consistent application of the land distribution laws on reindeer collective and State farms, and in particular the introduction of a proper rotation on the winter reindeer-moss pasture, which was not done under the original land and water distribution laws. The increase of technical equipment on reindeer collective farms and State farms and, in particular, the provision of essential farm buildings is of great importance for reindeer farming. In this connection the construction of new movable rope fences and stationary wooden corrals, and also of intermediate bases on the migration routes, is planned for the Far North in the next few years. Finally, among problems of first importance, the ultimate and decisive one is that of the training and retraining of reindeer herdsmen. Measures for training and retraining qualified herdsmen are carried out by the compulsory adoption of a system of apprenticeship in all collective farm and State farm herding teams and by organizing special seminaries and courses attached to the local agricultural bodies in *rayony* of the Far North. Besides this it is intended to increase the number of students and the length of the course in the present local schools, which are open all the year round for the training and retraining of specialist herdsmen.

"The carrying-out of these tasks, which guarantees the future development of reindeer farming in the U.S.S.R., will demand from the reindeer farm workers further strengthening of the economic organization of, above all, reindeer collective farms and State farms and an increase in their productivity (both absolutely and in the proportion of products marketed) and in their revenue. The fundamental condition of a successful fulfilment of the plans for developing reindeer farming is the scrupulous observance of Stalin's regulations for agricultural co-operatives as an unshakable law. Therefore the struggle against infringements and distortions of these regulations must be one of the fundamental economic and political tasks of the workers of *rayony* of the Far North."

OUTBOARD ENGINES USED BY THE CAMBRIDGE SPITSBERGEN EXPEDITION, 1949

[It is hoped that the following note, summarized from an unpublished report by R. G. Atkinson, will form a useful supplement to the note by P. S. B. Digby on small boats for use in Spitsbergen, published in the *Polar Record*, Vol. 5, No. 39, 1950, p. 467.]

The purpose of the report is to compare the relative merits of particular outboard engines from the experience gained during the Cambridge Spitsbergen Expedition in the summer of 1949.

In Norway the expedition had bought three boats; two new Norwegian clinker-built whalers, 16½ ft. long, known as Strandelbarmars, and an old 18-ft. dory, rather like a North Sea cobble, very heavy and with a transom stern. The Strandelbarmars were suitable for small parties and personal gear, but the dory was required for heavier expedition equipment.

As water was the most practical means of passage between the expedition's base, Longyearbyen, and the various camps, the boats were in constant use. Most of the trips were in fjords hemmed in by mountains about 3000 ft. (915 m.)

high and as a result strong winds could bring up choppy seas very quickly. Ocean swells and cross winds caused local disturbances which frequently made passage in small boats dangerous. Other hazards included floating ice, sand shallows, reefs and steep rocky shores. The lowest water temperature was about 29° F. (−1·7° C.), when ice formed locally in the fjords.

Available were five Atco Villiers "Boatimpellors", one B.M.B. "Britannia" outboard engine and one British "Seagull" Model 102 outboard engine. In general the motors were worked hard and had little attention.

The "Boatimpellor" has a single cylinder motor of 79 c.c. capacity, developing about ·75 h.p. at 1750 r.p.m. The tank capacity is two pints. Design and operation are extremely simple and most of the servicing requires little mechanical knowledge. There is no gearing as the propeller shaft is in direct alinement with the crankshaft. A clamp mounting enables the engine to be used over the stern or side of the boat. This fitting allows great manoeuvrability and the propeller may be swung clear of obstructions very easily. Starting is not difficult. Air cooling eliminates risk of freezing and permits indefinite running out of water. On the other hand, small power limits use so that these engines were normally mounted in pairs. One unsatisfactory feature which is important is that the carburettor air intake has insufficient spray protection. The makers supplied maintenance charts, spares and tools, all of which were adequate. Very little maintenance is required and the engines were operated by all members of the party at different times without much difficulty.[1]

The "Britannia" engine has a twin cylinder motor of 165 c.c. capacity developing about 4 h.p. at 3000 r.p.m. The tank capacity is 5½ pints. This engine gives great manoeuvrability with little physical effort and can be used over the side or stern. A swivel on the support bracket makes it possible to reverse, and allows the engine to tilt should an obstruction be fouled when running forward. An efficient silencer made long journeys more pleasant. Once the correct throttle setting was found, no trouble was experienced with starting. As an additional protection to the transmission the propeller is fitted with a brass shear pin, which was found to be too soft. On several occasions when running with stern seas the engine raced in a trough and on "biting" the crest sheared the pin. Replacement is not easy in a choppy sea, especially when hands are wet and cold. Heavy spray caused occasional splutters by shorting the plugs or entering the air intake, but the engine inspired confidence as it never completely stopped.

The spares most frequently required were shear pins, plug leads, plug terminals and a starting cord. The swivel support and transmission require regular lubrication.

The "Seagull" engine has a single cylinder motor developing 3½–4 h.p. The tank capacity is four pints, but a special long-range tank holding six pints can easily be fitted. The engine is easy to drive and has an efficient silencer. A clutch on the transmission proves most useful when frequent stops are desired. The propeller is fitted with a shear spring. Starting was rather difficult,

[1] It may be noted that "Boatimpellors" were used satisfactorily with an adapted lorry dynamo to charge wireless batteries.

mainly because the pulley for the cord is of small diameter, but also because it was necessary, for supply reasons, to use a heavier gearbox lubricant than that recommended. The engine stopped several times when spray entered the air intake, which is positioned rather low, while the "Britannia" mounted alongside continued to run. It is not possible to reverse, and the engine does not permit full steering when side-mounted. The maker's operating instructions, spares and tools were adequate. Regular lubrication of the transmission is necessary.

