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Collaboration between the Nansen Programme and the Large Marine Ecosystem Programmes

Gabriella Bianchi [a,*], Åsmund Bjordal [c], Kwame A. Koranteng [a], Merete Tandstad [a], Birane Sambe [b], Tore Stromme [c]

[a] Food and Agriculture Organization of the United Nations, Rome, Italy
[b] Food and Agriculture Organization of the United Nations FAO, Dakar, Senegal
[c] Center for Development Cooperation in Fisheries (CDCF), Institute of Marine Research (IMR), Bergen, Norway

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ABSTRACT

Norwegian development cooperation in fisheries has been taken place since the early 1950s and the Nansen Programme, now operating as the EAF-Nansen Project, has been one of its major representatives. The Nansen Programme has cooperated with developing nations, institutions and national and regional projects over the last forty years, representing an important mechanism for development assistance in the field of fisheries for the Norwegian Agency for Development Cooperation (Norad). The scope of the cooperation has changed over the years to respond to emerging needs and challenges in partner countries. Since the Large Marine Ecosystem (LME) concept appeared in the global marine science and governance agenda, the Nansen Programme was seen as an important partner for the regional projects in Africa that emerged from the concept. The Nansen Programme has collaborated with the Agulhas and Somali Currents LME (ACSLME) project, the Benguela Current LME (BCLME) project and its successor the Benguela Current Commission (BCC) as well as the Canary Current LME (CCLME) project and the Guinea Current LME (GCLME) project. In South Asia, the Nansen Programme has also collaborated with the Bay of Bengal LME (BoBLME) project. This paper chronicles the nature of the collaboration and the mutual benefits accruing to all the parties.

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1. Introduction

Norwegian development cooperation in fisheries dates back to the early 1950s with the Indo-Norwegian fisheries project in Kerala (1952–72). The Institute of Marine Research (IMR) has been involved from the start in India – and over the years in a series of bilateral projects in Africa, Asia and Latin America. This work has mainly been financed by the Ministry of Foreign affairs – either directly or through the Norwegian Agency for Development Cooperation (Norad). However, the major project in fisheries development cooperation since the mid 1970s has been the Nansen Programme, conducted as a close cooperation between the funding agency Norad, FAO, IMR and the different partner countries and regions. This contribution will provide a brief history of the Programme and its contribution to the LMEs.

* Corresponding author.
E-mail address: Gabriella.Bianchi@fao.org (G. Bianchi).

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2. The Nansen Programme

In the late 1960s the idea was launched in Norway to build a research vessel to assist newly independent countries with mapping their fishery resources. In 1974 the Nansen Programme was initiated by the Government of Norway and the Food and Agriculture Organisation of the United Nations (FAO) to assist developing countries to strengthen the contribution of their fishery resources to food security and growth.

The initial phase of the Programme, which was an exploratory one, started in 1974 with the launch of a research vessel Dr. Fridjtof Nansen, with the main objective of assessing the abundance of available resources in the Indian Ocean, which at that time was one of the least known oceans in the world.

During this first phase the surveys discovered new fisheries resources, but did also identify areas with weak resource bases for development of fisheries. From the start, the fisheries investigations (trawl and acoustic surveys) were accompanied with oceanography observations – collecting data on temperature, salinity and oxygen.

Around 1981, and with the extension of their jurisdiction to 200 nautical miles by many coastal nations, the Programme entered into a new phase and carried out detailed mapping of resources within the EEZs of West Africa, East Africa, the Arabian Sea, the Red Sea, the Mediterranean Sea, Southeast Asia, the Pacific coast of Central America and the Northern Coast of South America, in partnership with national research institutions. During this phase, co-funding was provided by UNDP/FAO to the order of 40% of the project amount up to 1983, then reduced to 20% and to a nominal amount since 1987 (Saetersdal et al., 1999).

Since 1993, and coinciding with the deployment of a new *Dr. Fridtjof Nansen* vessel, a new phase started aimed at developing capacity in fishery research and management in Southwest Africa, mainly Namibia, Angola and South Africa. During this phase the Nansen Programme was instrumental for the establishment of the BENEFIT (Benguela Environment Fisheries Interaction and Training Programme) as a platform for collaborative research work on transboundary resources and the Benguela Current ecosystem overall. Annual surveys were carried out off Angola and in Namibia which resulted in a unique time series of data on the fish resources in those regions. While the surveys still were focusing on monitoring fish stocks, a capacity development component within fisheries research- and management was added to the Programme. Geographically, much effort was spent in the Benguela and Canary current areas, with partner countries as South Africa, Namibia, Angola, Senegal, Gambia, Mauritania and Morocco. Particularly in Namibia, the Nansen Programme combined with bilateral assistance from Norway – gave a sector wide development approach in fisheries research, management and control (coast guard).

