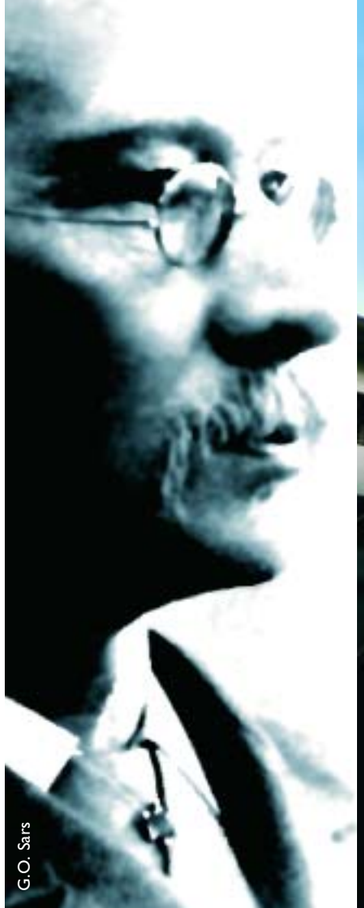


G.O. Sars

Our ships

– and the men whose names they bear

HAVFORSKNINGSINSTITUTTET

Contents

This text is based on
an earlier publication written by
Per Solemdal and Sigmund Myklevoll.

The work of the Institute of Marine Research

The Institute's four core areas of activity are marine resources, the marine environment, aquaculture and coastal zone management. The Institute lies at the cutting edge of research in these fields, and it regularly provides professional and scientific advice to the authorities, industry and the general public. The aims of our core areas of research are:

- to improve our basic knowledge of the most important species of marine animals in order to be able to offer more accurate stock assessments, prognoses and management advice
- to improve our understanding of environmental effects on the ecosystem and their importance for environmental and resources management, and to develop methodologies for incorporating environmental parameters in stock assessments
- to develop our knowledge of salmonids, marine species and crustaceans in order to improve aquaculture production, thus ensuring that the interests of both industry and society in general are taken into account in questions of health, the environment, food quality and ethics
- to provide a knowledge base and management advice for a balanced and future oriented utilization and protection of the coastal zone

The Institute of Marine Research

The Institute's headquarters are at Nordnes Point in Bergen, where the Marine Environment research and the Aquaculture research have their offices and modern laboratories. The main building also houses the Director General's offices, the Department of Information, and so on. Just down the road we find the headquarter for research of the Marine Resources in its own building (close to the Directorate of Fisheries). A few minutes walk in the same direction brings us to the Fish Capture Section and the Department of Fisheries Research in Developing Countries. On Nykirkekaien (New Church Quay) the Administration and Service Department and the Research Vessel Department rent premises from the Bergen Harbour Authority. This is also where the Institute's research vessels tie up on their occasional visits to Bergen, and where their research trawls and other equipment are stored.

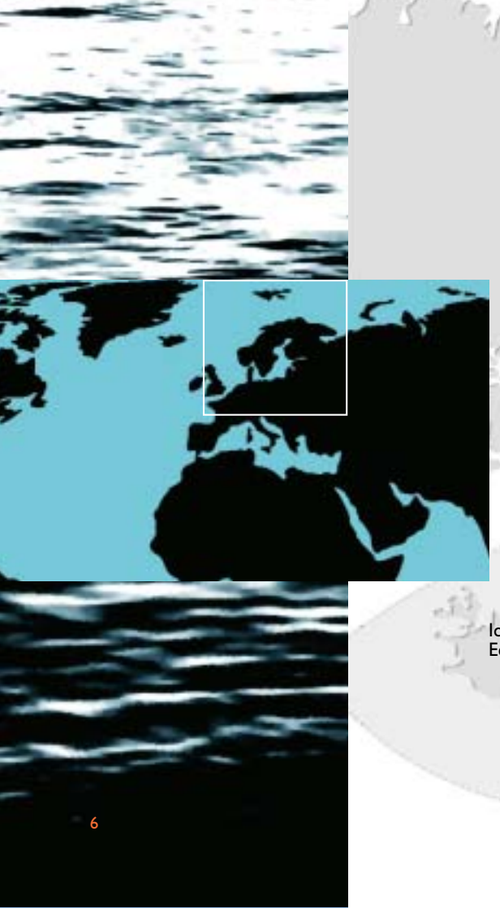
Our stations

Matre Aquaculture Station, on the shore of the Masfjord, was established in 1971. Its scientists mainly study salmon and trout, but they also do research on marine fish species.

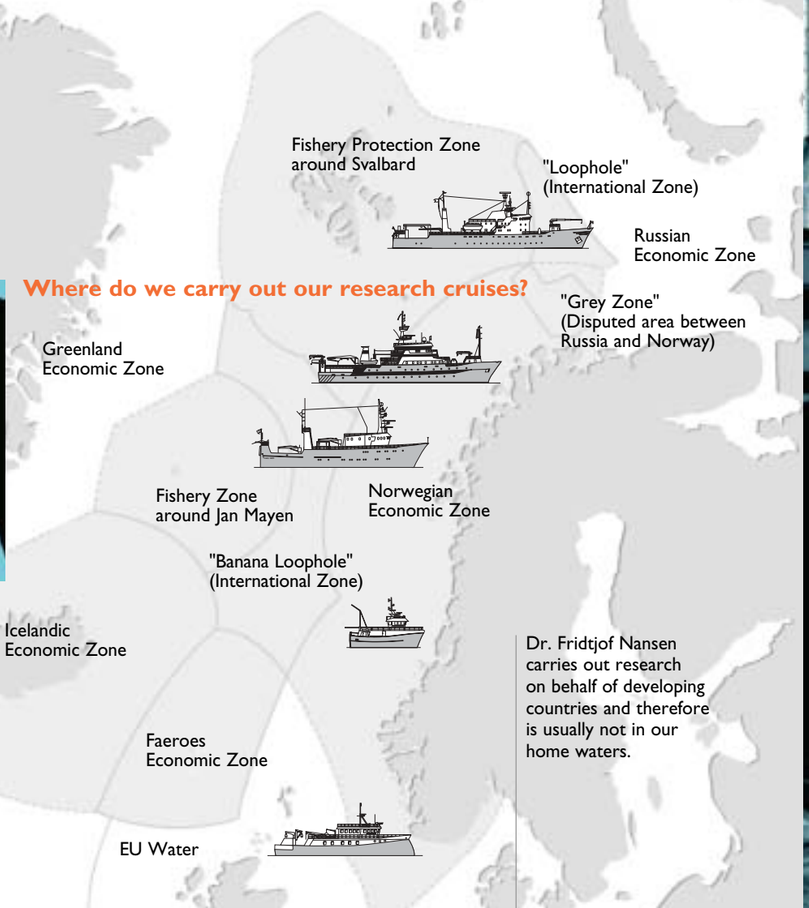
The Flødevigen Research Station lies on the island of Hisøy near Arendal. The station was established by Gunder Mathias Dannevig in 1882, when most of its work dealt with hatching and releasing cod larvae. The main activities of the station today revolve around coastal zone research and consulting.

Austevoll Aquaculture Station, which lies on the island of Huftarøy in Austevoll, was established in 1978. The activities of the station are concentrated on a wide range of marine aquaculture species, including halibut, cod, haddock, scallops, lobsters and hake.

