Catching THE Potential

An overview of best practices

What is currently happening in sustainable fisheries training

ProSea

The content of this memo represents the views of the author only and is his/her sole responsibility; it cannot be considered to reflect the views of the European commission and/or the executive agency for small and medium-sized enterprises (EASME) or any other body of the European union. The European commission and the agency do not accept any responsibility for use that may be made of the information it contains.

30 April 2020

With the contribution of the European Maritime and Fisheries Fund of the European Union.

TABLE OF CONTENTS

BEST PRACTICES

PROSEA SUSTAINABLE FISHING TRAINING

The ProSea Foundation is a non-profit organization that specializes in educating marine professionals. ProSea's mission is to teach, inspire, and convince current and future marine professionals to protect their working environment – the sea – with the long-term goal of ecological and commercial sustainability.

ProSea believes that marine professionals have a special relationship with the sea and a special responsibility toward the ocean. Anyone who works at sea needs to have basic knowledge of the ocean. Awareness of the sea combined with understanding of the effect that human activities can have on the sea and its resources should be a part of each marine professional's education. ProSea offers this knowledge and instigates marine awareness to fulfil its mission and to achieve ecological sustainability of the oceans, a sustainable workplace for those at sea and finally sustainable profits from activities at sea.

Sustainable Fishing Training series

Over the past fifteen years, ProSea has developed and executed three different trainings that inspire sea fishers to increase the sustainability of their fishing operations.

What training	For whom	Course duration
1. Fishing with a future	Future fishers (students at fishing colleges)	Four consecutive days
2. Cooperation in a sustainable fish supply chain	Practicing fishers and fish vendors: with the ambition of increasing cooperation in a sustainable fish supply chain	Three workshops of two consecutive days over the course of nine months
3. Future leaders' training	Practicing fishers and fish vendors: with the ambition of becoming future leaders in a sustainable fishing industry	Six workshops of two consecutive days over the course of two years

For each of these three trainings, a more detailed program overview is provided in this report.

Besides these trainings, ProSea has published a brochure about fish stock assessments (see annex 1), which was developed in cooperation with the scientific institute Wageningen Marine Research and the Dutch fishing sector. This brochure explains in steps how scientists assess the fish stocks and how fish stocks are managed within the European Union.

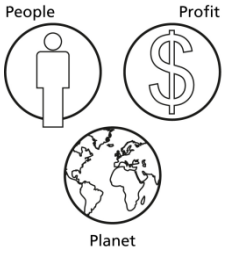
BASIC ELEMENTS

Each ProSea training programme contains three basic elements:

1. **Content & theory** – background knowledge and current information.
2. **Communication skills** – hear, see, then practice, and practice again.

3. **Sustainability futuring** – learn how to develop personal strategies and specific future plans.

Content & theory: Knowledge is power. For example, understanding concepts of marine ecology, fisheries management, and price forming in the supply chain, is essential for a healthy and sustainable business. Participants get up to date and independent information about all aspects of sustainability: Planet (environmental challenges), Profit (economic viability), and People (acceptance of your business by society – a license to operate). Guest lectures by experts in combination with Q&A sessions are also part of most trainings.



Communication skills: Crucial for the successful implementation of knowledge and awareness gained during the training, as well as, for cooperation, sharing ideas, and discussing important issues. Communication skills include organizing and participating in effective group meetings, personal conversations and discussions (e.g. talking with someone you disagree with). A short theory lesson, demonstrations and exercises to practice (with an actor) are part of each training.


Sustainability

Sustainability futuring: Enable individuals to create their own sustainability strategy including plans for the near future. This takes place throughout the training in the form of homework, exercises with opinion forming, actual futuring (both as individual and within a group) and an individual action plan.

FISHING WITH A FUTURE

ProSea has been organising sustainable fishing trainings for students of fishing colleges since 2004. Although the course content has developed and changed over the years, the course still has the following general content:

- Day 1: Sustainability (seen as a balance between the three P's: People, Planet and Profit), marine environment (planet P), marine spatial planning.
- Day 2: Value chain & entrepreneurial skills (Profit P) and relation between society and the fishing industry (People P).

- Day 3: Fisheries management & fish stock assessment and People P - continued (communication skills).
- Day 4: Environmental challenges e.g. marine litter (Planet P) and sustainability featuring.

The table presented below provides the training curriculum for a sustainable fishing training as conducted at Dutch and Belgian fishing colleges. The content of this training is part of the curricula of students who are trained to become fishers at all Dutch maritime academies since 2011. In the table an explanation is given on the training content.

Catching THE Potential

Training content	Description
Day 1	
Introduction - global context, sustainable development	Background story on why the world is talking about sustainable development and the participants are explained what it means for fishers (Triple P approach)
Personal opinion workshop	Participants are asked for their opinion on sustianability in a workshop
Marine Ecology	Crash course ecology: why is the ocean important? How does it work? (Planet P)
Excursion marine environment	Depending on the location we try to organise a field trip to bring marine ecology into practice.
Day 2	
Fisheries Economics	In fisheries economics we go into detail on the fishing fleet, supply chain and how fisheres earn an income with fishing. We discuss how this is chaning because of sustainable development. (Profit P)
Excursion fisheries economics	Depending on the location we try to organise a field trip to a fish processing facility or fish auction.
Image and identity workshop	The power of society. We have a disussion about the reputation of fishers. What is determining your reputation? How is the acceptance of society drive your fishing practice? (People P)
Day 3	
Tragedy of the commons - workshop	The concept of fisheries management is introduced with a game.
Fisheries Management	We explain the why, how and by whom fisheries are managed. Cooperation between fishers, fisheries scientist and fisheries managers is key. (All 3P's)
Communication - training	Communication training with an actor to make participants aware of the importance of communication
Day 4	
Environmental challenges - oil, solid waste (plastic), air emissions	The fishieries is facing environmental challenges. We explain what the challenges are and what is being done to address these challenges.
Environmental challenges - air emissions (climate change)	The fishieries is facing environmental challenges. We explain what the challenges are and what is being done to address these challenges.
Fishers of the future - workshop	The course is concluded with a workshop 'Fishers of the future', where participants are challenged to come up with a solution for a challenge. What can you do to make the fisheries more sustainable?

A detailed program can be found in Annex 2.

Over the years, the training content has become more and more part of the school curriculum in the Netherlands and teachers have been including elements of the training in their own teaching. In 2011, the entire training content was included in the official fishing school curriculum and teaching materials, and in 2016, in close cooperation with the Dutch fishing industry and the Ministry of Economic Affairs, the course content was included in the newly developed website 'Vistikhetmaar' (translated as 'I_fish I_knew').

COOPERATION IN A SUSTAINABLE FISH SUPPLY CHAIN

This training is for fishers and fish vendors who want to reshape their sustainable business. It consists of three 2-day workshops. It creates a shared knowledge base between fishers, traders, scientists, policy makers and environmental NGOs that can contribute to a sustainable development of the fishing industry. In addition, this training creates networking opportunities for effective and fruitful cooperation within the fishery supply chain.

- **Workshop 1**: The sea, people in the fish supply chain (who's who) and where do I stand.
- **Workshop 2**: From catch to the consumer (fish supply chain in detail).
- **Workshop 3**: Societal context, the value of cooperation and future plans.

Workshop 1	**Workshop 2**	**Workshop 3**
Day 1	Day 1	Day 1
• Partners in the Fish Supply Chain (who's who?) • Marine Environment (lecture)	• My Future – personal presentation • Presentation skills • Economic value chain analysis	• Stakeholder mapping • Role of NGO's (theory) • Communication: practicing fruitful discussions

• Communication: how to hold a meeting (talking in a group)	• The fish market (national and international) • Marketing and certification	• Meet the NGOs (interview them and discuss sustainability issues)
Day 2	Day 2	Day 2
• Aquaculture • Fish Stock Management • Group assignment – identifying most important and current sustainability issues in the fish supply chain	• Communication: the power of asking questions (personal conversations) • Cooperation in the fish supply chain • Business cases (best practices / inspiring examples)	• Project management (plan of action - how to reach goals) • Collective sustainability futuring + presentations • Debating: the art of convincing • Solutions debate

A Blueprint of this training series can be found in annex 3.

FUTURE LEADERS' COURSE

To shape a sustainable future, the fishing industry needs leaders with extensive knowledge and (communication) skills. This series of six 2-day workshops is aimed at young fishers and fish traders and retailers that have the ambition to become the leaders of the future. This training enables knowledge exchange between fishers, fish vendors, scientists and NGO's and actively promotes and practices communication skills.

- **Workshop 1**: People in the fish supply chain (who's who) and my business.
- **Workshop 2**: The marine environment, fisheries management.
- **Workshop 3**: From catch to the consumer (fish supply chain in detail).
- **Workshop 4**: Sustainable fisheries? Opinions of various stakeholders.

- **Workshop 5**: Establishing change and realizing goals.
- **Workshop 6**: Future goals and action plans.

Workshop 1	**Workshop 2**	**Workshop 3**
Day 1	Day 1	Day 1
• Partners in the Fish Supply Chain (who's who?) • Identification of main challenges in the fishing industry • Communication: how to hold a meeting (talking in a group)	• Marine environment: lecture and outdoor excursion • Current ecological cases: climate change and Marine Protected Areas (MPAs) • Communication: the power of asking questions	• Economic value chain analysis • Your influence on the supply chain • Marketing • A supermarket´s perspective • Communication: practicing fruitful discussions (part I)
Day 2	Day 2	Day 2
• Entrepreneurial skills • Business plans • Financial management	• Fisheries management: how, why and by whom? • Asking questions to scientists, policy makers and fisheries organizations	• The fish market (national and international): theory and forum discussion with stakeholders • SWOT* analysis for the fish chain • Alternative supply chain models • A retailer's perspective

* Strengths, Weaknesses, Opportunities, and Threats

Workshop 4	Workshop 5	Workshop 6
Day 1	Day 1	Day 1
• Sustainable fisheries? Opinions different stakeholders (fishermen's organisations, scientists, policy makers) • Communication: practicing fruitful discussions (part II)	• Organization and change management: theory • 'Dreams for the future' expressed by various key players in the fish sector + plenary discussion • Strategic planning: workshop • Communication: media training	• Preparation of a presentation + debate about future goals and strategic plans • Communication: let's debate! • Communication: practicing presentation skills, tips and tricks for an 'effective show'
Day 2	Day 2	Day 2
• Certification • Interview of environmental NGOs about their opinions on sustainable fisheries (in subgroups) • Plenary discussion **with environmental** NGOs	• The policy landscape: asking policy makers (national and European level) questions • Selecting best idea for end of course presentation • Practicing the presentation	• Final presentation and debate with group of various stakeholders from the fishing industry

VIST IK HET MAAR (I FISH I KNEW)

In close cooperation with the Dutch fishing industry and the Dutch Ministry of Economic Affairs, Prosea developed an online knowledge platform for the Dutch fishing industry called 'Vist ik het maar' (translated as 'I fish I knew'). On this platform knowledge on topical themes in the Dutch seagoing fishing industry is exchanged in so called 'kennisdossiers' (knowledge dossiers). Next to these dossiers, the platform contains all fishing related educational material of the Dutch fishery colleges. This platform was launched in 2016 and is owned by the fishing industry itself. A supervisory committee, consisting of various scientific institutes, ministries and maritime colleges and social partners from the fishing industry, ensures a balanced/correct representation of the content on the platform.

The dossiers on the platform discuss relevant topics identified by the Dutch fishing industry. Dossier content is supplied by various experts in the field. It is a collaboration between fishers, scientists, policymakers and NGO's to inform the fishing industry on complicated/relevant topics. For example, topics like Brexit and its implications, innovations in fishing nets, the landing obligation, marine protected areas etc.

The platform also contains the education material of the Dutch fishery colleges. This material can be found under 'Onderwijs' (Education). Here teachers/training instructors can find and download all the material necessary for teaching. The teaching material can be completely adapted to the program of teachers and trainers. Vist ik het maar specifically targets (future) Dutch fishers and therefore the website is completely in Dutch.

In order to increase support and acceptance of this platform amongst (future) Dutch fishers, ProSea successfully submitted a project proposal under the European Maritime and Fisheries Fund (EMFF) that allows the organization of various activities. Within this project ProSea organizes various theme days, the in-depth course 'Tussen Schip & Wal' (Between ship and shore) for young high potentials in the fishing industry and a masterclass effective science communication for scientist involved in fisheries. Next to an increased support and acceptance of the platform by Dutch fishers, the various activities also aim to bring fisheries research, politics and fishers closer together, thereby making their discussions more fruitful due to improved communication and mutual understanding.

EXAMPLES OF BEST PRACTICES

Examples of best practices that can serve as inspiration for this project, in addition to the trainings developed and conducted by ProSea for the fishing industry. This section tries to look into what is already happening in the field of sustainability training (or parts thereof) in fisheries. The search is mainly focused at EU Member States (MS). Important to mention is that the descriptions of the best practices are mostly directly copied from websites of the organizations involved or from literature and do not automatically express the views of the CTP-project partners.

BEST PRACTICES EU NETWORK

What do colleges and training institutions in the other EU MS do on sustainability training in fisheries? We tried to answer this question via Europêche, the FISH Platform and our own network (OSPAR, Denmark, UK, MAVA, MARINA project, partners ResponSeable, Seachange project).

FISHING INTO THE FUTURE

INFORMATION FROM THE FISHING INTO THE FUTURE WEBSITE AND CONVERSATION WITH EXECUTIVE DIRECTOR JIM MASTERS

Fishing into the future is a UK-wide charity acting for sustainable and prosperous UK fisheries. The aim is to sustain both fish and fishing – building viable futures for fishermen and fish stocks. Their vision is for a progressive, modern industry that harnesses the potential of fishermen to deliver long-term, sustainable and prosperous fisheries.

One of the core challenges identified by Fishing into the Future is ‘People and Skills’ and Fishing into the future has piloted a Sustainable Fisheries Education Program since 2017.

SUSTAINABLE FISHERIES EDUCATION PROGRAM - SUPPORTING COLLABORATION, EMPOWERING FISHERMEN

The very best fisheries management relies heavily on collaboration and dialogue, but a lack of investment has left many fishermen without the tools and opportunities they need to navigate the complex fisheries science and management systems of modern fisheries. The Sustainable Fisheries Education Programme (SFEP) bridges this investment gap, bringing fishermen, scientists and managers together to build trust, share ideas and develop a common language about the issues in fisheries.

Our team of world-class fishery professionals works directly with the UK fishing industry to give UK fishermen unparalleled opportunities to engage expertly with the regulatory processes that govern their livelihoods, giving them the tools, they need to drive change, improve their prospects and participate in shaping a sustainable future.