Starting in 1995, through an agreement with FAO, annual surveys were also carried out of the small pelagic resources off Northwest Africa as well as ad-hoc capacity development activities. The need to broaden the scope of the activities in Northwest Africa and to formalize FAO's technical contribution to the Nansen Programme in general led to the development of the FAO project "International cooperation with the Nansen Programme" in 1999. This project expanded the scope from

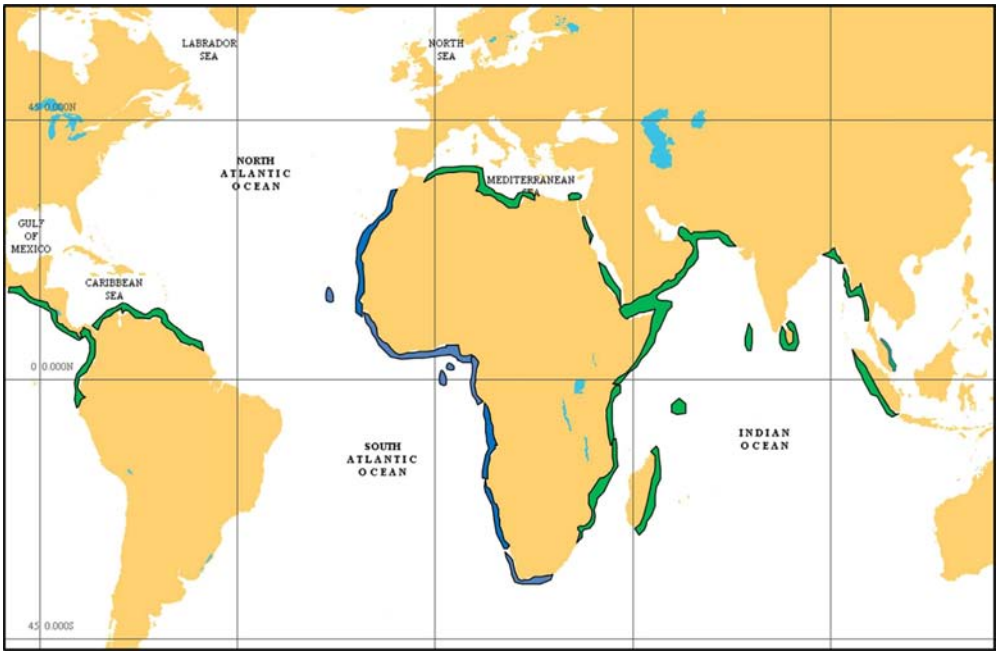

Fig. 1. Areas covered by the RV Dr. Fridtjof Nansen during 40 years of activity (blue and green). Some areas (particularly off West Africa, blue) have been covered systematically over longer periods of time thus resulting in unique time series. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

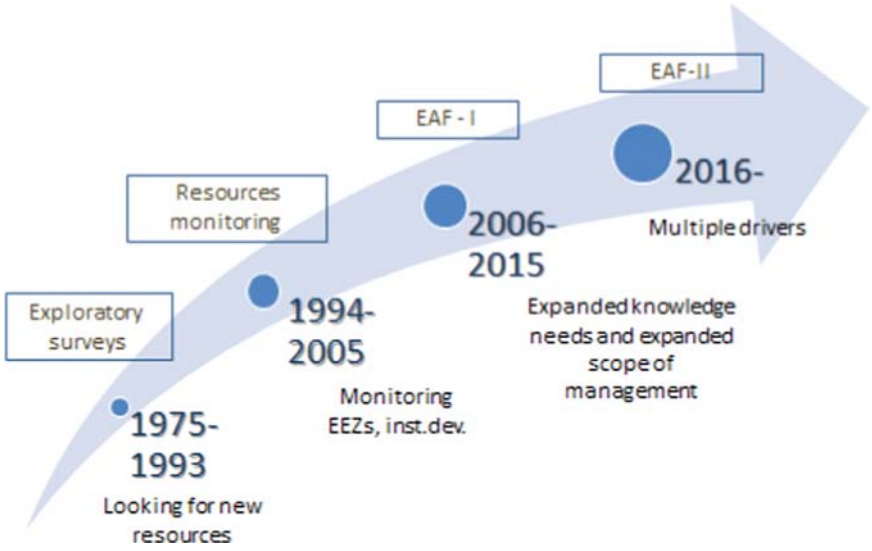

Fig. 2. Schematic representation of the main phases of the Nansen Programme showing how objectives have evolved in relation to emerging needs in partner countries.

focusing on the conduct of surveys to looking at the basis for shared stock management of the small pelagics in Northwest Africa, strengthened regional cooperation on survey related activities in the Gulf of Guinea and technical support from FAO to the Nansen Programme activities in Southwest Africa. During that period the grounds were laid for substantial collaboration with all African LME programmes that were then under development, particularly in relation to the use of the R/V *Dr. Fridtjof Nansen* to assess the productivity and status of resources and ecosystems.

