A TEACHING KIT ON THE ECOSYSTEM APPROACH TO FISHERIES FOR BASIC SCHOOLS IN AFRICA

TEACHERS GUIDE ON METHODS AND APPROACHES

NANSEN PROJECT

A TEACHING KIT ON THE ECOSYSTEM APPROACH TO FISHERIES FOR BASIC SCHOOLS IN AFRICA

Teachers Guide on Methods and Approaches

Food and Agriculture Organization of the United Nations, Rome 2014

Design and layout: studio@bartoleschi.com – Rome, Italy

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This Teaching Kit has been prepared through a collaboration between the EAF-Nansen project and *Mundus maris* Sciences and Arts for Sustainability, with technical support of the FAO Communication for Development group. It is the result of a collective effort involving people from different cultural, professional and organizational backgrounds who have worked together to create a high quality didactic tool that tries to address the specific needs of schools in Africa while recognizing at the same time, the diversity of educational systems across the countries.

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ABOUT THE **TEACHING KIT**

The themes and the contents of the Teaching Kit have been developed according to the results of a needs assessment study carried out in 21 primary and 13 secondary schools in Senegal and the Gambia. The work was done in coastal towns and villages where fishing and related activities are important, namely Saint Louis, Kayar, Hann, Mbour and Ziguinchor in Senegal and Brufut and Gunjur in the Gambia. The objective of the study was to identify the communication needs of young children in relation to marine and coastal ecosystem concepts so as to enable future generations to participate proactively in implementing the FAO Code of Conduct for Responsible Fisheries (CCRF) and the ecosystem approach to fisheries (EAF).

The needs assessment brought to the fore a large unmet demand, for specific communication materials and activities on marine ecosystem education and on the EAF. A communication strategy was developed immediately after the needs assessment in order to support, through appropriate participatory Communication for Development[1] approaches, a series of awareness-raising activities and training workshops on the EAF with partners in the region. The communication strategy included the development and testing of a set of teaching aids and information materials.

The first version of the Teaching Kit was tested in some schools in Senegal and the Gambia. It is still work in progress, and the content will be reviewed and refined as more schools from other African countries participate in its testing and evaluation. Readers are encouraged to send their comments and feedback to:

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1 Communication for Development is a process which uses participatory methodologies, tools and techniques to foster people's participation in development activities, enabling groups and communities to diagnose the problems they face, make well-informed decisions, mobilize for action, and assume responsibility for their own development.

1 INTRODUCTION

The EAF-Nansen Project "Strengthening the Knowledge Base for and Implementing an Ecosystem Approach to Marine Fisheries in Developing Countries" provides technical support to partner countries in sub-Saharan Africa for the implementation of the EAF management. Its aim is to promote management and sustainable utilization of marine living resources.

The long term objective of the project is to strengthen regional and country specific efforts to reduce poverty and create conditions to assist in the achievement of food security through development of sustainable fisheries management. Its immediate objectives are to provide the fisheries research institutions and management administrations, in the participating countries, with additional knowledge on their ecosystems for their use in planning and monitoring, and to further the acceptance and application of the key principles of the EAF.

A communication strategy developed for the EAF-Nansen project, has been supporting the objectives of the project through a number of activities and tools aimed at raising awareness among partner institutions and the public at large on the principles of the EAF, as well as creating synergies and facilitating information flow within project components.

This teaching kit is one of the many communication tools through which the EAF-Nansen project promotes values and best practices for responsible fisheries. Its purpose is to introduce children and youth from fishing communities, enrolled in primary and secondary schools, to concepts related to marine ecosystems and sustainable management of resources, their implications and challenges. More specifically, the kit was designed to provide school teachers with a set of practical guidelines and tools to stimulate dialogue and knowledge sharing among the students on sound fishing practices, aquatic ecosystems and critical habitats, and their relationships with fishers and fishing communities.

It is expected that the Teaching Kit will contribute to the dissemination of EAF messages within families and communities of fishers, as well as enhance the capacities of future generations of fishers to play a more active role in the management of fisheries that is consistent with the principles of the FAO CCRF and EAF.

The Teaching Kit comprises several components. It is modular, so that elements may be usable at both primary and junior secondary school levels and exercises can be chosen or adapted to the age group of the pupils or the specific educational context. The Kit is meant to be complementary to other teaching aids and guidelines provided by the Ministry of Education as part of the syllabus and the official curriculum.

2 HOW TO USE **THE TEACHING KIT**

THE TEACHING KIT WAS PRIMARILY CONCEIVED AS A SUPPORT TO MARINE SCIENCE, ENVIRONMENTAL SCIENCE AND GEOGRAPHY CLASSES, BUT CAN ALSO BE PRESENTED AS A SPECIFIC, TARGETED LEARNING ACTIVITY INVOLVING THE STUDENTS WITHIN AND OUTSIDE OF THE CLASSROOM. THE TRAINING CAN BE DELIVERED BY ANY TEACHER SINCE IT DOES NOT REQUIRE A SPECIFIC TECHNICAL KNOWLEDGE OF THE SUBJECT. HOWEVER, A GOOD UNDERSTANDING OF THE KEY ISSUES RELATED TO THE MANAGEMENT OF THE MARINE ECOSYSTEM AND FISHERIES WOULD BE AN ASSET.

The kit is designed to present scientific information and environmental knowledge in an attractive and entertaining way, while at the same time providing students with notions they can use for raising awareness about fisheries management issues as well as on the role that each member of a fishing community is expected to play. Most of the activities involving the children were designed to enhance science learning. However you will find that the exercises also stimulate the students to increase their skills in other disciplines such as language, social studies, drama, music, geography and visual arts.

The kit includes a comprehensive set of technical content consisting of a teachers' guide, posters and other types of visual aids for students to use in class and during outdoor activities. Additional in-depth information is also provided in the enclosed publications so that teachers and students can further explore specific topics related to the EAF concepts and framework.

TARGET AUDIENCE

The Teaching Kit is especially aimed at teachers and their pupils aged 6 to 15 enrolled in primary and secondary schools (basic schools). Even though the language used across the kit is quite simple there may be a need to break down specific technical concepts into simpler ideas, particularly for the younger age groups. Teachers are therefore encouraged to tailor the lessons to better meet their curricula and grade requirements based on their own individual teaching style, methodology and personal experience.

ORGANIZATION OF THE TEACHING KIT

The Teaching Kit consists of the following teaching tools:

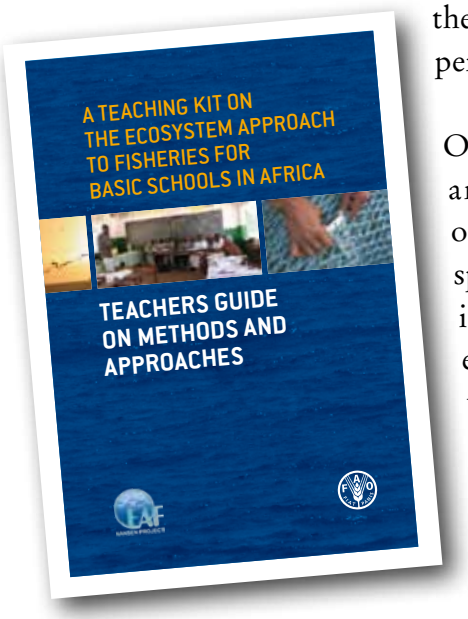
A The Teachers Guide on EAF methods and approaches
(this publication)

The Teachers Guide is divided into four main parts:

>> **Part 1** (chapters 3 and 4) lays the groundwork for creating an understanding of a marine ecosystem, its issues and challenges, the concept of primary production and food webs and the interaction between habitat and species so as to ensure the proper functioning of the ecosystem. This is followed by an introduction and a general overview of the objectives of the EAF.

>> **Part 2** (chapter 5) is dedicated to the human impact on marine ecosystems as part of the ecosystem approach to fisheries. It is organized into learning units built around the five key principles of EAF in order to cover the major aspects of the socio-economic activities affecting marine ecosystems directly. Each EAF principle is introduced by outlining the teaching objective and providing basic information about its concepts and features, in order to support the teacher's preparation of the learning unit.

At the end of each learning unit, there are a number of "*messages to be shared with the pupils in class*". These are key topics/ideas that the teacher should highlight when preparing the lesson and guiding class discussions. Ideally, through a series of questions on the specific principle, the teacher should encourage the students to explore all sides of the issues being presented and allow them to present their own perceptions and interpretations.



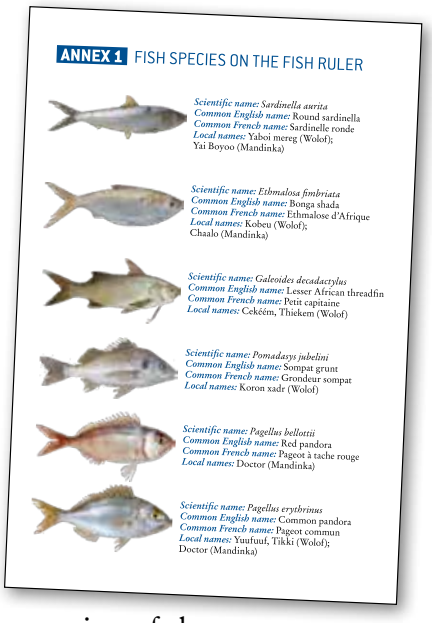
Obviously there are other aspects affecting marine ecosystems and their ability to support fisheries, such as pollution, ocean acidification, climate change and others. These are not specifically discussed in the guidelines, but can be integrated in different key principles at the teacher's discretion. At the end of this section the children should be able to understand why these principles are crucial to the sustainability of the ecosystem and what action needs to be taken to overcome the obstacles.

>> **Part 3** (chapter 6) provides a set of recommended exercises and activities to be done with the students, based on the issues identified in each of the five key EAF principles presented in section two. The exercises are meant to increase the students' understanding of the risks at stake, stimulate dialogue, discussion, reflection and in-depth analysis of specific EAF related issues, as well as provide them with the skills and the knowledge they will need to make a difference. Suggestions for outdoor excursions are also provided.

>> **Part 4** (chapter 7) consists of a series of tools and guidelines on monitoring and evaluation of EAF learning with the purpose of keeping a record of the lessons learned.

Throughout the sections of the guide, concepts and methodologies are provided along with specific examples illustrating the principles presented; also, references for additional reading material and trusted websites are indicated at the end of each section.

