Our Astronomical Column.

THE TOTAL SOLAR ECLIPSE OF SEPTEMBER 20, 1922.—Mr. A. R. Hinks read a paper at the meeting of the Royal Astronomical Society on March 12 on the conditions along the track of totality in this eclipse. The nearest available station is in the Maldive Archipelago, where the sun's altitude is 34½° and duration 4m. 11s. It is recommended that an uninhabited islet be selected, as there is less risk of illness on one of these, the others having a bad reputation for Europeans. Also it should be an islet in the centre of a lagoon, as the outer ones experience vibration from the surf, which would spoil fine definition. The weather is likely to be clear but windy.

Christmas Island, south of Java, is near the noon point; the sun's altitude is 78½° and the duration 3½m. at the south point of the island. There are a flourishing phosphate industry on the island, a monthly steamer from Singapore, and good jetties and cranes at Flying Fish Cove, whence there is a railway to the south coast. Much of the island is covered with forest (haunted by large land-crabs), so some clearing might be necessary to give enough sky room for adjusting the equatorial mounting which it is intended to use here. The weather conditions in September promise to be very good.

The west coast of Australia offers difficulties, the country being barren, and there being no port in the neighbourhood of the track. The east end of the track in Australia is in Queensland, just south of Brisbane. The sun's altitude here is only 18°, but it is possible to obtain an altitude of about 26° by travelling by rail into the interior.

The programme will include a repetition of the investigation of the Einstein shift; there is a fair field of stars round the eclipsed sun, though they are much less bright than those of the eclipse of May, 1919.

THE BINARY STAR p ERIDANI.—This southern binary star (R.A. 1h. 36m. 45s., S. decl. 56° 36′) was first noted as double by Dunlop in 1826, and observed by Sir John Herschel at the Cape, 1834 to 1836. It was for some time doubtful whether the relative motion was not rectilinear, but curvature is now definitely established. Mr. B. H. Dawson gives a determination of the orbit in the *Astronomical Journal*, No. 762, as follows:—Period 218·9 years, T 1806·14, e 0·721, a 8·025″, ω 301·40°, i ±114·26°, Ω 1·03°. There is still much uncertainty, as only one quadrant has been observed. The large size of a makes the pair an interesting one. Apastron was passed in 1916, and the stars are now 9″ apart. Both are of magnitude 6·2; the proper motion of the middle point between them is +0·0336s., +0·022″, according to Boss.

FAINT NEBULÆ.—Publications of the Yerkes Observatory, vol. iv., part 2, is occupied with an account of a research on faint nebulæ by Mr. Edwin P. Hubble. Mr. Hubble took a series of photographs, with the 24-in. reflector at the Yerkes Observatory, of some rich nebulous regions, including seven well-defined clusters, containing more than five hundred nebulæ. The measures for ascertaining their positions are given, but, owing to the bad figure of the images in the outer parts of the field, the precision is not considered very great. The exposures did not generally exceed two hours, as beyond that point very little seemed to be gained. The average diameter of the nebulæ is about 25″, but in certain regions, notably in Perseus, they are distinctly smaller, about 15″. The question of the distance and status of these small nebulæ is discussed at some length, but the evidence appears to be insufficient to decide whether they are in the remoter parts of the galactic system or altogether outside it.

International Fishery Investigations.

THE first meeting since the autumn of 1913 of the International Council for the Exploration of the Sea took place in the Surveyors' Institution, Westminster, on March 2–6. The Council exists to consider and conduct investigations into the fisheries of the North Atlantic; to examine how far these fisheries are being depleted by fishing; to investigate natural methods, such as by breeding, etc., of keeping up the stock; and in cases of certain future failure of supply to suggest the necessary remedial measures. The Council has been conducting researches for nearly twenty years, but its operations during the war were brought almost to a standstill. For the most part it deals with the sea-fish common to all countries, but a special sub-committee considers the salmon, and a second the eel; shellfish are not investigated. The countries represented were France, Belgium, Holland, Denmark, Sweden, Norway, Finland, and Great Britain, each country having two delegates, with scientific experts from the fishery authorities of each. France was represented for the first time, but Germany and Russia dropped out of representation; the meeting was too hurriedly convened to allow of the U.S. Congress appointing delegates, and there was no representative of Canada, the eastern fisheries of which are mainly coastal. Great Britain was represented by Mr. H. G. Maurice and Prof. D'Arcy Thompson as delegates, Mr. Holt representing Ireland, while most of the scientific staffs of the three countries took part in the deliberations of the committees, including Prof. Stanley Gardiner (temporary Director of Fishery Research) and Comdr. Jones (of the Scottish Office).

