NORTH ATLANTIC WEATHER SHIPS

PRESS reports show that the United States Government has notified the International Civil Aviation Organization of its intention to withdraw the weather ships which it maintains in the North Atlantic when the present international ocean weather ship agreement expires on June 30, 1954.

Ocean weather ships occupy 'fixed' ocean stations and perform several duties. These duties include the making of surface and upper-air meteorological observations at frequent definite intervals and transmitting the data by radio for use in weather forecasting; navigational aid to aircraft in flight by giving radio bearings and radar fixes, transmitting the latest surface and upper-air observations to aircraft on request and acting generally as relay stations between aircraft and air-traffic control centres; air-sea rescue duties; and making oceanographic and other scientific observations as opportunity permits. The ships are located at positions carefully selected for best fulfilment of their meteorological and navigational aid duties from the Norwegian Sea to between the Azores and the United States.

The North Atlantic weather station scheme was arranged at a conference of the International Civil Aviation Organization in 1946 and modified in 1949 by reducing the number of stations from thirteen to ten. The total cost is shared among the participating nations in proportion to the number of flights made across the Atlantic by their civil aircraft.

At present, the United States wholly maintains four stations, the United Kingdom one and Norway with Sweden one. The Netherlands assist in the operation of one station with the United States, one with Great Britain, and one with France; Canada assists the United States in operating one; and certain other nations contribute financially to the scheme. The number of ships needed to man the stations is at least two per station and may be three according to distance from base. The United States employ coastguard cutters, Great Britain and Norway "Flower" class corvettes, and the other participating countries use frigates in the weather ship service.

Besides those in the North Atlantic, the United States, Canada, and Japan maintain weather ships in the North Pacific under an entirely separate arrangement.

The cessation of reports from the American weather ships would handicap weather forecasters working for the North Atlantic air routes mainly by the loss of upper-air information. Location of the often rather narrow belts of high wind, the so-called jet-streams, which may seriously increase the flight-times of aircraft flying against them, is a matter of much concern to the North Atlantic forecaster. Pre-flight planning of the fuel to be carried by trans-Atlantic aircraft is based on the forecast upper winds. To obtain the same degree of safety with less certain knowledge of the winds to be expected would necessarily mean on many occasions that airlines would have to sacrifice paying load to carry more fuel as an insurance against the increased risk of encountering headwinds stronger than forecast. This would be a direct financial loss to the airlines of all countries concerned in North Atlantic flying.

Valuable observations are regularly made and transmitted by voluntary observers on merchant ships, but not so frequently as by the meteorologists on weather ships, and, in particular, they include no upper-air observations. Merchant ships are, of course, almost always moving, and even with the good organization in force for collecting their reports, large areas without observations on the weather maps are inevitable.

Apart from the immediate use of weather ship observations in forecasting, the detailed logs are interchanged among the nations for the building up of a comprehensive climatology of the North Atlantic from the surface to heights of more than 50,000 ft. Never before have continuous weather records from fixed ships in mid-ocean been obtained. Further, the ships provide admirable laboratories for special investigations in oceanography and other geophysical subjects, and small expeditions from university research institutes have worked in them.

It is to be hoped that a new agreement providing for the maintenance of some, at least, of the American stations will be reached before the present one expires.

A WHALE-MARKING EXPEDITION

By Dr. N. A. MACKINTOSH, C.B.E.
National Institute of Oceanography, Wormley, Surrey

THE marking of whales can assist nearly all investigations on the populations and life-cycle of whales, it seems the only satisfactory method of gaining information on many aspects of their distribution and movements, and it was carried out on a considerable scale by the Discovery Committee before the Second World War. A previous article in *Nature*[1] gave a summary of the information already obtained from recovered marks, and directed attention to the need for more marking, both in the Antarctic and in other regions. It was noted that the National Institute of Oceanography (which now includes the Discovery Investigations) could not now meet the cost of special marking expeditions; but the hope was expressed that some means of continuing the work would be found.

The generosity of a number of whaling companies has now led to such an expedition, and a ship is on the way to the Antarctic to mark whales during some weeks immediately before the opening date (January 2) of the whaling season of 1954. The marking has been organized jointly by the National Institute of Oceanography and the Norwegian State Institute for Whale Research.

The importance of whale marking had been endorsed at recent meetings of the International Whaling Commission, and after correspondence with the National Institute the former chairman of the Commission (Ambassador B. Bergersen) and the secretary of the Association of Whaling Companies (Mr. E. Vangstein) took the initiative in approaching the whaling companies. In the summer of 1953 a number of these companies (British, Norwegian, Dutch and South African) agreed to share the cost of about a month's marking by the modern whale catcher *Enern*, owned by the Norwegian company, A/S Thor Dahl. Whale catchers hitherto had not been the ideal ships for whale marking on account of their relatively short cruising range, which tended to restrict marking to the immediate field of hunting. But the *Enern* is a powerful new diesel-driven vessel with a cruising-range which enables her to sail more than a month in advance of the parent factory ship, from which catchers are normally refuelled.