The subsequent period saw the Programme transformed into the EAF-Nansen project in 2007 which has been running to date (2015). This phase was based on the endorsement by the FAO Committee on Fisheries (COFI) of the ecosystem approach to fisheries and the implementation of the FAO Code of conduct for responsible fisheries.

The new phase harnessed the combined experience of FAO and the Norwegian Institute of Marine Research (IMR) to build capacity of developing countries to adopt and implement the then emerging Ecosystem Approach to Fisheries (EAF). During this phase the collaboration with the LME programmes was continued and further strengthened. In the formulation of most of the LME projects, in particular those around Africa, financial and in-kind contribution to be offered by the Nansen Programme/EAF-Nansen project were considered as a key source for co-funding. Similarly, the LME projects were considered to provide the necessary partnership opportunity in the assessment of the feasibility of the EAF-Nansen Project for which the survey programme was to be based on partner contributions.

Fig. 1 provides an overview of the regions covered by the surveys with *Dr. Fridtjof Nansen* and Fig. 2(a) schematic representation of the different phases of the Programme.

3. Activities and results

Over the four decades of the Programme, the vessels have surveyed the waters of more than 60 countries providing data for marine research and basis for fisheries management advice. Since the establishment of the Large Marine Ecosystems (LME) concept, the Nansen Programme has assisted these in providing marine data particularly as in the case of the Benguela Current LME, the Canary Current LME, the Guinea Current LME, the Agulhas and Somali Currents LME and the Bay of Bengal LME. The Programme has also over decades assisted several the regional fisheries bodies or commissions in Africa with survey data and assessments.

For some of the partner countries visited in the 1970s and 80s, the Nansen survey data are still the main knowledge base for their marine ecosystems and fish resources, while for other countries like S. Africa, Namibia and Angola – the Nansen Programme has assisted in building data time series over decades.

First and foremost, the Nansen Programme has contributed to improved national and regional knowledge and management of fisheries. Also, the Programme has contributed significantly to improved global knowledge about marine ecosystems, particularly from otherwise data poor areas. In particular, the following has been delivered in cooperation with partner institutions:

– Survey data

  The survey data are typically fish data from pelagic and demersal trawl samples and hydro-acoustics, plankton, hydrographic data (CTD), current profile data (ADCP) and meteorological data. In recent years with the ecosystem surveys and

environmental baseline studies the data collection has been expanded with 3D bottom profiling, sediment, benthos and pollution.
Among biological data, about 4600 fish species are recorded (2500 in photo data base) and 2000 invertebrate species.
Invertebrates: 1800 species of benthos and infauna and in addition numerous species of plankton, arthropods/crustaceans, echinoderms, bivalves, gastropods, cephalopods, reptiles.
Survey reports can be found on the EAF-Nansen home page: www.eaf-nansen.org and Saetersdal et al. (1999) gives a comprehensive review of the surveys from 1975 to 1993.
Collected data are submitted to the partner country after each survey while IMR keeps a copy as custodian of the data. The data belongs to the respective partner country. The Nansis (Nansen Survey Information System for logging, editing and analysing survey data), was developed in the early 1980s (Strømme, 1992) and a Windows-based version is now available (version 1.9 of the software was officially released on 17 May 2015).
Preliminary analyses of the data collected through the surveys are used to produce survey reports. However, the data collected provide a valuable and sometimes unique basis for generating additional knowledge on marine ecosystems status and dynamics. An example is the NansClim project, also funded by Norad, with the aim of clarifying possible climatic effects on marine life in the Benguela region. Through good cooperation between Angolan, Namibian, Norwegian and South African scientists, the project had an output of more than 20 scientific publications, including a synthesis paper (Jarre et al., 2015).

– Capacity building

On board training of scientific personnel from partner countries has been an important part of the surveys since the start of the Programme. In addition numerous courses in different subjects have been given such as survey planning and design, hydro-acoustics, stock assessment, fisheries statistics, laboratory training, fisheries management and more.

In academic training, the Nansen Programme has contributed to about 100 master and PhD degrees by candidates from partner countries of which many have central positions in the fisheries administration in their home country today. In addition, the Norwegian Universities of Bergen and Tromsø, have through Norad funded programmes educated nearly 300 MScs and a number of PhDs.

Activities carried out during the various phases of the Nansen Programme and some of the results are discussed in subsequent sections of this paper. The results from the early phases of the Nansen Programme are also described as these contributed substantially to the baseline of the different LME projects.

3.1. Early phases of the Nansen Programme (1975–1993 and 1993–2006)

Collaboration with African LME projects has been substantial since their establishment. It is widely recognised that the BENEFIT programme, largely funded by the Nansen Programme and with the R/V *Dr. Fridtjof Nansen* as the main research platform, laid the basis for the BCLME programme.