March 2 was devoted to general business and the formation of committees, the whole body meeting together under the chairmanship of Prof. Petterssen (Sweden). After a telegram of respectful homage had been dispatched to the King, the chairman referred in sympathetic terms to the troubles of the last years and to the increased importance to Europe of safeguarding its supplies of fish. Commodore Drechsel (Denmark) and others spoke of the closure of the greater part of the North Sea as the most gigantic scientific experiment ever made in respect to the closure of areas, and one from which we might be able to draw the most important deductions in respect to the conservation of our fish supply. Mr. Maurice pointed out the difficulties under which all countries are at the present time labouring, and appealed to all to help in drawing up practical programmes of work such as each country could guarantee to carry out. The meeting then split into two committees for fishery investigations and fishery statistics and for hydrography and plankton (floating life in the sea).

The committees met twice daily during the next three days to draw up their programmes to be submitted on Saturday, March 6, to the whole body of delegates. The main deliberations of the Fish Committee were in respect to the plaice. All were agreed that the fishery statistics of Western Europe up to 1914 proved that there had been a most serious depletion of the stock of plaice on the fishing-grounds of Western Europe, particularly in the southern half of the North Sea. The apparently probable disappearance of this fish, from the point of view both of the industry and of the consumer, was felt to be so calamitous that even the strongest measures were thought to be justifiable. It was proposed that the Council should suggest to the diplomatists to negotiate a size-limit and the permanent closure of certain areas to provide a reserve, from which the young plaice might spread so as to restock the open grounds. It was pointed out that Denmark had already insti-

tuted a size-limit of nearly 10 in., but that Holland did not favour one of more than about 8 in. The representatives of Great Britain considered that the effect of the closure of areas on the industry had not been sufficient studied; that the closed areas must be as small as possible, consistent with the preservation of the plaice stock of the North Sea; and that the study of the effect of the war in having closed great areas would materially assist the Council in arriving at the most practical results.

The British view was finally adopted, and it was decided to undertake a year's intensive plaice investigation with the view of considering the whole question in 1921 and making recommendations. The committee then proceeded to draw up a programme of investigations. A thorough collection of statistics of plaice marketed was deemed essential. Furthermore, an accurate knowledge of the sizes of the fish both as marketed and as caught on commercial trawlers was recommended. The liberation after marking of a series of fish would be necessary to show their wandering during the year. Further experiments in the liberation of marked fish of small size on the Dogger Bank were recommended. The spawning-grounds should be more fully investigated and charted. The liberation of a large series of drift-bottles, both surface and bottom, was deemed essential so as to ascertain the drift of the eggs and young larvæ which float for many weeks in the water. The examination of numbers of eggs so as to ascertain the intensity of spawning in different areas was deemed advisable, as well as an investigation into the food on which the larvæ feed.

As most of the spawning areas of the plaice are off the east coasts of Great Britain, it was generally recognised that this country would have to concentrate in the present year mainly on these plaice investigations, but the hope was expressed that the examination of the life-history and wanderings of the lemon-sole would not be neglected, while the other fish occupying plaice grounds should be carefully recorded. The continued examination of the constitution of the herring shoals and of the other work on the life-history, growth, etc., of the herring was recommended, Great Britain being requested to collect samples and to send them to Norway, the representatives of which (Dr. Hjort, Prof. Gran, and Dr. Lea) undertook to examine them.

The Danish representatives described their plans for a second great expedition in the North Atlantic to search, among other objects, for the spawning-grounds of the fresh-water eel, which their previous work showed to be somewhere in the latitude of Madeira and at depths of at least 1000 or 1500 fathoms. They also gave an account of the commercial results obtained by the importation of the young eels (elvers) and their liberation in Danish rivers and lakes. Dr. Johansen (Denmark) and Dr. Rosen (Sweden) described the work of their respective countries on the movements of salmon and sea-trout, the ages of these fishes for spawning, the liberation of fry, etc., showing results of considerable economic importance—results capable of immediate application in many British rivers could the difficulties in respect to pollution be overcome.

