coastal people of Kar Kar by reason of the multitude of tests to which they had been exposed with no apparent direct or indirect benefit to them. They felt exploited for the purposes of the Europeans.

Several speakers dealt with the genetic information. Dr A. E. Mourant (St Bartholomew's Hospital, London) has assembled more data on red cell enzymes in New Guinean people than on any other peoples in the world. Some of the new genetic markers, such as haemoglobin-J, first discovered 6 years ago in the islands of the south-west Pacific (discussed by Dr G. H. Beaven, National Institute for Medical Research, London) have great significance for studying population movements and variability. The movement, relatedness and genetic structure of the coastal New Guinean people of Kar Kar, and the genetic distances between certain adjacent language groups (of the order of 3,000–4,000 years), were discussed by Dr G. A. Harrison (University of Oxford) and Dr P. B. Booth (Christchurch Hospital, New Zealand) respectively.

Some peculiarities of growth and physique were described by Mr R. G. Harvey (University of Surrey). The age of menarche is 18 years or later in some highland girls. There is a decrease in body weight with ageing from young adulthood onwards in both males and females—a remarkable contrast to European and North American people.

In some respects, the most interesting results on the New Guineans were reserved for the afternoon session. Health studies (Dr R. W. Hornabrook, Institute of Human Biology, Papua-New Guinea) have shown an almost complete absence of the diseases of Western society—hypertension, cardiovascular degenerative disease and diabetes mellitus. Dr J. V. G. A. Durnin and Dr N. G. Norgan (University of Glasgow) discussed various aspects of the exceptional nutritional findings. The physique of the New Guineans, especially the men and the young women, is excellent; their way of life entails a good deal of moderately hard work and yet the energy and protein intake in their diet is very low—1,400 and 1,900 kcal/day for the coastal women and men respectively and 2,100 and 2,500 kcal/day for the highland women and men. There is no obesity and the fat content of the men and women is the equivalent of that found in athletes in Europe, and middle aged people are no fatter than young adults.

Dr J. E. Cotes (MRC Pneumoconiosis Unit, Cardiff) and Dr J. M. Patrick (University of Ife, Nigeria) described lung function and exercise capacity, which again are comparable to very athletic people in the United Kingdom. Many of the New Guineans smoke native leaf tobacco, which has appar-

ently no measurable effect on lung function.

Tests on temperature regulation, carried out by Dr R. H. Fox (MRC Human Physiology Division, London) and Dr G. M. Budd (University of Sydney), indicate peculiar and unusual adaptation. Exposure to a standard heat load produced similar deep body and skin temperatures in New Guineans compared with acclimatized Europeans, but much smaller sweat loss—showing an ability to conserve body fluid without restricting heat loss by the evaporation of sweat.

The meeting produced many glimpses into the extraordinarily interesting biology of the remarkable peoples of New Guinea. The new information on genetics, nutrition and physiology has wide-ranging implications.

FISHERIES

Acoustic Methods

from a Correspondent

ACOUSTIC methods in fisheries research was the topic of a symposium organized by the International Council for the Exploration of the Sea with the collaboration of the Food and Agriculture Organization of the United Nations and the International Commission for the Northwest Atlantic Fisheries in Bergen on June 19 to 22. The scope of the meeting included investigations of the seabed, study of fish behaviour and the action of fishing gear, estimation of fish abundance and description of fish stocks; the last of these topics was accorded most attention.

Because fisheries biologists in the past have been unable to see and count directly fish in the sea they have used indirect methods involving tedious sampling and elaborate mathematical models and calculations to make quantitative estimates of stocks. Now acoustic echo techniques have been developed not just to find fish but to quantify the received echoes. Electric counting, integrating and computing systems are being developed in many countries for assessing fish populations by high speed surveys. A striking illustration of the use and potential of the echo-integrating technique, whereby the voltages of the returned signals from fish in a series of water layers are summed, was provided by Mr L. Middtun and Mr O. Nakken (Institute of Marine Research, Bergen); in about two weeks, with one research vessel, they had plotted the distribution of the Barents Sea capelin and estimated the size of the spawning stock to be between 2.0×10^6 and 3.1×10^6 tons, which agrees well with estimates made by the classical indirect methods. They had also similarly mapped blue whiting to the north-west and west of the British Isles and estimated the spawning of stock to be between 4.0×10^6 and

8.0×10^6 tons which indicates a big fishery potential of this unexploited species. Dr R. Thorne (University of Washington) obtained in near ideal conditions of single species in partially enclosed waters an encouraging linear relationship between his acoustic integrator estimates and fishing catches of Pacific hake and herring.

Acoustic echo techniques are also being tried for identifying species of fish and for estimating their sizes; for these methods and for estimating abundance a knowledge of target strengths of fish is essential. Mr J. Suomala (C. S. Draper Laboratory, MIT) presented an analysis of echoes from up to 1,000 floats which simulated various arrays of fish in a water-filled tank of 9.5 m diameter. Mr O. Nakken and Mr K. Olsen (Institute of Marine Research, Bergen) measured target strengths of real but dead fish fixed below the echo-meter in various aspects, and Dr G. Goddard (University of Birmingham) and Mr K. Johannesson (FAO, Rome) had used caged live fish. The variations of target strength with fish aspect are very big—much larger than the differences between species, so that identification of fish by echoes is not likely and acoustic surveys must include sample fishing. In an interesting note Mr S. Olsen (FAO, India) pointed out that, whereas the echo from a fish is usually dependent on its air bladder, the shape of the porcupine fish causes it to act rather like a radar reflector and so it has an anomalous target strength.

Mr W. Acker (University of Washington) overcame the problem of counting salmon in surface waters by submerging echo-meters transmitting upwards. With ingenious use of the Doppler effect to assist in measuring swimming speeds of fish, and to study the internal dynamics of fish shoals, Dr D. Holliday (TRACOR Inc., San Diego) estimated the mean size of fish by using the number of body lengths travelled per second at average cruising and burst speeds, thus neatly illustrating the interdependence of biologists and physicists in this field.

In a section devoted to use of acoustics in fishing gear and fish behaviour research, Dr S. Rusby (now Institute of Oceanographic Sciences, Godalming) showed that the 6.4 kHz GLORIA system developed at the National Institute of Oceanography (now the Institute of Oceanographic Sciences) provided an excellent method of studying the distribution, size, shape and movement of pelagic fish shoals at ranges up to 20 km. Alongside this the ARL sector-scanning sonar is unrivalled for detailed shorter range observation; it had been used by Dr D. Cushing (Fisheries Laboratory, Lowestoft) to observe fish shoal packing densities directly and by a group of colleagues at Lowestoft to observe fish reaction to a trawl and to measure trawl efficiency.