B Fish Ruler


ANNEX 1 FISH SPECIES ON THE FISH RULER

Scientific name: Sardinella aurita
Common English name: Round sardinella
Common French name: Sardinelle ronde
Local names: Yaboi mereg (Wolof); Yäi Boyoo (Mandinka)

Scientific name: Ethmalosa fimbriata
Common English name: Bonga shada
Common French name: Ethmalose d'Afrique
Local names: Kobeu (Wolof); Chaalo (Mandinka)

Scientific name: Galeoides decadactylus
Common English name: Lesser African threadfin
Common French name: Petit capitaine
Local names: Cekëëm, Thiekem (Wolof)

Scientific name: Pomadasys jubelini
Common English name: Sompat grunt
Common French name: Grondeur sompat
Local names: Koron xadr (Wolof)

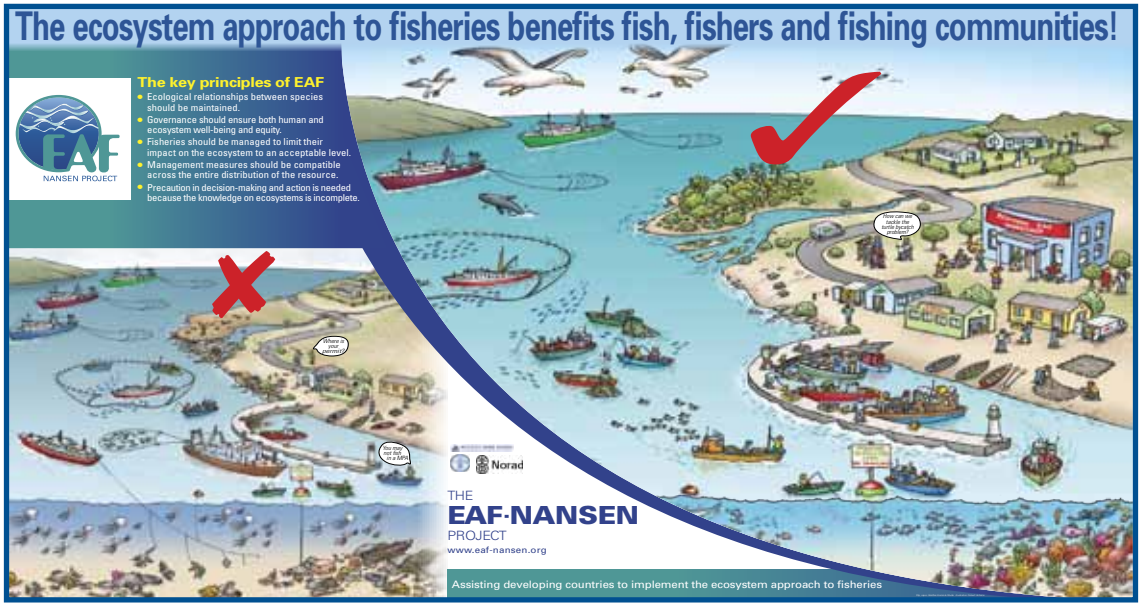
Scientific name: Pagellus bellottii
Common English name: Red pandora
Common French name: Pageot à tache rouge
Local names: Doctor (Mandinka)

Scientific name: Pagellus erythrinus
Common English name: Common pandora
Common French name: Pageot commun
Local names: Yuufuuf, Tikki (Wolof); Doctor (Mandinka)

Fish that are caught before they reach a mature age do not have the opportunity to reproduce, thus the fish population decreases, threatening the future of fish stocks. This is the main idea behind the use of the ruler. Students can use it during field trips to landing sites or at the fish market (see section 6), to determine whether the fish caught is of the right size to have spawned at least once. The ruler is printed on water-resistant material; it shows pictures of the most common fish caught by fishers from communities where the children live. It is accompanied by a log sheet where children can record the different measurements of fish taken during the field trip[1]. In Annex 1, you will also find a table showing the picture of the fish with its common and scientific names, as well as the name in the local language. This exercise will help students get acquainted with the various types of fish, gain a better understanding of the importance of good fishing practices and also to get a first-hand impression of the amount of undersized fish in a catch. For many fish species the minimum mature size could vary from area to area (e.g. Northwest Africa, Central Africa, etc), therefore a different Fish Ruler is required for each area.

1 Chapter 6.6 - Exercises outside the classroom, exercise 2, recording fish quantity and size.

C EAF-Nansen Project poster



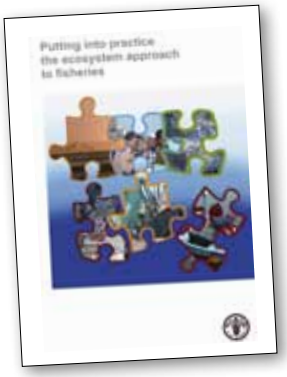
The poster shows two different scenarios of fisheries managed with and without taking into account the EAF. The poster is designed to visually illustrate the concepts and the issues presented in chapter 5. As a class exercise it can serve as an exploratory activity for students to identify activities that refer to a particular EAF principle.

D Monitoring and evaluation forms

The purpose of the monitoring and evaluation forms is to measure the impact of the EAF lessons and to keep track of children's learning progress. The forms are available in this guide as Annex 4. A separate form is also provided as Annex 5, for teachers to send their feedback on the use of the teaching kit as a whole.

annexes number and pictures amended

E Publication – Putting into Practice the ecosystem approach to fisheries



This publication is an additional resource of information on the EAF. It is intended to provide a more concise and less technical outline of the purpose and meaning of the EAF and guidance as to how to implement the approach. The publication is also available online at:
http://www.fao.org/docrep/009/a0191e/a0191e00.HTM

FURTHER BACKGROUND READING AND WEB-BASED AVAILABLE RESOURCES

The background reading in this section is focused on additional generic materials about the EAF and the EAF-Nansen project to provide the wider context.

- **EAF-Nansen Project flyer:** The Fisheries Manager and the ecosystem approach to fisheries: ftp://ftp.fao.org/FI/DOCUMENT/eaf_nansen/COMMUNICATION_MATERIAL/EAF_Flyer_ENGLISH.pdf;
- **EAF-Nansen Project brochure:** Strengthening the knowledge base for and implementing an ecosystem approach to marine fisheries in developing countries: ftp://ftp.fao.org/FI/DOCUMENT/eaf_nansen/COMMUNICATION_MATERIAL/EAF-NANSEN_brochure_ENGLISH.pdf.

While not formally part of the Teaching Kit, it is desirable that each school acquires a digital camera to visually document its experience. Some financial resources would be necessary for excursions (e.g. to fish landing sites, fish markets, visit of research institutes etc.) and for purchase of materials for theatre plays, painting competitions and other such activities. Access to internet facilities inside or outside the school would create highly desirable enrichment of teaching opportunities and provide dynamic access to additional resources

3 BASICS OF **MARINE ECOSYSTEMS**

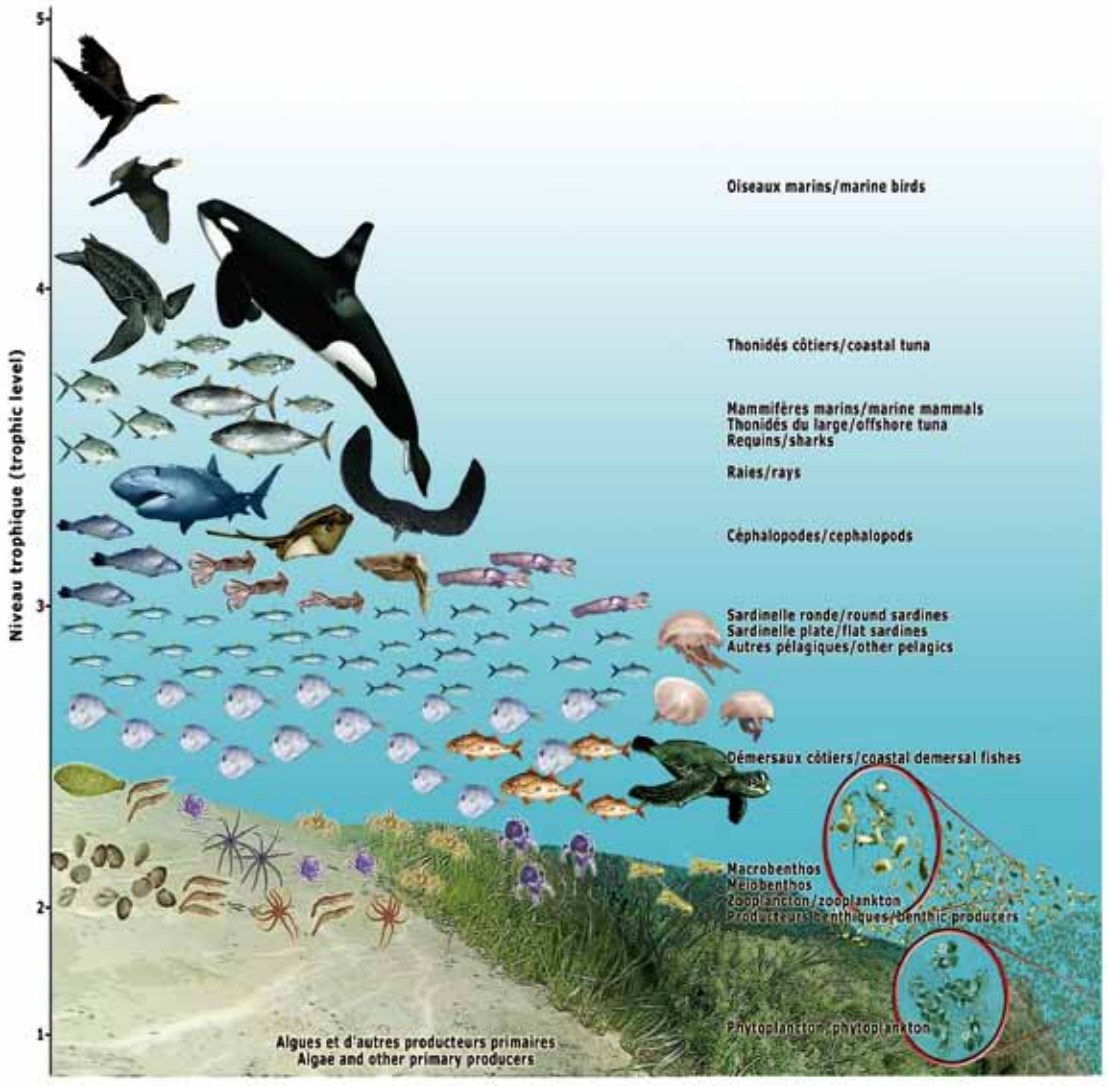
DEFINITION: AN ECOSYSTEM IS A FUNCTIONAL UNIT CONSISTING OF A COLLECTION OF PLANTS, ANIMALS, MICRO-ORGANISMS AND NON-LIVING COMPONENTS OF THE ENVIRONMENT, AND THE INTERACTION BETWEEN THEM.

A functional unit means that the individual parts are interdependent. They interact with one another and form a functional whole to maintain itself and its individual components in what is called a "trophic pyramid". Altering any of the components of the functional unit (increasing, reducing, eliminating or introducing new parts) affects all the other components and changes the way the ecosystem functions as a whole. Human beings are important parts of the marine ecosystem. Understanding these interactions is extremely important because of the cascading effects of human activities such as fishing, which generally reduces the number and biomass of high trophic level species (birds, mammals and fish).

To understand how habitat and species interact with each other in order to ensure the proper functioning of the ecosystem, we can think of some examples: some organisms create living conditions for others, e.g. mangrove swamps are nursery areas for shrimps and many fish species, the roots of mangroves are a substrate for mangrove oysters; seaweeds and sea grasses offer protection for fish species and offer living environments for many other species; the faeces of marine birds, fishes and marine mammals contribute to providing nutrients for aquatic plants.

The feeding of one organism upon another in a sequence of food transfers is known as a food chain. In an ecosystem there are many different food chains and many of these are cross-linked to form a food web. The interaction between the species forms the food web in which large organisms eat smaller ones and some animals such as shrimp and crabs, clean away dead animals that sink to the bottom of the sea. Ultimately all plants and animals in an ecosystem are part of this complex food web. Each link in a food chain is known as a trophic level. It is the position that an organism occupies in a food chain – what it eats, and what eats it.

Composantes de l'écosystème sénégambien
Components of the Senegambian Ecosystem



Support to scientific and art work: FishBase Information and Research Group (FIN), based on Birane Samb et Asberr N. Mendy, 2004.
Dynamique du réseau trophique de l'écosystème sénégambien en 1990. UBC Fisheries Centre Research Reports, 12(7):57-70.