The *Enern* is expected to reach the edge of the pack-ice in the later part of November, and to mark whales between the Greenwich meridian and South Georgia in the Dependencies of the Falkland Islands. Prof. J. T. Ruud, director of the State Institute for Whale Research, is in charge of the work, and sailing with him are Mr. R. H. Clarke, of the National Institute of Oceanography, Mr. Per Øynes, also of the State Institute, and Mr. van Utrecht, of the Netherlands Whales Research Group. December is a little early for finding the maximum number of whales, but on the other hand the work will be done by a much more powerful vessel than has yet been used for whale marking, and she is commanded by an experienced whaler, Captain M. Marthinsen. Much depends, however, on the weather.

Very little marking has been done in the Antarctic since the War, and of the pre-war marks only small numbers are now being recovered each year. The main object of the present cruise is simply to increase the number of marked whales at large, and hence the number of marks recovered; but it is also intended to test the value of certain modifications to the standard 'Discovery' mark, which have been devised by Prof. Ruud and his colleagues to improve their effectiveness, and to estimate the chances of marks being overlooked when the carcasses are treated at the factories. In July this year some experiments were made by Prof. Ruud, Mr. Clarke, and Mr. A. Jonsgård at a whaling station at Steinshamn in Norway. Preliminary tests with the modified marks showed that they were worth extensive trials on a whale-marking voyage, and examination of the carcasses of marked whales and the position in which a mark is lodged after penetrating the blubber gave further evidence that there is little risk of injury to the whale. An account of these experiments has already been published[2]. It is hoped that with improved efficiency in the recovery of marks, the ratio of marks recovered to marks fired will come nearer to the ratio of total whales killed to total whales in the population. The latter ratio is at present unknown, and it is naturally of great importance. Large numbers of recovered marks are needed, not only to make the ratio of recovered marks more significant but also for studies of migration, of the rate of dispersal or interchange between the populations of different regions, and of the age and rate of growth of whales. Of course, a single new marking voyage will not dispose of all these problems, but it is hoped that it will lead at least to some progress in the investigation of this interesting mammalian population and assist the work of the International Whaling Commission.

For subsidiary work during the voyage, especially for observations on sea temperatures and the shoals of krill (*Euphausia superba*) on which whales and other animals feed, the *Enern* is equipped with a sea-thermograph, a 'fish-finder' echo sounder, a bathythermograph, and a 1-metre townet.

It has been arranged that the National Institute of Oceanography will act as co-ordinating body, and will receive all recovered marks. The Norwegian Institute will receive duplicates of all such data, and the two organizations will co-operate in examining the material. A report on the voyage will be sent to the International Whaling Commission and to the whaling companies participating in the scheme.

[1] Mackintosh, N. A., *Nature*, **169**, 435 (1952).
[2] Ruud, J. T., Clarke, R. H., and Jonsgård, A., *Norsk Hvalfangsttid.*, **8**, 429 (1953).

PHYSIOLOGY OF ATHLETIC TRAINING

ALTHOUGH a large amount of time, effort and money is expended on the training of human and animal athletes whose subsequent performances are witnessed in the aggregate by thousands of spectators, it was probably the inherent interest in the subject which led the Physiology Section (I) of the British Association to devote a whole day at the Liverpool meeting to a symposium on the "Physiology of Athletic Training". The methods of training both men and animals are mainly empirical; but by having a panel of speakers made up of physiologists, active athletes, trainers and coaches of both animals and men, it was hoped that the papers and subsequent discussion would show what assessment, on a physiological basis, could be made of training methods.

Middle- and long-distance running was taken by Prof. A. Hemingway (University of Leeds) as a fairly straightforward example of athletic performance. It requires skill, but not in the sense of using specialized techniques of handling implements or of employing strategy and tactics as in complex games. The limitations to performance in running are ultimately dependent on chemical reactions in muscle. Some of the reactions are anaerobic; but they can only be used to a limited extent. If oxygen is available the overall reactions can be aerobic, and the extent to which they are used is dependent upon the oxygen supplies to the muscles. If the rate of energy liberation outstrips the available oxygen supplies, then part of the energy must be supplied by the anaerobic mechanisms. But as these are limited, fatigue must ultimately ensue, the period elapsing before its onset depending on the rate of energy liberation. The fundamental problems of the athlete are to convert his energy into locomotion with maximum efficiency and to provide as large a proportion of the energy as possible by aerobic mechanisms. To what extent does training help in solving these problems?

Comparisons between trained and untrained men show great differences in their ability to take up oxygen. The highest rate of oxygen uptake measured on a trained athlete is 5·3 l./min. when breathing atmospheric air at normal pressure. The ability to transport oxygen at this rate from the lungs to the working muscles seems to depend upon a large output of blood from the heart. Such differences as there are between the capacity of the lungs, the rate at which they can be ventilated, or the composition of the blood, in trained and untrained men are insufficient to explain the discrepancy between their ability to take up oxygen. The main difference seems to be in the output of the heart. Recent advances in the technique of measuring the output of the heart make it possible to estimate that the maximum output may rise to about 40–50 l./min. in a first-class middle-distance runner. The severe training methods used by some long-distance runners increases the strength of both the skeletal muscles and the heart. The athlete makes optimum use of the oxygen which is available through this large blood output by running usually at a constant pace and by employing an economical style. Recent Scandinavian work illustrating the relationship between stride-length and efficiency of running was