Fishing into the Future organizes two different educational programs:

1. The program 'Business of Fishing (#BOF)' for quota fisheries.
2. The 'Introduction to Sustainable Fishing (#ISF)' for non-quota fisheries.

Both programmes are based on the highly successful Marine Resource Education Programme (MREP) from the United States and, in the pilot phase, have both been executed twice.

COURSE 1: BUSINESS OF FISHING (#BOF) - FISHERIES DIALOGUE FOR QUOTA FISHERIES

What is it?

Our Business of Fishing programme lifts the lid on fisheries science and management and gives all fishermen and other professionals involved in quota-

based fisheries the language, tools, insights and relationships they need to navigate modern fisheries.

How does it work?

We bring fishermen, scientists, managers and supply chain professionals together for 2-3 days in a neutral setting, where they work with the complexities of fisheries science and management away from the pressures of fishing. See attachment 4 for a program summary.

Fishermen leave motivated to collaborate further, using what they know to shape the future of their industry and improve their prospects; scientists and managers gain a deeper insight into the inner workings and concerns of the quota-based fishing community.

Who is it for?

This programme is aimed at quota-based fisheries in the UK. It caters for all levels and abilities, building on your current level of knowledge: no prior learning is required. The programme is open to all active fishermen, but professionals from other sectors such as processing, supply and fleet management are welcome.

COURSE 2: INTRODUCTION TO SUSTAINABLE FISHING (#ISF) - FISHERIES DIALOGUE FOR NON-QUOTA FISHERIES

What is it?

Our Introduction to Sustainable Fishing programme lifts the lid on fisheries science and management and gives all fishermen and other professionals involved in smaller-scale and non-sector fisheries the language, tools, insights and relationships they need to navigate modern fisheries.

How does it work?

We bring fishermen, scientists, managers and supply chain professionals together for 2-3 days in a neutral setting, where they work with the complexities of fisheries

science and management away from the pressures of fishing. See attachment 5 for a program summary.

Fishermen leave motivated to collaborate further, using what they know to shape the future of their industry and improve their prospects; scientists and managers gain a deeper insight into the inner workings and concerns of the non-quota, smaller-scale fishing community.

Who is it for?

This programme is aimed at small-scale, non-quota fisheries in the UK. It caters for all levels and abilities, building on your current level of knowledge: no prior learning is required. The programme is open to all active fishermen, but professionals from other sectors such as processing, supply and fleet management are welcome.

FARFISH

FarFish aims to provide knowledge, tools and methods to support responsible, sustainable and profitable EU fisheries outside European waters, compatible with Maximum Sustainable Yield.

To achieve this, FarFish will develop practical, achievable and cost-effective fisheries management tools and advice which can be applied immediately. The work will be done in collaboration with scientists, policy makers, resource users and other stakeholders aimed to improve fisheries management competences.

FarFish will provide a better knowledge base of these fisheries and encourage resource users to actively take part in the management, thus empowering them, generating a sense of ownership and enhancing compliance.

FarFish has the highly ambitious aim of addressing main limitations that are hindering full implementation of the reformed Common Fisheries Policy (CFP) in relation to fisheries in non-EU waters. By the end of the project, FarFish will offer a robust framework and guidelines towards increased cooperation between the EU

and contracting countries, which will include a roadmap towards improved sustainability and responsible fisheries. These roadmaps will be robust and adaptable as they will be created and tested, not only in selected West African waters, but also in the Indian Ocean and selected international waters that are relevant for the EU fleet.

By significantly advancing biological and ecological knowledge in these waters, thoroughly examining the existing management tools and models and suggesting improvements, the vision of FarFish is to remove main barriers towards implementing Maximum Sustainable Yield as a management tool and enable the concept of "surplus" catch in SFPA fisheries. FarFish will take this a step further and add a socio-economic angle to its work, with the aim of improving value chains and creating a platform for increased cooperation between the EU, third countries and other foreign fleets the EU shares fisheries resources with.

MARINE MANAGEMENT AND INNOVATION COURSE TROMSO UNIVERSITY

This course is aimed especially at fish business operators and EU fleet representatives who want to learn more on two main topics, being 'Laws and regulations' and 'Value Chains'.

The course will run from the 9th - 13th of March 2020 in Tromsø (Norway) (link to program), with sessions streamed in parallel in Vigo (Spain), Reykjavik (Iceland) and TBA (Sri Lanka).

If you would like to attend the course in any of the locations, please follow this link to enrol (please note that you can apply for funding to attend to the course in Tromsø).

FISHERIES INNOVATION SCOTLAND

Fisheries Innovation Scotland (FIS) is an independent non-profit organization working to bring the fishing industry together with scientists and government

representatives to undertake research, facilitate knowledge exchange, and encourage innovation in Scotland's marine fisheries. FIS's projects focus on education and capacity building programs, the development of improved fisheries management models, and the assessment and development of new fishing gear and techniques. In 2017, FIS launched a Fisheries Innovation Award Competition, looking for innovative ideas and approaches that could inspire new research and development projects

OPAGAC – BEST FISHING PRACTICES TRAINING

The Organization of Associated Producers of Large Freezer Tuna Freezers (OPAGAC) subsidizes since 2012 best fishing practices training for its crews, held in collaboration with the International Seafood Sustainability Foundation (ISSF). In 2012, OPAGAC/AGAC, together with the National Association of Tuna Freezer Vessels Shipowners (ANABAC) developed a Code of Good Practice for the tuna purse seine fishery (click here). The Code is based primarily on best practices for the handling and release of bycatch other than tuna; it requires the design and use of non-entangling FADs to reduce the interactions with sensitive species like sea turtles, sharks and rays to a minimum; the implementation of a FAD management system; a 100% observer coverage, both physical and electronic, including support vessels; scientific verification of activities related with good practices and continuous tracking by a steering committee; and training for fishing masters, crew and scientific observers.

Regarding the latter, the professional fishing crew and the scientific observers on board are all trained specifically about the items covered in this good practice code. They are especially taught on the manoeuvres for handling and releasing marine species and the correct construction and use of FADs. Similarly, the Code encourages the training of scientific observers to collect high-quality data, and thus it works to develop appropriate local and third-country observer training. Training periods are also used to evaluate programme follow-up and learn about any difficulties that have arisen.

The training courses are promoted worldwide by ISSF (click here).

SOSPESCA - ENVIRONMENTAL SUSTAINABILITY TRAINING

Capacity development and raising of awareness about sustainability is the first step to reinforce the competitivity of responsible and regulated fisheries. SOSPESCA is a European project towards the improvement of the sustainability of the Spanish fisheries, co-financed under the program 'Green Jobs' from the Spanish Biodiversity Foundation. Within the framework of SOSPESCA, CEPESCA, the Spanish Fisheries Confederation, with special collaboration of OPAGAC (Organisation of Producers of Frozen Tuna-Spain) and ANFACO (National Association of Canned Fish & Shellfish Manufacturers-Spain) carried out nine free trainings co-financed by the European Maritime and Fisheries Fund (EMFF).

These training sessions were developed focusing on good fishing practices on board the fishing vessels. In the courses, under the title 'Good practices for mitigating the environmental impacts of fisheries', the basic concepts of environmental sustainability and ecosystem management, the evolution of market and consumer expectations of fishery products have been analysed; as well as the latest scientific advances in fisheries, mitigation techniques for accidental catches of sensitive species and other environmental challenges, such as energy efficiency in ships or the prevention of marine pollution risks. In addition, specialised advisory sessions in the form of one to one training were carried out on board different fleet segments to transfer the notions addressed in the theoretical courses to the day-to-day fishing activity.

Over 250 workers in the fishing sector, like crew members, captains, ship owners, and managers of fishing associations, were trained from the most representative fisheries – be that trawlers, long liners, and purse seiners, both from long distance and coastal fleets. With a duration of one year (2013-2014), the project allowed to increase environmental competencies and qualifications, providing workers in the sector with knowledge about methodologies, techniques, and good practices that reduce the environmental impact of their activity on the marine environment.

The Spanish fishing fleet has already shown clear examples of this new concept of sustainability in practice of pioneering examples well recognized in the international

arena. An example of these best practices can be found in the reduction of over eighty percent in the bycatch of loggerhead turtles captured by the Mediterranean long lining fleet, the recovery of the blue fin tuna through a solid management plan, the implementation of biodegradable and anti-entanglement Fish Aggregation Devices (FADs), and the unilateral prohibitions of threatened species such as the porbeagle and the thresher sharks to ensure their protection. All of these actions are developed to protect the marine resources while ensuring the continuity of those sustainable fishing activities in order to ensure their place for the next centuries.

Special effort is put on outreach and in making all the products and training sessions available via comunicacion@cepesca.es.

QUICK SCANS BY PROSEA

BELGIUM

GOVERNMENTAL ORGANIZATION, VDAB

INTERVIEW VIA EMAIL WITH JONAS DEILGAT OF THE VLAAMSE DIENST VOOR ARBEIDSBEMIDDELING EN BEROEPSOPLEIDING (VDAB), THE PUBLIC EMPLOYMENT SERVICE OF FLANDERS. MR. DEILGAT IS THE QUALITY COORDINATOR OF THE TRAINING CENTER AND THE CENTRAL CONTACT FOR THE TRAINING OF FISHERS WITHIN THE VDAB.

Training & Certification

Competency and certificates of fishers are organized by the Belgian federal government which upholds a royal decree which defines certificates. There are five certificates which a fisher can achieve defining the fisher's function and capability aboard (i.e. sailor, skipper, helmsman, motorist).

Courses for attaining these certificates are offered in the VDAB Zeebrugge and maritime institute Mercator. These two institutes work closely together regarding course material and instructing personnel.

Data on total students is complete, but for the course ‘prevention of marine pollution’ of the VDAB (see headline sustainable fisheries) 129 students attended in 2014.

Sustainability in fishery

Every fisher in Belgium is required to go through the course 'Prevention of marine pollution'. In this 8-hour course they learn and discuss the following topics:

- Which organisations are involved in the fight against marine pollution;
- Which certificates and board documents are required with regards to the prevention of marine pollution;
- How to handle polluting materials on board e.g. oil, waste, wastewater, gasses, etc.

Regulations specific for Belgium are given as well.

Lastly, every specific course has several chapters regarding this subject: several aspects of the international maritime law are covered, motorists learn about SOPEP, etc.

Impression of ProSea

Awareness of sustainability and marine environmental awareness is taught and discussed to a minimum. The fishers training in Belgium seems to have a clear focus on competency and maritime law and local regulations.

MERCATOR MARITIEM ONDERWIJS - JAN DENYS

4. Is sustainable fishing part of the curriculum? If so, how do you teach this subject?

   Sustainable fishing is of course part of the curriculum of the Maritiem Instituut Mercator. It is given in the course fisheries science, with subjects like innovation in fish gear and techniques and environmental impact.

5. Is the subject waste/plastic in the ocean part of the curriculum?

   Yes, the Maritime institute joined projects like Waste free Oceans and Fishing for Litter.

6. Would you like to expand the material/subjects on sustainable fisheries and shipping in your curriculum?

   Of course.

7. Would you like to be kept informed on this project?

   Yes please.

DENMARK

GOVERNMENTAL AGENCY

INTERVIEW VIA EMAIL WITH SUNE RAHN OF THE DANISH AGENCY FOR HIGHER EDUCATION.

Training & Certification

Education is according to standards in the STCW-F. It is regulated by an executive order issued by the Danish Agency for Higher Education. The detailed planning of the education is carried out by the "Fiskieriskolen Thyborøn" in co-operation with representatives for employers and employees in the commercial fishery industry. Denmark's main fishery school, "Fiskieriskolen Thyborøn" in Thyborøn had 138

students in 2015. The second school, ''Skagen skipperskole'', offers a more general education for skippers.

Sustainability in fishery

Sustainable fishing and marine litter are included in the specific themes relating to fishing, but Sune Rahn has no more specific information regarding the content and curriculum.

Impression of ProSea

It looks like there is no tight connection between the school in Thyborøn and the one in Skagen since the director of the Skagen Skipperskole said they were the only fisheries and skipper school in Denmark, while Sune Rahn stated that the fisheries school in Thyborøn was the only fisheries school of Denmark.

SKAGEN SKIPPERSKOLE

INTERVIEW VIA TELEPHONE WITH MR. ANDERSEN, DIRECTOR OF SKAGEN SKIPPERSKOLE.

Sustainability in fishery

The Skagen Skipperskole includes sustainable fisheries and marine litter in the various subjects taught at school, in navigation and English. And they have two modules regarding fishing & environment.

Interest in project / Desire for material

Mr. Andersen is very interested in ProSea and our material and keen on keeping in touch. He thinks there is a need for the international ProSea material. He wants to take a look at what we have.

IRELAND

FISHERIES SCHOOL CASTLETOWNBERE

Interview with director Shane Begley of the National fisheries school Castletownbere.

Sustainability in fishery

The school focusses on safety training and attaining the certificate for competency to sail fishing vessels. Also, a training in aquaculture is given. The curriculum contains MARPOL and protection of the marine environment. This includes marine litter and the personal role of fishers.

Interest in project

Shane Begley is very interested and would like to see the material and be updated on the project.

SCOTLAND

SCOTTISH MARITIME ACADEMY

INTERVIEW WITH LINDA HOPE, MANAGER AT THE SCOTTISH MARITIME ACADEMY AT THE NORTH EAST SCOTLAND COLLEGE.

Training & Certification

The standard is set up by the Maritime and Coastguard Agency (MCA) in conjunction with the Seafish Industry Authority for most fishers' training. The school has approximately 200 training enrolments per year, which is about 100 trainees since

some attend more than one training. The duration of a training ranges from one day up to twelve weeks.

Sustainability in fishery

This is not currently a mandatory requirement in the training for Fishing Deck Officers but is covered in the Seafish 3-week Introduction to Commercial Seafish Course for new entrants. The school includes guest speakers from KIMO UK, Aberdeenshire Council Fishing for Litter Scotland scheme to discuss sustainability, marine litter and the role of the fisher. In the future the inclusion of the subjects above will be mandatory following the implementation in the UK of STCW-F.

Interest in the project

Linda Hope is very interested and would like to be informed.

BEST PRACTICES (WORLDWIDE)

We will also try to collect best practices outside the EU. Initially via a search on the internet, and through contacts in our network (NAMEPA, FAO, etc).