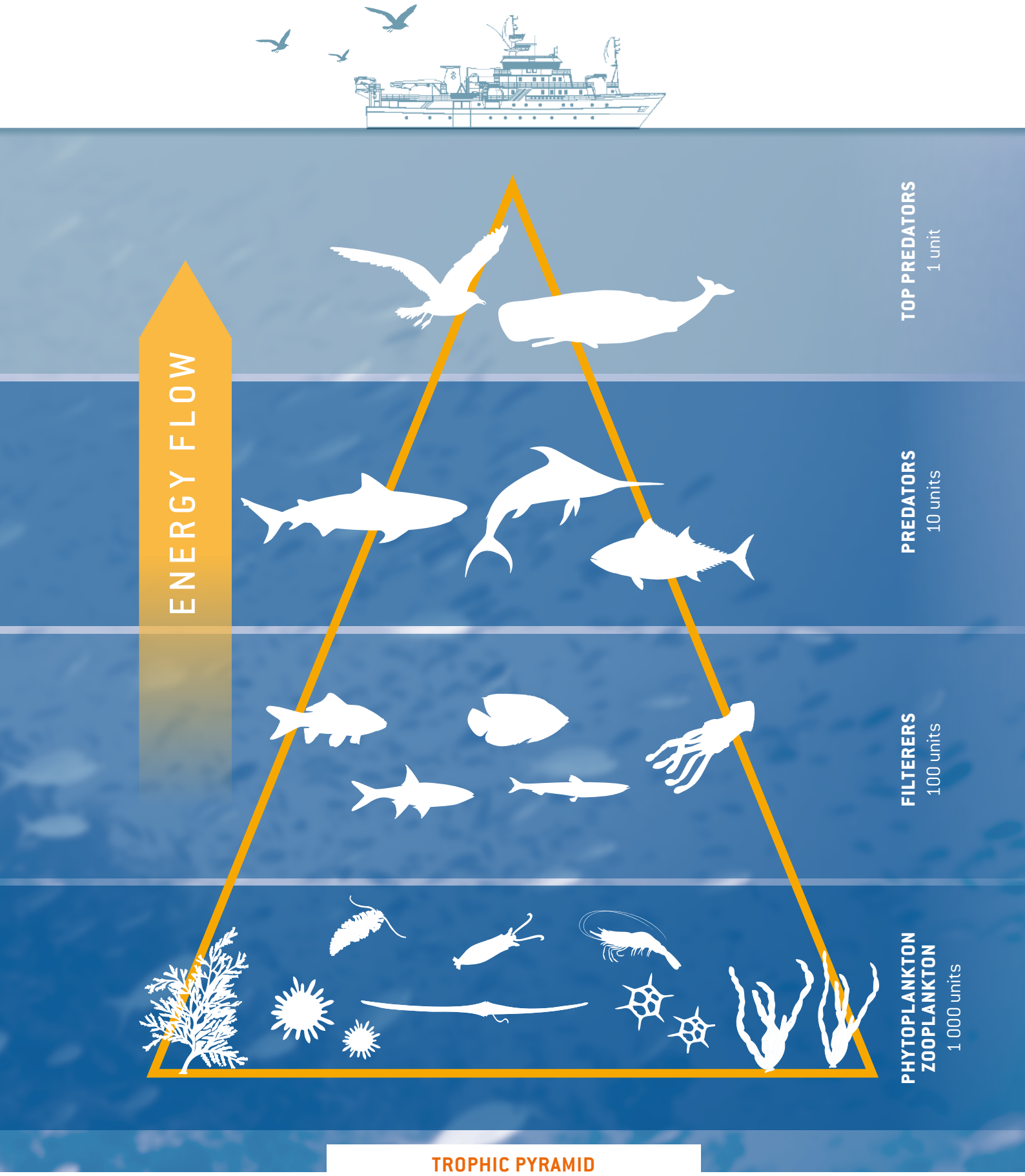
Phytoplankton (microscopically small plants), macroalgae and seagrasses, trees and shrubs in estuaries are the foundation of the food web on which all other species rely. This foundation is referred to as trophic level 1. The plants transform the energy of the sunlight into organic matter through a process called photosynthesis. The sun thus provides the energy to allow plant growth first and the grazing and feeding of all animal species, either directly eating plants or eating other animals which feed on plants.

Generally, only about 10 percent of the energy and organic matter produced by the conversion of solar energy by photosynthesis in plants is transferred to the second trophic level. The second level is made up of microscopic plants (zooplankton, small crustaceans (shell fish), fish larvae and other marine organisms which eat the plankton algae and incorporate them in their own body mass as well as using the energy for movement and other life functions. Similarly trophic level 3, composed for example, of sardines and other small pelagic fish or squid, represents only about 10 percent of the biomass of zooplankton. Larger fish, which in turn eat small fish, squid and many other smaller animals, will have a biomass about 10 percent of that of the lower level. Highly migratory fishes and many seabirds are at trophic level 4 in marine food webs. Humans who fish for tuna and swordfish operate at level 5 but if they fish for small pelagic species then that operation is at trophic level 4. Also other consumers, such as fish, marine mammals, birds, etc. may be feeding at different trophic levels.

Trophic level can also change throughout the life cycle: the larvae (babies) of a large fish species start life at trophic level 2 or thereabout and complete their life cycle in the upper trophic levels of the food web only when they grow to adulthood.

Only about 10 percent of the biomass (and therefore the energy) from one trophic level is 'transferred' to the next level because the normal life-functions (metabolism) of each organism require a lot of energy. Much of the energy contained in the food of animals just goes to sustain the body and its normal functions. Only a small portion of the food intake gets transformed into growth in size and weight. All other life functions, like swimming, eating, removing undigested substances, breathing, hiding or fleeing from predators in order not to be eaten, require a lot of energy. Some energy is also 'lost' when an animal dies and is not eaten by another one of a higher trophic level but is decomposed by bacteria, which are at a low level of the food web. Thus, an ecosystem needs lots of energy just to maintain itself and its individual components in what is called a "trophic pyramid".

A well-functioning marine ecosystem with multiple interactions between the different trophic levels needs to have a broad base and a lot of biomass in the ocean at all levels. The illustration on the composition of the Senegambian ecosystem shows how the width of each level is approximately proportionate to its biomass.



TROPHIC PYRAMID

FURTHER BACKGROUND READING AND WEB-BASED AVAILABLE RESOURCES

To learn more about marine and coastal ecosystems in Northwest Africa and its components, you can consult the following sources:

- **PRCM. 2011.** *Discovering the Coastal and Marine Environment in West Africa – Knowledge Handbook.* Prepared in the context of the Regional Program of Education for Coastal and Marine Environment (PREE). IUCN Guinea-Bissau.
  Available also from the web at: http://www.prcmarine.org/images/stories/food/cahier_connaissance_ang.pdf
- **Froese, R. & Pauly. D., eds. 2000.** *FishBase 2000: concepts, design and data sources.* ICLARM, Los Baños, Laguna, Philippines. 344 pp. http://www.fishbase.org or http://www.fishbase.de.
- **Life cycle of a jelly fish:** http://www.dnr.sc.gov/marine/pub/seascience/jellyfi.html

4 THE ECOSYSTEM APPROACH TO FISHERIES

TODAY MILLIONS OF PEOPLE DEPEND ON FISH FOR THEIR MAIN DAILY SOURCE OF PROTEIN AND AS A SOURCE OF INCOME. THIS HIGH DEMAND FOR FISH HAS LED TO AN EXCESSIVE USE OF MANY FISHERY RESOURCES RESULTING IN CONFLICT AND THREATS TO LONG-TERM SUSTAINABILITY OF FISHERIES.

About 30 to 40 years ago many efforts were made to regulate fisheries but the attention was centered on individual fish types that fishers would target. It is obvious, however, fishing activity does not only impact on the fish species that the fishers want (referred to as the target species), but also on other parts of the ecosystem as well. For example, most fishing methods are not selective and in addition to the target species, other species are caught. Some of this so called bycatch species may be valuable and retained by the fishers, while others may simply be discarded. The bycatch of fisheries can include species whose numbers have been drastically reduced in the sea (endangered or threatened species) such as sharks and turtles.

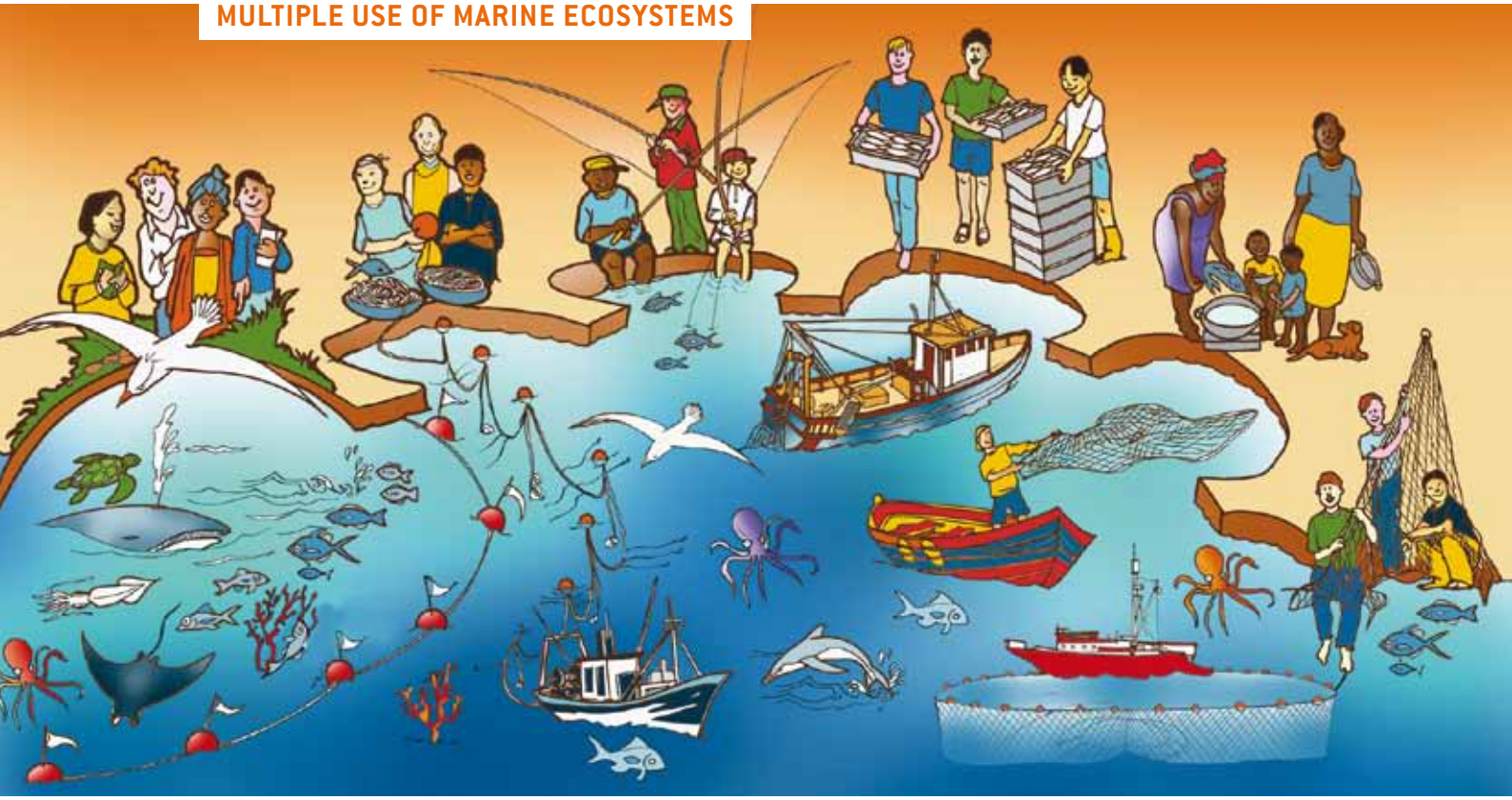
OVEREXPLOITATION IS THE EXCESSIVE USE OF A POPULATION TO THE POINT THAT IT DOES NOT HAVE THE TIME OR ABILITY TO REGENERATE ITSELF.