Tromsø: The Institute of Marine Research has taken over the research activities on marine resources which was formerly carried out by the Norwegian Fisheries Research Institute in Tromsø, and since January 2003, this area of research has been organised as a department of the Institute of Marine Research in Tromsø.



Where do we carry out our research cruises?



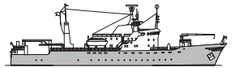
Dr. Fridtjof Nansen carries out research on behalf of developing countries and therefore is usually not in our home waters.

Vessels and activities

The following table shows the number of cruise days in 2002 sailed by our own vessels and chartered boats. Personnel cruise days are cruise days multiplied by the number of scientific personnel on board.

Vessel	Cruise days	Personnel cruise days
"G.O. Sars" (now "Sarsen")	249	1 422
"Johan Hjort"	303	1 774
"Michael Sars"	265	1 092
"G.M. Dannevig"	163	551
"Fangst"	135	334
"Dr. Fridtjof Nansen"	302	657
"Håkon Mosby"	20	134
Other chartered vessels	371	482
Sum	**1 808**	**6 446**

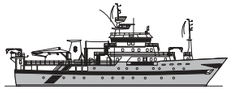
JOHAN HJORT • built: 1990 • LOA (m): 66.5 • GRT: 910



G.O. SARS (now "Sarsen") • built: 1970 • LOA (m): 70 • 1446 GRT

MICHAEL SARS • built: 1978/79 • LOA (m): 47,5 • 493 GRT

G.M. DANNEVIG • built: 1979 • LOA (m): 27,85 • 171 GRT



DR. FRIDTJOF NANSEN • built: 1970 • LOA (m): 70 • 1446 GRT

FANGST • built:1999/2000 • LOA (m): 14,98 • 25 GRT

Foto: Pål B. Mortensen

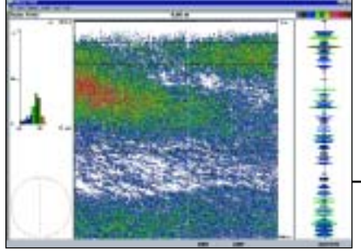
How we gather information

Every year, our research vessels gather large quantities of environmental and fisheries data. The illustrations on the opposite page show how catch data are collected.

Acoustic instruments (echosounders and sonar) make continuous recordings of "echo data" and trawls are set and hauled at regular intervals to collect samples of the fish registered by these instruments. The fish taken by the trawls are sorted into species, weighed and their length is measured. We remove their otoliths (tiny stones in the ear), which lets us determine their age, and their stomach contents are analysed in order to find out what they have eaten. These fish data from the trawl hauls provide the basic information that we use to interpret the acoustic data. The total echo density is mathematically transformed into numbers of fish. In conjunction with reliable catch data from the commercial fishing fleet, these data provide essential input for our calculations of the total number of fish of each species found in our waters.

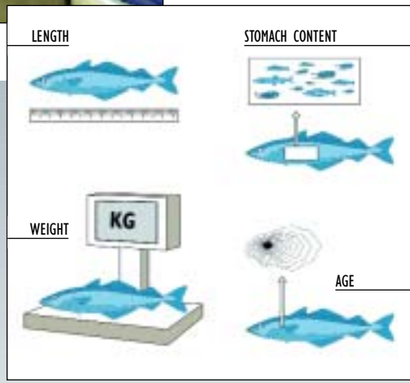
Managing the ecosystem

Good resources management means that we must look at stocks in an overall context, for example in terms of how the stocks of each species influence each other. Cod, for example, prey on capelin. This is known as "multi-species management". Non-commercial species have to be taken into account in resource management of this sort, and the ocean environment is an important factor in a management strategy that looks to the future. One thing we need to ensure is that the sea is kept as "clean" as possible. This sort of integrated management of all life-forms and of the marine environment itself is what we can call ecosystem management, one of the most important aims of the Institute of Marine Research and the International Council for the Exploration of the Sea (ICES).



Acoustic registration (echosounder)

Acoustic data are compared with trawl catches



Analysis of the trawl catch

Michael Sars (1805–1869) – one of the founding fathers of modern zoology.

Trained as both a priest and a zoologist, Michael Sars was the son of a German-born ship's captain of the same name. His mother, Diwert H. Heilman, had come to Norway from Narva, a town on the Russian-Estonian boundary. Even as a young boy, Michael displayed a burning interest in natural history, especially palaeontology. He started to study natural history at the University of Christiania (now Oslo), but abandoned the course after only three terms, changing to theology, although without giving up his interest in natural history. In 1830 he was called to the poverty-stricken parish of Kinn, moving to Manger parish, just north of Bergen, in 1839. Financial difficulties plagued him for much of his life. His wife Maren, sister of the poet J. S. Welhaven, bore him 14 children, eight of whom survived to adulthood.

After 24 years as a priest Sars became Professor of Zoology at the University of Christiania. His scientific production covers his periods both as priest and professor. Most of his work was on marine animals; their reproduction, development and their horizontal and vertical distribution in the ocean. At that time, it was widely believed that animal life did not exist at great depths. Together with his son Georg Ossian, and the story-teller and zoologist Per Christian Asbjørnsen, Sars exploded this belief. In 1853 Asbjørnsen caught a primitive and free-swimming starfish from the bottom of the Hardanger Fjord. This was given the name Brisinga, after the goddess Frøya's brooch. In 1864, Georg Ossian was responsible for the greatest sensation when he brought up an ancient sea-lily, a living fossil, from the bottom of the West Fjord. This was described by Michael Sars and given the name Rhizocrinus lofotensis. These finds, and many other like them, told us much about the animal life and the geology of previous eras. It was just at this time, in 1859, that Darwin published his epochal work "On the Origin of Species". At first, Michael Sars was unwilling to accept the evidence in favour of the theory of evolution, but towards the end of his life he defended Darwin. His own work supported evolutionary theory, but it was his son who would become the most serious missionary for the new learning in Norway.

Per Christian Asbjørnsen offered an amusing personal description of Michael Sars as a "good comrade and excellent man. He also smokes tobacco like a maniac and curses as though he had never mounted a pulpit".

Michael Sars was probably the only Norwegian zoologist with an international reputation in the 19th century; only his son Georg Ossian enjoys the same scientific stature.

"Michael Sars" (1) – the research vessel of the "golden age"

The miserable cod fisheries at the turn of the century caused real distress, especially in northern Norway, and the authorities demanded that marine scientists should find out why catches varied so much. Johan Hjort accepted the challenge, but demanded an ocean-going research vessel. "Michael Sars" was built as an English steam trawler, and equipped with the latest scientific sampling equipment and every type of fishing gear. For 14 years, "Michael Sars" made a long series of cruises off the coast of Norway and in more remote waters, pursuing both purely scientific and more practical objectives, sometimes in combination. "Michael Sars" led Norwegian marine research into the international scientific community.

In 1910, "Michael Sars" crossed the Atlantic and spent four months collecting an enormous amount of research material. In collaboration with Sir John Murray, who financed the expedition, Johan Hjort published the classic "The Depths of the Ocean". This was followed by a series of articles which continued to appear until 1962, the last of them written by Einar Koefoed, a Dane who was headhunted by Hjort and became one of his closest associates. A little-known detail of interest is found in a note on eel larvae which was published in the well-known journal "Nature" in 1910 by the highly regarded Norwegian scientist Einar Lea. On the basis of their size and distribution, he came to the conclusion that the spawning area of the eel must be somewhere between the Azores and the West Indies, and in fact it was in the Sargasso Sea that the Danish scientist Schmidt demonstrated several years later that spawning takes place.