In 1990, the *Dr. Fridtjof Nansen* was the first research vessel to visit the region following Namibian Independence.

Table 1
Example of surveys carried out in the Benguela region from 1994 to 2007 (modified from O'Toole, 2008).

Year	Countries covered	Survey description
1994	Angola, Namibia	Transboundary pelagic
1996–2007	Angola	Sardine and sardinella distribution and biomass estimation
1996–2007	Angola	Demersal fish biomass estimation
1997	Angola, Namibia	Benguela front
1997	Namibia	Hake ichthyoplankton
1998	Namibia	Horse mackerel distribution and biomass estimation
1999	Namibia	Hake recruitment
2000	Namibia	Multi-frequency acoustics
2001–2003	Namibia	Efficiency of bottom trawl
2004	Angola	Sardinella recruitment
2004	Namibia	Hake recruitment; Orange River
2005	Namibia and South Africa	Regional demersal survey
2005	Namibia	Gobies
2005		Deepwater hake
2006	Namibia	Gobies
2006	South Africa	Hake – SA west coast
2007	Namibia	Hypoxic environment studies

Particular attention was given to surveying transboundary species such as hake, sardines, horse mackerel and sardinellas (O'Toole, 2008). The R/V *Dr. Fridtjof Nansen* became the region ocean laboratory in which training in fish species identification, quantitative acoustic assessment, mapping and environmental monitoring was undertaken throughout the Benguela Current ecosystem under the direction of the Institute of Marine Research (IMR) in Bergen. Since 1990, more than 50 surveys have been carried out by the vessel in the region, providing an invaluable quantitative time series on fish stock abundance and marine environmental parameters. Measurements such as temperature, salinity, oxygen and chlorophyll were taken which provided the region with a useful baseline dataset against which future environmental changes can be estimated. A list of some of these surveys is given in Table 1.

The Norwegian scientific and technical staff on board the research vessel provided much needed training and capacity building for African scientists and local fisheries institutions and made available quantitative information for governments on the abundance and distribution of fish stocks in their waters, in particular in Namibia and Angola where specific effort to build national capacity was invested. The annual surveys provided the necessary data and information to the fisheries ministries in setting a total allowable catch (TAC) for a number of stocks, and as such supported the regulation and management of the fisheries (O'Toole, 2008).

Soon after the end of apartheid in South Africa the Nansen Programme spearheaded regional cooperation in marine research in Southwest Africa. In October 1994 the R/V *Dr. Fridtjof Nansen* carried out a survey off the Cape peninsula with a group of scientists from Namibia, South Africa and Norway. The main purpose of the survey was to find a common ground for future collaboration in the field of fishery acoustics, survey techniques and biological oceanography.

With the onset of BENEFIT in 1997 the R/V *Dr. Fridtjof Nansen* was already a principal player in fisheries assessment work in the Benguela region.

The overall goal of BENEFIT was to promote the optimal and sustainable utilisation of the Benguela region living resources by[1]:

- Increasing knowledge of fluctuations in important living marine resources of the Benguela Current and improving understanding of the way in which environmental factors influence these fluctuations.
- Developing human capacity and infrastructure for marine science and technology in Angola and Namibia.
- Providing system-wide data and information for the management of both national and shared resources.

The vessel played a major role in the implementation of the BENEFIT Programme. The programme required regional institutions and scientists to develop specific project proposals on key topics in line with the goals of the Programme. These projects yielded valuable results and greatly contributed to the training of local scientists and technicians and the achievement of higher education awards, certificates and degrees. Through the Nansen surveys and other activities, aspects of the BCLME which were not previously understood became clearer (O'Toole, op. cit.). In order to foster regional collaboration in fishery and marine environmental research, one of the requirements to receive funding by the Nansen Programme was that the proposal addressed transboundary issues and included researchers from at least two of the three countries in the region. Furthermore, project proposals needed to demonstrate that the research would be relevant to fisheries management. These requirements were important to ensure the relevance of the Programme activities not only in relation to cooperative science, but also to develop a regional approach to address transboundary concerns.

The support of the Nansen Programme continued during the implementation phase of the BCLME Programme as well as the use of the R/V *Dr. Fridtjof Nansen* for surveys in the region. Initially the work of the Nansen Programme in the BCLME region focused on three areas: fisheries acoustics including sonar; early life history of fish, particularly the hake; and fish behaviour in relation to trawl and trawl performance. The regional work on hake that in later years has been used to clarify questions around shared stocks in the BCLME region was not part of an initial planned strategy. Instead, it unfolded as a result of coincidence and learning along the way. The Namibian Government was able to set quotas for hake because of the valuable stock surveys conducted by the R/V *Dr. Fridtjof Nansen*. In 2000, the work on hake was taken over by Namibian scientists, but continued with the same methods that were used on board the Nansen thus continuing the time series initiated in 1990. This time series continues today under the responsibility of Namibia's fishery research institute National Marine Information and Research Centre (NatMIRC).