In 1995 member states of the Food and Agriculture Organization of the United Nations (FAO) adopted the **Code of Conduct for Responsible Fisheries** (CCRF) as a framework for national and international efforts to ensure the sustainable exploitation of aquatic living resources. The Code has established principles and standards applicable to the conservation, management and development of all fisheries. In 2003 the FAO member states also adopted the Ecosystem Approach to Fisheries (EAF) as the appropriate and practical way to fully implement the CCRF.

The key objective of EAF is the sustainable use of the *whole system* and not just the targeted species. The need to sustain or improve the condition of ecosystems and their productivity is essential for maintaining or increasing the quality and value of fisheries production. EAF also recognizes that humans are an integral component of the ecosystem and that the many (sometimes competing) interests of people in fisheries and marine ecosystems have to be addressed.

THE MAIN PURPOSE OF THE ECOSYSTEM APPROACH TO FISHERIES (EAF) IS TO PLAN, DEVELOP AND MANAGE FISHERIES IN A MANNER THAT ADDRESSES THE MULTIPLE NEEDS AND DESIRES OF SOCIETIES, WITHOUT AFFECTING THE OPTIONS FOR FUTURE GENERATIONS TO BENEFIT FROM THE FULL RANGE OF GOODS AND SERVICES PROVIDED BY MARINE ECOSYSTEMS.

MULTIPLE USE OF MARINE ECOSYSTEMS



To manage fisheries according to EAF involves asking the following key questions:

- What impacts are the fishing activities having on target and other species and also on the ecosystem?
- What are the economic and social benefits and costs of fishing to the sector and society as a whole?
- What management measures should be taken to address the issues affecting the sustainability of a fishery?
- What other activities and factors which are beyond the control of the fishery manager but affect the fishery such that society is not able to obtain the full benefits from it?

The ecosystem approach to fisheries is based on a number of principles, the following being the five key ones:

1. MAINTAINING ECOSYSTEM INTEGRITY (ECOLOGICAL RELATIONSHIPS BETWEEN SPECIES SHOULD BE MAINTAINED);
2. APPLYING THE PRECAUTIONARY APPROACH AND RESPECT FOR RULES. USE PRECAUTION IN DECISION MAKING AND PAY MORE ATTENTION NOW RATHER THAN LATER WHEN IT HAS BECOME TOO LATE;
3. BROADENING STAKEHOLDER PARTICIPATION IN DECISION MAKING;
4. PROMOTING SECTORAL INTEGRATION;
5. IMPROVING RESEARCH TO BETTER UNDERSTAND ECOSYSTEMS AND ALL ITS COMPONENTS.

FURTHER BACKGROUND READING AND WEB-BASED AVAILABLE RESOURCES

- **FAO.** 2003. *The Ecosystem Approach to Fisheries.* FAO Technical Guidelines for Responsible Fisheries No 4, Suppl 2. Rome, FAO 112 pp. (also available at www.fao.org/docrep/005/y4470e00.htm)
- **FAO.** 2005. *Putting into practice the ecosystem approach to fisheries*. Rome. 76 pp. (also available at ftp://ftp.fao.org/docrep/fao/008/a0191e/a0191e00.pdf
- EAF-Nansen Project flyer: The Fisheries Manager and the ecosystem approach to fisheries: ftp://ftp.fao.org/FI/DOCUMENT/eaf_nansen/COMMUNICATION_MATERIAL/EAF_Flyer_ENGLISH.pdf
- Code of Conduct on Responsible Fisheries: http://www.fao.org/docrep/005/v9878e/v9878e00.HTM

5 WORKING WITH THE FIVE KEY PRINCIPLES OF EAF

IN THIS CHAPTER THE FIVE KEY PRINCIPLES OF THE ECOSYSTEM APPROACH TO FISHERIES ARE EXPLAINED SO THAT THEY WOULD BE READILY UNDERSTOOD BY BASIC SCHOOL PUPILS.

PRINCIPLE 1: **ECOSYSTEM INTEGRITY**

As explained above, most of the interactions in a given marine ecosystem are between the marine species themselves, in other words, bigger fish eating smaller fish or other organisms. As the adage goes: No fish is an island. Altering any of the components of the functional unit affects all the other components and changes the way the ecosystem functions as a whole – its integrity. Because of these interactions, only a fraction of what is in the water can be taken out for human uses without seriously affecting the integrity of the ecosystem itself. Most of the animals and plants making up the ecosystem need to be left in the water to grow and reproduce. The part that can be harvested safely varies between different types of ecosystems. But there is reason to assume that it is unsafe to take more than 20 percent of the biomass present in a given year.

Reconstructions of past states of West African ecosystems show that they had a richer composition several decades ago, before overfishing became generalized. Major targeted fish species suffered 50 to 70% loss of their biomass in as few as 25 years starting in the 1970s. This was scientifically documented in an international symposium convened in June 2002 in Dakar, titled "*Marine Fisheries, Ecosystems and Societies in West Africa: Half a Century of Change*". It showed the pervasive effects of overfishing on marine ecosystems in the region and how the massive reduction of big fish high in the food web has made the entire ecosystem more vulnerable to change from other pressures.

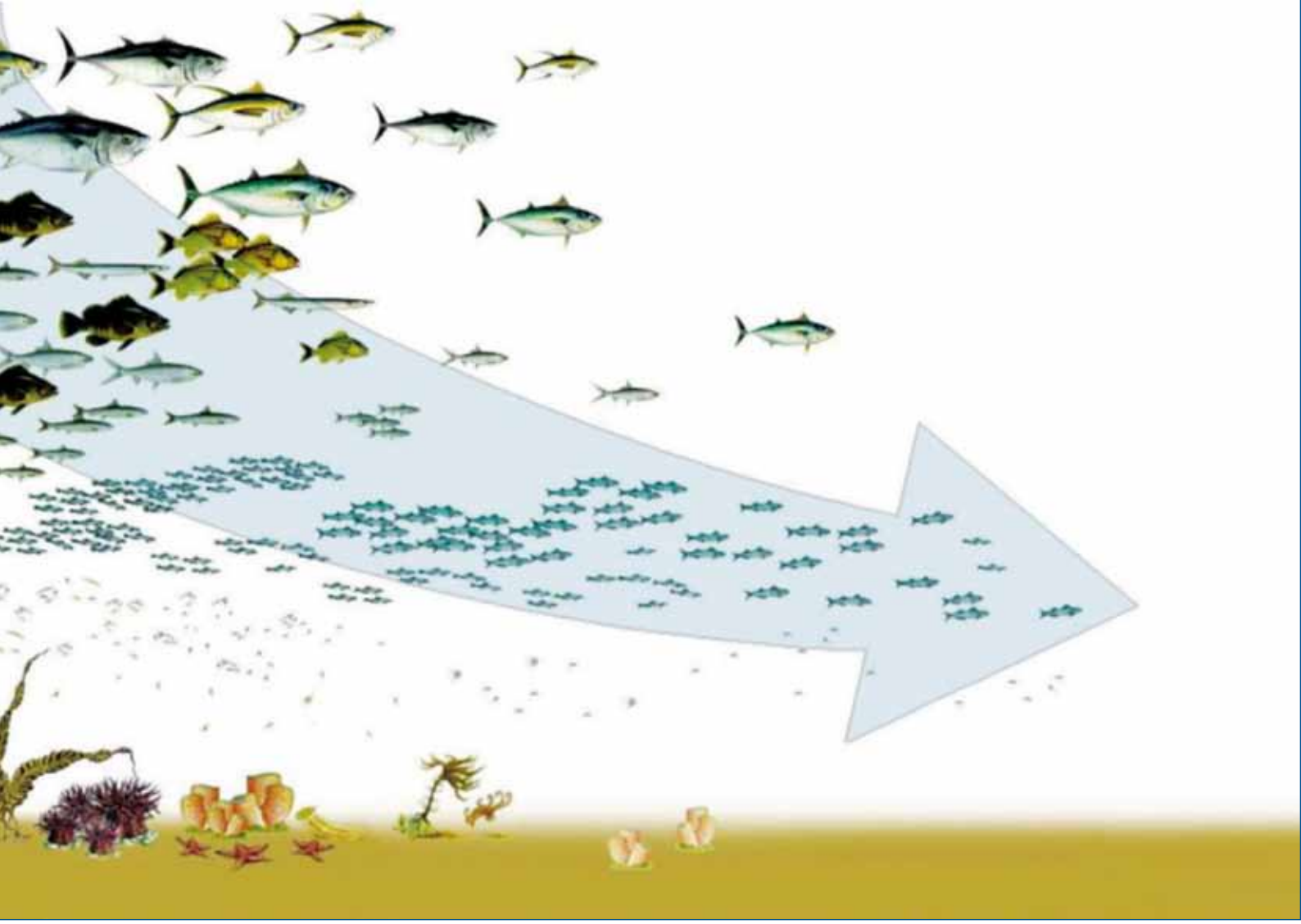
Objective and background for teachers

The objective of this principle is to provide an understanding that overfishing, whatever its origin, is currently the main threat to the integrity of most marine ecosystems. Overfishing means too many boats chasing too few fish or in general, too much fishing effort is exercised to exploit the resources that can be harvested sustainably from a given ecosystem.

Scientists measuring fish on board the fisheries research vessel "Dr. Fridtjof Nansen"

Ecosystem integrity is therefore threatened by human activities. This can take several forms.

- The progressive **elimination of large individuals of all fish species targeted** by different fisheries, in addition to other species incidentally caught and killed, increases the vulnerability of ecosystems and reduces their productivity. The presence of large, long-lived predators (often attaining many years of age) contributes significantly to a stabilization and maintenance of a productive and well-functioning ecosystem. Their dramatic reduction through indiscriminate fishing threatens ecosystem integrity. The elimination of large fish through fishing is called "**fishing down marine food webs**", a phenomenon unfortunately widespread in all oceans.
- The imbalance in the composition and sizes of species in a badly affected ecosystem changes the flow of matter and energy through the trophic levels. Thus, if there are not enough large animals in the system, a higher percentage of the primary production of algae is not eaten and channelled up the system, but ends in the circuit of bacteria and other organisms not much appreciated by humans, like jellyfish. The fish also become more susceptible to other stressors, including pollution and climate change – which may show through increasing variability of the populations and may enlarge the imbalance.
- Another, often ignored, aspect is that **large females of the same species produce more and better eggs than small ones, especially those spawning for the first time.** The removal of the large females could have serious consequences on the integrity and fertility of a population as a whole and can jeopardize the recovery potential of an overfished population.