In 1914, the Norwegian authorities and the international research community were given the answer to their question why fishing catches showed such enormous variations: the size of year-classes varies widely from one year to the next. This realisation marked a historical change of direction in modern marine research. In the course of the First World War, however, both "Michael Sars" and Johan Hjort, who by then was director both of fisheries and of marine research, left the Norwegian marine research arena. The "Golden Age" was over.

Read about "Michael Sars" (2) on page 33.

Shipyard:	AS Fredrikstad Mekaniske Verksted
Built:	1900
LOA:	125 ft
Beam:	23 ft
Draught:	12 ft (aft)
Gross tonnage (GRT):	226
Main propulsion machinery:	Coal-fired steam engine (300 HP.) (also sail-rigged)

Georg Ossian Sars (1837–1927) – our first marine scientist

Georg Ossian Sars was the son of Michael Sars, and was christened after the (mythical) Celtic poet Ossian. While he was still a student he was also collaborating with his father and accompanying him on research trips. After his father's death in 1869 he completed the studies they had been doing together, producing a series of basic works on various groups of marine invertebrates: starfish, molluscs, etc.). He followed up his father's methods in that he studied living material.

G.O. Sars' principal work, "An Account of the Crustacea of Norway", described most of the Norwegian crustaceans, and is still an international standard work. Its nine volumes and 4000 pages were published between 1895 and 1928. The drawings in these volumes bear witness to his artistic abilities; he engraved his crustaceans directly on copper plates. In 1864, G.O. Sars and the herring scientist Axel Boeck (1833–1873) became Norway's first full-time marine scientists. Sars gradually took over responsibility for the practical scientific studies of Norway's ocean fisheries, which he led until 1893, when Johan Hjort took over. He also became a fellow of the University in 1870 and professor in 1874.

Sars' made his most important findings in fisheries science in the Vestfjord during the annual cod fisheries, between 1864 and 1869. As he was rowed around the fjord he could observe with his own eyes the millimetre-sized eggs and recently hatched cod larvae floating on the surface. The finding that cod eggs float in the sea or on the surface was new to science, which until then had firmly believed that all fish laid their eggs on the seabed (as salmon do). However, Sars' discovery was not news to the Lofoten fishermen! Sars' methods of direct observation depended on the following conditions: 1. a small boat; 2) good eyesight (Sars was 27 when he discovered the pelagic eggs); 3) good weather! As far as the weather was concerned he had no choice (as we do today with our modern ocean-going research ships), and his reports to the Ministry of the Interior usually begin: "On a fine, calm day…".

Georg Ossian Sars' studies of the life-history of the spawning cod were models of their kind, even though he did not get to the bottom of all the mysteries involved. His research vessel was simply too small. His research methods showed the unmistakeable influence of his father, with their use of living material and their thorough planning. But his reports also reveal a brilliant independent scientist with a highly developed ability to concentrate and a great deal of imagination.

The Vestfjord studies convinced Sars that an understanding of the animal life and the fisheries off the coast of Norway could not be isolated from each other. It was essential to study the "whole of the Northern Seas". Together with the geophysicist Henrik Mohn, Sars managed to finance three expeditions to the Norwegian Sea with SS Vøringen in 1876–1878. Norway had joined the competition to explore the ocean depths.

"Ossian Sars"

For long-distance transport of large quantities of fish and fry, motorised fishing boats were chartered. The need for a larger, more suitable boat became more and more obvious as tasks of this sort increased in number.

In 1923 the Institute was able to take over a German motor cutter that had been impounded by the Customs Service. (This was during Prohibition in Norway). This vessel was 40 ft in length and had been built in 1914. The question arose of what to call the new acquisition, and an obvious choice was the name of the man who had laid the foundations for the work of Flødevigen – G.O. Sars. With the permission of the professor, the boat was called "Ossian Sars". It was suitable for transporting spawning fish and fry; and it also made it possible to carry out field studies throughout the year, both in the fjords and off the coast.

However, old age gradually began to leave its traces on the boat, and in 1946 it was condemned.

LOA:	40 ft.
Built:	1914, in Germany

Finn Devold (1902–1977) – the herring shepherd

Finn Devold was the son of Harald Ophus Devold, a minister of the Church, and Alida Elise Marie Lampe. He was born in Bergen but grew up in Tromsø. He studied at the Sorbonne, and had many different jobs before joining the Institute of Marine Research in 1935.

Devold was an assistant at the Department of Geophysics in Tromsø and to Fridtjof Nansen in 1922–23. He soon acquired a taste for the exciting life of the Arctic, and ran the meteorological stations at Kvadehuken on Svalbard and on the island of Jan Mayen. At the request of the Norwegian Government he led the occupation of an area in Southeast Greenland in 1931, while his brother Hallvard occupied what was known as Eirik Raudes Land in Northeast Greenland. Norway lost this case at the International Court in the Hague. Finn Devold became a fisheries biologist, and was awarded his masters degree for a fine piece of work on the biology of the plaice. He is best known for his study of the migration pattern of the Atlanto-Scandinavian herring. He also suggested an explanation for the long-term changes in the size of the herring population off the coast of Norway, an explanation which is still discussed today.

Helge Ingstad wrote in a memorial article about Finn Devold: "Finn Devold was one of the finest and most fearless men I have ever known. Now he is gone from us – a giant tree has fallen in the forest".

"G. O. Sars" (1)

- Devold's "herring shepherd"

The fact that Devold's name is so closely coupled with the vessel "G .O. Sars" (1) is due to the great efforts he made on behalf of the people of the coast during the rich herring years of the 50s. These efforts were made with the aid of a device which had been developed by the British during the Second World War to locate German submarines. This was ASDIC (Anti-Submarine Detection Investigation Committee), and as with the echo-sounder, it was Norwegians who modified this vertical-search device to enable it to locate shoals of fish. It was Einar Lea, one of Hjort's closest associates, who took up the idea in 1947, and 1949 saw the delivery of the first herring asdic. The instrument was re-baptised SONAR (SOund NAvigation and Ranging), which sounded rather more peaceful.

The 1950 herring year-class was extremely large. "G.O. Sars" set sail in July and made an important discovery with its new sonar set: large quantities of that year's herring fry were observed as far as 200 nautical miles from the coast. At that time, most people believed that all herring fry stayed close to the coast. Drift nets do not catch these tiny fish, but the sonar could see them! Before the end of the year, "G.O. Sars" had set out on yet another pioneering cruise with Devold and the sonar on board. This was the first attempt to follow herring shoals in the Norwegian Sea on their migration to the spawning grounds off the coast of Western Norway, and they succeeded in great style! A couple of the most curious purse-seine boats came across "G. O. Sars" and realised that the herring were under observation. A large fleet of fishing boats had soon gathered, and Devold had to ask them to stay out of the way in order not to hinder his work. The "parade" of boats must have looked rather strange. When one of the skippers asked what was going on, the skipper of the seine-netter "Reform" from Sunnmøre answered, "Well, we're all marching in a 17th of May (Constitution Day) procession, and the Sars boat is setting the tune!"

