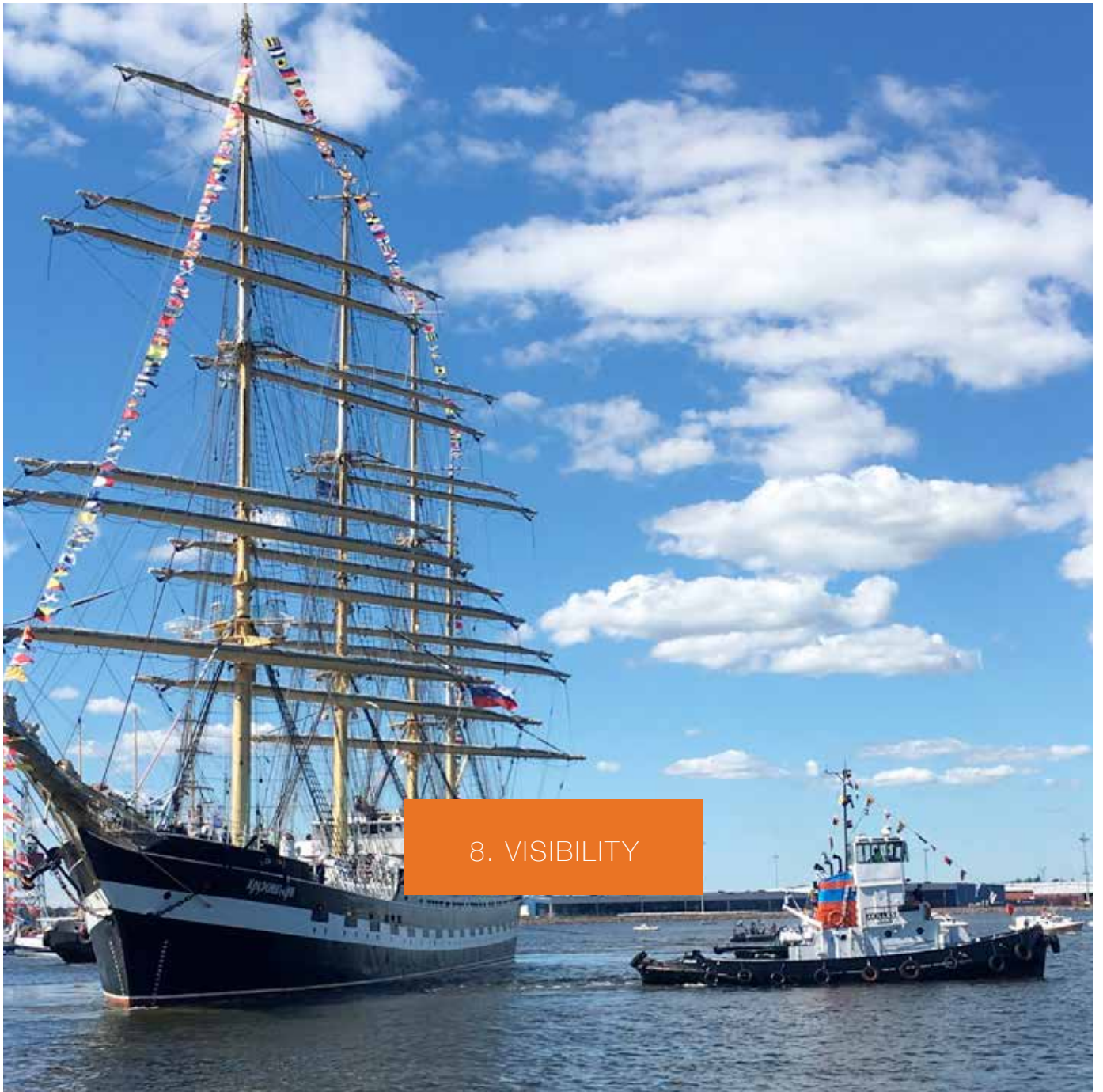
8. VISIBILITY

As we produce scientific evidence to improve maritime safety and sustainable maritime transport, we are committed to advancing evidence-based decision making in private and public sectors alike. In addition to our research projects, this is done through outreach and visibility.

We coordinate the Maritime Assembly Network of maritime professionals from Finland, Estonia and Russia. The network supports the Baltic Sea Strategy and creates cooperation projects between the three countries. Last year, we held two seminars, one in St. Petersburg and one in Turku.

It is important to us that as many as possible benefits of our work. Thus we organized several discussion forums in the private sector. Last year the two main themes were development of inland waterways and the digitalisation.

Proud of its origin, Kotka Maritime Research Centre engages also regionally. We belong to a local business networks, such as FinnHub and Kymenlaakso Chamber of Commerce. Also, we are acting in the Information Centre Vellamo, a research and learning centre at the Maritime Centre Vellamo.

The Baltic Sea Village is one of our main outreach events. The village provides practical advice on how to promote the wellbeing of the Baltic Sea. The family-friendly event takes place in July during the Kotka Maritime Festival. In 2017, we raised awareness on eutrophication and microplastics.
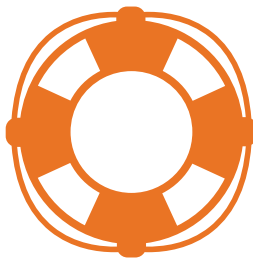
FACTS AND FIGURES

VISION

Merikotka is **a pioneer** and **a respected research centre** in the field of multidisciplinary maritime research
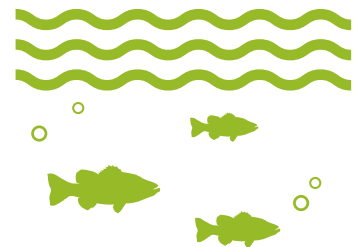
RESEARCH THEMES

Maritime safety
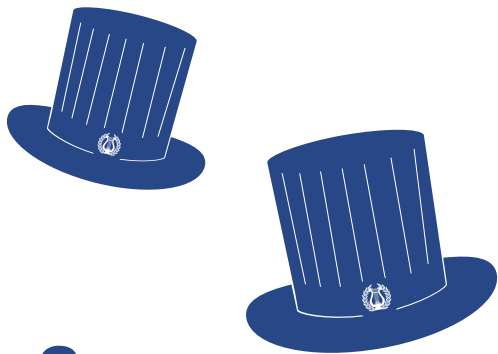
Maritime industries & logistics

Marine environment

MISSION

Research for **sustainable maritime transport**

2 DOCTORAL DISSERTATIONS

SCIENTIFIC ARTICLES 34

FUNDING 3,7 M€

THE VALUES

1. WORKING TOGETHER
Learning and solving through interdisciplinary collaboration

2. INNOVATIVENESS
Creating novel and competitive solutions through excellent science

3. HONESTY
Building trust by understanding and communicating the limitations of our research

4. RESPONSIBLY SERVING SOCIETY
Supporting society by proactive value creation and preservation

EMPLOYEES 33

KOTKA · CITY BY THE SEA · MERIKAUPUNKI

Turun yliopisto
University of Turku

SYKE

Luke
NATURAL RESOURCES
INSTITUTE FINLAND

MARETARIVM

A"
Aalto-yliopisto
Teknillinen korkeakoulu

XAMK
Kaakkois-Suomen
ammattikorkeakoulu

HELSINGIN YLIOPISTO
HELSINGFORS UNIVERSITET
UNIVERSITY OF HELSINKI

cursor

EKAMI

TraFi

Liik
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METSÄHALLITUS

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www.merikotka.fi