O'Toole (op. cit.), noted that the survey work formed part of the development of the ecosystem approach to fisheries management in the BCLME Programme. Annual surveys in Angola have continued since 1985, with only a few breaks when the research vessel was operating in other regions (Strømme, 2008).

Northwest Africa and the Gulf of Guinea, with their productivity and considerable history of artisanal and industrial fisheries, have also been major partners of the Nansen Programme for many years. The survey programme in that region started in 1981 with surveys covering all the area from Morocco to Ghana. Main survey objectives included distribution and biomass estimation of main exploited species, particularly pelagic stocks in the case of Northwest Africa. Since 1981, more than 40 surveys have been carried out by the R/V *Dr. Fridtjof Nansen* in those regions, with main emphasis on the upwelling region in Northwest Africa, part of the Canary Current ecosystem (Morocco to Senegal–Gambia). From 1999, the partnership and collaboration in these regions became expanded to include additional activities in support of regional collaboration in

[1] http://www.benguelacc.org/index.php/en/about/the-history-of-the-bcc/the-benefit-programme

Table 2
Major surveys carried out with the R/V *Dr. Fridtjof Nansen* in the Canary Current LME in the period 1995–2006.

Year	Countries	Survey description
1995	Guinea Bissau, Senegal, Gambia, Mauritania, Morocco	Pelagic fish resources
1996	Mauritania, Morocco, Senegal, Gambia	Pelagic fish resources
1997	Senegal, Gambia, Mauritania, Morocco	Pelagic fish resources
1998	Senegal, Gambia, Mauritania, Morocco	Pelagic fish resources
1999	Senegal, Gambia, Mauritania, Morocco	Pelagic fish resources
2000	Senegal, Gambia, Mauritania, Morocco	Demersal fish resources
2000	Senegal, Gambia	Special studies
2000	Senegal, Gambia, Mauritania, Morocco	Pelagic fish resources
2001	Morocco, Mauritania, Senegal, Gambia	Pelagic fish resources
2001	Senegal, Gambia, Mauritania, Morocco	Pelagic fish resources
2002	Morocco, Mauritania, Senegal, Gambia	Pelagic fish resources
2002	Senegal, Gambia, Mauritania, Morocco	Pelagic fish resources
2003	Morocco, Mauritania, Senegal, Gambia	Pelagic fish resources
2003	Senegal, Gambia, Mauritania, Morocco	Pelagic fish resources
2004	Senegal, Gambia, Mauritania, Morocco	Pelagic fish resources
2005	Senegal, Gambia, Mauritania, Morocco	Pelagic fish resources
2006	Senegal, Gambia, Mauritania, Morocco	Pelagic fish resources

science, capacity development and scientific support for management.Table 2

The Canary Current Large Marine Ecosystem (CCLME) provides vital food and other economic activities for coastal populations. It is one of the most productive ecosystems in the world with an enormous opportunity for fisheries.

For over three decades, the Norwegian Agency for Development Cooperation (Norad) through the Nansen Programme, and the EAF Nansen Project, has invested substantially in the CCLME area to ensure sound management of fisheries resources there. This intervention is at various levels, namely the acquisition of scientific knowledge especially with the surveys at sea, improving capacity through training workshops, and assistance in the development and implementation of fisheries management plans.

Multiple scientific surveys carried out by the R/V *Dr. Fridtjof Nansen*, with the participation of national experts, have provided a forum for knowledge-sharing in the CCLME area. Some data acquired especially during acoustic surveys have been used in the assessment of pelagic stocks which are the most abundant resources and mainly shared in the CCLME area. This important scientific cooperative effort has greatly enhanced the work on monitoring of certain fish stocks and also motivated the organisation of regular meetings of the sub-regional Working Group on pelagic stocks.

Scientists that have participated in the R/V *Dr. Fridtjof Nansen* research cruises have been trained on survey methods and on data management and analyses. This has promoted technical integration often spoken about by experts from the sub-region. Through the organisation and/or funding of training courses as well as the extensive practical experience obtained from the R/V *Dr. Fridtjof Nansen* surveys, a good number of national experts of the region are able to conduct acoustic surveys using national research vessels. Scientists of the region are also able to conduct coordinated research surveys on the shared pelagic resources of the area. The R/V *Dr. Fridtjof Nansen* has facilitated this healthy exchange of knowledge and expertise as well as inter-calibration with the research vessels of the region.