When the herring arrived off the coast at Runde on January 21, 1951, "G.O. Sars" had demonstrated its good qualities and seaworthiness and the sonar its fantastic ability to find herring, and Devold and the Institute of Marine Research had won the trust of the people of the coast. This was a fine start for the Institute's first sea-going research vessel since "Michael Sars".

In the early 60s, the echo integrator was developed at the Institute of Marine Research. This instrument made it possible to "collect" echoes from a large number of fish and use these to estimate their biomass. The prototype was tested on board "G.O. Sars", and later became the most important instrument for the Institute of Marine Research's fish stock assessments.

Although "G.O. Sars" is closely linked to herring studies in the popular consciousness, the vessel was also the Institute's workhorse in several other fields. During the post-war years, the aim of Norwegian fisheries policy was to build up a diversified fishing fleet, including ocean-going vessels. There was a particularly high level of research activity in the Barents Sea during this period. This is a region that makes very high demands of both crews and ships, especially in the winter months, but in 1958 "G.O. Sars" was joined by the third "Johan Hjort".

Read about "G.O. Sars" (2) on page 32.

Shipyard:	AS Pusnes Mekaniske Verksted, Arendal AS Moss Værft & Dokk
Built:	1945/1950
LOA:	51.985 m
Beam:	8.690 m
Draught:	5.185 m
GRT:	594.69 tonnes
Main propulsion machinery:	2 x Crossley HRL6, each of 600 GHP

Gunder Mathisen Dannevig (1841–1911) -sea captain and pioneer in the aquaculture of marine fish

Gunder M. Dannevig was the son of skipper Mathias Wilhelm Dannevig and Kirsten Gundersdatter Guldsmedengen. He went to sea at an early age and became a skipper when he was only 24 years old, when Arendal was the richest and most important shipping centre in Norway. In 1878 he became a fisherman. There was a critical shortage of fish on the coast of Southern Norway at the time, and fishermen wanted to have certain types of fishing gear banned. Dannevig, who had a good understanding of how the fisheries were developing in other countries, had heard that the Americans had begun to experiment with hatching marine species of fish. The idea of improving cod stocks by releasing newly hatched larvae into the sea won the support of everyone in the fishing industry, and community spirit in Arendal provided the necessary financial support for a cod hatchery. Dannevig received scientific backing from G.O. Sars who, in his first report from Lofoten in 1864, had already proposed artificial hatching in order to even out annual variations in the cod fisheries. Dannevig's hatchery in Flødevigen was the first large-scale hatchery for marine fish in the world. Hundreds of millions of cod eggs were hatched every year, and the yolk-sac larvae were released into specially selected locations. Dannevig attempted to demonstrate the results of the releases by local questionnaire studies.

The fishermen who had a positive attitude to these measures also tended to respond positively to questions about trends in cod stocks. When the launch of the venture obtained financial support, the practical scientific studies also began. Dannevig then proposed to investigate the effects of the releases by means of beach hauls of nets in selected fjords where fish had been released, and in others without releases. This was in 1904–06. Johan Hjort was not convinced of the usefulness of this sort of activity, and he insisted that his assistant Knut Dahl should be on the spot to check the catches. The spirit of co-operation between the old sea-captain and the young academic must have been poor. The front page of the first mimeographed report from the beach-net studies is "decorated" with the following remark: "Damned lies. Knut Dahl". But it was precisely this report that provided the first signals about a new explanation of the wide annual fluctuations in fish catches, the central finding of the golden age. The report showed quite clearly that the number of fry was much greater in 1904 than in 1905 and 1906, no matter whether yolk-sac larvae had been released or not. The fact that differences in fish catches were largely due to variations in year-class strength was later demonstrated in herring, which also had a successful year-class in 1904.

The verdict of history on the economic importance of Dannevig's releases of cod fry has been negative. On the other hand, the scientific activity which his initiative triggered in the infant Norwegian marine research sector has given him a major place in the history of marine research in Norway. The biologist O. Nordgaard described Dannevig in the following words: "Dannevig was characterised by his unusually practical bent, his almost violent energy, and his sharp understanding. Whether he was speaking Norwegian, English or French, he resembled a post that was difficult to shift. He could be unpleasant to have as an opponent".

"G.M. Dannevig" (1) - transport vessel for fish fry

"G.M. Dannevig" was brought into service in 1950 and was intended for use as a transport vessel for fish fry (releases of cod larvae) and research cruises off the Norwegian coast and in the Skagerrak.

The building of "G.M. Dannevig" signalled the start of a new epoch in the history of the Flødevigen Research Station, in that the new vessel greatly extended the range of tasks that could be carried out at sea. The ship gradually became too small to perform the functions it was intended for, and was sold in 1987.

Read about "G.M. Dannevig" (2) on page 31.

Shipyard:	Lunde Båtbyggeri, Tysnes in Sunnhordland
Built:	1949
LOA:	19.80 m
Beam:	5.5 m
Draught:	2.70 m
GRT:	55 tonnes
Main propulsion machinery:	Alpha, 200 HP
Accommodation:	3 double cabins.

Johan Hjort (1869–1948) – still a current name in Norwegian marine research

Johan Hjort's father was a professor and eye specialist, who came from an old Danish family of civil servants. His mother was from the Falsen family. Johan Hjort inherited his interest in science from his father; his rather volcanic temper came from his mother. He studied biology in Munich and was G. O. Sars' successor as leader of the fisheries studies in Christiania in 1893, at the age of 24.

In 1900 these studies were moved to Bergen, and after a few years, Hjort became both director of marine research and director of fisheries. He had a will of iron, an enormous capacity for work, and a well-developed interest in scientific collaboration. He was also one of the founders of the International Council for the Exploration of the Sea (ICES), and was its president during the last few years of his life.

Hjort resigned during the First World War in protest against the behaviour of the authorities in connection with the sale of fish to Britain, believing that Norway was not observing the conditions of neutrality. After the War, Hjort studied biology in Cambridge, and he also spent some time in Denmark before becoming a professor at the University of Oslo. His scientific production covered a wide range of subjects, from larval development in Ascidians to studies of population dynamics in whales. His more polemical writings in connection with Captain Dannevig's cod-hatching experiments in Flødevigen are also well known.

Johan Hjort as a person was shrewdly described by Francis Bull in the following terms:"As a superior, he was without peer; helpful, kind, patient – as an equal, rather difficult, because he always believed that he was right – and as a subordinate, sure of himself and full of the need to oppose". His ability as a leader to "fire up" his colleagues is illustrated by what was once said by two of his favourites, Hjalmar Broch and Einar Koefoed: "Not the least of the factors that stimulated our work in the old laboratories was Hjort's great gift of making each of us feel that we were working freely and independently on our allotted tasks. At the same time, he always kept us in contact with practical life, which was an unusual attitude for those times".

Johan Hjort's achievement has acquired renewed relevance during the past few years. His underlying ecological attitude is in line with the ecological management model for marine resources which we can glimpse in the distance. Hjort's observations came to the aid of the Institute of Marine Research in the 80s in particular, when one "stock earthquake" after another was discovered in the Barents Sea. Hjort's descriptions of similar situations in 1903 showed that Nature itself occasionally "goes mad", without human beings necessarily being the worst culprits.