Fishing Down Marine Food Webs Source: Pauly, D. et al., 1998, Science, 279(5352); 860-863

Messages to be shared with pupils in class

1. Species of plants, animals and bacteria in the marine ecosystem interact with one another – small is eaten by big.
2. Humans are part of the ecosystem. We depend on it for our livelihood but we are not alone in using it.
3. When humans take out fish, octopus, clams, shrimp and other species from the ecosystem, they need to be careful in order to safeguard the overall integrity of the ecosystem. This way the ecosystem can produce good harvests year after year.
4. Unfortunately, some fishing methods produce undesired effects on non-target species and the habitat that the species need to live well. Too much fishing poses threats to ecosystem integrity and it is bad for future catches. Too much fishing is also bad economically, as earnings go down with increasing fishing effort.
5. Catching baby fish defeats the purpose of harvesting the seas sustainably and has undesirable effects on ecosystem integrity.
6. If humans do not catch baby fish or do not destroy the living environment of the fish (e.g. through dynamite fishing, heavy bottom trawling or pollution) then an exploited ecosystem will get back into balance and ecosystem integrity will be preserved.

PRINCIPLE 2: **PRECAUTIONARY APPROACH AND RESPECT FOR RULES**

There are uncertainties attached to the understanding of the biological, economic and social processes in fisheries. Management according to the precautionary approach is to exercise foresight to avoid unacceptable or undesirable situations, taking into account that changes in fisheries systems are difficult to control, not well understood, and subject to change in the environment and human values. The **concept of precautionary action** aims generally at improving conservation of the environment and the resources by reducing the risk of inadvertently damaging them. It aims at helping decision-makers and managers to take a cautious decision when the knowledge about the system is inconclusive but a course of action has to be chosen.

Objective and background for teachers

The objective for introducing this principle is that where serious or irreversible damage is likely to occur, the lack of full scientific knowledge should not be used as a reason for postponing cost-effective measures to prevent environmental degradation and overfishing. The need to take practical steps quickly should be the outcome of teaching this key principle.

Exercising precaution and even active restoration efforts are important to avoid further degradation of the marine ecosystems and rebuild the ability of humans to harvest them on a sustainable basis. The EAF Nansen illustrative poster shows the contrast between a fishery managed with the ecosystem approach, showing healthy resources and prosperous coastal communities (right), and one that is characterised by lack of such an approach, and depicting declining coastal habitats and communities (lower left). Using the ecosystem approach to fisheries is one step towards applying the precautionary principle under today's conditions of often already degraded ecosystems and the difficulties to enforce the rules.

In traditional fishing communities, many restrictions are exercised, bearing in mind that fish that are spawning as well as baby fish need special protection. For example, spawning and nursery grounds are declared as sacred or prohibited areas, at least for part of the year. Fishing is also prohibited on certain days. Many of these traditional management practices are rooted in religious or other beliefs and are applied to such areas as mangroves or during the rainy season. They may not have had the explicit purpose of protecting the ecosystem and its components, but in practice they help to limit the pressure on the resources and their ecosystem and to keep an equilibrium between what people harvest and the reproductive capacity of the ecosystem.

Although some of these traditional management practices persist, the influx of external cultures and fishing units, and rapid technological developments have combined to dilute such social control mechanisms. The precautionary approach allows for building on traditional restrictions, while potentially enriching them with scientific knowledge to provide for sustainable outcomes, both for marine ecosystems and for coastal human communities.

One simple way to contribute towards implementing the precautionary approach is to avoid fishing baby fish. The principle is easy to understand and has wide-ranging ecosystem and social effects, not only for maintaining but possibly rebuilding marine ecosystems and the opportunities to use them sustainably. The principle can be applied, even if the young people and others practicing it are not familiar with the details of the more comprehensive concept of the ecosystem approach to fisheries. A baby fish is one that has not had the chance to spawn at least once.

In the laws regulating fisheries in every country there are rules on minimum sizes of fish to be landed by fishers. Some of these sizes may have been set without necessarily taking into account the results of scientific research. However, enforcing these rules as scientific research is carried out will help ensure the health of the marine ecosystems which also affect the social and economic conditions of coastal communities and others that depend on the sea for their livelihood. The rules on sizes may evolve as we learn more about the marine ecosystems and how they can be used sustainably.

The use of the fish ruler in the Teaching Kit is therefore to support a simplified and practical way towards practising the precautionary approach. Unfortunately, even though the precautionary principle is well understood, relevant actions are still not taken in many cases. Shark finning, for example, is forbidden or at least officially discouraged in many areas. Yet, the practice continues to take place because of short-term gains, even in the face of risking irreversible damage to ecosystems. This is an example of how difficult it can be to apply the precautionary approach.

FAO's Committee of Fisheries has promoted international and National Plans of Action for the conservation and management of sharks (NPOA-Sharks) since 2011. Non-governmental organizations like the Regional programme for coastal and marine protection in Northwest Africa (PRCM) has also worked towards avoiding local extinction of shark populations and the need to strengthen and extend the coverage of marine protected areas as a major safety measure (like an insurance policy and precautionary measure). Making sure that existing rules are known and respected by all communities is important, but not always easy to enforce.

A beach seine fishing operation.

A trawl catch comprising fish of various species and sizes.

Many fishing gears that are destructive in nature make the application of the precautionary approach extremely difficult. Among destructive gear types are those which are not selective and take much undesirable by-catch. Examples are bottom trawls, very large encircling nets, longlines that are in the water for days rather than hours, drift nets of huge dimensions and all types of nets with very small mesh sizes, such as beach seines, which catch mainly baby fish. Mono-filament nylon nets with high potential to continue killing marine life, even when lost (a phenomenon referred to as "ghost fishing") are also destructive and are generally prohibited in many places in Africa, even though they can still be found almost everywhere. Large-scale dredging for clams or cutting mangrove aerial roots for collecting mangrove oysters are very destructive practices.

Using non-destructive fishing gear is an important component of the precautionary approach. Selective gear types with more limited impact include most gears that are fixed, particularly when they have sufficiently large mesh sizes, and hook-and-line with sufficiently large hooks.

Establishing and strengthening marine protected areas (MPA) as a reservoir for replenishing heavily fished areas outside the MPA is another essential part of the practical application of the precautionary approach.

Messages to be shared with pupils in class

1. Precautionary approaches involve exercising some restraint and building some safeguards into human use of the sea so that our children's children will also be able to catch and eat fish and other marine organisms.
2. Practical examples of the precautionary approach are:
   - 'Let the baby fish live and grow';
   - Avoid destructive and unselective gear and reduce by-catch of fish that will be thrown away dead or dying;
   - Promote the establishment and enforcement of marine protected areas, even if we do not know the exact state of the marine ecosystem and how we have already affected it;
   - Promote respect for the existing rules on the use of the sea and its resources.

PRINCIPLE 3: **BROADENING STAKEHOLDER PARTICIPATION IN THE MANAGEMENT OF NATURAL RESOURCES**

Rules are most effective when they are established in a participatory manner, when they are well understood by those expected to respect them and when there is some social consensus that helps enforce the rules and norms. Rules based only on external enforcement tend not to work.

In many developing countries certain rules to regulate the fishery are generally not obeyed for several reasons. One key reason is the absence of dialogue between decision-makers and stakeholders on the importance of those rules and regulation. A constructive and participatory dialogue must be established between those responsible for enforcing fisheries regulations and stakeholders for effective management of fishery resources. In the context of EAF, stakeholders can be defined as individuals, groups, organizations or associations that are involved in, have interest in, or are affected by fisheries resource use and ecosystem management. For the implementation of EAF to be successful, all stakeholders will need to understand and accept the need for this more inclusive approach to fisheries management. This will require that effort is made by the fisheries management agency to educate the stakeholders.

Objective and background for teachers

The objective is to achieve a better shared understanding about the importance of broader stakeholder participation in the application of EAF.

Generally, people undertaking different activities can have very different perspectives of what is desirable and acceptable. An example may be competition between fishing communities and tourist resorts to access the beach. Another example may be different perceptions and values between traditional fishing communities and investors external to the community.

Access to basic services, clean water, fish handling and processing installations and equipment, access to ice or other refrigeration facilities, shelter for gear, credit and land are among factors which condition the operation of the fishery and the postharvest activities in which women are often involved. Capacity for active participation in understanding, making and respecting the operating rules and norms is enhanced by social organisation, education and knowledge.

Guiding children and young people towards good adult life in their community in today's conditions is best served by an approach based on the principle of "learning with the learners" and active mentoring by experienced adults. This enables the youth to grow into responsible and respected roles in the community. It also reveals and nurtures the natural curiosity and creativity young people have.

Messages to be shared with pupils in class

Everybody has the right to participate in the social life and decision-making affecting the community and the choices made both in and outside the fisheries. Women play a very important role in many fishing communities in developing countries especially in West Africa and must be involved in all discussions on the fishing industry.

1. Broad stakeholder participation needs to be built on mutual respect, willingness to listen and contribute experience and knowledge according to the individuals' abilities and the willingness to learn from one another.
2. It is always good to know who is in charge and responsible for what.
3. Together we can achieve more.

PRINCIPLE 4: **PROMOTING SECTORAL INTEGRATION AND SAFEGUARDING LIVELIHOODS**

In many countries, the fishing industry is confined to an isolated sector. As a result, the interaction and interdependence of this sector with other socio-economic activities are not generally considered. For example, the interactions between fishing activities on the one hand and other activities such as tourism, transport, mineral extraction, agriculture or other public services activities on the other hand, may produce both direct and indirect effects on the sea. Given the worsening of human living conditions in rural areas, many environmental refugees rely on fisheries for their income.

Many people migrating from rural areas eventually settle in coastal cities. This and other factors have led to an increasing demand for space, labour and resources and therefore more social infrastructures are required. Reconciling these demands is a huge challenge and may pose a threat to sustainable use of natural resources like fisheries.

An ecosystem approach to fisheries requires coordination, consultation, cooperation and joint decision–making, not only between different fisheries operating in the same ecosystem or geographical area, but also between the fisheries management agency and sectors that have an impact on fisheries or are affected by fisheries.

Objective and background for teachers

The objective of looking at this principle is to understand the interaction and interdependence of fisheries and other socio-economic activities. Such other activities may or may not have a direct relation to the sea. Examples may be tourism, transport, mineral extraction, agriculture or public service activities.

Fisheries, even in relatively remote locations or operating on a small scale, are part of a global economy. This affects the way the entire value chain is organized from fishing through handling, processing, marketing and consumption. Compared to other food commodities, the percentage of fisheries products entering international trade is very high – currently around 40 percent.

The FAO guide on ‹Putting into practice the ecosystem approach to fisheries› and other pertinent publications dwell on the multiple interactions and the need to be alert to the often unseen links between different activities related to the marine ecosystem.

Reconciling the different demands for space, natural resources, labour and physical and social infrastructure is a huge challenge. Not doing so may pose a threat to ecosystem approaches to fisheries. Likewise, various other weaknesses can be serious obstacles to sector integration and EAF application as a whole. Among these are insufficient knowledge about different interacting sectors, unrealistic expectations of stakeholders or operational capabilities of responsible institutions and agencies.

Messages to be shared with pupils in class

1. Even apparently local, small-scale fisheries are connected to economies of very distant countries such as those in Asia and Europe, through international trade and migration (e.g. think of the trade in shark fins and high-value fish species).
2. It is important to learn more about what happens in sectors other than fisheries, nature conservation etc.
3. Considering the use of the marine ecosystem in the broad sense, how do the various sectors interact with each other? The answers need to be carefully recorded to assess the level of comprehension in class and where to start updating the existing knowledge of pupils.
4. Which non-extractive marine activities may generate income for locals? What sort of skills would the people need to carry out these activities successfully? Would these be compatible with fisheries and other activities?