The Hydrographical and Plankton Committee divided into sub-committees for its two subjects. The former is mainly concerned with the currents on the fishing-grounds in respect both to the movements of such fish as herring, mackerel, and pilchards, and to the drifting of fish-eggs and young. It was generally considered that the hope of foretelling the movements of the fish and the success or otherwise of the spawning year by year depended on a more extensive study of the movements of Gulf Stream waters from Barents Sea to Iceland and down the European coasts to Mogador, with more intensive investigations in the North Sea. The nature of the spawning was deemed peculiarly important, as on this depends to a large degree the success of the fishing some years afterwards when the spawn has grown into fish of marketable size. Extensive temperature records and water samples from a series of transoceanic liners month by month were recommended, and the hope was expressed that the United States would co-operate by collecting samples on liners cutting the Gulf Stream nearer where it leaves the Straits of Florida.

A full programme of hydrographic work was recommended in the southern half of the North Sea in view of the plaice investigations. Here the sea is so shallow that the water is thoroughly churned up from surface to bottom, and, in consequence, surface samples only, mostly from passenger ships, were proposed. The drift-bottle programme was approved and somewhat extended in the hope of understanding better the isobaric, temperature, and salinity charts of the region in respect to the movements of fish, with the view of making them usable by fishermen.

The plankton sub-committee, under Prof. Gran, drew up a very small programme on account of present difficulties, but it decided to recommend researches on the physico-chemical conditions of sea-water in respect to the life in the sea. It regarded this basal research as impossible either to initiate or carry out under the Council, and so decided to record its opinion as to the necessity of such researches on living animals in respect to the water in which they live. It was pointed out that the acid or alkaline nature of the water affects the rate of growth of young fish, and that further knowledge here in respect to trout, salmon, and plaice might become at once of economic importance. Animals, too, show growth in the most carefully filtered sea-water—a matter of the greatest importance, the meaning and utility of which could not be foretold. It is well known that the blood of human beings can be replaced by sea-water, but not so effectively by artificial sea-water, which is made from distilled water by dissolving in it the various salts. The possible meaning of this was discovered by Dr. Allen (Plymouth) working on minute marine animals, and points to those mysterious substances "vitamines," of which so much has been heard in the last six years and so little is known. The searcher for economic results in fisheries must have the basal theory and knowledge in respect to his living fish duly developed as the foundation on which he has to build. Incidentally, an increase in knowledge of this soluble food, etc., should be rapidly applicable to oyster- and mussel-farming, and the sub-committee could only hope that the requisite genius to give further ideas would soon be found.

The development of lakes and rivers for the production of food was of special interest to Mr. Holt (Ireland), the Swedish and Finnish representatives, and Dr. Redeke (Holland), the last giving an account of the very great development of the fresh-waters of his country. So far as fish were concerned - salmon is treated separately—the subject is of little importance to Great Britain, but the possibility of the development of a button industry by the cultivation of mussels was thought worthy of investigation.

France was represented by M. Kersoncuf (Director of Marine Fisheries), accompanied by M. Tissier, Prof. Behal, Prof. Joubin, and Dr. le Danois. A meeting with the English and Irish representatives resulted in the formation of a special committee to consider and report as to fisheries off the mouth of

the English Channel and in the Bay of Biscay and to the west and south. The chief fish of this region are the migratory mackerel and pilchard and the hake, which apparently is a great wanderer. It is hoped also to investigate the possibilities in respect to tunny, of which there should be an almost unlimited supply in the Atlantic. France undertook the preparation of a fishing chart of certain grounds, Ireland particular cruises to meet the French vessel, and England to continue and extend her investigations into the waters of the Channel. England was also asked to undertake, as soon as possible, regular cruises to the south-west to investigate the approach of the Gulf Stream waters in respect to mackerel, pilchards, and tunny.

At the full meeting on Saturday, March 6, the programmes of the committees were adopted, and Mr. H. G. Maurice was unanimously elected president for the ensuing year, the next meeting to be held in Copenhagen in 1921. The present writer believes that the fishery industry appreciates the vital importance of these very technical investigations, in the results of which the interests of the fisherman and the researcher are identical; he appeals to the industry to co-operate in every way in its power, and in particular to return drift-bottles and marked fish.

Exhibition of Diseases of the Para Rubber-tree.

AN important exhibition illustrating the fungal diseases to which the Para rubber-tree (*Hevea brasiliensis*) is subject in Ceylon and Malaya was opened on March 10 in the Botany Department of the Imperial College of Science and Technology by the Marquess of Crewe in the presence of leading representatives of the rubber trade. The exhibition, which has been organised by Prof. J. B. Farmer, Director of the Biological Laboratories of the college, includes a large number of trunks of rubber-trees, specially shipped from the East, showing the diseases as they occur in the plantation, and forms a striking commentary on the optimism which obtained in the first years of the industry as to the probable relative immunity of Hevea from disease.