ENVIRONMENTAL DEFENCE FUND

The Environmental Defence Fund (EDF) is a worldwide non-profit organisation for a more sustainable world. It consists of 12 offices in the United States and four worldwide (China, UK, Mexico and Indonesia). The Fishery Solutions Center (FSC) is a team within EDF's Oceans program that designs and develops innovative fishery management tools and strategies to support efforts to reverse overfishing and restore our oceans to abundance. From developing innovative data collection programs to designing flexible management plans, they work with conservation groups, fishers, governments, and other stakeholders around the world that seek new approaches to fishery management that allow both people and the oceans to

thrive. To support fishers and fisheries managers FSC developed a virtual academy and a toolkit. Both contain information to design a sustainable fisheries management plan.

VIRTUAL ACADEMY

What is it?

A brighter future for our oceans depends on people who believe in a better future and are empowered to drive transformational change.

How does it work?

The eight chapters contained in this series provide an opportunity to diagnose fishery challenges and help design a solution in a hypothetical fishery. You can take this course to build your fundamentals in fisheries science, economics, and policy. In addition, this course can help learners become more familiar with secure fishing rights principles, application and design. After taking this course you should be able to:

- Diagnose basic fishery challenges.
- Understand secure fishing rights principles and the design process.

Who is it for?

The Virtual Fisheries Academy is intended to help you – whether you are a manager, fisher, scientist, or other interested party – build key knowledge and skills to design fishery solutions that work for people and the environment.

TOOLKIT

What is it?

The Sustainable Fisheries Toolkit is a comprehensive set of resources that can help diagnose the challenges, opportunities, drivers and dynamics in your fishery system and inform strategies for successful design and implementation of sustainable fisheries management.

How does it work?

The Toolkit is organized by phases, which serve as a roadmap for fishery reform. The phases describe the general steps typically taken over the course of the fishery reform process. The phases are generally sequential, but your fishery reform process may begin at any point, or you may be working to address multiple phases at once. You can access and use the Toolkit no matter what phase your fishery is in.

Who is it for?

The toolkit can be used by fishers, managers and educators.

FISHERIES MANAGERS

PSF has more tools and resources for managers to reform fisheries into sustainable fisheries. Follow this link.

FAO - CAPACITY BUILDING AND TRAINING

Capacity building is a cross cutting theme which is one of the major elements for sustainable development. The FAO Fisheries and Aquaculture Department undertakes capacity building activities for marine and inland fisheries as well as aquaculture. These include provision of training courses within Technical Cooperation Projects (TCPs), preparation of training materials (e.g. simple methods in aquaculture series, disease diagnostic guides, surveillance methods, extension manuals, technical manuals, etc.), awareness raising through training/workshops, financial and technical support to existing training programmes carried out by partner institutions and custom training courses on specific topics.

Capacity building uses methodologies to enable participants to work independently with fisheries management issues and participate actively in the formulation of management plans in the region where they work.

Through TCPs (Technical Cooperation Programmes) and unilateral or multilateral funded field projects, the Department provides technical information, advice and training to member countries and Regional Fisheries Bodies (RFB). Outputs are then used by fishers and fish farmers, resource managers and policymakers to improve production, conservation and policymaking in the fisheries and aquaculture sector. Results help improve food supply and rural livelihoods through responsible production, better management practices and improved environmental sustainability.

For all publications on training by the FAO, click here.

TRAINING AND EXTENSION MATERIAL, GUIDELINES AND PARTICIPATORY APPROACHES

The FAO Fisheries and Aquaculture Department is working towards strengthening the capacity of men and women in fishing communities – particularly small-scale fisheries – in the promotion and use of sustainable, cost efficient and safe fishing operations and methods, their enhanced participation in fisheries and coastal management and socio-economic development, disaster preparedness and training, extension and information dissemination. These are being done through the development of guidelines and extension materials and the promotion of participatory approaches through their demonstration and pilot testing together with stakeholders.

FAO activities include:

- Responsible and efficient small-scale fishing technologies.
- Cleaner and better managed harbours and fish landing sites.
- Use of socio-economic and demographic indicators in community-based and integrated coastal zone management.

- Microfinance and micro-enterprise development.
- Strengthening fisher organizations, cooperatives and self-help groups.
- Disaster preparedness; support to emergency assistance and rehabilitation.
- Training on selective fishing gear, bycatch reduction and sustainable fishing methods.

FISHERMEN'S COMMUNITY & TRAINING CENTRE MALDIVES

The Fishermen's Community & Training Centre (FCTC) officially opened on Gan Island in Laamu Atoll, south central Maldives in January 2014, as a joint venture between IPNLF and the Maldives Fishermen's Association – and supported by Engagement Migros (of the Swiss retail group Migros). The FCTC now provides long-term support for the country's one-by-one fishing communities through the provision of invaluable fisheries training and education.

From this base location instructors, both at the center and travelling throughout the Maldives, teach active fishers and school-leavers on a range of subjects, from post-harvest handling to improved recording of catch and fishing effort, to safety at sea. Collectively this training adds to the sustainability, quality and safety of fishers' practices.

IPNLF works in collaboration with the Maldives Marine Research Centre (MRC) and the Ministry of Fisheries and Agriculture (MoFA), to run schemes from this base, such as the Training of Trainers, and the National Curriculum.

GUIDELINES FOR IMPROVING KNOWLEDGE SHARING AMONG FISHERIES

The following guidelines identify six steps that should be considered before implementing a knowledge sharing initiative: assess, identify, plan, indicators, longevity and communication. These guidelines are provided as recommended best practice for knowledge sharing among fisheries, but is done in recognition that, depending on the nature of the fishery, the providers and the target recipients of the knowledge, some points will be more relevant than others.

You can find the guidelines here.

GULF OF MAINE RESEARCH INSTITUTE – MREP

THE GULF OF MAINE RESEARCH INSTITUTE (GMRI) PIONEERS COLLABORATIVE SOLUTIONS TO GLOBAL OCEAN CHALLENGES. LOCATED IN PORTLAND, MAINE (ME), GMRI IS DEDICATED TO THE RESILIENCE OF THE GULF OF MAINE ECOSYSTEM AND THE COMMUNITIES THAT DEPEND ON IT.

Founded in 2002 by fishers, for fishers, the Marine Resource Education Program (MREP) empowers fishers with a better understanding of how, when and where to engage effectively in fishery management.

MREP maintains its industry-led, collaborative approach. For each region, local industry members and fisheries science and management experts work with GMRI staff to guide the two-part workshop series. Through this process, workshops are regionally relevant while transferring universally valuable tools and information.

In a neutral setting, we bring together commercial, charter, and recreational fishers with scientists, managers, and other marine resource professionals. MREP gives participants the opportunity to:

- Learn the nuts and bolts of fisheries science and management processes.
- Demystify the acronyms and vocabulary used in fisheries science and management.
- Gain tools and insight into engaging effectively in federal fisheries management.
- Connect with key regional science centre experts and fishery managers.

MREP GREATER ATLANTIC

MREP Greater Atlantic was created by fishers, for fishers. It provides an inside look at the fisheries science and management processes, demystifies the acronyms and vocabulary, and equips fishers with the tools to engage in shaping regulatory action

and participating in collaborative science. In a neutral setting, fishers work through the 'how and why' of the whole process, meet the people behind agency jobs, and share important feedback from the fishing community.

The program is offered as a series of workshops that build upon each other: a three-day Fishery Science Workshop, followed by a three-day Fishery Management Workshop. Presenters are drawn from National Marine Fisheries Service (NMFS), informally known as NOAA Fisheries, Regional Office and Science Centre, the Fishery Management Councils, research institutions, and the fishing community. Workshops are designed and held as a collaborative effort, with members of the community moderating the meeting and assisting fellow fishers to articulate issues, keeping the discussion real. Participants leave the workshops with better understanding of how, when and where to engage effectively in fishery management.

Program Goals

The Marine Resource Education Program (MREP) was founded in 2001 to provide fishers the tools and information to foster an emerging conservation ethic. While it is crucial for fishers to understand the science and management tools used to regulate their industry, it is equally important to help make policy and science professionals more familiar with the workings of the fishing community.

MREP is a sturdy bridge over the gaps between fishers, scientists, and managers. It brings these diverse disciplines together in a neutral setting, providing an opportunity to explore both differences, and common goals, outside of the regulatory forum.

Guiding Objectives of MREP

- To substantially increase the number of individuals at work in New England and Mid-Atlantic fisheries who are comfortable navigating fishery data and management systems.

- To break down historical barriers to cooperation, develop leaders in the fishing industry, and fully engage fishers in the development of best available science.
- To deepen the familiarity of policy and science professionals with the workings of the fishing community.
- To bring fishers, scientists, and managers together in a neutral setting to explore differences as well as common goals.

Curriculum

We offer the following workshops:

Concepts in Ecosystem Based Fishery Management

Fishers often express concern that what they are seeing on the water is not reflected in fisheries science, pointing to aspects like species interactions, ecological relationships, and climactic factors. Many scientists share these concerns and have been studying ways to incorporate environmental data and the relationships between different species into stock assessments. This emerging approach is called Ecosystem-Based Fishery Management (EBFM).

The MREP Concepts of Ecosystem-Based Fishery Management workshop takes participants through an in-depth discussion of what EBFM is, what it is being used for, and how it can better include fishers. The workshop is always held in conjunction with a NMFS research lab so that participants have the opportunity to meet top NMFS scientists, explore on-going research, and learn first-hand how fisher's information can shape assessment models. Participants leave the workshop with a better understanding of the purpose of EBFM, what data sources are being used to develop the science, and how it may change fisheries management in the future.

Fishery Science: 200 Workshop

This two-day workshop provides an in-depth look at the trawl survey methodology and the collection and processing of data used in stock assessments.

The workshop includes a visit to the NMFS gear loft to explore the trawl nets and scallop dredges used in survey work, a trip aboard the Henry Bigelow research vessel with a tour of the onboard labs and sample handling stations, a visit to the Woods Hole Age and Growth lab, a discussion with port agents on data reporting, and time spent at the northeast Observer facility. The program concludes with an in-depth discussion about how the various pieces all contribute to stock assessments.

Fishery Science and Management: 100 Workshop Series

This 2-part workshop series provides participants with a core foundation in the fundamentals of fisheries science and management.

At the 3-day fishery science workshop, participants obtain a basic working knowledge of concepts in population biology and the assessment process, including survey sampling techniques, statistical tools, models and their uses, as well as biological reference points used in management. Information presented in this section helps relate fishing effort to stock assessments and shows how fishermen's knowledge, fishery-dependent data, and collaborative science partnerships help to strengthen stock assessment models and results. The module examines developments in conservation engineering, as well as principles of ecosystem-based management and environmental influences on stock assessments.

The second 3-day workshop provides an overview of entities that manage commercial and recreational fisheries with emphasis on the structure of the Fishery Management Council and the requirements under the Magnuson-Stevens Act and National Standards. The curriculum covers the components of a management plan, describes the progression of plan development, and identifies critical opportunities for participation and input. The module explores alternative ways for fishers to initiate management solutions, including training in consensus building and negotiation skills. An important new component developed in 2012 simulates the Council process through a case study examination that provides participants an opportunity to immediately apply new knowledge to a management application. The final day ties in curriculum elements from the Science Module, examining the role of science, scientific process, and influence of scientific uncertainty in management systems.

Fisheries Science and Management for Recreational Anglers Module

Recreational saltwater fishing in the United States is more popular than ever, driving an expansive and diverse economy in every coastal corner of the country. As the number of recreational anglers has increased, so have the demands of the recreational saltwater fishing industry. Saltwater anglers have inherently different concerns than their commercial counterparts. This has led to both challenges and opportunities for the existing management system and highlighted the need for educated, engaged recreational anglers who are comfortable working within that system.

MREP Fisheries Science and Management for Recreational Anglers is an introductory look at the foundational concepts of the science and management of federally managed saltwater fisheries, with a special focus on those aspects most important to the recreational fishing industry. The three-day workshop gives participants insight into how fisheries data are collected and how those data lead to the regulations which govern recreational fishing. As with all MREP workshops, a primary focus is the opportunity for fishers, scientists, and managers to network, exchange ideas, and build relationships. Participants leave the workshop prepared to engage effectively in the fisheries science and management process.

The Board of Advisors select dates to fit well with fishery management schedules. We attract a class size of 20 to 24 participants per session and have also explored a large class size of 32 participants. The participants are selected from an applicant pool. We create a mixed cohort to include active commercial fishers from diverse sectors, recreational/Charter for hire fishers, seafood processors/dealers, as well as other professionals, such as environmental NGOs.

The MREP curriculum reflects the information needs of the fishing and management community in which it is being implemented. Early in preparation for workshop delivery, we poll key industry and management members in the region for relevant topics and encourage the localized Board of Advisors to shape the curriculum accordingly.

The success of this program hinges on sensitivity to the cultural differences that impede communication. The MREP implementation team works with content presenters to translate course material into approachable English and to develop novel ways to illustrate complex concepts.

The curriculum receives regular evaluation and upgrades to maintain relevance for fishers. MREP emphasizes the importance of fishermen's information and knowledge as a primary source of data. This builds confidence for individuals to contribute to effective fishery management.

MREP Southeast, West Coast and Caribbean

MREP Southeast

Fishers in the Gulf of Mexico, South Atlantic and Caribbean regions have joined forces to guide the development and implementation of a new offering, aimed at improving the communications between industry, scientists, and managers in the Southeast fisheries region. This program is tailored to the unique fisheries and management processes of the Southeast.

MREP West Coast

MREP West Coast is a workshop series designed for west coast fishers interested in building their understanding and involvement in fisheries science and management decisions. It was developed to equip fishers with the tools to confidently engage with the tough issues facing their region today.

MREP Caribbean

The specialized needs of Caribbean fishers have prompted the development of a unique program offering, held once a year and rotating to the individual islands. This program is offered in Spanish in Puerto Rico, and in English in the U.S Virgin Islands.

ISSF – TUNA SUSTAINABILITY GUIDEBOOKS

The International Seafood Sustainability Foundation (ISSF) was founded in 2008 by fisheries scientists, industry leaders, and the World Wildlife Fund (WWF) based on shared concerns about the future of tuna fisheries and a desire to do something about it. Its mission is to undertake science-based initiatives for the long-term conservation and sustainable use of tuna stocks, reducing bycatch and promoting ecosystem health. This by developing and implementing verifiable, science-based practices, commitments, and international management measures that result in tuna fisheries meeting the MSC certification standard without conditions, and becoming the industry standard for vessel owners, traders, processors, and marketers.

ISSF cooperates with and supports Regional Fisheries Management Organizations (RFMOs), and vigorously advocate to RFMO members for the adoption and implementation of science-based management measures so that tuna stocks and their ecosystem are managed comprehensively and sustainably.