The engines were used in various combinations, but it was found most satisfactory to drive the Strandelbarmars with two "Boatimpellors" or the "Britannia", and the heavy dory with both "Seagull" and "Britannia".

In good conditions it was found that a Strandelbarmar with a crew of two made the following speeds with different engines:

One "Boatimpellor"	4·7 knots	Two "Boatimpellors"	5·2 knots
One "Britannia"	5·8 knots	One "Seagull"	5·9 knots

With fully loaded boats, carrying a crew of three and a load of 4 cwt., speeds were cut down to about 3·5 knots using two "Boatimpellors" but much less, to 4·8 knots, using the 4 h.p. engines. When the dory was fully laden, with almost a ton, one 4 h.p. engine would move it, but without good steerage, at about 2·5 knots, while with two 4 h.p. engines mounted on the transom stern the speed was about 5·2 knots.

It was found convenient to refuel all engines hourly, even though the tank remained one-quarter or even one-third full, as movement let air into the feed pipes. It proved to be more difficult to drive two "Boatimpellors" than one 4 h.p. engine and in addition there was much more vibration and noise with the lighter engines. Thus on the Strandelbarmars the "Britannia" was usually preferred; it was also more popular on the dory because of its easy starting and greater reliability in rough weather.

Reliable engines are essential and it is advisable to have spare engine-power. Strandelbarmars and boats of similar weight are suitably powered by one 4 h.p. engine, but a dory requires 8 h.p. If, however, weight is an important consideration it may be necessary to cut down fuel supplies and use smaller engines. In that case it is recommended that engines of only one type be used to allow for interchanging, if necessary, and to cut down the spares, oils and tools required. One spare engine for every four working engines should allow all maintenance work to be carried out without undue delay.

In addition to the makers' instructions, spares and tools, engine kits should include extra shear pins for the "Britannia"; extra starting cords; watertight tool-boxes; oils and lubricants, including underwater greases for both "Britannia" and "Seagull"; small petrol cans and flexible hose attachments to refill the engines when running at sea; and lengths of ropes to secure the engines in case the clamps work loose. During the expedition the same man should be responsible for all maintenance and minor repair work on any one engine.

Before the expedition sets out at least one member should visit the makers, or their agents, in order to learn the working and correct maintenance of the engines. Many useful practical hints will be picked up in this way. The literature supplied with the engines should be studied and will save much time otherwise wasted on trial and error. Minor faults are most likely to develop in the early stages of the engine's life, so that all running-in should be completed before leaving. This will also give initial experience in handling both engines and boats.

CANADIAN FISHERIES RESEARCH VESSEL *CALANUS*

[Based on notes in *Arctic. Journal of the Arctic Institute of North America*, Vol. 2, No. 1, 1949, p. 56–57 and *Arctic Circular*, Vol. 1, No. 5, 1948, p. 53–54.]

During the first season's field work of the Ungava Bay Fisheries Expedition, 1947–49,[1] the need was apparent for a vessel of special design and robust construction, specially equipped for marine biological investigations. The Fisheries Research Board of Canada therefore decided to go forward with the design and construction of a research vessel for use in arctic waters. Messrs German and Milne of Montreal were given the task of producing a suitable design, in co-operation with M. J. Dunbar of McGill University, who was in charge of investigations in Ungava Bay, and E. Rigby of the Atlantic Biological Station of St Andrews, New Brunswick. The Industrial Shipping Company at Mahone Bay, Nova Scotia, undertook the work of construction, and the vessel, known as the *Calanus*,[2] was designed, drawn, and built between January and August 1948.[3]

The *Calanus* is a ketch designed to be drawn up on shore during the winter, and is suitable both for deep-sea and inshore work. Details are:

Length, 49½ ft.
Beam, 15 ft.
Draught, 6½ ft.
Gross tonnage, 80.
Displacement tonnage, 43.
Engine, Diesel 77 h.p.
Auxiliary, Lister Diesel 3 kW.
Sail area (staysail, mainsail, and mizzen), 668 sq.ft.
Cruising speed (under power alone), 7 knots.

The ribs, combings, gunwale, wheel-house, ice sheathing and planking (above the water-line) are built of oak; below the water-line 2-inch yellow birch planking is used. The decks are of white pine.

Internally the vessel is divided into the following compartments: forecastle,

[1] For a report on this expedition see p. 92.

[2] The generic name of the most important member of the Copepod plankton of the North Atlantic.

[3] It is interesting to record in this connection that a motor fishing vessel, also named *Calanus*, was acquired by the Scottish Marine Biological Association in October 1947, for work at the Marine Station at Millport on the Isle of Cumbrae. Strongly constructed of wood, she is larger than the Canadian *Calanus* and is of a type built according to Admiralty specifications during the war: length 75 ft. 7 in.; beam 19 ft. 4 in.; draught 10 ft. 11 in.; gross tonnage, 77; engine, Blackstone Diesel 160 h.p.; auxiliary, Lister Diesel 12 h.p.; accommodation for eleven.