"Johan Hjort" (1)

– fragile, but still useful

After the First World War there was little money available for research cruises, and "Michael Sars" was laid up, while the most important field-work was carried out with the aid of chartered boats. In 1922 the Institute acquired a small wooden vessel which was specially designed for research purposes. This was the first "Johan Hjort", and it is said that Dr. Hjort was not particularly satisfied by the honour of having such a "pathetic" vessel named after him. Nevertheless, the new boat performed well in Lofoten (cod), off the coast (winter and spring spawning herring) and in the fjords (sardines and yearling herring). Plankton and hydrographic studies also provided valuable new knowledge.

Since it turned out to be impossible to get "Michael Sars" into operation again (except for a whaling trip to the Davis Strait in 1924), "Johan Hjort" was refitted for large-scale studies in the Norwegian Sea. However, it was felt that such operations were beginning to verge on the irresponsible. The Institute's scientists Sund, Lea and Bjerkan led most of the field-work during that period. During a shipyard refit in 1931, rot was discovered in the hull of the boat. The attack was so serious that it was regarded essential to invest in a completely new boat, but everything that could be used of the existing equipment and fitments was transferred to "Johan Hjort" (2). Meanwhile, the shipyard took over and rebuilt the old boat, which sailed in cargo traffic under the names of "Kola" and "Ruth Vagle", until it ended its days on the beach rocks in the Morfjord.

Shipyard:	Gravdal Skipsbyggeri, Opsanger, Sunde in Sunnhordland
Built:	1922 (rebuilt:1928)
LOA:	68 ft
Beam:	16' 4.5"
Draught:	9' 10.1"
GRT:	48.61 tonnes
Main propulsion machinery:	Bolinder B20M21, 70 HP
Accommodation:	9 bunks; certificated for 11 persons

Oscar Sophus Sund (1884–1943) -marine scientist from the North

Oscar Sund was born on the Sund property in Gildeskål in the County of Nordland. His father, Haagen Olsen, was a country policeman and was married to Annette Katharina Neumann. He grew up among the northern fisherfolk, virtually at the gateway to the sea. His great ambition was to study fish and their migrations, in order to help the fishermen. While he was still a student he published a number of studies on central topics in zoology, demonstrating that he was an excellent basic scientist.

In 1908 he was engaged as an assistant to Hjort, and he carried out most of the age determinations of cod that formed much of the data in Johan Hjort's important publication of 1914. Like most of Hjort's close associates, Sund was keen to keep the fishermen always up to date about his research results, and he had a gift for doing so. His schematic method of showing the variations in catches of spawning cod are particularly well known. Gunnar Rollefsen has characterised Oscar Sund's presentations as "masterly analyses and diagrams of the changes in cod stocks". Oscar Sund also played an important role in processing the material from the major "Michael Sars" expedition in 1910. In 1916 he took over as leader of the fisheries studies when Johan Hjort resigned.

Perhaps Oscar Sund's gifts of popularisation were most evident in "Skårungen" ("The Youngster"); his last and best-known work, published in 1942. The sub-title of the book offers a fine characterisation of Sund: "A book about the sea and its fauna, ships and travel, for the young people of the coast."

In 1947 the people of Northern Norway erected a monument to Oscar Sund at the new church in Gildeskål, bearing the following inscription: "He was a tireless servant of science, and a friend and helper of the fishing community. A faithful, warm-hearted northerner who brought honour to his community".

"Johan Hjort" (2), "Oscar Sund" – small but revolutionary

The second "Johan Hjort" was also a small wooden vessel of 79 ft. LOA, designed for use in coastal water. Financial conditions were difficult at this time, and the fishing industry was struggling with overproduction and market problems. Hjort's expansive ocean fishery model was de-emphasised, and the scientists' wishes for new boats were modest.

"Johan Hjort" (2) had the honour of testing out the echosounder to locate fish. This extremely important tool for practical fishing had originally been developed by the British Admiralty in the 30s as a depth sounder. In 1934, Oscar Sund heard that the brisling seine netter "Signal" had recorded echograms of fish shoals. Sund managed to obtain money for an echosounder, and on March 11, 1935, "Johan Hjort" arrived at Hølla in Lofoten. Now, for the first time, it was possible to "see" the concentrations of spawning cod in a thin horizontal layer in thermocline water at 4–6 oC. The results of the investigations were published in the well-known journal "Nature" on June 8 that very same year. A new era in world fishing had arrived. When the third "Johan Hjort" was handed over in 1958, the second boat was renamed "Oscar Sund"; a well-deserved honour!

Read about the current "Johan Hjort" on p. 34.

Shipyard:	Gravdal Skipsbyggeri, Opsanger, Sunde in Sunnhordland
Built:	1932
LOA:	79 ft
GRT:	67 tonnes
Main propulsion machinery:	Wichmann 90–120 HP

"Johan Hjort" (3) – modelled on the "G.O. Sars"

The success of "G.O. Sars" (1) opened people's eyes to the possibility of carrying out important new tasks in fishing research, and when the new "Johan Hjort" (the third vessel of that name) arrived in 1958, it was designed, with "G.O. Sars" (1) as its model and ideal, as an ocean-going vessel. Even then, some people believed that a stern trawler would have been more useful, but the side-trawler tradition was still powerful.

With two ocean-going vessels available, the geographic range of the Institute's investigations could be increased, and new fish stocks were added to the study programme. Fish-finding and hydrographic instruments were renewed in step with developments in technology. In 1975 the vessel was fitted with stern-trawling gear, which was not particularly practical for that type of vessel, and the scientists began to dream of a new boat. The idea at that time was top rent rather than buy, and the result was a multi-year contract with the fishing boat "Eldjarn", which was fitted up with the necessary equipment for research.

"Johan Hjort" was sold in 1983 and moved to the North Sea offshore sector under the name of "Skandi Ocean".

Shipyard:	Mjellem & Karlsen AS, Bergen
Built:	1958 (rebuilt 1975)
LOA:	52.35 m (53.30 m)
Beam:	9.30 m
Draught:	5.28 m
GRT:	697
Main propulsion machinery:	MAN G7V 40/60 MA, 1300 hp
Class:	DNV +1A1 ice
Accommodation:	25 cabins (crew, 32; scientists, 7)

Peder A. Rønnestad
(1879–1949)

Peder A. Rønnestad joined "Michael Sars" in 1902 as a fisherman under Captain Thor Iversen. Following several years of education and commercial fishing, he returned to the ship as its captain in 1912. I 1916 he became an expert consultant in fisheries to the Directorate of Fisheries. Rønnestad has been praised for his wide-rage of contributions to fisheries research, and in particular for his work on the Load-line Act and registration of Norwegian fishing vessels, as well as his efforts to improve sanitary conditions in the fishing villages and in building fishermen's shacks for use in the seasonal fisheries.