The warnings issued by botanists at the time that the Para rubber-tree would no more escape epidemic fungal disease than any other crop plant has, unfortunately, been justified by events. At the present time there are several diseases which, if not checked as the result of sound scientific knowledge, intelligently applied, may seriously affect the future of the plantation industry. The former optimism finds a present-day counterpart in the equally dangerous view held in certain quarters that "sanitation" is all that is necessary as a safeguard against disease, and that, in consequence, expenditure on mycological research is waste of money. The fact that the causative organism (if organism it be) of the most dangerous disease in the plantations at the present time ("brown bast") is as yet unknown is sufficient reply to so short-sighted a view. The exhibition comprises three main sections: (1) A series of rubber trunks affected by the chief diseases met with in the East, illustrated by admirable coloured wall-pictures of the diseases *in situ*; (2) cultures and microscopic preparations of living fungi isolated at the college from the trunks exhibited; and (3) a section devoted to the important bearing of a knowledge of the anatomy of the bark of the tree upon questions of latex yield. This section also includes trunks illustrating different systems of tapping. All the exhibits are accompanied by explanatory labels.

The principal diseases represented are as follows:

(1) *Brown Bast.*—This is by far the most important disease at the present time, and is rapidly increasing, certain estates in Java having as many as 60 per cent. of the trees attacked. It is an affection of the bark in the tapping area, and is of acute importance, since it quickly results in the complete cessation of latex flow. Later, the bark becomes discoloured and burrs appear over the affected area. The disease is met with on young and old and on vigorous and backward trees, and occurs in every type of soil. At present preventive measures are confined to disinfection and excision of the affected tissues, but successful treatment is hindered by ignorance of the real nature of the disease. Hitherto physiological disturbance produced by tapping has been held to be the cause, but recent work in Sumatra suggests a bacterial origin. Further research alone can settle this fundamental question.

(2) *Fomes lignosus.*—Next to brown bast this is the most serious disease of Hevea. It is a fungus of the familiar Polyporus type, attacking the cortex of the roots. In cases where it was neglected in the early stages it has since wiped out large blocks of rubber, and from the nature of the disease the replanting of such areas has been impracticable. The mycelium spreads to the Hevea roots from old jungle stumps, or from soil in which old jungle roots have been lying. From the infected Hevea roots it passes to all healthy roots in the vicinity, finally destroying the trees. Treatment consists in exposing the root-system and painting the diseased roots with Bordeaux mixture or other fungicide. The soil is also heavily limed to destroy the mycelium invariably present in it, and the whole infected area isolated by a trench.

(3) *Fomes pseudoferreus* (*Poria*).—This fungus penetrates deeply into the wood of the Hevea roots, often leaving the cortex as a living cylinder until the wood is destroyed by a "wet rot." The tree thus shows little external signs of attack until the disease has reached the final stage. In consequence, measures of dealing with Poria are limited to preventing its spread. The treatment adopted is essentially the same as for *Fomes lignosus*.

(4) *Dry Rot* (*Ustulina zonata*).—This fungus is a wound parasite, and gains entrance *via* lesions on roots, stems, and branches, killing the wood, which becomes soft and tindery. Owing to former neglect of wounds, the disease is greatly increasing in older plantations. The best preventive treatment is a periodical dressing of all wounds with tar. When confined to the branches the disease may be removed by pruning, but if on the base of the trunk or on the roots, the tree is usually found to be infected with Fomes in addition, and treatment is impracticable.

(5) *Patch Canker* (*Phytophthora Faberi*).—This disease is increasing in all the rubber-growing countries of the East. The bark just below the surface becomes claret-coloured, and eventually dies off in patches. The disease can be controlled by early removal of the bark and coating the exposed surface with tar but the chief difficulty is that the affected bark is freely entered by boring beetles which penetrate deeply into the wood, carrying with them spores of dry rot (Ustulina). In consequence, nearly every case of neglected patch canker is also infected with dry rot.

(6) *Stripe Canker* (*Phytophthora sp.*).—This canker was a formidable menace during 1915–17, more than 70 per cent. of the trees in tapping on some estates being attacked. The disease first appears as narrow vertical stripes just above the newly tapped bark, and if tapping is continued during the wet season the whole of the tapping surface rots away. Fortunately, it is now almost completely preventable by daily disinfection of the tapping cut.

(7) *Pink Disease* (*Corticium salmonicolor*) has