PRINCIPLE 5: **IMPROVE RESEARCH AND ACCESS TO INFORMATION FOR CONSERVATION AND MANAGEMENT**

The EAF management process will highlight areas of uncertainty about the system to be managed and show where further research is still required. It will identify the priority research needs for fishery management and assist in guiding research investments.

In many developing countries scientific information is usually difficult to find. Therefore, it is important to stimulate curiosity and enthusiasm for learning more about marine ecosystems and how this can be facilitated by securing access to research results, data and information.

Objective and background for teachers

The objective of introducing this principle is to encourage curiosity and enthusiasm for learning more about marine ecosystems. It is to provide working methodologies and sources for further learning about marine ecosystems and management of fisheries. Pupils should be made to understand that there is uncertainty associated with most types of knowledge and that it is important to continue to look for more information about all natural resources to be managed.

Messages to be shared with pupils in class

> We have learnt a lot through the previous exercises but there is still a lot to find out about marine ecosystems to enable you (the pupils) to make better choices in the future. How do you go about finding out?

BACKGROUND READING AVAILABLE IN PRINT AND FROM THE WEB

- The IUCN knowledge handbook (see additional reading in section 2) is readable also for interested secondary school pupils.
- European Commission. 2005. *Rebuilding our marine ecosystems, protecting our future.* Key findings of the International Symposium on Maritime Fisheries, Ecosystems and Societies in West Africa: Half a century of change. Dakar, Senegal, 24–28 June 2002. European Commission, Luxembourg. 20 pp. ftp://ftp.cordis.europa.eu/pub/inco2/docs/dakar_brochure_fin_en.pdf

Other interesting information resources about the sea available on the Web:

- FishBase.org (information about all 33 000 species of fish, searchable by name, local name, country, other criteria)
- SealifeBase.org (information about marine non-fish species, organised similarly to FishBase)
- Seas at Risk produced several educational videos and games in different languages and for a variety of audiences (not only on ecosystem approach to fisheries: http://www.learn2sea.org/projects.php)
- WWF film about the consequences of overfishing: http://www.youtube.com/watch?v=VxacxShp3LY
- Film by Thomas Grand about a boy in the fishing village of Kayar in Senegal (sound track in Wolof with French voice over) "Kayar – a childhood caught in the nets" http://www.mundusmaris.org/index.php/en/reviews/films-en/172-kayar-film-en
- National Geographic: 10 things to save the oceans: http://ocean.nationalgeographic.com/ocean/take-action/10-things-you-can-do-to-save-the-ocean/
- Games and playful learning about the ocean, its creatures and ecosystems: http://kids.nationalgeographic.com/kids/activities/new/ocean
- Ocean education: http://education.nationalgeographic.com/education/program/oceans-education/?ar_a=1

6 EXERCISES RELATED TO THE FIVE KEY PRINCIPLES OF EAF

THE FOLLOWING EXERCISES ARE AIMED AT IMPROVING THE LEARNING PROCESS THROUGH DIFFERENTIATED TOOLS, EITHER IN CLASS OR OUTDOOR. THEY ARE INTERCHANGEABLE AND CAN BE ADAPTED TO SERVE MULTIPLE PURPOSES, IN RELATION TO THEIR CONTEXT AND ITS CHARACTERISTICS. THE EXERCISES THEMSELVES – AND THE OUTDOOR ACTIVITIES, CAN ALSO BE USEFUL INSTRUMENTS TO MONITOR THE PUPILS' LEARNING PROGRESS.

ECOSYSTEM INTEGRITY

Exercise 1 – Role play

Objective: Understand the components of the marine ecosystem and their interactions.

- Based on the poster of the "Marine ecosystem" ask pupils to play the role of a member of the marine ecosystem (phytoplankton, zooplankton, fish, turtle, seabirds, humans, etc). Keeping in mind that smaller organisms are eaten by bigger ones, ask the pupils to speak about themselves as for example: "I am a phytoplankton, I live in trophic level 1 and I am eaten by the zooplankton". Then the zooplankton says "I am a zooplankton, I live in trophic level 2 and I am eaten by the sardine". The process will continue until reaching the highest level (humans).
- The pupils will then build food webs highlighting how the different components interact.
- Using the fish ruler point out to the viewers the minimum size of different fish species. Read aloud the minimum size of each species and draw comparisons with fishes observed at the landing place or in the market.
- Ask the pupils to discuss the following questions:
  - What happens to the animals and plants when a trawler drags a heavy net through the food webs?
  - What happens when artisanal pirogues or industrial purse seiners catch lots of small fishes like sardines or sardinellas which are the food of big fishes and seabirds?
  - What happens to the food webs when fishers use methods that catch most of the big fish?
  - What happens to the food webs when some fishers use explosives (like dynamite) that kill lots of fish and destroy the valuable habitat or living space for fishes and other marine organisms? Also think about the danger to the fishers' own health.
  - How can you promote the reduction of damage to non-target species or to the ecosystem?

Exercise 2 – Drawing

Objective: Understand the damage caused to the marine ecosystem when large quantities of baby fish are caught.

- Ask the pupils to draw fishes in different sizes – small fish (many), big fish (few), sea birds (some) and cut them out.
- Place the fishes on a large sheet of blue paper representing the sea and the pupils to discuss the following questions:
  - What happens to the ecosystem each time we remove some baby fish? How will the marine ecosystem survive?
  - On the other hand, what happens if we remove only fully grown fish from the picture? Baby fish can grow and reproduce, keeping the marine ecosystem in balance.
  - What can a baby fish do to survive and become an adult?
- Draw posters of an ideal ecosystem.

Exercise 3 – Songs

Objective: Learning the marine ecosystem components

- Write together with the pupils a simple text about the marine ecosystem and its components. This text should serve as lyrics for a song.
- Where possible, ask a music teacher to help you compose the music for the new song. Alternatively, use the music of a song that the pupils know very well and substitute with the lyrics that the students have written.
- Then the song can be performed for parents, in the town hall, at school or in competitions.

PRECAUTIONARY APPROACH AND RESPECT FOR RULES

Exercise 1 – Poster analysis

Objective: Understanding the difference between good and bad fishing practices and their effects on the ecosystem.

- Display the EAF Nansen poster and encourage analysis and discussion on the two scenarios. Ask the pupils the following questions:
  - What does the seabed look like on each side?
  - What kinds of boats are there?
  - What human activities are there?

Exercise 2 – Drama

Objective: Understanding the consequences of good and bad fishing practices on family livelihoods in the long term.

Encourage the participation in the plays of as many family members as possible playing different roles. Also, underlining the role of the school in teaching EAF principles in the community is important.

- Pupils are to represent the members of two different families coming from different fishing communities (roles for at least two mothers, two fathers, several children). The scene takes place at the market where the two mothers meet.
- Wife of Family 1 has a lot of fish to sell while wife of Family 2 has very little and most of it is baby fish. They exchange on why the amount of fish caught is different and they find out that Family 1 and its community use responsible fishing practices while Family 2 doesn't.
- Husbands join their wives and discuss the different fishing practices: Family 2 doesn't understand why the amount of fish caught is decreasing in time.
- Pupils playing Family 1 kids can provide information on balanced ecosystem and consequences of bad fishing practices and eating baby fish.
- Parents of Family 1 explain how the whole community supported what kids had learned in school about EAF. If a community tries to be more respectful towards the ecosystem, everyone has enough fish to catch, eat and sell also in the future.

Exercise 3 – Maps

Objective: Understanding what Marine Protected Areas (MPAs) are and where they are located.

- Explain what an MPA is and, with the help of internet (if accessible) or of the staff of the Fisheries Department, show a map of the MPAs in the country especially those that may be located near the fishing community.

BROADENING STAKEHOLDER PARTICIPATION IN THE MANAGEMENT OF NATURAL RESOURCES

Exercise 1 – Role play

Objective: An understanding of how each member of the community can contribute to a healthy marine ecosystem and sustainable fishery. Underline how children and adults should care for their coastal environment and livelihood.

- Ask each pupil to play a different member of the community: teacher, fisherman, village chief, policeman, animal breeder, farmer, fisheries officer, lawyer, public services workers, etc.
- Simulate a village meeting to discuss an issue related to the marine ecosystem and guide the discussion for possible solutions. For example, the issue can be: pollution of coastal waters from human waste. Ask each pupil to make a proposal to solve the problem in relation to the role played, e.g. the policeman should provide more control on discard areas, the village chief should set up a system for waste collection, the teacher should teach the importance of recycling materials; etc.

Exercise 2 – Interview

Objective: Listening to a Fisheries Officer's experience

Invite an officer from the local office of the Fisheries Department and interview him/her. What does the Department do? What are his/her tasks? What are the major visible improvements in the marine ecosystem thanks to the Department's work? What are the major constraints in the Department's work to protect the marine ecosystem and how does the Department try to overcome them?

PROMOTING SECTORAL INTEGRATION AND SAFEGUARDING LIVELIHOODS

Exercise 1 – Interviews and debate

Objective: Have an overview of how the actions of people working in sectors other than fisheries affect the marine ecosystem and explore their perceptions about it.

- Ask each pupil to interview a member of their family or an acquaintance with respect to their profession and how it interacts with the marine ecosystem in their daily life.
- The people interviewed should be working in a variety of sectors (tourism, transport, agriculture or other public services). Some interview questions could be as follows: What is their knowledge of the marine ecosystem? Are they familiar with the ecosystem approach to fisheries? What are their perceptions/actions with respect to fisheries? Why?
- Compare the answers in class: commonalities and differences should be highlighted, leading to a discussion with the pupils on how to have a common respectful approach towards the marine ecosystem across different sectors.

Exercise 2 – Creative writing

Objective: Brainstorming on how authorities could take action in respect of the marine ecosystem.

- Ask pupils to produce drawings about how different activities in the coastal zone may affect each other – reconciling multiple uses and demands.
- Discuss whether zoning of activities could help reduce conflicts between activities. Should some activities be reduced or avoided?
- Ask the pupils to write an essay describing what they would do if they were the President/local authority of the country.
- Some guiding questions for the essays could be: What would they like their country to be like in the future? What rules would they establish so that people act correctly to maintain a healthy marine ecosystem?
- Then ask the pupils to read their essays in class. What are the similarities/differences in the described actions? Use group work to encourage peer-to-peer learning and practice of other social skills, such as mutual respect, listening capabilities and joint analyses.

Exercise 3 – Songs

- Write together with the pupils a simple text about how they imagine their village in the future with respect to fisheries and the marine ecosystem. This text should serve as lyrics for a song.
- If possible, ask a music teacher to help you compose the music for the new song. Alternatively, use the music of a song well known by the pupils and adapt the lyrics you have written to the music.
- The song can then be performed in the presence of their families and/or other classes.

IMPROVE RESEARCH AND ACCESS TO INFORMATION FOR CONSERVATION AND MANAGEMENT

Exercise 1 – Poster drawing

Objective: Getting to know the endangered marine species.

- Gather material from the local library, the Fisheries Department or internet about marine species known to your community and that are endangered.
- Show the pictures to the pupils. Do they recognize them? Do they know how much in danger the species are and why?
- Ask each pupil to draw a different species and cut out the drawings.
- Make a poster with all the drawings and the names of the endangered species.
- Hang the poster in the classroom and add new species as and when they are presented and discussed in class.