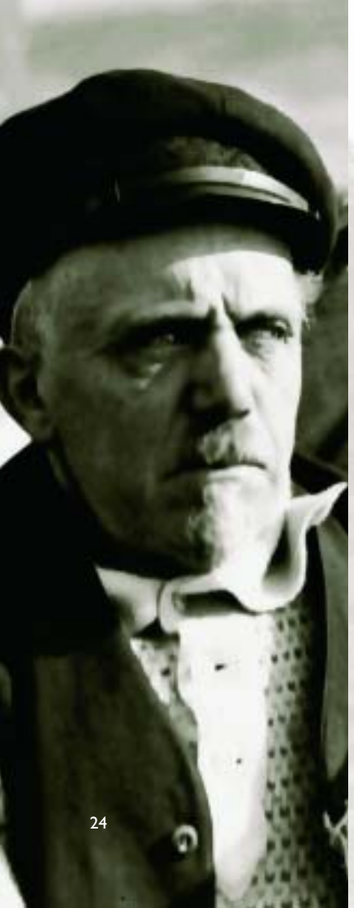
"Peder Rønnestad"

- trawler and fishing trials vessel

The boat was built as the trawler "Spitzbergen" and was purchased by the Directorate of Fisheries in 1951. During its first few years with the Directorate, it was primarily used as a fishing trials vessel by the Directorate's practical fishery consultants.

When "Oscar Sund" (ex. "Johan Hjort" (2)) was taken out of service in 1958, "Peder Rønnestad" was rebuilt and handed over to the Institute of Marine Research. The vessel lost its "good looks" as a result of the rebuilding operation, while it acquired the laboratory and cabin facilities needed for research cruises. It was employed on the coast and in the fjords, and occasionally over large areas of the North Sea and on the banks west of the Shetlands. The boat was equipped with side trawls, drift-netting and long-lining gear and a hydrography/plankton winch. "Peder Rønnestad" was sold in 1979.

Built:	Germany 1948
LOA:	26.25 m
Beam:	6.40 m
Draught:	3.22 m
GRT:	126 tonnes
Main propulsion machinery:	Bergen Diesel 250 HP
Accommodation:	8 single and 2 double cabins
Class:	Deutsche Lloyd 100A4 fishing vessel/North Sea



Thor Iversen (1873–1953)

Thor Carl Iversen was a well-know personality in the world of Norwegian fisheries and marine research. Already in possession of experience from merchant shipping, fishing, sealing and whaling he joined "Michael Sars" as a seaman in 1900. He was later captain of the vessel, and skippered it on its famous Atlantic research cruise in 1910.

In 1912, Thor Iversen became a consultant to the Directorate of Fisheries, and in addition to a number of administrative tasks, he carried out several research cruises, particularly in northern waters. His list of publications bears witness to a wide range of interests, which included the history of fishing, geographical measurements and descriptions, charting fishing banks, etc. His artistic bent found expression in film and photography, a hobby that he cultivated with such keenness and talent that he must be given a place among the " greats" of Norwegian photography.

"Thor Iversen"

- practical fishing trials and research

This vessel was originally built as the trawler "Gerdy Mia", but was purchased as a relatively new vessel by the Directorate of Fisheries for test fishing, and especially for training Norwegian fishermen in trawling techniques. The boat was named after Thor Iversen, and was used first and foremost by the Directorate's consultants for practical fishing trials. "Thor Iversen" was also used by the Institute of Marine Research.

The vessel was sold in 1968, and as fishing vessel, "Thor Iver" sank west of Kvannhovden Lighthouse in 1976.

Built:	the Netherlands 1951
LOA:	83 ft
Beam:	19.7 ft
Draught:	9.3 ft
GRT:	84 tonnes
Main propulsion machinery:	200 HP diesel engine
Crew:	8

Fra Per Alsakers samling

Fridtjof Nansen (1861–1930)

Fridtjof Nansen was a man of many talents. He began to study zoology at the University of Christiania in 1880, and after only two years of study was appointed curator at Bergen Museum. In the same year he sailed with the sealing boat "Viking" of Arendal to the Western Ice off Greenland, where he studied seals and made hydrographic observations of the waters of Eastern Greenland. Here, in the drift ice, Nansen found driftwood and mud which probably came from Siberia. As a result of these observations he led the 1893–96 "Fram" expedition, on which he collected oceanographic data as the vessel drifted across the Polar Sea. Among other things, Nansen noted that the polar ice drifted at an angle of about 45 degrees to the right of the direction of the wind – and he was the first to realise that this must be due to the rotation of the Earth. Nansen believed that the ice dragged the water beneath along with it. In the same way, each layer of water would drag the next layer along. Friction would mean that the current velocity would fall off with depth at the same time as the direction of the current gradually turned more to the right. Nansen did not have the mathematical knowhow that would have enabled him to demonstrate that this was the case, but at his request, Professor V. W. Ekman succeeded in proving Nansen's theories. The phenomenon has since been known as the "Ekman Spiral".

Fridtjof Nansen made major, pioneering discoveries in several aspects of the development of modern marine research, particularly in physical oceanography. He was also a keen exponent of international cooperation in marine research, and played a key role in the establishment of the International Council for Exploration of the Sea (ICES).

Nansen's doctorate (1888) was a study of the central nervous system of the hagfish (an invertebrate), with a thesis whose quality and range was probably not fully appreciated by his contemporaries. Today, however, Fridtjof Nansen is internationally recognised as one of the pioneers of brain research. In 1897 Nansen became Professor of Zoology at the University of Christiania, and planned the physical-oceanographic studies for the Board of Fisheries carried out by the "Michael Sars", which was named after his father-in-law.

In 1922 Fridtjof Nansen was awarded the Nobel Peace Prize for his important humanitarian efforts in the wake of the First World War. It was Nansen who negotiated and organised the transport home of about 400,000 German and Russian prisoners of war. He was also the underlying force and the organiser of efforts to feed millions of people threatened by famine in Russia.

"Dr. Fridtjof Nansen" (1)

- the international helper

The marine research vessel "Dr. Fridtjof Nansen" is a Norwegian contribution to international development efforts, the appropriate choice of a nation that can point to a rich tradition of research in fisheries and marine science. The vessel is operated on behalf of developing countries which lack vessels and expertise. Its programmes are drawn up in close collaboration with these countries, and with scientific support provided by the UN's Food and Agriculture Organisation (FAO).

The vessel is financed by NORAD (Norwegian Agency for Development Cooperation) and is operated by the Institute of Marine Research. Its principal tasks are mapping the distribution and quantity of fish stocks, which it has been studying continuously since 1975, from the South China Sea in the east to the Pacific coast of Central America in the west. Most of the work of the vessel has been off the east and west coasts of Africa.

It is appropriate that the ship bears the name of Fridtjof Nansen, who was so well known for his contributions to both marine research and in the field of international aid.

Read about the current "Dr. Fridtjof Nansen" on page 35.

Shipyard:	Mjellem & Karlsen AS, Bergen
Built:	1974
LOA:	47.50 m
Beam:	10.30 m
Draught:	4.35 m
GRT:	495 tonnes
Main propulsion machinery:	Normo LDMCB9, 1500 HP
Accommodation:	14 single cabins, 2 double and 2 four-berth cabins

From the Image archive of the Norwegian Export Council for Fish

"Fjordfangst"

This vessel originally belonged to the Fish-capture Section of the Norwegian Fisheries Technology Research Institute, and it was built in order to carry out tests and trials of fishing gear. The vessel came to the Institute of Marine Research when the Fish-capture Section was incorporated into the Institute in 1990, and it was sold to Iceland in 1999.

Built by Sandøy Plast AS (hull) and Storebø Slipp & Mekaniske Verksted AS.

Lengthened by Lunde Båtbyggeri AS.