The ISSF approach to improving tuna sustainability:

1. Working with RFMOs to conserve tuna stocks and their ocean ecosystems through sponsored workshops, direct advocacy, and capacity-building;
2. Employing sound science to attain maximum sustainable yields of targeted tuna stocks by supporting RFMO science bodies, convening leading scientists to address research challenges, and communicating results;
3. Striving to eliminate illegal, unregulated, and unreported (IUU) tuna fishing by implementing the use of Unique Vessel Identifiers (UVIs), mandating 100 percent observer coverage for purse seine vessels selling to ISSF Participating Companies, and testing the viability of electronic monitoring systems;
4. Minimizing bycatch, discards, and abandoned gear through extensive research on fishing strategies and technologies, mandating 100 percent

retention of all tuna and bycatch for purse seine vessels selling to ISSF Participating Companies, and other measures;

5. Collecting and exchanging data to promote better scientific understanding of tuna stocks by sponsoring workshops, side events, and meetings (as well as the individual participation of participants from developing countries) regarding a variety of issues, bringing together scientists, environmentalists, vessel owners, and fishers.

ISSF promotes several guidebooks specialised for different fleet segments (click here):

1. Skippers' Guidebook to Sustainable Longline Fishing Practices
2. Skippers' Guidebook to Sustainable Purse Seine Fishing Practices
3. Training Guide for Purse Seine Fishery Observers
4. Skippers' Guidebook to Pole-and-Line Fishing Best Practices

The ISSF requires that ISSF Participating Companies transact business only with vessels whose skippers and observers have completed this online module or attended one of the in-person ISSF Skipper Workshops.

MARINE STEWARDSHIP COUNCIL FOR TEACHERS

MSC provides material for teachers to teach and learn about ocean sustainability. There are multiple things they provide.

MOVIE ABOUT FISHERMANS DAUGHTER

This film, created with young people and their teachers in mind, follows a fisherman's daughter into the wild, as she explores ocean sustainability, the reasons why our oceans are threatened, and the science behind sustainable fishing. It is important to explain about the safety rules on board. If these are not followed in video material this needs to be addressed.

CONTACT WITH KATE JONES

1. What is the name of the company/organisation and what is your vision and mission?
   Marine Stewardship Council - We're on a mission to end overfishing. Ensure future generations can enjoy the wild seafood we love by choosing certified sustainable seafood with the blue fish label.
2. What is the target group of your program?
   The education program at MSC targets teachers in schools and their students aged 10-15, sometimes younger and older too.
3. What are the goals of the program and how do you achieve these?

   The learning objectives are for young people:

   - develop knowledge of and a unity with nature and with life in the sea;
   - understand what sustainability means in the context of the ocean and fishing – environmental, social and economic;
   - have a connection with the ocean, understanding where their seafood comes from and the roles of the people involved in getting it to them;
   - understand the role of seafood in a healthy diet;
   - put together all of the elements above, developing systems thinking to become conscious of their own impact and role in sustainable oceans.
4. Does your program include issues, such as the Common Fisheries Policy, fish stock assessment, marine spatial planning, marine litter, climate change, certification schemes, cooperation within the fish supply chain, and enhanced communication skills?
   Certification scheme, the concept of fish stock assessment in sustainable fishing, with plans to include wider ocean issues such as climate change.
5. Does the curriculum include the role of fishers in the above-mentioned issues?
   Yes – the role of fishers is discussed in choosing sustainable fishing methods,

in assessing fish stocks to ensure sustainability and in catching fish so we can eat it.

6. Would you like to be informed about/involved in this project?
   I am not sure that the MSC's education programme is relevant to it.

SPC – THE PACIFIC COMMUNITY

The pacific community works for the well-being of Pacific people through the effective and innovative application of science and knowledge, guided by a deep understanding of Pacific Island contexts and cultures.

THE DEPARTMENT FAME FOCUSSES ON FISHERIES, AQUACULTURE AND MARINE ECOSYSTEMS.

FAME (SPC Division of Fisheries, Aquaculture and Marine Ecosystems) main's work is to provide the 22 SPC's member countries and territories with the information they need to make informed decisions on the management and development of their aquatic resources, and help to provide the tools and strengthen the capacity needed to implement these decisions.

FAME is composed of two programmes: The Oceanic Fisheries Programme and the Coastal Fisheries Programme. You can find both programmes here.

SPCs vision for the region is a secure and prosperous Pacific Community whose people are educated and healthy and manage their resources in a sustainable way. While FAMEs goal mainly focuses on the sustainable management of marine resources, we don't neglect the opportunities that these provide to improve education, health and prosperity.

THE NORTHWEST ATLANTIC MARINE ALLIANCE (NAMA)

The Northwest Atlantic Marine Alliance (NAMA) is a fisher-led organization working to protect marine diversity and promote social, environmental, economic, and food justice. Through building a network of community-based fishers, crew, fish workers, and allies, NAMA advocates for policy and market strategies that advance the rights of small- and medium-scale fishers. NAMA actively works on building leadership capacity, both within the organization and for the next generation of fishers and fishing community advocates, to build a strong, ongoing movement working toward healthy fisheries and fishing communities. NAMA also provides a range of resources and guidelines for consumers to make healthy, sustainable seafood choices.

BYCATCH TRAINING MODULE FIJI

The Fiji Maritime Academy launched its “Protected Species Bycatch Mitigation for the Fiji Offshore Fisheries” training manual, which will strengthen theoretical knowledge of maritime seafarers in the Offshore Fishing sector on the issues of bycatch.

The bycatch training and manual was made possible through WWF Pacific’s ‘Developing Sustainable and Responsible Tuna Longline Fisheries in Fiji’ project that is funded by New Zealand Aid’s Ministry of Foreign Affairs and Trade (MFAT). The bycatch module is a first for Fiji where a tertiary institution will introduce such training as previously; seafarers would undergo bycatch training whilst on board a fishing vessel.

In launching the bycatch training manual, Minister for Fisheries, Semi Koroilavesau highlighted the bycatch manual was a step in the right direction in addressing the issues of bycatch for Fiji and the region. Read the entire article here.

LIST OF ANEXES

The science of counting fish

Stock assessment – the basics

Contents

Goal of this brochure

The goal of this brochure is to inform fishermen and other stakeholders in the North Sea fishing sector about the basics of a stock assessment, in other words, how scientists assess the amount of fish in the sea. General knowledge about stock assessments is essential when discussing and understanding several aspects of fisheries management, such as quota and stock surveys carried out by commercial vessels. Moreover, general understanding of stock assessments can ease the communication between different stakeholders in the fisheries arena, such as fishermen, scientists, policy makers, and environmental organisations.

What is a stock assessment?

A stock assessment is a way of calculating the abundance of a certain fish species in the sea. There are different types of stock assessment models; some calculating the absolute abundance of fish in tons, others calculating changes in relative abundance (i.e. not ‘how many tons of fish’, but rather ‘how the amount of fish is changing over time’).

FOTO OMSLAG: I. DE BOOIS, IMARES

The focus in this brochure is on so-called 'age-based assessments' that calculate the abundance of fish in tons. These models are used for managing some of the most important commercial fish stocks in the North Sea. The outcomes of such stock assessments are estimates of the most probable amount of fish in the sea. The chance remains that in reality, there are more or less fish in the sea. Complete certainty is impossible.

This brochure explains the principle of stock assessments for North Sea fish species by looking at the stock assessment of **North Sea sole**. The end of this brochure briefly describes the stock assessment of other North Sea fish species

Why do we need a stock assessment?

A stock assessment is needed for species that are managed by quota (TACs[1]). For a policy maker to decide how much fish can be caught in a certain year without undermining the future health of the fish stock, information on stock size and stock development is needed. Basically, stock assessments are a necessary aspect of fisheries management.

Who assesses the stock?

Stock assessments for North Sea fish species are carried out by ICES[2] scientists. They estimate the size of the fish stock and the fishing pressure exerted on the stock by fishermen. ICES carries out stock assessments for the manager of North Sea fish stocks: the European Union (EU). Eventually, EU policy makers decide upon the quota[3], based on stock assessment information from ICES.

1 TAC = Total Allowable Catch
2 ICES = International Council for the Exploration of the Sea; a cooperation between scientists from 21 countries
3 For some stocks this involves negotiations with Norway

Fish are born, they grow, they reproduce and they die – whether from natural causes or from fishing. That's it. Modelers just use complicated (or not so complicated) math to iron out the details. (Andrew B. Cooper)

BRON: I. DE BOOIS, IMARES

Stock assessment: three basic steps

The stock assessment of sole has three basic steps:

1 First, the **relative changes** of the fish stock are examined: are there more or less fish in the sea compared to previous years (for example, 'twice as many'). At this point, we are not looking at the amount of fish in tons yet. The relative changes in fish abundance can be meaured by **catch rates**, the catch per unit effort (e.g. kg of fish per haul). Catch rates can be measured by scientific vessels (called 'surveys') or by data from commercial fishing vessels.

2 Next, the size of the fish stock in the past is reconstructed. Now, we are looking at the **amount of fish in tons** (biomass). This is called a '**reconstruction**' because the size of the fish stock can only be estimated in retrospect, once assessors know how many fish that were born in a particular year, have died over time. In general, and also for sole, this includes taking into account:

a. natural mortality (due to predation, disease, etc.)

b. the total catch in tons (mortality due to fishing).

3 Then, the **relative changes (1)** are compared with the **reconstructed tons of fish (2)**. This is called calibration and is needed to obtain absolute estimates of the fish stock size during the past years. After calibration, it becomes clear how the fish stock has developed in the past and how many fish are currently present in the sea. Based on this information, quota can be set.

This brochure explains these three steps of a stock assessment in greater detail.

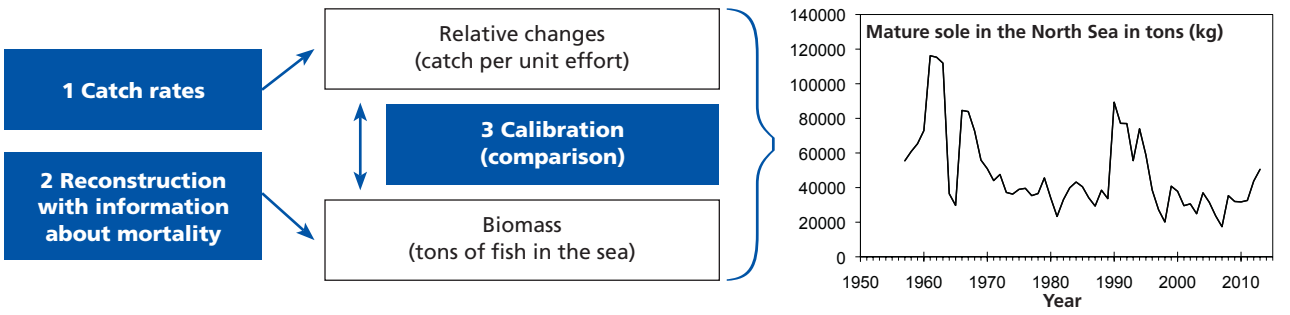


Figure 1: The three basic steps of stock assessment for sole. Stock assessments of other demersal fish species (such as plaice and cod) follow the same basic steps. Note: To be able to, finally, calculate the total biomass of all mature sole in the sea (graph on the right), one also needs data on weight, age, and age at maturity.

1 Catch rates (relative changes)

Relative changes in the fish stock, 'is it growing in size or shrinking?', can be visualised by measuring catch rates, or catch per unit effort (cpue), of the commercial fishery and of standardised research vessels. Catch rates can be measured, for instance, as 'kgs of fish caught per hour of fishing' or 'kgs per kilowatt-day'.

Information about catch rates can be based on information from fishermen's log books. In these books, fishermen note their engine power, fishing gear type, kilograms of marketable fish caught and the fishing location. All this information enters a database that contains data of the total landings (kilograms) and the total fishing effort (days at sea multiplied by engine power). By dividing the total landings by the total fishing effort, the catch rates for North Sea sole fisheries can be calculated (in kilograms per kilowatt-day). By calculating these catch rates for every year, a time series can be built up showing the average catch rate per year (Figure 2).

Catch rates can only reliably mirror changes in the fish stock if fishing takes place throughout the area where sole occurs, fishes during the same season(s) every year, and does not change it's fishing efficiency. With this in mind, catch rates from scientific research vessels (Figure 3) are good indicators for relative changes in the fish stock, because these vessels fish while following a standardized protocol, meaning that, year after year, they use the same gear type, the same fishing speed, fish during the same season, and cover the same fishing areas. So, when a scientific research vessel catches twice as many fish per hour this year, compared to last year, it is very probable that the fish stock in the sea is twice as large as the year before.

Fishermen are at sea throughout the entire year, so they can provide more information on catch rates throughout different seasons than research vessels do. However, commercial fishermen do not always fish in all areas of the North Sea. Fishermen adjust

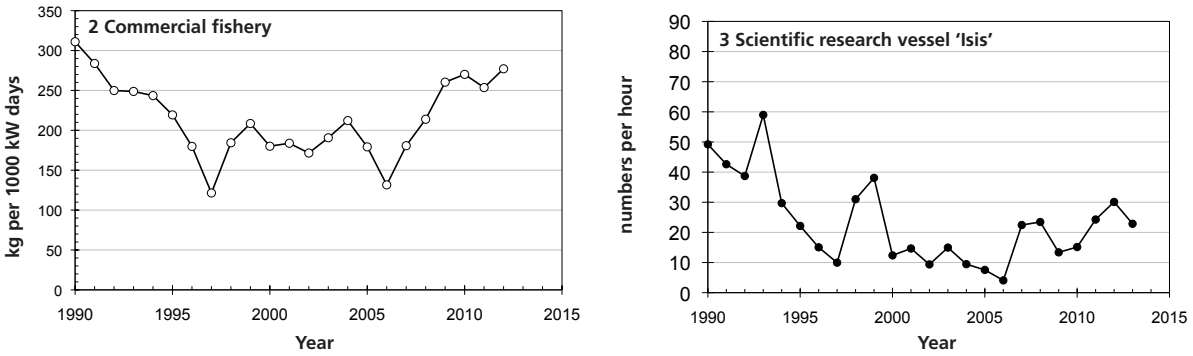


Figure 2-3: Average yearly catch rates of marketable North Sea sole (above the minimum landing size of 24 cm) for the entire North Sea as measured by (left) commercial beamtrawlers, calculated from EU log books; (right) scientific research vessel 'Isis' (BTS – beam trawl survey). Figure 2: the 1000 kW-days at the vertical axis can for instance be read as 'kgs of sole caught by a cutter with an engine power of 1000 kW during one day at sea', or as 'kgs of sole caught by a Eurocutter with an engine power of 250 kW during four days at sea'.

their fishing locations according to the presence of fish or certain size classes of fish, their quotum and catching opportunities, or other external factors such as the oil price. In addition, fishermen change their fishing techniques over time, leading to a change in fishing efficiency. If fishermen increase their fishing efficiency, their catch rates increase, even though the fish stock may not have increased.