In 2002 the Nansen Programme initiated and facilitated cooperation among the countries in the region on a mechanism for sharing benefits of the pelagic stocks in the region and coordinated fishery management in view of the transboundary

Table 3
Example of surveys with the R/V *Dr. Fridtjof Nansen* in the Guinea Current LME area in the period 1994–2006.

Year	Countries covered	Survey description
1994	Gabon, D.R.Congo	Pelagic fish
1994	Gabon, D.R.Congo	Pelagic and demersal fish
1995	Gabon, D.R.Congo	Pelagic fish
1996	Gabon, D.R.Congo	Pelagic fish
1999	Benin, Togo, Ghana, Côte d'Ivoire	Pelagic and demersal fish
2000	Benin, Togo, Ghana, Côte d'Ivoire	Pelagic and demersal fish
2002	Benin, Togo, Ghana, Côte d'Ivoire	Pelagic and demersal fish
2004	Benin, Togo, Ghana, Côte d'Ivoire	Pelagic and demersal fish
2004	Nigeria, Cameroon, Equatorial Guinea, S. Tomé e Príncipe, Gabon	Pelagic and demersal fish
2004	Gabon, Congo, D.R.Congo, Angola	Special studies
2005	Benin, Togo, Ghana, Côte d'Ivoire	Pelagic and demersal fish
2005	Nigeria, Cameroon, Equatorial Guinea, S. Tomé e Príncipe, Gabon	Pelagic and demersal fish
2005	Gabon, D.R.Congo	Pelagic and demersal fish
2006	Guiné-Bissau, Guinea, Sierra Leone, Liberia	Pelagic and demersal fish
2006	Benin, Togo, Ghana, Côte d'Ivoire	Pelagic and demersal fish
2006	Nigeria, Cameroon, Equatorial Guinea, S. Tomé e Príncipe, Gabon, DR Congo	Pelagic and demersal fish

nature of those fish stocks. Training courses on the ecosystem approach to fisheries and the development of a regional fisheries management framework for pelagic fish stocks in line with the ecosystem approach to fisheries were also jointly facilitated by the EAF Nansen Project and the Canary Current large Marine Ecosystem project.

The Nansen Programme continued to partner with the Guinea Current LME (GCLME) project (which was an expanded phase of the Gulf of Guinea LME project). Initial collaboration was in the area of ecosystem surveys, but also included training activities both at sea and on land and in partnership with CECAF. Table 3 gives the major Nansen surveys carried out in the GCLME area.

In the first phase of the Nansen Programme (1975–1993) a number of surveys were carried out in the ASCLME with the R/V *Dr. Fridtjof Nansen* but no surveys were conducted in the second phase (1993–2006). The data collected in the region still represent an important reference point for monitoring changes in resources and the marine ecosystem.

3.2. EAF phase of the Nansen Programme

From December 2006, the Nansen Programme started operating as the EAF-Nansen Project under the direct management of FAO. The LME projects which were operating at the time and the ones in the pipeline were considered to provide the necessary partnership opportunity for the new Project and this was a critical factor in the assessment of the EAF-Nansen Project. Similarly in the formulation of the LME projects in Africa, financial and in-kind contributions to be offered by the Nansen Programme were considered as a key source of co-funding.

From 2007 when the EAF-Nansen project became fully functional, a partnership agreement was signed with the LME projects under implementation, namely ASCLME, GCLME and also the Interim Benguela Current Commission (BCC). The CCLME project came on line a few years later. The partnership agreements specified collaboration in the following:

- To carry out ecosystem surveys with the R/V *Dr. Fridtjof Nansen*; emphasis was on transboundary and/or shared resources;
- To institute schemes for monitoring resources and as well as the status of the marine ecosystems;
- To carry out joint capacity development in ecosystem approach to fisheries methodology and implementation; and
- Other specific areas of work.

A number of ecosystem surveys were carried out in partnership with all the LME projects in Sub-Saharan Africa. The surveys were co-funded by the parties and provided additional knowledge, data and information for Transboundary Diagnostic Analyses (TDAs) that the LME projects were undertaking and also in support of the demonstration projects that were under implementation. The areas covered in the surveys included some of the least-researched maritime areas in the world, e.g. the Mascarene plateau and the southern Indian Ocean seamounts bordering the ASCLME area.

Under specific areas of work, different activities were taken with the different LME projects. The Project collaborated with the BCC to implement the following projects:

- Implementing a process which allows the review (auditing) and tracking of EAF in management (also known as the Tracking Tool project);
- Guidance on institutional arrangements which support EAF; and
- Integrating the Human Dimension of EAF into fisheries management in the BCC region.