LOA: 14.17 m
Beam: 4.25 m
Draught: 2.25 m
GRT: 25 tonnes
Main propulsion machinery: Yanmar 6 HAE 165 HP
Accommodation: 2 two-berth cabins

"Virgo" and "Krill"

- modest servants of marine research

Between the wars, the Institute of Marine Research had a 40 ft motor boat, "Virgo", but this was confiscated during the Second World War. After the War, a new boat was purchased and given the name of "Krill". It had a cabin forward, with room for two or three persons. The boat was equipped with a hand-powered winch for plankton sampling and hydrography, and it was employed in studies in these fields in Hardanger and Sunnhordland, but it was also used more and more often for studies of brisling, crabs, lobsters and eels in the same area.

In spring 1985 the boat was transferred to the Matre Aquaculture Station, but was condemned after a couple of year.

"Virgo"
LOA: 40 ft
No further technical details available.

"Krill"
Built in Nordtveitgrend during the 40s
LOA: 25.5 ft
Beam: 6.6 ft.
Motor: Sleipner petrol engine, 10–14 HP
Marna diesel, 18 HP
Sabb 22 HP (1970)

"Fangst"

"Fangst" replaced the old "Fjordfangst", which was the boat the Institute used for research studies on the coast and in the fjords. The Institute does not own "Fangst", but has chartered the vessel on a long-term basis.

"Fangst" is only about half a metre longer than "Fjordfangst", but has a greater beam and is much more roomy. The boat has three double cabins and provides good living and working conditions for its crew and scientific personnel. There is ample deck-space and a small wet laboratory. The vessel is ideal for many of the Fish-capture Section's behavioural studies and trials of new types of fishing gear. The Institute's aquaculture scientists also use "Fangst" frequently.

A small vessel such as "Fangst" has low running costs in comparison with the Institute's ocean-going research vessels, and it is a good, cost-effective facility for many types of coastal studies and research projects.

Shipyard:	Båt & Motorservice AS, Rørvik
Built:	1999/2000
LOA:	14.98 m
Beam:	5.50 m
Draught:	3.20 m
GRT:	24.99 tonnes
Main propulsion machinery:	Fiat IVECO, 8210 SRM-36, 400 HP
Side thruster:	2 x Mjosund, 60 HP aft, 50 HP forward
Power supply:	2 generators: 220 VAC, 32 kW, 50Hz
Accommodation:	3 two-berth cabins

"G. M. Dannevig" (2)

- the environmental monitor

In 1985, the Fisheries Technology Research Institute's vessel "Kystfangst" was transferred to the Institute of Marine Research and stationed in Flødevigen, where it was given the new name of "G.M. Dannevig". In order to meet modern standards, the vessel was lengthened to 92 ft and refurbished in 1986-87.

Its instrumentation and equipment was supplemented in the next few years, so that after 1988 the Institute had a fully operational modern vessel suitable for marine research in the Skagerrak, the Kattegat and the North Sea.

Shipyard:	Kystvågen Verft, Frei in Møre og Romsdal
Built:	1979
Rebuilt:	1987
LOA:	27.85 m
Beam:	6.75 m
GRT:	171 tonnes
Main propulsion machinery:	2 x Volvo 330 HP
Accommodation:	7 two-berth cabins, one single

"G. O. Sars" (2) - into the computer era

The 60s saw a series of very rapid developments in fisheries technology and instrumentation. The new "G. O. Sars" was built as a stern trawler and rigged to be able to deploy both bottom and pelagic trawls at the same time. The vessel's hull was designed to disturb the echosounders as little as possible, since these had become essential instruments for fisheries research. While the boat was under planning, a new generation of echosounder was being developed in collaboration with Simrad. Used in combination with the echo integrator, the new sounders made it possible to perform quantitative measurements. While it had previously been possible to register where the fish were and to only roughly estimate their biomass, scientists now had much more accurate measures of the amount of fish that they were recording.

Electronics was also entering the field of oceanographic instrumentation. Water samplers, which had been developed by Nansen at the turn of the previous century, and turning thermometers, were being replaced by sondes which recorded temperature, salinity, etc. while they were lowered through the water column. Signals from these sondes were registered and processed on board while the sondes were still being lowered, a process that required computer power. Echo integration was later also carried out by the computer system. After 33 years of operation, "G.O. Sars" is still a functional and serviceable vessel.

In February 2003, "G.O. Sars" (2) was renamed (R/V) "Sarsen". "Sarsen" was the nickname of the first "G.O. Sars".

Shipyard:	Mjellem and Karlsen AS, Bergen
Built:	1970
LOA:	70.0 m
Beam:	13.3 m
GRT:	1.446/1658 tonnes
Main propulsion machinery:	Bergen Diesel 2250 HP (1655 kw)
Class:	Det Norske Veritas, Class +1A1 Stern trawler, Ice C, Hull Ice A
Accommodation:	Crew + 16 scientists

"Michael Sars" (2) - fish finding and research

The vessel was designed according to the "Dr. Fridtjof Nansen" (1) model, but with a slightly modified interior design. It is equipped to perform more or less the same range of tasks as "G.O. Sars" (2), though with certain limitations due to its smaller size. The vessel also has a dropkeel with echosounder and sonar heads, which enables it to carry out acoustic studies of herring and other fish species even in fairly bad weather. The vessel is very suitable for coastal water operations.

The idea of this vessel was brought up as early as 1967, but 12 years were to pass before the second "Michael Sars" went to sea.

The vessel was originally used by both the Directorate of Fisheries and the Institute of Marine Research, but the Institute has gradually taken it over on a full-time basis.

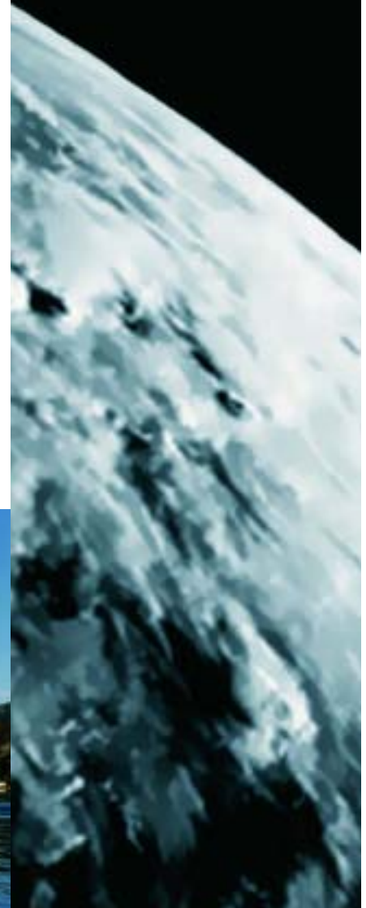
Shipyard:	Mjellem & Karlsen AS, Bergen
Built:	1978/79
LOA:	47.50 m
Beam:	10.30 m
Draught:	4.30 m
GRT:	493/690 tonnes
Main propulsion machinery:	Norma diesel LDMCB-9, 1500 HP
Accommodation:	20 persons

"Johan Hjort" (4)

The new "Johan Hjort" was based on the Institute's good experience with "G.O. Sars" (2). The vessel was given a more modern hull form, which made it so sea-kindly that work on board is not held back to any extent even in the Barents Sea in mid-winter. An important advance in this respect was the fitting of de-icing gear on the foredeck, as was the fact that winches and other items of deck equipment were largely built in under protective housings. It was hoped that "Johan Hjort" could be brought into service without a long period of trials, and the Institute managed to do so. A very solid, good research vessel, was the verdict of the scientists after its first season of operation.