So, generally speaking, catch rates from two different sources can be used as an indicator for relative changes in the stock size:

1 Standardised survey

Catch rates from a standardised (scientific) survey, where a (research) vessel fishes according to a standardized protocol year after year, are reliable measures for trends in a stock size and can be used directly, without corrections for gear efficiency etc. This is the preferred data source for a stock assessment. Such surveys can also be conducted with commercial vessels, as long as a standardised protocol is used. For example, Dutch fishers have been conducting a standardized survey for North Sea sole and plaice since 2011. This 'industry survey' on average catches larger and thus older fish, and it also visits fishing grounds that are not covered by the research vessel surveys.

2 Commercial catch rates, while accounting for changes in fishing efficiency

For some species there is limited data available from an appropriate (right time, right area) scientific survey. In this case, commercial catch rates calculated from fishermen's logbooks can serve as an alternative measure for trends in the abundance of the species. The effects of changes in fishing gear and methods need to be taken into account, for instance by using only catch rates of a recent period, where changes are assumed to be minimal. Developments that affect the catch efficiency of the fishery, such as the introduction of pulse trawling, will have to be taken into account, because these may affect fishing efficiency and therefore the reliability of commercial catch rates as an indicator for changes in the stock size.

2 Reconstruction of the fish stock (in tons)

The determination of fish biomass in the sea has a simple underlying principle: every fish in the sea dies at some point in time. If you know how many fish die yearly because they are caught by fishermen, and how many fish die because of natural causes (sickness, predation, or old age), you can reconstruct how many fish were originally in the sea.

Every year fish die because they are caught by fishermen: landings plus discards (a certain portion of discards do not survive – depending on the species). Discards are fish that are hauled in, but are discarded again (thrown back into the sea), for instance, because they are too small to be legally landed, or because fishermen do not have enough quota for these fish.

Fish mortality = total natural mortality
+ total discards
+ total landings

Fish landings are registered at the fish auctions and in fishermen's logbooks. This aspect of fish mortality we know exactly. Discards can be estimated using onboard observer programmes or self-sampling by the fishery.

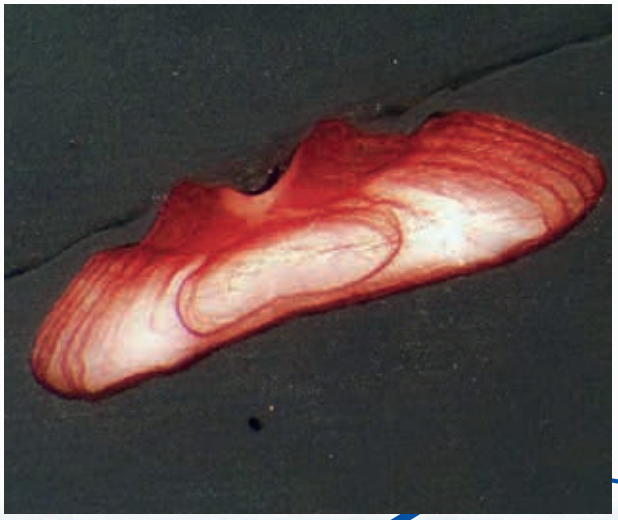
The fish that die from natural causes, are never seen at the fish auction or as discards. To account for natural mortality in the stock assessment, scientists make an assumption about natural mortality. For many North Sea fish species, an estimate of the approximate level of natural mortality comes from the period around World War II. During that war, fishing was practically non-existent, so all the fish that died during that period died from natural causes. By examining the age structure of the fish population before and after the war, the natural mortality could be estimated. This estimate is still used in the stock assessment of sole. Because natural mortality is influenced by so many different complex factors, the actual natural mortality for each age of fish, in each year cannot be measured. So scientists have no choice but to assume that natural mortality is constant (which, of course, it is not). This is one of the most influential assumptions in the stock assessment model.

To reconstruct the fish stock, the age of the fish that were landed must be known. Landings are usually sorted into different market categories (size classes) at the fish auctions. Sole has five market categories. To examine the age distribution of the landed fish, scientists visit all North Sea ports (portside sampling – Figure 4), collecting a fair amount of fish per market category and assess the length, weight, sex, and sexual maturity of the fish. Scientists also determine the fish's age by counting the growth rings in an otolith (ear bone), much like counting the rings of a tree (Figure 5). Scientists from different countries visit many North Sea ports throughout the entire year, so that the age distribution of sole landings all across the North Sea can be mapped. In the discards obervation programmes scientists also measure fish lengths and collect otoliths. By doing this every year, a complete overview of caught number of fish

per age group is collected (see Table 1, uses fictive numbers, as an example). By using the information from Table 1, you can see how many sole have died through fishing since the year of 2000.

To further explain the principle of fish stock reconstruction, let us assume that, in theory, no sole has died due to natural causes and that all sole for a certain year class have been completely fished up after 5 years. Then, we can reconstruct how many sole were born in the sea in any given year in the past. For example, we will use the year class of 2000 (fish born in the year 2000). The fish in that year class were born in the year of 2000 (0-year-old), were one-year-olds in 2001, and 2-year-olds in 2002, etc.. We can start to reconstruct the fish of year class 2000 on the first of January 2006 (5 years after these sole were born). This can be done very simply by adding up all the catches (landings + discards), starting with 20.000 fish landed in the year of 2005, then the 40.000 fish landed in 2004 etc. (Table 1 and Figure 6).

Figure 4-5: (left) Portside sampling, (right) cross-section of an otolith of sole aged 6 years (with 6 rings). Source: IMARES



In Figure 6, natural mortality is not being accounted for, yet. It is estimated that, yearly, around 10% of the sole stock dies due to natural causes. Those fish have also been part of the fish stock, so must be accounted for in the reconctruction (Figure 7).

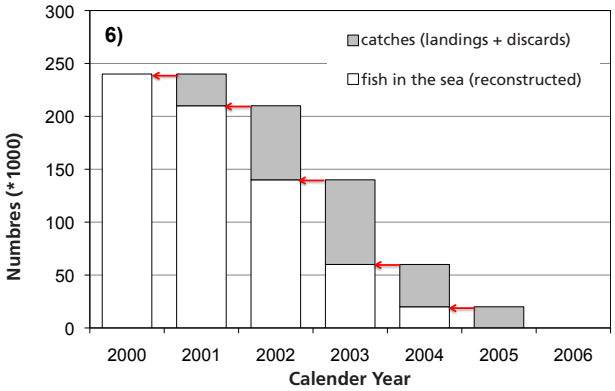


Figure 6: Reconstruction of the number of sole in year class 2000 by using the catches only (Table 1) in a fictive situation where there is no natural mortality (fictive numbers). Landings are grey, the height of the bars indicates the size of the year class of 2000 at the beginning of that year. ***Tip: read this graph from right to left.***

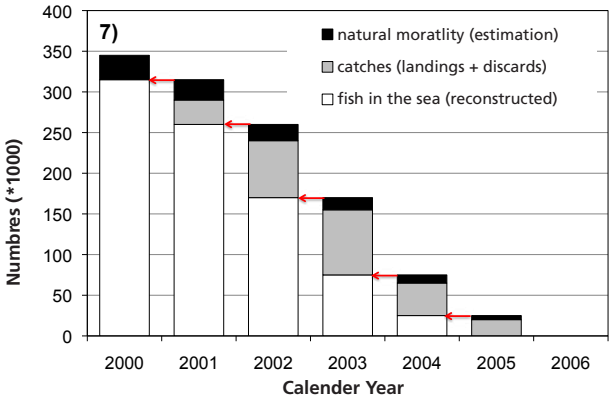


Figure 7: Reconstruction of the number of sole year class 2000 by using catches (grey) and natural mortality (black) (fictive numbers). Height of the bars indicates the size of the year class of 2000 at the beginning of that year.
Tip: read this graph from right to left.

	Calender Year										
Age group	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
0-year-olds	0	0	0	0	0	0	0	0	0	0	0
1-year-olds	10	30	15	10	30	20	25	15	20	15	20
2-year-olds	30	20	70	90	20	90	40	35	40	30	65
3-year-olds	50	40	60	80	20	40	65	60	85	75	65
4-year-olds	20	5	20	30	40	30	45	30	35	50	40
5-year-olds	10	5	15	5	10	20	20	10	10	20	5

Table 1: Sole catches in numbers (× 1000) per calender year and per age group (fictive numbers). In this example, 0-year old fish are too small to be captured and landed, and all sole are caught after 5 years maximum. Blue = fish from year class 2000 (born in the year 2000) – example explained in text.

In this way, the size and development of any year class in the past can be reconstructed, then one can add up the size of the different year classes per calender year: see example in Figure 8–11 (fictive numbers).

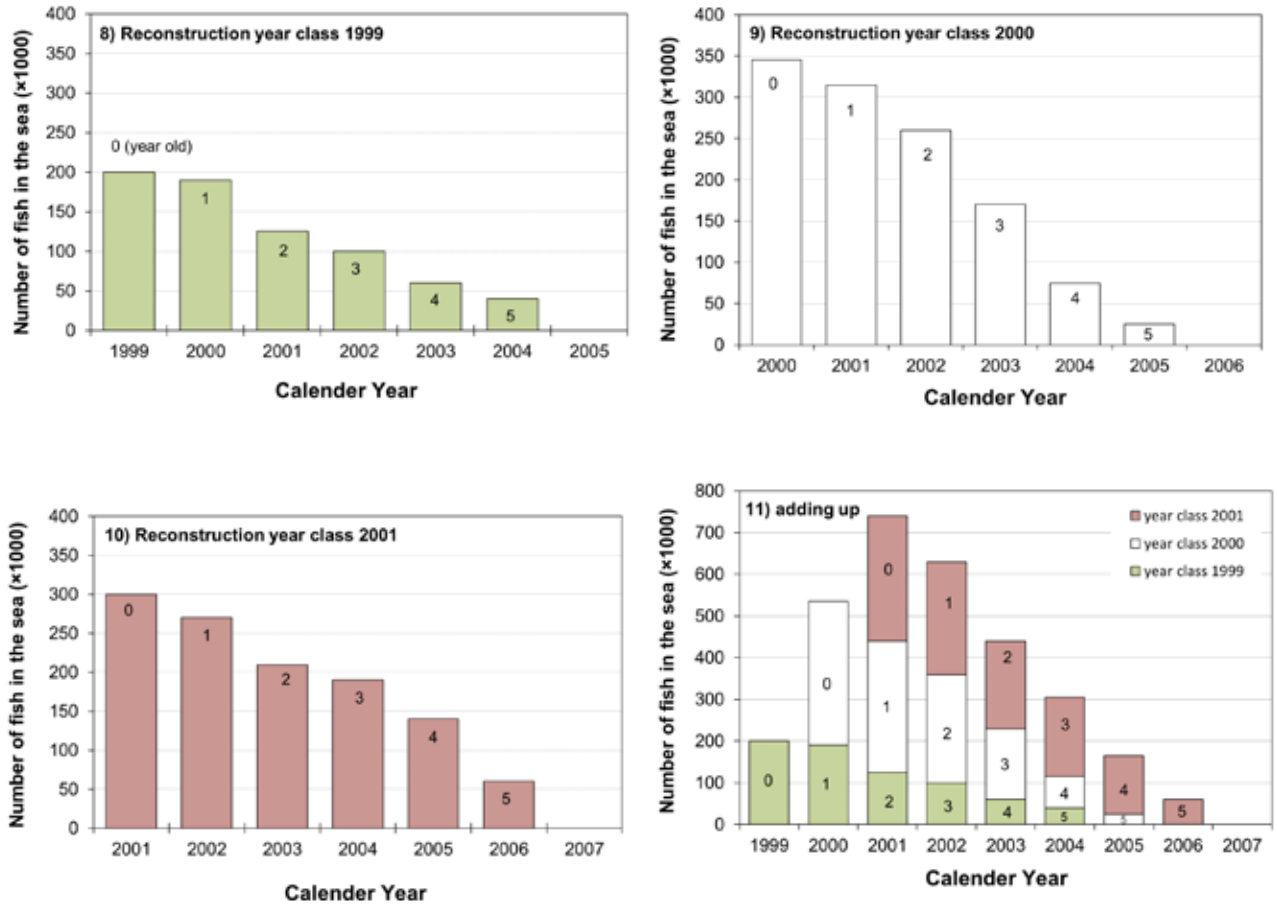


Figure 8-11: Reconstruction of year classes 1999, 2000 and 2001 of sole (fictive numbers) and adding up those year classes per calender year (Fig. 11) to reconstruct the size of the fish stock through time. The numbers in the bars indicate the age of the fish (in years).

Figure 12 shows the number of sole in the sea per age class per calender year, as reconstructed by ICES scientists (real numbers).

So far, we have been talking about numbers of fish. But the fish stock size is assessed in biomass (numbers × weight). The TAC, too, is expressed in weight. By measuring and weighing fish in the ports (portside sampling) and during the surveys, the average weight of sole per age group is assessed. By multiplying the number of sole per age group with the average weight, the sole stock in tons of fish per year can be reconstructed.

Summary
The size of the fish stock in the past can be reconstructed by adding up all fish of a certain year class that have died over the years (catch and natural mortality).

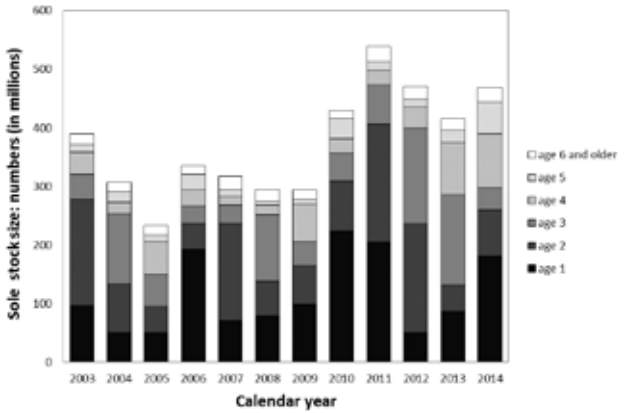


Figure 12: Reconstructed numbers of sole in the North Sea per age group for the period of 1990-2000 (real numbers - ICES). The numbers of sole in the sea fluctuate per year, due to high variability in recruitment (the number of newborns).