The Tracking Tool project was intended to adapt the FAO/WWF-South Africa EAF Tracking Tool for use in the three countries in the BCC area and to build the capacity of scientists and managers in all three countries and particularly in Angola in ecological risk assessment (ERA) methodology and practice and the use of the tracking tool to be able to participate fully in the project. Another objective was to assess progress made in implementing an EAF in the region through periodic ERA reviews. The project was very successful and the approach was used to establish EAF implementation baselines in all the other LMEs (ASCLME, CCLME and GCLME). Workshops were jointly by the EAF-Nansen Project, the LME project and the Regional Fisheries Bodies (RFBs). By December 2014, the Tracking Tool had been used on selected fisheries of 29 of the 32 countries covered by the Project; only Somalia, Guinea and Angola were missing (Johnson et al., 2014; Koranteng, 2015).

A study (*An assessment of the adoption and implementation of the ecosystem approach to fisheries by coastal African countries*) was commissioned in 2014. The results of the study showed that the average implementation score for the 29 countries was 43%. The study showed that progress has been made by the countries in the adoption and implementation of the ecosystem approach to fisheries and gave areas where emphasis must be placed in order to move the countries further towards full EAF implementation. The key areas are with ecosystem impacts of fisheries and their consideration in management, management plans, and addressing external impacts on fisheries.

In addition to the ecosystem surveys, the EAF-Nansen Project also collaborated with the South West Indian Ocean Fisheries Project (SWIOFP) which is one of three projects in the ASCLME programme to assist each ASCLME country, except Somalia and South Africa, both technically and financially to prepare an EAF management plan for at least one fishery. The

process involved establishment and facilitation of EAF National Task Groups (NTGs), training of national experts in risk assessment methods and general fisheries management planning and providing external experts to help the NTGs finalise the plans. Eight plans were prepared and are under implementation having been approved by the national competent authorities.

The EAF-Nansen Project partnered with the CCLME project to assist four countries in North West Africa (Morocco, Mauritania, Senegal and The Gambia) to prepare a sub-regional fisheries management framework for small pelagic fisheries that they share. The sub-regional initiative was also supported by the Sub-Regional Fisheries Commission (SRFC), and led by the EAF Regional Task Group (RTG). Efforts to put in place rational management mechanisms for the small pelagic species of Northwest Africa to ensure the sustainability of the resources and contribute to responsible management of the resources date back to 1979 (FAO, 1979). Since then several attempts have been made by the four countries, FAO and also the SRFC to translate this vision or wish into reality. The purpose of the sub-regional framework is to ensure, through close collaboration among all relevant stakeholders in the four countries and development partners, the conservation of the transboundary small pelagic resources and generate sustainable social and economic benefits from the exploitation of the small pelagic fisheries to all stakeholders within the constraints imposed by ecological and social requirements. It identifies the main objectives and requirements for the fisheries, as well as the management measures that will be used to achieve these objectives.

Through a partnership between the EAF-Nansen project, the CCLME, SRFC and the countries, a policy document was also developed concurrently with the management framework and for the same fisheries. The policy is intended to provide the direction for the transboundary management of shared small pelagic fish stocks in the four CCLME countries.

While the EAF-Nansen project is mainly implemented in Africa, collaboration has also taken place with the Bay of Bengal Large Marine Ecosystem (BoBLME). Two surveys were organised in Myanmar (December 2013 and May 2015) with the objective of assessing the biomass of demersal and pelagic fish and carry out an ecosystem survey. The vessel had previously worked in this region in 1979 and 1980 and in addition to Myanmar (at that time Burma), the vessel also covered Sri Lanka, Bangladesh, Thailand and the northwest coast of Sumatra.

In July 2011, the African LME Caucus put together a paper entitled *Acknowledgement of the impact of the Nansen Programme, in particular the R/V Dr. Fridtjof Nansen, on African Large Marine Ecosystem projects.* The African LME Caucus has the objective of establishing close cooperation between five African Large Marine Ecosystem programmes to discuss issues of common concern, share experiences and develop strategies to work together.

The paper noted that over the past 30 years, the R/V *Dr. Fridtjof Nansen* has conducted a wide range of surveys in African waters and in the process hundreds of African researchers and technicians have received hands-on training on board the vessel. Many of those researchers now play important roles in the management of African fisheries. The paper also noted that the work and results of the R/V *Dr. Fridtjof Nansen* have raised the profile of fisheries management and attracted the support of African ministers concerned with fisheries as well as the environment. It was also recorded that the vessel has become a symbol for the sustainable development of fisheries in almost all maritime countries in Africa and that Namibia and South African are among the top ten nations in the world when it comes to complying with the FAO Code of Conduct for Responsible Fisheries, partly as a result of the contribution made by the R/V *Dr. Fridtjof Nansen* and bilateral cooperation projects with Norway.

4. LME projects and the future phase of the Nansen Programme

Following the decision of the Norwegian government to build a new vessel to replace the present R/V *Dr. Fridtjof Nansen*, FAO and IMR were asked to develop a programme and a science plan for the future of the Nansen Programme. Although fisheries research and management will still be the core of the Programme, the next phase will build on the EAF principles, the surveys will be more ecosystem oriented and new scientific challenges as effects of pollution, climate change and ocean acidification will be included.