In order to reduce surface noise (bubble formation by the hull in bad weather) during acoustic measurements, "Johan Hjort" was designed in such a way that towed echosounder heads could be deployed from the bottom of the hull. This system did not function well, but in 1995 "Johan Hjort" was fitted with a dropkeel containing the echosounder and sonar heads. This set-up works so well that good acoustic measurements can be made even in heavy gales. Nowadays, all new ocean-going research vessels have such retractable dropkeel.

Shipyard:	Flekkefjord Slipp & Maskinfabrikk AS Kvina Verft AS
Built:	1990
LOA:	64.4 m
Beam:	13.0 m
GRT:	910/1828 tonnes
Main propulsion machinery:	Wärtsilä Wichmann diesel, 8V28B, 3264 HP (2400 kW)
Class:	Det Norske Veritas +1A1, Ice 1B (hull), Ice 1C (propeller)
Accommodation:	24 single cabins, 5 two-berth cabins



"Dr. Fridtjof Nansen" (2)

When it was decided that it was time to replace the old "Dr. Fridtjof Nansen" with a new vessel, the Institute of Marine Research had only recently taken delivery of the new "Johan Hjort", which was one of the most advanced marine research vessels in the world. It was therefore only natural that the team responsible for planning the new "Dr. Fridtjof Nansen" should incorporate both drawings and experience from "Johan Hjort". The new international helper was not to be inferior to our domestic flagship, and in fact the two vessels almost look like sister ships in terms of design, internal layout and scientific equipment. This is also rational in purely research terms, given that both research and technical personnel alternate between cruises in domestic waters with the Institute's vessels and cruises on board "Dr. Fridtjof Nansen". Acoustic equipment, marine environment instrumentation and trawl set-ups are identical. This also makes it easier to utilise the same or similar methods, compare and exchange experiences, and to use the results and experiences gained for example in West African waters in our own Scandinavian waters, and vice versa. "Dr. Fridtjof Nansen" also gives students and scientific personnel from our development partner countries an ideal opportunity to become familiar with a modern marine research vessel, and with the marine resources in their own domestic waters.

Shipyard:	Flekkefjord Slipp & Maskinfabrikk AS
Built:	1993
LOA:	56.75 m
Beam:	12.50 m
GRT:	1444 tonnes
Main propulsion machinery:	Wärtsilä Wichmann diesel 6L28B, MCR 1980 kW (2700 HP)
Class:	Det Norske Veritas +1A Ice 1C, MV, EO, Stern Trawler
Accommodation:	23 cabins (33 berths)

Håkon Mosby (1903–1989)

Mosby was awarded his Cand.real. (M.Sc.) degree in 1940 and his doctorate in 1934. As a student in Oslo he acted as assistant to Professor Fridtjof Nansen at the Department of Oceanography, participating in several cruises with the research vessel "Armauer Hansen". In 1927, before he took his final degree exams, he was engaged as a lecturer at the Department of Geophysics, Section for Theoretical Meteorology, at Bergen Museum. In 1927/28 Mosby was a member of L. Christensen's first "Norvegia" expedition to the Antarctic Ocean, on the basis of which he wrote his doctoral thesis "The Waters of the Antarctic Ocean". Håkon Mosby subsequently led several expeditions to our northern ocean regions. In 1939 he became a lecturer at the Department of Geophysics, Section A (Hydrography), and in 1947 he succeeded Bjørn Helland-Hansen as Professor at Bergen Museum.

Håkon Mosby played a central role in the development and organisation of oceanographic research at national and international level. He was director of the Department of Geophysics for two periods, and from 1966 to 1971 he was Rector of the University of Bergen.

"Håkon Mosby"

The research vessel given his name, "Håkon Mosby", is the sister ship of "Michael Sars" (2) and is owned by the University of Bergen. The vessel is equipped to carry out oceanographic, geological and biological research studies. It is used by the University of Bergen for teaching and research purposes, but is operated by the Research Vessel Department of the Institute of Marine Research.

Built:	1980
LOA:	47.24 m
Beam:	10.32 m
Draught:	4.70 m
GRT:	493/701 tonnes
Main propulsion	machinery: Normo LDMB-9, 1500 HP
Class:	Veritas 1A1 Ice
Accommodation:	17 cabins (crew; nine single-berth cabins; scientists: six single and two four-berth cabins)

The new "G.O. Sars"

– the most advanced marine research vessel in the world; handed over in spring 2003

The new "G.O. Sars"

represents a new generation of marine research vessels. With its vibration- and noise-damped diesel generators and its propellers driven by direct-current motors, "G.O. Sars" is an extremely quiet vessel under way. It emits 99 % less noise under water than conventional research vessels. This means that the fish that are being registered by the vessel's acoustic instruments are not scared off, giving the scientists better biomass measurements of the fish in the sea.

Roomy trawl-deck

The new "G.O. Sars" has an extremely roomy and well-equipped trawl-deck. This is no less than 18,6 m broad, is equipped with two sets trawl winches and has room for two complete sets of trawl-doors. This means that a pelagic trawl can be deployed as soon as the bottom trawl has been hauled, and the scientists can thus combine cod and capelin studies, for example, on the same cruise.

The efficiency of research cruises has also been improved by the fact that "G.O. Sars" has sufficient engine power to tow a large pelagic trawl at speeds as high as 5–6 knots, which is important when representative samples of fast-swimming fish such as mackerel are being taken.

Environmental studies

"G.O. Sars" is equipped with a large midships "environmental hangar" which contains no fewer than six winches, each of which carries up to 6000 metres of cable for lowering instruments to the deepest parts of the sea. One of the winches is loaded with fibre-optic cable, which is capable of transferring large quantities of data. At the after end of the trawl-deck are two winches for towing plankton sampling equipment and remotely operated underwater vehicles (ROVs). The new "G.O. Sars" contains several special laboratories for performing environmental, plankton and fish analyses, and the aim is that most of the analysis of data will be carried out on board before the vessel returns to port.

Geology and seismics

The vessel is also equipped to collect core samples 25 metres into seabed sediments, and a special echosounder will be capable of studying sediments as much as 150 m below the seabed. The new "G.O. Sars" will also be able to carry out seismic studies using towed air-guns and hydrophones. These studies will be carried out by the University of Bergen.

Advanced acoustics

The new vessel is equipped with advanced acoustic instruments (echosounders and sonars) which will be capable of registering fish throughout the water column, from the surface down to the seabed. The vessel has an echosounder that operates at six different frequencies simultaneously. Three multi-beam sonars have also been installed to identify and measure shoals of fish. A special echosounder will chart the seabed topography, while yet another will measure ocean currents.

The new "G.O. Sars", which is used by the University of Bergen and the Institute of Marine Research, was handed over in May 2003.

LOA:	77.50 m
Beam:	16.40/18,60 m
Depth to 1st deck:	6.30 m
Depth to 2nd deck:	9.10 m
GRT:	4.067 tonnes
Main propulsion machinery:	Diesel-electric, three generators totalling 8,100 kw (3 x 2,700 kw), or 11016 HP
Class:	DNV +1A1 Ice C, Eo, Dynpos AUT, Clean
Top speed:	17 knots; cruising speed 11–13 knots
Accommodation:	45 persons, in 19 single-berth and 13 double-berth cabins

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