BRON: PROSEA

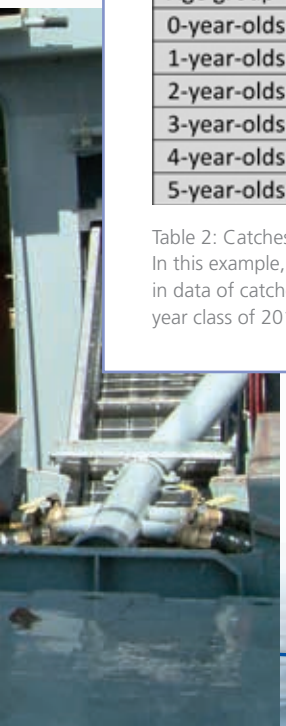
Reconstruction, as explained above, works well for fish born in a year class that has completely been fished up or died from nautral causes. For sole that takes about 10 years: for most sole the maximum age. This means that the year classes older than 10 years can be completely reconstructed. But for fish from younger year classes, born more recently, the reconstruction cannot be completed with data from the catch only (see Table 2).

To clarify this further; now, it is the year 2015, and because the maximum age of sole is 10 years, it takes until 2025 before scientists can assess the developments in the fish biomass until the year 2014 based on reconstruction only. Only by that time (in 2025), all sole that was present in the sea in 2014, has either been caught or has died from natural causes. But we can not wait until 2025 to assess the stock size in 2014, because policy makers need the information now, in order to set the TAC.

Fortunately, the stock size in recent years can be estimated; by comparing the incomplete reconstructions with catch rates ('calibration': see next section).

	Calender Year										
Age group	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
0-year-olds	0	0	0	0	0	0	0	0	0	0	0
1-year-olds	20	10	30	15	10	30	?	?	?	?	?
2-year-olds	90	30	20	70	90	20	?	?	?	?	?
3-year-olds	40	50	40	60	80	20	?	?	?	?	?
4-year-olds	30	20	5	20	30	40	?	?	?	?	?
5-year-olds	20	10	5	15	5	10	?	?	?	?	?

Table 2: Catches of sole in numbers (× 1000) per calender year and per age group, as assessed at the beginning of 2015 (fictive numbers). In this example, 0-year-olds are too small to be fished up, and the maximum age of fish is 5 years. The youngest age classes do not appear in data of catches, yet: they will in the future. Blue: fish from the year class 2009 (example of complete reconstruction), red: fish from the year class of 2012 (example of incomplete reconstruction).



3 Calibration: stock size now and in recent past

Calibration means that developments in the reconstructed fish stock are compared to developments in catch rates of scientific vessels and those of the commercial fishery. Calibration estimates the most probable development in stock size in the recent past (see Figures 13 and 14).

The black solid line in Figure 13 shows the developments in the reconstructed stock size until 10 years ago. Again, this reconstruction is based on adding up all registered landings and assumptions of natural mortality.

The black dotted lines in Figure 13 are three possible developments of the stock size thereafter (according to model calculations). The catch rates of research vessels and that of the fishery (Figure 14) also show the developments in the fish stock (in catch per unit effort), but these are not model outcomes, these are actual measurements. The grey arrow in Figure 13 points at the stock assessment model outcome that shows the same pattern as changes in the catch rates: that is calibration. This is the most probable development in the fish stock (in biomass) over the past ten years.

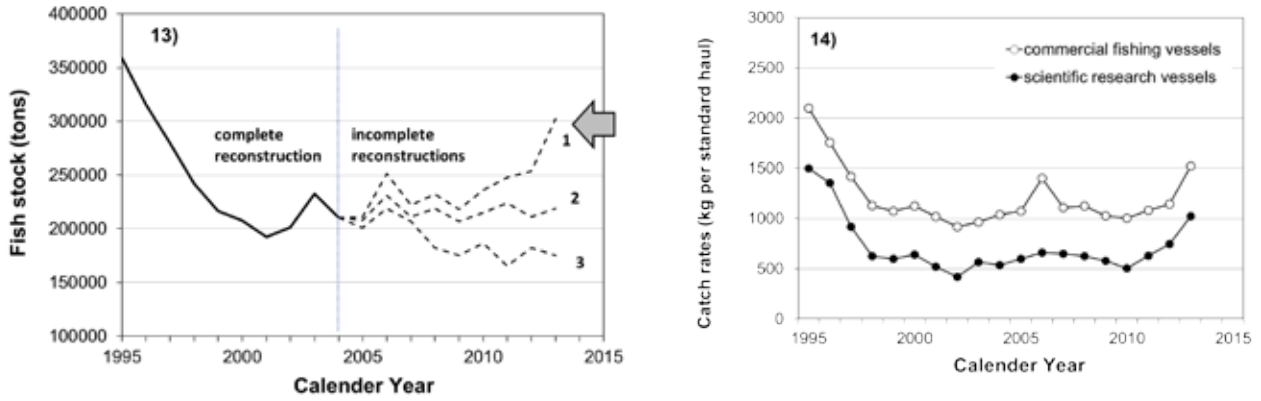


Figure 13-14: Calibration, where (13) a couple of possible developments in the stock size (in this example: three), as assessed by reconstruction, are compared with (14) catch rates of the fishery (black circles) and of research vessel (white circles) (fictive numbers). Grey arrow: explained in the text.

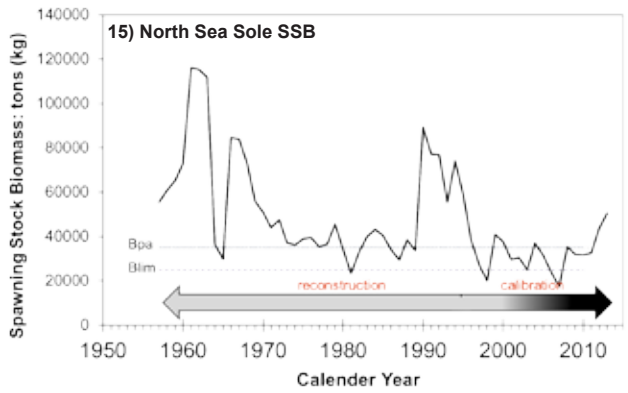


Figure 15: Spawning stock biomass for sole in tons, as assessed by ICES in 2013 (real numbers). Calibration is especially important for stock size estimates in the recent past. Reference levels Blim and Bpa are explained in the text.

Calibrating stock development with catch rates of commercial fishing vessels will not necessarily lead to a higher fish stock biomass in the model, even though a commercial vessel fishing with commercial gear catches more kilograms per haul than a scientific research vessel. That is because, while calibrating, it does not matter how many kilograms of fish are caught, what matters are the relative changes in the number of kilograms (increase or decrease). Using more than one catch rate series in the calibration can help improve the certainty of the stock estimates.

Summary
The sole stock is assessed by adding catches from the past and estimated natural mortality (reconstruction) and by comparing the reconstructed fish biomass with catch rates of research vessels in the most recent years (calibration).

Spawning stock biomass (SSB)

For fisheries management it is not so much the total fish biomass, but the spawning stock biomass (SSB) that is important. SSB is the biomass of reproductively mature fish in a stock: the parent fish that produce offspring and ensure stock replenishment for future years. For North Sea sole, the size at sexual maturity corresponds with the minimum landing size (24 cm). The policy maker wants to keep spawning stock biomass above a certain level, to minimize the risk of decreased reproduction. For that purpose, scientists have identified the minimum level of sexually mature fish that are needed to ensure sufficient reproduction to keep the fish stock healthy, called the biomass limit reference point (**Blim**). For sole, Blim is set at 26.300 tons of sexually mature fish and this value is the same every year. Because Blim is uncertain to some extent (it is an estimate) the policy maker always chooses a more safe level, the precautionary level (**Bpa**), above which the SSB should be kept. For sole, Bpa is 37.000 ton, 40% higher than Blim (Figure 15).

Uncertainties and adjustments

The absolute size of the fish stock at this moment, and in the recent past, cannot be assessed with certainty. That is the consequence of the stock assessment method that is used for many North Sea stocks, as described in this brochure. There is no better alternative; this is the best scientists can do. Every year that a new stock assessment is carried out, the estimated size of SSB in recent years may be slightly adjusted. That is because every spring, the total landings of the past year are published, which provides a bit more information on the size of the year classes currently in the population.

For instance, in 2014, 5 years of data from landings on the year class from 2008 are available (age-1 in 2009, age-2 in 2010 etc. until age-5 in 2013). In 2015 there will be 6 years of data. This means that each year the estimate of how many fish were born in 2008 will be more precise. The same goes for the estimates of SSB.

As an example, Table 3 shows that the SSB of sole at the beginning of 2005, was estimated higher in the stock assessment during calendar year 2005, and was often adjusted downwards in the years thereafter. In other words, between 2005 and 2013, the sole SSB estimate at the beginning of 2005, was assessed to be lower each year (from around 41.000 tons to 31.000 tons). In retrospect, the sole SSB estimate at the beginning of 2005 has been overestimated between the years of 2005 and 2013.

Sole SSB at the beginning of:	Estimated in the year:								
	2005	2006	2007	2008	2009	2010	2011	2012	2013
2005	41000	38000	36000	34000	34000	32000	32000	32000	31000
2006	-	30000	28000	26000	26000	24000	24000	24000	24000
2007	-	-	24000	19000	20000	18000	18000	18000	17000
2008	-	-	-	33000	41000	38000	38000	36000	35000
2009	-	-	-	-	38000	35000	35000	33000	32000
2010	-	-	-	-	-	33000	35000	34000	32000
2011	-	-	-	-	-	-	37000	35000	33000
2012	-	-	-	-	-	-	-	47000	44000
2013	-	-	-	-	-	-	-	-	51000

Table 3: Sole spawning stock biomass estimates, rounded off at 1000 tons (ICES 2013). Red numbers is the SSB of sole at the beginning of 2005, assessed in different years. They are further explained in the text.

As long as the policy maker needs information about the size of the fish stock in the sea at this very moment, in order to set a TAC for next year, we will have to deal with the fact that stock estimates are uncertain, for the stock size now and in the recent past. These uncertainties are accounted for when deciding upon the TAC for the coming year.

At the moment, the stock assessment method using reconstruction and calibration is the one that best fits the current fisheries policy in the North Sea. However, the uncertainties of the stock assessment model could be decreased. Some issues are: Do scientists underestimate the stock size because of incomplete registration of landings? Is the estimated natural mortality rate still valid? Do catch rates reliably monitor relative changes in the fish stock? ICES scientists keep looking at such questions, and at ways to increase the certainty of stock estimates.

Stock assessments for other species

The basic principles of stock assessments, as explained in this brochure for sole, also apply to other demersal species (such as plaice and cod). For pelagic species (such as herring and mackerel) the fish stock is also reconstructed by using landings and an estimated percentage of natural mortality, **but not always calibrated with catch rates**. That is because for pelagic fisheries, commercial catch rates may not reliably reflect changes in the size of the fish stock. Pelagic fish swim in big schools and fishermen often track these schools using sonar. Fishermen can catch a large school in a single haul (high catch per unit effort), even though the entire stock size might be small (of course in that case, the time needed to find such schools is much longer). Standardised scientific trawl surveys can still be used to calibrate pelagic assessments, but more commonly the stock size of pelagic species is calibrated by using acoustic (sonar) estimates of stock size from research vessels. Additional information from fish egg surveys can also be used to get an estimate of the total SSB (the adults that produced the measured amount of eggs).

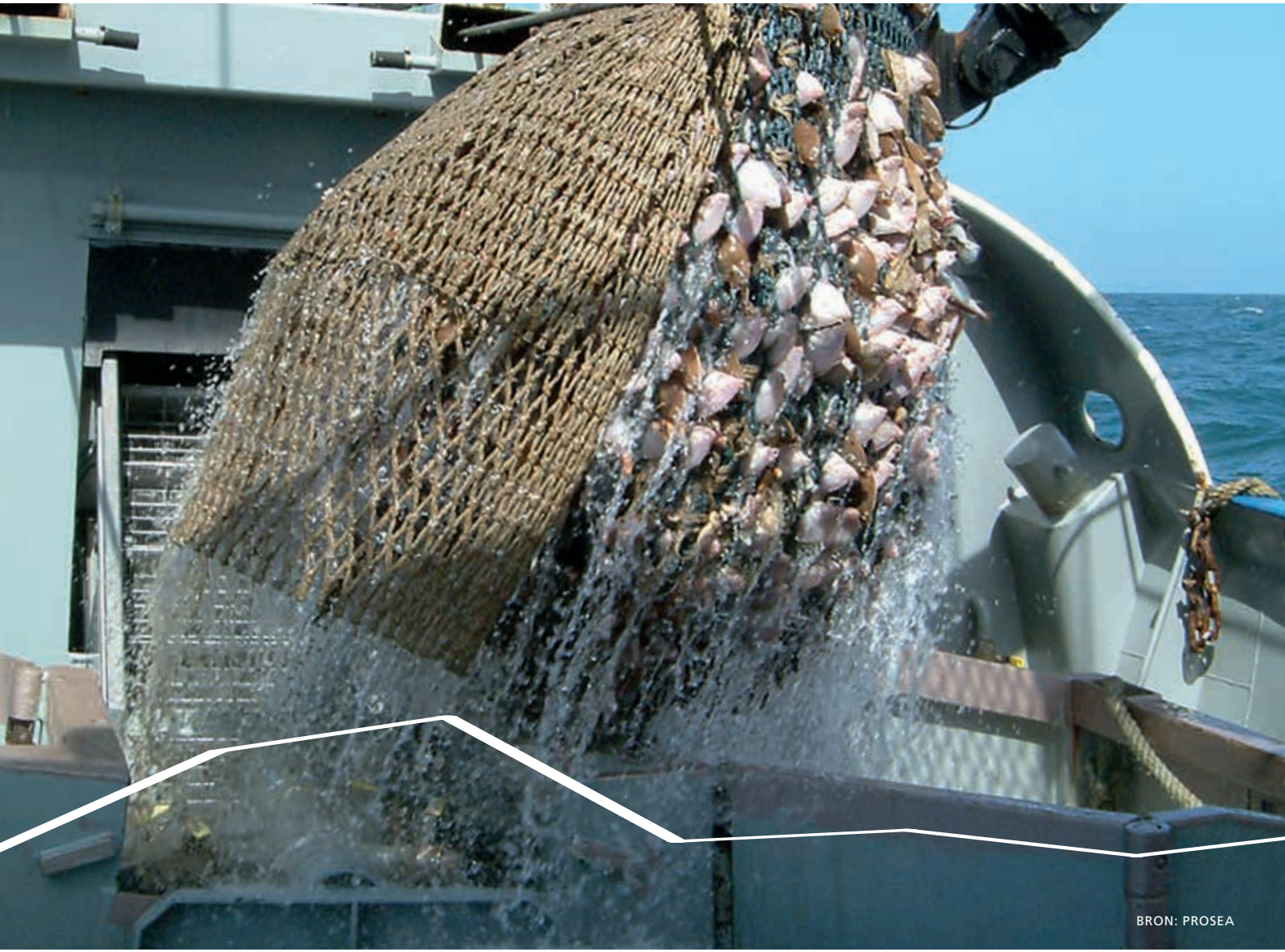
Summary
The fish stock of pelagic species is estimated by adding up catches from the past plus an estimated percentage of natural mortality (reconstruction) supplemented scientific catch rate data, or with stock size estimates based on sonar data or the number of eggs.