Exercise 2 – Knowledge exchange

Objective: Exchange information and knowledge with other schools.

- Get in touch with other schools of the area; what do they do with respect to the study of marine ecosystems?
- Do they know about EAF? Exchange of information through visits or letters written by the pupils can be a good way to increase and share knowledge related to the marine ecosystem.

Exercise 3 – Storytelling

Objective: Sharing information gained through the media

- Have the pupils watched any TV programmes or heard any stories told about the marine ecosystem?
- What did these programmes/stories say?
- Share them in class and discuss.

Exercise 4 – Consulting scientific material

Objective: Finding information through the selection and consultation of scientific material.

Bring to the class some scientific material on the marine ecosystem and share it with the pupils. How do we consult scientific material? How do we find the information we are interested in? What does the material say? Debate the information found.

Exercise 5 – Internet

Objective: Using ICTs to gain/update information.

If available, the Internet could offer a variety of information on marine research.
Here a list of suggested useful websites:

- EAF Nansen website
- Website of marine research institutions
- Fish Finder
- Youtube (videos)
- Google Maps
- Website of local Fisheries Department
- Interactive games

EXERCISES OUTSIDE THE CLASSROOM

LEARNING ACTIVITIES BEYOND THE WALLS OF THE CLASSROOM CAN HELP PUPILS APPRECIATE FIRST HAND EXPERIENCES FROM A VARIETY OF DIFFERENT PERSPECTIVES. THEY CAN STIMULATE INTEREST AND ENHANCE ENQUIRY, ANALYSIS, CLARIFICATION AND PROBLEM SOLVING SKILLS IN REAL-LIFE SITUATIONS. THEY CAN ALSO HELP TEACHERS IN DEVELOPING NEW EDUCATIONAL TOOLS AS WELL AS RAISING AWARENESS ON THE POSITIVE IMPACT OF OUTSIDE THE CLASSROOM EXPERIENCES.

The following exercises are aimed at increasing the pupils' observation skills in analyzing various aspects of the approach to fisheries in their daily lives. They can be done either individually or combined together during the same school trip.

Exercise 1: Observation on the beach and/or at the landing site

Take the pupils on a school trip to a fish landing site. Divide them into groups and ask them to:

- Describe the use of the beach by people (e.g. landing of fish)
- Describe debris / cleanliness (take photos, if possible)
- Take note of the number of boxes or buckets of fish unloaded per boat
- Count the active pirogues on the beach by type.

Analyse the results:

- Once back in the classroom ask the pupils to draw whatever impressed them most during the observation and ask each one of them to describe his/her drawing to the whole class.
- What are the recurring elements in the pupils' drawings?
- How do their perceptions differ?

Exercise 2: Recording fish quantity and measurements

Take the pupils on a school trip to a fish landing site. Divide them into groups and ask them the following questions:

- Looking at the fish pictures in Annex 1, can you identify the animals observed?
- Using the table in Annex 2, record the indicative quantity per type of fish you can recognize. Specify the unit of measure (single fish, bucket, box, etc)
- Can you measure some fish with the fish ruler? Measurement must be taken with the fish lying on its side and its mouth closed; the total length of the fish is the measure from the tip of its mouth to the tip of the tail fin. The fin should be closed as shown in the illustration below.
  Using the table in Annex 2, select a limited number of fish samples and write down the total length of each fish. For large quantity of catch, measure at least 30 individuals.
- Find out from the fishers whether any fish or other marine organism are thrown back into the water and understand why they are thrown away; try to write the names of the types of fish thrown away.

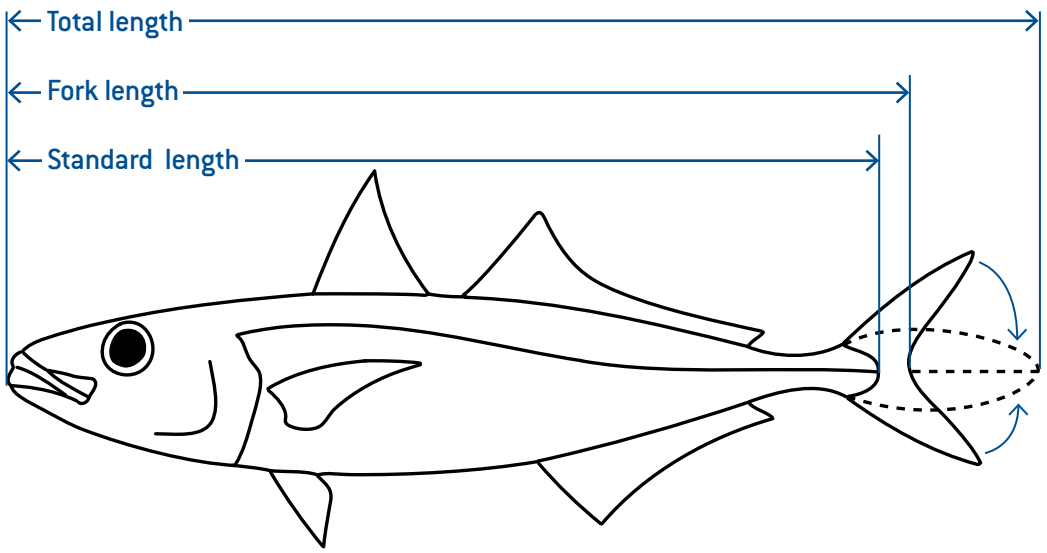
	TYPE OF FISH	QUANTITY (eg. buckets, singles)
1	Round Sardinella	5
2	Bonga Shad	3
3	Catfish	1

Example of fish quantity table

	TYPE OF FISH	LENGTH (cm)
1	Round Sardinella	12 30 20 8 24
2	Bonga Shad	15 12 5
3	Catfish	22

Example of fish quantity table

A. Measurement must be taken with the fish lying on its side and its mouth shut
B. For measurement of the Total length the tail fin must be closed as shown



Analyse the results using the notes taken and the tables filled out:

- How many types of fish were identified correctly?
- How much fish is landed for each type? Is all the fish for sale or is some discarded first?
- Are baby fish landed? Many?/Few? More than the mature ones?
- Is the baby fish you found belonging to a particular fish type?

Exercise 3: Understanding changes in time

Divide the pupils into groups and ask them to interview the following people:

- Ask old fishermen: Are fishermen taken into consideration nowadays more than in the past? How have their fishing practices changed in time? What caused these changes? Do they remember better catches a few years ago or are the catches better now? How much time do they stay out at sea now compared to a few years ago?
- Ask specialists of the Fisheries Department: Were there more or fewer boats 10 or 20 years ago (or before you were born)? How were the fisheries 10 or 20 years ago? Were there bigger fishes, more, less, other species?
- Ask someone in your family who is a fisherman or processes and/or sells fish: What changes have they observed over time?

Exercise 4: Exploring different perceptions about fisheries

Divide the pupils into groups and ask them to interview some fishers, fish processors, managers of the fishing centres, scientists, government officials, tour operators, nature conservationists or others.

- How do they see and experience the fisheries and their management?
- What are their expectations about participation in fishery management?
- How well do they know the local marine ecosystem? Are they aware of the possible damages some human activities could cause to its balance?
- What are their expectations and fears for future developments?

Analyse the results:

- Is the interviewees' knowledge about the marine ecosystem correct?
- In relation to each occupation, how do the interviewees' perceptions and expectations differ?
- How do the interviewees see the future in relation to fishery matters?

Exercise 5: Visit to a fish processing plant/fish factory/Fisheries Department

A guided tour of these facilities with proper explanation of what each facility does, who is working in it and how, is important for the pupils as a real life experience. After the visit you can recap what you saw by asking pupils to draw what they found most interesting and then share their impressions with the rest of the class.

7 MONITORING AND EVALUATION OF THE LEARNING PROCESS

SYSTEMATIC MONITORING AND EVALUATION ARE A MAJOR FACTOR IN ENSURING THE EFFECTIVENESS OF THE TEACHING MODULES. DIFFERENT MONITORING AND EVALUATION METHODS ARE PROPOSED WITH THE AIM OF ASSESSING THE IMPACT OF THE TEACHING KIT AND THE PUPILS' ACHIEVEMENTS IN LEARNING ABOUT THE EAF.

Most of the exercises presented in Section 5 can also be useful tools for evaluating children's understanding of the 5 key principles, the challenges at stake and actions that are required to make a change.

USING THE MONITORING AND EVALUATION FORMS

In order to keep track of the progress pupils make during the learning process, we propose two different models aimed at monitoring class and individual performances respectively. We suggest periodic recording of the outcomes of the activities undertaken within the teaching of EAF, with a view to acquiring sufficient elements for comparison to proceed with the evaluation of the general approach. The forms are available as Annex 4.

Form 1 – Overall class performance

This form is intended to record class participation in the exercises and the level of pupils' commitment in the eventual following activities (i.e. drawing what has been seen during a trip on a beach or fish market, etc). Based on the data recorded, teachers can adjust for future exercises and teaching approaches to improve the impact of EAF related lessons.

Form 2 – Pupil performance

If possible, monitoring of individual progress is strongly suggested. This form is focused on the pupil's performance during a single exercise exploring his/her interest and participation. We suggest recording eventual difficulties the pupils might encounter during the exercises and monitor whether these can be overcome during the process itself.

MONITORING AND EVALUATING CLASS WORK

We propose three different methods for monitoring class work that can be combined.

Random questioning

- Keeping questions at an appropriate level of difficulty; that is, at a level where most students can experience a high degree of success in answering.
- Paying close attention to who is answering questions during classroom discussion and calling upon volunteers.

Classroom testing

- Administered regularly and frequently.
- Collected, scored, recorded and returned to students promptly so that they can correct errors of understanding before these become ingrained.

Review sessions

There is a strong link between integrating monitoring methods into periodic classroom reviews and the later achievement of students involved in the review sessions.

Daily, weekly, and monthly reviews can all enhance the learning of new material and, if they incorporate questioning and other learning probes, can call attention to areas where re-teaching is needed.

USEFUL TIPS FOR MONITORING AND EVALUATION

- Plan: a careful planning of exercises, setting proper frequency and regularity, eases the execution of monitoring activities and increases their effectiveness.
- Give feedback: providing feedback to students lets them know how they are doing and helps them to correct errors of understanding and fill in gaps in knowledge.
  - Set high standards: when pupils' work is monitored in relation to high standards, student effort and achievement increase. Be careful, however: standards must not be set so high that students perceive them as unattainable; if they do, effort and achievement decrease.
- Create a rewarding system: a simple system such as creating a board where smileys or gold stars can be assigned to each pupil in relation to their learning progress, can be encouraging especially for younger pupils.

GLOSSARY

Biodiversity: The variability among living organisms from all sources including, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems.

Bycatch: Species taken unintentionally in a fishery that is targeting other species or a different size range of the same species. That part of the bycatch with no economic value is discarded and returned to the sea, usually dead or dying. Bycatch can be either retained or discarded.

Climate change: Long term change in the earth's climate. Climate refers to the average weather conditions in a certain place over many years. These changes will affect people, animals, and ecosystems in many ways.

Code of Conduct for Responsible Fisheries (CCRF): Initiated in 1995 by the FAO, the CCRF defines the principles of responsible fishing, taking into account all relevant biological, technological, economic, social, environmental and commercial aspects. It's a holistic approach.

Community: The region occupied by a group of interacting organisms.

Conservation: The preservation and careful management of the environment and of natural resources.