As all the Africa LME projects move towards the implementation of the Strategic Action Plan (SAP) negotiated with and approved by the countries, the cooperation with the Nansen Programme will continue to be relevant. From 2016, implementation of a new phase of the Nansen Programme (to be called the EAF-Nansen Programme phase (2) will start. The new expanded phase will take on board many issues and study areas of vital importance to the LME projects. The new Programme is expected to contribute to global climate change by monitoring the oceans bordering developing nations and the R/V *Dr. Fridtjof Nansen* is envisioned as a UN platform for marine observations. Obviously, achieving these objectives will depend on stronger partnerships with other UN agencies and initiatives including the LME projects.

It is important to note that all the LME projects, especially those in Africa, will also be at their SAP implementation phase and for which current information on the ecosystem and resources will be crucial. A new ultra-modern research vessel (also called *Dr. Fridtjof Nansen*) will from January 2017 be commissioned to support the EAF-Nansen Programme and the partners. The new vessel is especially equipped to carry out investigations relevant to all the components of the LME modular approach.

The new EAF-Nansen Programme will continue to further the EAF as a comprehensive fisheries management approach and to assist the countries that have developed EAF management plans to establish a Fisheries Management Cycle (FMC) that consists of all the activities that a fisheries administration is expected to carry out annually as part of its mandate to

manage the fisheries. This is an activity that should be of utmost importance to the SAP implementation phase of the LME projects and further cooperation between the EAF-Nansen Programme and the LME projects in this work will be crucial for its success. The programme will also prepare the fisheries sector to better integrate within broader multi-sectoral governance frameworks such as ecosystem-based management (EBM), which is being promoted through the LME programme.

5. Conclusions

No doubt that collaboration between LME programmes and the Nansen Programme has been extremely useful to all partners involved, particularly in Africa. The collaboration has so far mainly taken the form of surveys with the *Dr. Fridtjof Nansen,* but there is great potential for expansion to include other aspects of marine ecosystem sustainability including, research, governance and capacity development. The substantial training programme foreseen in the new phase of the EAF-Nansen Project could be coordinated/integrated in the IW Learn programme with obvious reciprocal strengthening of capacity development outcomes. The legacy of the Nansen Programme in relation to data and information available, time series of distribution and abundance of main transboundary resources and biodiversity could more systematically be used to complement other sources of information and develop knowledge tools for LMEs. These are just examples. Given the shared development objectives, a strategic and formal partnership between the LME movement and the Nansen Programme could lead to significantly strengthened outcomes for coastal developing regions.

References

FAO, 1979. Report of the fifth session of the CECAF sub-committee for the management of resources within the limits of national jurisdiction, Agadir, Morocco.

Jarre, A., Hutchings, L., Kirkman, S.P., Kreiner, A., Tchipalanga, P.C.M., Kainge, P., Uanivi, U., Van der Plas, A.K., Blamey, L.K., Coetzee, J.C., Lamont, T., Samaai, T., Verheye, M.M., Yemane, D.G., Axelsen, B.E., Ostrowski, M., Stenevik, E.K., Loeng, H., 2015. Synthesis: climate effects on biodiversity, abundance and distribution of marine organisms in the Benguela. Fish. Oceanogr. 2015 (Suppl. 1), S122–S149.

Johnson, A., Koranteng, K., Petersen, S., Tandstad, M., 2014. Establishing a baseline for the implementation of an ecosystem approach to marine fisheries management in West and Central Africa. FAO, Rome, pp. 89.

Koranteng, 2015. Project progress report no. 7, FAO EAF-Nansen Project Report. FAO, Rome.

O'Toole, M., 2008. The legacy of the research vessel Dr. Fridtjof Nansen Pp 90–91. In: Hempel, G., O'Toole, M., Sweijd, N. (Eds.), Benguela Current of plenty. A history of international cooperation in marine science and ecosystem management, Benguela Current Commission, pp. 144.

Saetersdal, G., Bianchi, G., Strømme, T., Venema, S.C., 1999. The Dr. Fridtjof Nansen Programme 1975–1993. Investigations of fishery resources in developing regions. History of the programme and review of results. FAO fisheries technical paper no. 391. FAO, Rome434.

Strømme, T., 1992. NAN-SIS. Software for survey data logging and analysis. Users' manual. FAO computerized information series (fisheries), 4. FAO, Rome 103.

Strømme, T., 2008. BENEFIT and the Nansen Programme Pp 92–93. In: Hempel, G., O'Toole, M., Sweijd, N. (Eds.), Benguela Current of plenty. A history of international cooperation in marine science and ecosystem management, Benguela Current Commission, pp. 144.