Data-limited stocks

For approximately two-thirds of the North Sea fish stocks for which ICES provides advice, no stock assessment is possible, due to a lack of information. These are species that are not caught much by the commercial fleet (examples: turbot and brill), or that are discarded in large numbers (example: dab). The problem then is, for instance, that there is no reliable catch rate series available to calibrate the stock size, or landings by the commercial fleet are so small that the data are scarce and therefore difficult to use. For data-limited stocks, ICES cannot propose a TAC based on a stock assessment as it does for plaice and sole. ICES advises to either restrict the landings at no more than the current level, or to decrease/increase the allowable landings according to the trend observed in a relative index of abundance/biomass. In practice, there is a big chance that the TACs for these species may decline; the less data there is, the more cautious policy makers are. Time and effort will have to be invested to examine available alternatives to traditional data sets (and possibly start collecting new data), in order to develop models to assess the status of these stocks and provide better quality advice with stronger scientific basis.

This brochure was written in 2015 by ProSea and IMARES, in a project of VisNed (Dutch Fishermen's Association) and the project Study Group Fisheries. This report has been produced with financial support of the European Fisheries Fund: Investment in sustainable fisheries.

European Fisheries Fund:
Investment in sustainable fisheries



BRON: PROSEA

www.kenniskringvisserij.nl

Course program – Fishing with a future

Target group: Students fishermen academies

Day 1: Sustainability, the Sea (theory and practice)

Time	Activity	By
9.00	Introduction Sustainable Fishing – 3 P's of sustainability (People, Planet, Profit)	ProSea
9.30	Group assignment (TOP 5)	
10.00	Group presentations (TOP 5)	
10.30	Break	
10.45	Marine Ecology or … how does the sea work? Special local areas	ProSea and local expert
12.00	Lunch	
13.00	Excursion to local 'sea area'	Local expert
16.00	End of day 1	

Day 2: Fishing economy (profit P) and Societal acceptance (People P)

Time	Activity	By
9.00	The fishing fleet in my country	ProSea and local expert
10.15	Break	
10.30	Profit P – Fishing as a business (making money) – The fish chain – Economy and sustainability	ProSea and local expert
12.00	Lunch	
13.00	Profit P – part 2	ProSea and local expert
14.00	People P - Societal acceptance - Image of fishing	ProSea
16:00	End of day 2	

Day 3 – Fisheries Management (Planet P), Communication (People P)

Time	Activity	By
9:00	Fisheries management - Who owns the fish? - About fishing effort, mesh size, catch rates - Fishing management - Fish stock assessment	ProSea and local partner
9.30	Break	
10.45	Fisheries management – part 2	ProSea and local partner
12:00	Lunch	
13.00	PEOPLE P – Communication	ProSea and local partner
16:00	End of day 3	

Day 4 - Environment (Planet P), marine litter workshop, Final workshop

Time	Activity	By
9.00	Environmental challenges - Climate change and other air emissions - Oil and marine litter	ProSea
10.30	Break	
10.45	Workshop – marine litter solutions	ProSea
12.00	Lunch	
13.00	*Back to the future* – close out workshop	ProSea
15.00	Group presentations	Students
16.00	End of course	

Content Blueprint Training for a Sustainable Fish Chain

Preface

This is a detailed blueprint for a course about smart cooperation in a sustainable fish chain for people working in the fish chain, focusing on practicing fishermen and fish vendors. It can be used as an inspiration to develop sustainability trainings for people working in the fish supply chain in North Sea countries.

ProSea bases this document on experience that ProSea has accumulated over the past 8 years while providing economically, environmentally and socially sustainable practice courses for Dutch fishermen and for groups composed of both fishermen and retailers, with the most recent example the 'Sustainable Fish Chains'[1]. The course example included at the end of the blueprint is based upon this training. The Dutch fishing sector recognizes the added value of these kinds of courses, including current formal and informal leaders from the fishing sector, as well as, fishermen, retailers and distributors that have participated in one of ProSea's courses.

We strongly believe that all fishing sectors could gain from a sustainability course. That is why we have written this blueprint, with the hope that it will contribute to the initiation and continuation of this kind of training, given by ProSea in cooperation with others (local partners!). Sustainability training is of great importance for developing a strong, resilient and profitable fishing sector with a future. Everyone in the fish chain would be helped by the knowledge, skills and thinking processes offered in the blueprint course. Fishermen and distributors that know how the fish chain and the playing field around the chain is put together, and know which processes influence the chain and playing field, can better benefit from the situation.

---

1 This project has been selected in the Dutch Operational Program 'Perspective for a sustainable fisheries' that is co-financed by the EFF (European Fishery Funds: Investing in sustainable fisheries).

Introduction: the need for sustainability training

Employees in the fish supply chain have to deal with a totally different work place than 10 years ago due to many changes such as increasing oil prices, increasing social pressure for environmentally responsible fish products, a North Sea that is more and more intensively used by more and more sectors, and increasing import of farmed fish. In addition, and partially as a reaction to these developments, the fishing sector itself has experienced large changes in the past 10 years such as new fishing techniques and more market-focused thinking. To continue to successfully operate in the changing society and the changing fishing sector, competences[2] of those working in the sector need to change and grow. **To this end, education is essential**.

The existence of a successful and sustainable fishing sector is unthinkable if the expertise and competences of the different fish chain partners, including active fishermen, distributors and retailers, stay the same. A successful business today not only includes economic profitability but also a strong position within society (a license to operate), and a responsible attitude, combined with actions, toward the environment. When there is enough attention for each of these three P's (profit, people and planet), we speak of 'sustainability'. Often when people speak about a sustainable, strong, healthy and innovative sector with a future, they first think about what rules, regulations and technical innovations are needed. Education is often forgotten, despite the fact that competent and skilled personnel are key to the existence of a strong and sustainable sector with a future. **Now is the time to invest in knowledge and skills for active fishermen and fish vendors.**

The course described in this blueprint is for fishermen, distributors and retailers that want to cooperate for a more intelligent, profitable and sustainable fish chain. These people are essential for the future of the fishing sector. **The blueprint course offers necessary knowledge and skills for these individuals who want to move forward.** Some of the subjects included are marine ecology, fisheries management, the fish supply chain (how it´s build up, how prices are formed, cooperation), various communication skills, and sustainability futuring (defining challenges, opportunities, goals and action plans).

It is essential that a combination of fishermen, distributors and retailers take this sustainable fish chain course together. In the fish chain supply, distribution and retail are inherently connected: they are mutually dependent for delivering the complete fish product, and the story of sustainable fish to the consumer. Fishermen, at the beginning of the supply chain, need to know the rest of the supply chain in order to know the niches for their products and market demands. In converse, vendors and retailers need knowledge about the supply sector, such as where the fish come from and how these are caught, to sell their fish to the clients. Besides that, both fishermen and vendors need knowledge of societal and political issues concerning sustainable fish. **Trust and good communication within the fish chain is essential for a strong, sustainable and successful fishing sector.** A basis is laid to build this trust and communication in this blueprint course.

[2] Competences are or, are composed of: skills, knowledge, motives, personality and innate capacities

A. Course Framework

Objectives

After finishing the course, the participants

1. have sufficient **knowledge** about sustainable fish supply chains to be able to participate in sustainable development of the fishing sector, including but not limited to: sustainability and how to apply it, marine ecology, fishery management, composition of the fish supply chain, the fish market, marketing and certification, and societal playing field.
2. have sufficient **skills** in the area of sustainable fish supply chains to participate in sustainable development of the fishing sector, including but not limited to: how to participate in a meeting, basic communication (listening and asking questions), how to hold a discussion (a conversation where parties disagree), and how to prepare and give a presentation
3. are able **to give an opinion** about the sustainable development of the fish supply chain, both within own circles, as well as, to the outside world;
4. show **entrepreneurship** by developing ideas how to play a role in the sustainable development of the fish supply chain;
5. take advantage of their **contacts** with other chain partners that they have met and learned to **trust** during the course.

These training outcomes can lead to increased cooperation between retail, distribution and supply, mainly though a shared knowledge base, increased understanding of the position of others, and trust building.

Target group

This training has been composed for fishermen and fish vendors who want to scope their sustainable (which includes profitable) business. The target group includes people working in the fish chain, with an emphasis on:

- Supply: fishermen, fisherwomen, fish farmers,
- Employees of fish auctions (meeting location of supply and retail),
- Distributors and Resale: wholesale, processing, supermarkets, retail, catering.

Number of participants

The maximum number of participants per group is 25, ideally half supply and half other. To provide as broad as possible picture of the chain, it is also an advantage if participants come from different parts of the country and are involved in different kinds of fishing and resale. In addition it can help enormously to have different ages within a group, to stimulate a diversity of ideas.

Course leader capacities

The course leader:

- Is a good process coach, able to:
  - lead discussions and facilitate opinion forming and vision development
  - create an atmosphere within which trust can develop and within which the participants feel safe enough to share personal opinions and information,
- Has experience with groups with large internal diversity, and has insight into group processes;

- Has (global) knowledge of the fish chain, including but not limited to how the fish chain is composed, what the current trends in the fishing sector are and how the concept sustainability can be given meaning;
- Must act and speak independently, relying on factual information, not on opinions (his or her opinion is NOT important for the group);
- Must have a network of experts that are willing to participate in the courses.

Course approach

ProSea has 12 years of experience in developing and providing courses with the focus of sustainability and marine environmental awareness within various sectors of maritime professionals, such as fishermen and seafarers. From this experience the following course approach has developed and is essential for achieving the objectives belonging to the course that is being described in this blueprint.

The seven principles necessary to inspire/cause the change to sustainable entrepreneurship:

1. **Challenge participants without blaming them:**
   - respect the knowledge and professionalism of each course participant
   - challenge participants to listen to, and, accept the existence of 'other opinions' and criticism of the sector
2. **Involve at personal level:**
   - Create a sense of personal responsibility and facilitate formulation of personal opinions
   - participants share personal ideas and opinions with each other, in plenary sessions and in smaller groups.
3. **Stimulate participants to think positively, solution oriented and realistically directed at the future:**
   - challenge participants to create own area of influence: stimulate participants to investigate which role they can play in the making the fish chain more sustainable.
   - challenge participants not to focus on what cannot happen (obstacles) but on what can (opportunities)
4. **Examine how protection of the marine environment, increasing public support and economic growth can go hand in hand**
5. **Kindle the realization that the sea, its diversity and its many functions are important**
6. **Introduce and interact with other interest groups and players in the fishing sector:**
   - bring different interest groups in contact with one another such as fishermen, fish retailers, scientists, environmental organizations and policy makers
   - clarify different perspectives of various interest groups, if you understand one another's perspective it can be easier to cooperate
   - investigate benefits of cooperation and interaction
7. **Deliver most accurate, relevant, independent and current information:**
   - sometimes this involves bringing in external experts, including people working in the government, scientific institutes, companies and environmental organizations
   - connect the course training as much as possible to current business cases from the sector

Facilities and other necessities

- **Good quality locations:** Organizing 'internal' courses at an inspiring location, away from the daily worries, offers the greatest chance that the participants are able to create enough 'brain space' to work with the course content. This includes a good accommodation and catering.
- **Good contacts with external experts and stakeholders:** Involving stakeholders and specialists guarantees that the course contains the most current information and legitimizes the information.

- **Enough time and effective methods to create trust within the group:** The objectives of this course series succeed or fail with trust. Many fishermen have formed the habit of reacting suspiciously, defensively, and sometimes aggressively toward other stakeholders such as fish vendors, environmental groups and (fish) biologists. The wrong atmosphere, setting, or style of a course will achieve no, or even negative, results. An appropriate process will increase the chances of achieving the objectives and help avoid polarization. Such a process needs enough time to evolve. A training of three 2-day sessions, with the inclusion of social activities such as having dinner together, seems to be the minimum training intensity required. These sessions should be spread out over several months.

Motivations and evaluations

Or in other words: why do participants come to the course? And what some of them think after the course. Motivations to join the course include:

- Knowledge + skills = power! That means more influence on own future;
- Participants can use the learned knowledge and skills in their own business and make a positive contribution to both an environmentally and an economically sustainable fishing sector;
- Participants learn to actively search for constructive solutions to challenges they encounter in their business (learn to view a challenge as an opportunity instead of a threat);
- More knowledge about the playing field of and around the fish chain, so participants discover where they can have more influence and how to use it;
- Learn to communicate better, to have difference of opinion, participate in a meeting, so participants will be able to express themselves easier and more efficiently during meetings and talks;
- Learn from and meet specialists that are experts in a certain areas of the fish chain, such as researchers and policy makers;
- Participants retain a useful network with various chain partners and other stakeholders with which they can further continue.

Following are statements ProSea course participants. They provide some insight into what participants have gained from the courses:

- *[A fisherman]: After this course I dare to speak up at meetings.*
- *[A fisherman]: My view of the entire fishing sector and sustainability has changed.*
- *[A fisherman]: It was an eye-opener for me to see how the supply chain creates the price of fish.*
- *[A fisherman]: We entered in our own small cubby-holes and then opened ourselves up for ideas from others.*
- *[A fish vendor]: I see how important it is that we have distributors and suppliers sitting here together. Normally I never meet any fishermen. And I am interested in their story. My clients are too.*
- *[A fish vendor]: Through this course I get more and more respect for the fishermen who do enormous amounts of work for relatively little money.*
- *[A fish vendor]: I am very enthusiastic about the progress of the process. While working here, sustainable fishing is being accepted and incorporated by all parties in the fish supply chain. In addition, a good basis for cooperation within the fish supply chain is being built.*

B: Basic educational elements

The course contains three basic educational elements under the umbrella of 'a sustainable fish chain'.