Discards: The components of a fish catch that are thrown back into the habitat after capture, due to their low economic value. Normally, most of the discards can be assumed not to survive.

Habitat: The area or environment where an organism or ecological community normally lives or grows.

Ecology: The science dealing with the interrelationships between living organisms and their environments.

Ecosystem: A functional unit consisting of a collection of plants, animals (including humans), micro-organisms and non-living components of the environment, and the interaction between them.

Ecosystem approach to fisheries (EAF): The main purpose of the ecosystem approach to fisheries (EAF) is to plan, develop and manage fisheries in a manner that addresses the multiple needs and desires of societies, without affecting the options for future generations to benefit from the full range of goods and services provided by marine ecosystems.

Ecosystem integrity: The quality of a natural unmanaged or managed ecosystem in which the natural ecological processes sustain the function, composition and structure of the system.

Environment: The complex of physical, chemical, and biological factors in which a living organism or community exists.

Fishery: The industry of catching, processing and selling fish.

Fish stock: The living resources in the community or population from which catches are taken in a fishery. Use of the term "fish stock" usually implies that the particular population is more or less isolated reproductively from other stocks of the same species and is thus self-sustaining. In a particular fishery, the fish stock may be one or several species of fish, but the definition is also intended to include commercial invertebrates and plants.

Food chain: A series of organisms interrelated in their feeding habits. The smallest being fed upon by a larger one, which in turn feeds a still larger one, etc.

Food web: A food web is a model that depicts several food chains that are linked together. A food web shows how energy is transferred among organisms in an ecosystem.

Marine protected areas (MPA): A protected marine area, within territorial waters, exclusive economic zones (EEZ) or in the high seas, set aside by law or other effective means, together with the overlying water and associated flora, fauna, historical and cultural features. It provides degrees of preservation and protection for important marine biodiversity and resources; a particular habitat (e.g. a mangrove or a reef) or species, or subpopulation (e.g. spawners or juveniles) depending on the degree of use permitted. The use of MPAs for scientific, educational, recreational, extractive and other purposes including fishing is strictly regulated and could be prohibited.

Ocean acidification: Relates to the on-going decrease in ocean pH as a result of the uptake of anthropogenic carbon dioxide (CO_2) in the ocean. This acidity is responsible for the dissolution of the shells of living shellfish and other organisms such as coral reefs.

Overexploitation: Excessive use of a population to the point that it does not have the time or ability to regenerate itself.

Photosynthesis: Process by which plants use sunlight, water and carbon dioxide to create oxygen and sugars.

Plankton: The aggregate of small plant and animal organisms that float or drift in great numbers in fresh or salt water.

Phytoplankton: is an aggregate of microscopic plants that live in the ocean. These small plants are very important to the ocean and to the whole planet as they are at the base of the food chain. Many small fish and whales eat them.

Zooplankton: Small herbivores that float or drift near the surface of aquatic systems and that feed on plant plankton, mainly small crustaceans and fish larvae.

Precautionary approach: The precept that an action should not be taken if the consequences are uncertain and potentially dangerous.

Primary production: The process in which plants convert light energy into organic matter.

Pollution: The introduction of contaminants into the natural environment that cause adverse change.

Sustainable use (of resources): The method/process of using limited resources in a prudent/conservative manner, leaving the resource the time to restore itself naturally.

Species: A group of individual organisms that are capable of interbreeding to produce fertile offspring in nature.

Endangered species: a species whose numbers are so small that the species is at risk of extinction.

Threatened species: a species which is likely to become endangered in the near future.

Stakeholders In the context of EAF, these can be defined as individuals, groups, organizations or associations that are involved in, have interest in, or are affected by fisheries resource use and ecosystem management.

Target species: Those species that are primarily sought by the fishermen in a particular fishery. There may be primary as well as secondary target species.

Total fish length: This is measured by bringing the longest lobe of the caudal fin into the mid-line of the fish.

Trophic level: Step in a nutritive series, or food chain of an ecosystem. The first and lowest level contains the producers, green plants. The plants or their products are consumed by the second-level organisms-the herbivores, or plant eaters. At the third level, primary carnivores, or meat eaters, eat the herbivores; and at the fourth level, secondary carnivores eat the primary carnivores. These categories are not strictly defined, as many organisms feed on several trophic levels.

Trophic pyramid: The basic structure of interaction in all biological communities characterized by the manner in which food energy is passed from one trophic level to the next along the food chain and represented by a pyramidal graphic.

Undersized fish: Fishes that have not reached maturity stages; such fish should be released during fisheries operations.

SOURCES

- FAO Technical guidelines for responsible fisheries. 4. Suppl. 2. Fisheries Management. Food and Agriculture Organization of the United Nations. Rome, 2003
- http://mundusmaris.org/index.php/en/projects/2011/162-fao
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ANNEX 1 FISH SPECIES ON THE FISH RULER

Scientific name: *Sardinella aurita*
Common English name: Round sardinella
Common French name: Sardinelle ronde
Local names: Yaboi mereg (Wolof);
Yai Boyoo (Mandinka)

Scientific name: *Ethmalosa fimbriata*
Common English name: Bonga shada
Common French name: Ethmalose d'Afrique
Local names: Kobeu (Wolof);
Chaalo (Mandinka)

Scientific name: *Galeoides decadactylus*
Common English name: Lesser African threadfin
Common French name: Petit capitaine
Local names: Cekéém, Thiekem (Wolof)

Scientific name: *Pomadasys jubelini*
Common English name: Sompat grunt
Common French name: Grondeur sompat
Local names: Koron xadr (Wolof)

Scientific name: *Pagellus bellottii*
Common English name: Red pandora
Common French name: Pageot à tache rouge
Local names: Doctor (Mandinka)

Scientific name: *Pagellus erythrinus*
Common English name: Common pandora
Common French name: Pageot commun
Local names: Yuufuuf, Tikki (Wolof);
Doctor (Mandinka)

Scientific name: *Pagrus caeruleostictus*
Common English name: Bluespotted seabream
Common French name: Pagre à points bleus
Local names: Waragne (Wolof);
Nyarr Nyee (Mandinka)

Scientific name: *Cynoglossus senegalensis*
Common English name: Senegalese tonguesole
Common French name: Sole-langue sénégalaise

Scientific name: *Arius latiscutatus*
Common English name: Rough-head sea catfish
Common French name: Mâchoiron de Gambie
Local names: Kunkelengo (Mandinka);
Kongh (Wolof)

Scientific name: *Pseudotolithus senegalensis*
Common English name: Cassava croaker
Common French name: Otolithe sénégalais
Local names: Feute (Wolof); Sindo (Mandinka)

Scientific name: *Epinephelus aeneuss*
Common English name: White grouper
Common French name: Mérou blanc
Local names: Thiof (Wolof);
Choo-foo (Mandinka)

Scientific name: *Elops lacerta*
Common English name: West African ladyfish
Common French name: Banane,
Guinée d'Afrique occidentale
Local names: Salan-ngo (Mandinka)

ANNEX 2 FISH QUANTITY TABLE

	TYPE OF FISH	QUANTITY
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		

ANNEX 3 FISH MEASUREMENT TABLE

	TYPE OF FISH	LENGTH (cm)
1		
2		
3		
4		
5		
6		
7		
8		

Table follows in the next page >

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	TYPE OF FISH	LENGTH (cm)
9		
10		
11		
12		
13		
14		
15		

ANNEX 4/01 EVALUATION FORMS

FORM 1. Overall class performance. Monitoring-evaluation of the exercises of the teaching kit on Ecosystem Approach to Fisheries

Please use a new sheet for each class in which you carry out an activity (in the context of teaching about the Ecosystem Approach to Fisheries) and please number and date each one clearly for separation.

NAME OF TEACHER: SCHOOL:

SHEET No.	DATE	CLASS		INTERNAL / EXTERNAL ACTIVITY / BOTH
NUMBER OF PUPILS		GIRLS	BOYS	AGE GROUP OR AVERAGE AGE

		EXCELLENT	GOOD	FAIR	WEAK
Prior knowledge of the pupils about marine ecosystems					
Level of attention during explanations					
Exercise 1 (specify)	Level of participation				
	Related activities				
Exercise 2 (specify)	Level of participation				
	Related activities				
Exercise 3 (specify)	Level of participation				
Level of knowledge at the end of the module (please specify the number of hours):					
Overall result					

OTHER OBSERVATIONS

ANNEX 4/02 EVALUATION FORMS

FORM 2. Pupil performance. Monitoring-evaluation of the exercises of the teaching kit on Ecosystem Approach to Fisheries

Please use a new sheet for each pupil participating in the activities (in the context of teaching about the Ecosystem Approach to Fisheries) and please number and date each one clearly for separation.

NAME OF TEACHER: SCHOOL:

SHEET No.	DATE	CLASS		INTERNAL / EXTERNAL ACTIVITY / BOTH
NUMBER OF PUPILS		GIRLS	BOYS	AGE GROUP OR AVERAGE AGE

		EXCELLENT	GOOD	FAIR	WEAK
Prior knowledge about marine ecosystems					
Level of attention during explanations					
Exercise 1 (specify)	Level of comprehension				
	Level of participation				
	Related activities				

OBSERVATIONS ON EXERCISE 1

Exercise 2 (specify)	Level of comprehension				
	Level of participation				
	Related activities				

OBSERVATIONS ON EXERCISE 2

Exercise 3 (specify)	Level of comprehension				
	Level of participation				
	Related activities				

OBSERVATIONS ON EXERCISE 3

Level of knowledge at the end of the module (please specify the number of hours):				
Overall result				

OTHER COMMENTS

ANNEX 5 TEACHING KIT EVALUATION FORM

EVALUATION OF THE TEACHING KIT ON THE ECOSYSTEM APPROACH TO FISHERIES

page **01**/02

NAME OF TEACHER: SCHOOL:

SHEET No.	DATE	CLASS		INTERNAL / EXTERNAL ACTIVITY / BOTH
NUMBER OF PUPILS		GIRLS	BOYS	AGE GROUP OR AVERAGE AGE

TEACHING KIT COMPONENTS

Please, rate each component of the kit on the given scale and add eventual comments.

TEACHERS GUIDE	POOR	FAIR	GOOD	EXCELLENT
Technical content	☐	☐	☐	☐
Instructions	☐	☐	☐	☐
Exercises proposed	☐	☐	☐	☐
References	☐	☐	☐	☐

COMMENTS

FISH RULER	POOR	FAIR	GOOD	EXCELLENT
Variety of fishes displayed	☐	☐	☐	☐
Quality of the material	☐	☐	☐	☐

COMMENTS

Table follows in the next page >

ANNEX 5 TEACHING KIT EVALUATION FORM

> From previous page

EVALUATION OF THE TEACHING KIT ON THE ECOSYSTEM APPROACH TO FISHERIES

page **02**/02

EAF NANSEN POSTER	POOR	FAIR	GOOD	EXCELLENT
Utility	☐	☐	☐	☐
Clarity of the content displayed	☐	☐	☐	☐

COMMENTS

MONITORING AND EVALUATION SHEETS	POOR	FAIR	GOOD	EXCELLENT
Utility	☐	☐	☐	☐
Variety of indicators	☐	☐	☐	☐

COMMENTS

FURTHER BACKGROUND READING	POOR	FAIR	GOOD	EXCELLENT
"Putting into practice the ecosystem approach to fisheries"	☐	☐	☐	☐
EAF Nansen brochure	☐	☐	☐	☐
EAF Nansen flier	☐	☐	☐	☐

COMMENTS

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