1) Content & Theory (knowledge, consciousness, current information)
2) Communication skills (hear, see, then practice, and practice again)
3) Sustainability futuring (develop visions, goals, and future plans – first individual, then collective)

Educational element	Why	How
1. Content & Theory	Knowledge is power. Understand playing field of and around the fish chain so can give an informed opinion and be able to estimate own sphere of influence. Create collective knowledge base.	Presentations by experts with time for questions from participants, and, discussion.
2. Communication skills	Crucial for implementing gained knowledge, plans, cooperation and improving the image of the sector, the individual or business.	Theory (short lecture) and practicing with situations, other participants, and an actor in workshops and roll-play.
3. Sustainability futuring	Learn to develop and express concrete action plans about smart, cooperative and sustainable development, so that this can be brought into practice.	Course-long assignment, partially in form of homework. Practicing with opinion forming, creating a vision and writing an action plan based on sustainability futuring (first individual, then collective). Finally, share plan and discuss with fellow participants.

The three basic educational elements are composed of the following components.

Content & Theory [Content]

1) Concept 'sustainability' (lecture) as a balance between People, Planet and Profit
2) Start of the chain: how does the sea work? Lecture, marine ecology
3) Start of the chain: how to manage the sea? Lecture, fishery management. Including local and EU policy, and understanding 'the tragedies of the commons'
4) Start of the chain: what is aquaculture? Lecture fish farming
5) The chain partners: who does what? Role of the different partners and their location in the chain
6) The chain as whole: how does it work? Number of links, pricing, margins, domestic market
7) International market and role of international trade
8) The end of the chain (the consumer), marketing, and certification
9) The societal playing field around the fish chain – what does it look like? Who are the stakeholders? What do they want? --- importance of societal acceptance as 'license to operate'

Communication skills [Com skills]

1) Basic communications skills: verbal and nonverbal
2) Meeting techniques: speaking in a group
3) Presentation: telling a story or about yourself
4) Carrying on a conversation (speaking one on one): learn to listen, summarize, ask and ask again
5) Discuss: a conversation over a disagreement
6) Debate: a structured discussion – arguing and convincing

Sustainability futuring [Vision]

1) Forming personal opinion about the most important challenges for a sustainable fish chain
2) Individual business vision/sustainability futuring: what do you want to achieve in 5 years? Step 1 = dream (what you want the most), step 2 = determine goals (what is realistic) and step 3 = how to achieve it (project management / managing change)
3) Collective vision and plan: solution for a challenge in the sustainable fish chain. What can you influence together with other in the fish supply chain? And how can you collectively achieve that? Which stakeholders in/around the fish chain do you need for this?

C. Detailed example of a ProSea Sustainable Fish Chain course

Overview

The ProSea course consists of three 2-day workshops:

1. The sea, people in the fish supply chain (who's who) and Me
2. From net to plate (fish supply chain in detail)
3. Societal context, the value of cooperation and future plans

These three workshops include the three basic educational elements, content & theory [Content], communication skills [Com skills] and sustainability futuring [Vision], woven into and through all six days. In this course example ProSea lists both the actual subject of the workshop as well as the educational element.

Detailed program

Workshop 1

Day	Daily Period	subject	Educational element
1	Morning	Reception with coffee, official opening, short introduction of entire program	-
1	Morning	Lecture sustainability	**Content** (sustainability theory)
1	Morning	Introduction: who is who? Thorough, personal/individual introductions in the form of questions and assignments • Group assignment with question list • Interview in pairs and introduce each other to the group	**Content** (role of the different chain partners) **Com skills** (asking questions, listening, summarizing)
1	Afternoon	How does the sea work? Lecture • Basic marine ecology • Importance of the oceans • A few current ecological issues connected to fishing	**Content** (where the fish chain starts: supply)
1	Afternoon	Further introductions & how to participate in a meeting (I) • Meeting techniques - theory • 4 group meetings: why are we here/how are we connected? • Presentation and plenary review: content and procedure (how did the meeting go?)	**Content** (role of different chain partners) **Com skills** (participating in a meeting - speaking in/to a group - and presenting)
1	Evening	How to participate in a meeting (II) • Short lecture basic communication • Practice: what (does not) work in a meeting? Do's & Don'ts	**Com skills** (participating in a meeting - speaking in/to a group)

2	Morning	Short preview and review (today and yesterday)	-
2	Morning	How does fish farming work – lecture aquaculture	**Content** (where the fish chain starts: supply)
2	Morning	Fishery management – Lecture and assignments • Tragedy of the commons (by game) • Q&A session with a scientist and a fishery manager	**Content** (managing the start of the fish chain: supply and suppliers) **Com skills** (asking questions and listening)
2	Afternoon	Group project: Make and present a list of the top 5 greatest challenges to sustainability in the fish chain	**Vision** (form an opinion about the challenges to a sustainable fish chain) **Com skills** (presenting)
2	Afternoon	Conclusion, evaluation, homework and preview of, and wishes for, the rest of the program	-

Workshop 2

Day	Daily Period	Subject	Educational element
1	Morning	Reception, short review of last workshop, intent of this workshop	-
1	Morning	Homework: My business in 5 years (dream) • In pairs, retail en supply mixed, tell each other • Share highlights in plenary session (one tells about the other)	**Vision** (brain storm to determine course of action) **Com skills** (asking questions, listening, summarizing, public speaking)
1	Morning	The fish chain (I) – General form, pricing, influential factors	**Content** (the national fish chain)
1	Morning+ afternoon	Marketing • Theory: What is marketing? How does it work? Influence the consumer? What does the consumer want anyway? • Practice: a business case	**Content** (the end of the fish chain: the consumer)
1	Afternoon	Presentation techniques, theory and practice	**Com skills** (presenting a story / yourself)
1	Afternoon	The chain (II) – World market: role international supply and trade	**Content** (what does the international fish chain look like)
1	Evening	Group work: Make your own fish score card	**Content** (why certification / ranking based on sustainability) **Vision** (what do I think is sustainable?)
1	Evening	Certification • Lecture on quality labels • Business case (for example MSC)	**Content** (quality labels)
2	Morning	Short preview and review (today and yesterday)	-
2	Morning	What do you mean, *together* in the chain? • Image and identity within the fish chain • What do we think about one another?	**Content** (image and identity)
2	Morning	Having a discussion (talking one on one) • Short lecture about different forms of questions (open, closed, directive) • Practice: asking questions and differentiating facts and opinions	**Com skills** (having a discussion: asking questions, listening, summarizing, asking again)
2	Afternoon	Business cases: visions of the fish market (or alternative fish chain models) • From the supply side • From the retail side	**Content** (fish chain models / shortening the chain)

2	Afternoon	Own success stories: • How to influence the sale process • What are the successful strategies at the fish market? • Why do they work (key to success)?	**Vision** (What can I do differently? What can we, as a collective, do differently in the fish chain?)
2	Afternoon	Conclusion, evaluation, homework and preview of the rest of the program	-

Workshop 3

Day	Daily Period	Subject	Educational element
1	Morning	Reception, short review of previous workshop, intent of this workshop	-
1	Morning	Homework: My business in 5 years (practical and realistic goal) • Who do I need to achieve this? • Concrete first step?	**Vision** (what do I want to reach, realistically) **Com skills** (2 minute presentation – elevator pitches)
1	Morning	Stakeholder mapping • Who are the key players in 'fish land'? • Group project (make an overview together) and present	**content** (get overview of broader playing field - stakeholders) **Com skills** (presenting)
1	Morning	Role of NGO's in perspective (lecture)	**Content** (what are NGOs? What do they want? How to deal with them?)
1	Afternoon	disagreeing (discuss) • Short lecture on discussion theory • Practice talking to someone you disagree with (and with whom you must cooperate)	**Com skills** (discuss)
1	Evening	Meeting environmental organizations • Interviews in small groups (based on open questions) and present one of the NGO's to the plenary group • Talk about a few contentious points	**Content** (what do NGO's want?) **Com skills** (asking questions and discussing)
2	Morning	Short preview and review (today and yesterday)	-
2	Morning	The top 5 revisited: What are the most important challenges for sustainability in the fish chain?	**Vision** **Com skills** (presenting)
2	Morning	Short lecture on project management (I know what I want to change, how do I achieve it?)	**Content** (change management)
2	Morning	Write a collective vision / project proposal (´smart and together´ plan): • For one of the challenges from the top 5 • Concrete solutions for that problem • Who needs to be involved? • Concrete first step? • Focus on: 'what can I do' (in cooperation with others)	**Vision** (formulating steps needed to reach goal) **Com skills** (project management)
2	Afternoon	End conclusions and present plans to group. If possible and desired, also to third parties.	**Vision** (collective goal and actions) **Com skills** (presenting)
2	Afternoon	Debate positions on solutions for challenges in the sustainable fish chain	**Vision** (collective goal and actions) **Com skills** (convincing)
2	Afternoon	Conclusion, evaluation whole course	-

SUSTAINABLE FISHERIES
EDUCATION PROGRAMME

Business of Fishing 2019

WORKSHOP SUMMARY (draft)

DAY 1 – 14th May	DAY 2 – 15th May	DAY 3 – 16th May
Programme & Agenda overview Alexa Dayton (GMRI) Jim Masters (FITF)	**Reflections on Day 1** Alexa Dayton (GMRI) Mike Park (Moderator)	**Morning Welcome** Alexa Dayton (GMRI) James Duthie (Moderator)
Introductions & welcome Mike Park (SWFPA) Kenny Coull (SWFPA)	**SCIENCE & MANAGEMENT (1)** **Stock Assessment and modelling** Coby Needle (Marine Scotland Science)	**ECONOMICS (1)** **Economics and Social Science: Business in the real world** Hazel Curtis (Seafish)
SCIENCE (1) **International Context** Eskild Kirkegaard (Outgoing ICES Chair)	***BREAK***	***BREAK***
SCIENCE (2) **Introduction to Marine Science** Bill Turrell (Marine Scotland Science)	**SCIENCE & MANAGEMENT (2)** **ICES – Who do they think they are?** Eskild Kirkegaard (Outgoing-ICES Chair)	**ECONOMICS (2)** **Markets and Access** Iain Lowrie (Young's Seafood and UK Seafood Industry Alliance)
BREAK	**SCIENCE & MANAGEMENT (3)** **ICES – Demystifying Stock Sheets** Steve Mackinson (SPFA)	**ECONOMICS (3)** **Markets as Drivers of Change** Claire Pescod (Marine Stewardship Council)
SCIENCE (3) **Fisheries sampling and Data Collection** Steve Mackinson (SPFA)	***LUNCH***	**ECONOMICS (4)** **Panel Debate: All Presenters and Moderators** Alexa Dayton (GMRI)
SCIENCE (4) **Fish Biology and Sustainability** Dr Tara Marshall (Aberdeen Uni)	**SCIENCE & MANAGEMENT (4)** **Negotiations for Real: TAC and quota allocation** Alan Gibb (Marine Scotland)	**LUNCH**
***LUNCH** + Optional practical activities: otolith extraction*	**SCIENCE & MANAGEMENT (5)** **Fisheries Negotiation Activity** Alexa Dayton (GMRI)	**WRAP UP:** **Final reflections, expense forms and certificates** Alexa Dayton and Jim Masters
SCIENCE (5) **Swept-Area Survey Design: Hands-on Activity** Steve Mackinson (SPFA)	**SCIENCE & MANAGEMENT (6)** **Governance – how to get involved** Mike Park (SWFPA)	**WORKSHOP CLOSES:** **(2:00 - 2:30pm)**
SCIENCE (6) **Industry-Science in Action** Andrew Brown (MacDuff)	**Moderated Discussion** Moderator: Mike Park Followed by Social Hour	
Moderated Discussion Moderator: Kenny Coull Followed by Social Hour		

Contact: jim.masters@fitf.co.uk | 01803 659219; mike@swfpa.com | 07710504773

Introduction to Sustainable Fishing

WORKSHOP AGENDA - SUMMARY

DAY 1 - 6th March	DAY 2 - 7th March	DAY 3 - 8th March
Programme & Agenda overview Alexa Dayton (GMRI)	**Reflections on Day 1** Alexa Dayton (GMRI)	**Morning Welcome** Alexa Dayton (GMRI)
Introductions & welcome Peter Williams (fisherman) David Stevens (fisherman)	**SCIENCE (6) Stock Assessment "Master-Class"** Carl O'Brien (Cefas)	**ECONOMICS (1) Economics and Small-Scale Fisheries** Hazel Curtis (Seafish)
SCIENCE (1) Setting the Scene Carl OP'Brien (Cefas)	***BREAK***	**ECONOMICS (2) Access to Markets** Andy Pillar (Interfish) & Andy Hickman (Tesco)
SCIENCE (2) Fisheries Science Overview Michel Kaiser (Bangor Uni)	**MANAGEMENT (1) Governance** Tim Robbins (D&SIFCA) and Hazel Curtis (Seafish)	**BREAK**
BREAK	**MANAGEMENT (2) Negotiations and Quota Allocation** (Defra & CPO)	**ECONOMICS (3) Certification, FIPS and a flexible supply chain** Claire Pescod (MSC)
SCIENCE (3) Fisheries science in practice – sampling and data collection Michel Kaiser (Bangor Uni)	***LUNCH***	**ECONOMICS (4) Case Study: Cornish Sardines** Gus Caslake (Seafish)
SCIENCE (4) Fish Biology and Fisheries Science Lab Rachel Brittain (Cefas)	**MANAGEMENT (3) Participation & Data** Sarah Clark (D&SIFCA)	**ECONOMICS (5) Community Supported Fisheries: Case Study** Chantelle Williams (fresh from the Boat)
LUNCH + *Optional practical activities: otolith extraction + sexual maturity of whelks*	**MANAGEMENT (4) Fisheries Management Role Play** Martin Attrill (Plymouth Uni) & Alexa Dayton (GMRI)	**LUNCH**
SCIENCE (5) Fishing Survey Design: Hands-on Activity Paul Hart (Leicester Uni)	***BREAK***	**Open Forum – moderated discussion** Chair: Peter Williams
WORKING BREAK	**MANAGEMENT (5) Moderated discussion and reflection** Chair: David Stevens (fisherman)	**Wrap up**
Moderated Discussion Chair: Peter Williams		**WORKSHOP CLOSES: 2:30 / 3:00**

This programme is supported by: EMFF, Morrison's Foundation and Seafish SW Advisory Group

Demonstration Expo + Social Hour (drinks available) Various demonstration stations		