the exhibition of a herd of reindeer in charge of a party of Lapps, an exhibition which led to the importation of parties of natives from many other parts of the world.

Either personally or by means of his representatives, Mr. Hagenbeck has explored a very large portion of the globe, having brought home, and reared, walruses from Greenland, giraffes, elephants, and rhinoceroses from the heart of Africa, tigers and sambar from the jungles of India, and wild horses and onagers from the fringe of the Gobi desert. The most interesting chapters in the book are undoubtedly those in which the author describes the various methods of capturing wild animals alive, and the behaviour and habits of particular species and groups. Did space permit, we might refer to many stories of adventures and escapes, but we must be content with mentioning one case where a party of some 3000 baboons attacked and beat off the captors of their fellows. These baboons, like many carnivora, are captured as adults by means of traps; but in the case of the larger herbivores Mr. Hagenbeck's most successful method is to train the natives (if they require it) to ride in pursuit of the herds until the young ones are brought to a standstill.

The book, which deserves a fuller notice than can be given here, is rich in interest from beginning to end; and should be of considerable value to all the custodians of zoological gardens. R. L.

THE SEXTO-DECIMAL YEAR OF BRITISH CALENDARS.

IN searching English and Welsh calendars for sequences of festivals at intervals corresponding with the sun's stations on quarter and half-quarter days, or, in other words, the quarter days of both the solstitial and the May years—the octave year consisting of eight half-quarters—I find another octave year definitely marked in the calendars, and to a large extent still observed by festivals and fairs. The year of British calendars is definitely sexto-decimal, both the solstitial and May quarter days being duplicated, with the striking result that the eight half-half-quarter days coincide within three days of the exact half-half-quarter stations of the sun, the unit interval being roughly three weeks. The interval between a solstitial and a May quarter day being roughly six weeks, the duplicate octave year may be called an intermediate year.

The intermediate year is evidently the oldest octave of the two. It is the year as observed previously to the publication of the Julian calendar. Its basis was a calendar which was not corrected for the precession of the equinoxes, but which in other respects has been kept up to date. Calendars of other countries present similar anachronisms, but the persistence in Britain of such a belated calendar calls for special notice.

The jumbling together of two festival reckonings, on bases two thousand years apart, has resulted in a strikingly symmetrical sexto-decimal year. The festivals of the older octave were accurately fixed on solar quarter and half-quarter days, a fact which implies either the continued use of astronomical monuments for solar or stellar observation on those days, or a computation based on the exact length of the year. Within the Christian era, the festivals of the older reckoning drifted out of correspondence with the original solar stations. When the dates of the older sequence of festivals were marked in the Julian calendar, it was found—and I think it is hardly possible that the fact could have been overlooked—that the dates were just midway between the solar stations of a Julian sequence of festivals, and it became possible to utilise the half-half-quarter stations of the sun to indicate the incidence of the belated festivals. What makes the subject still more interesting is the discovery by Sir Norman Lockyer and others of indications of similar half-time dates in monument measures (NATURE, November 12, 1908, p. 36).

A complete sexto-decimal solar year may be expressed as follows, the nearest round number of minutes of declination being given:—

Sun's decl.	Dates
N. 23° 30′ E.	June 22
,, 21 30 ,, ...	May 29–30, July 16
,, 16 20 ,, ...	May 6, August 8
,, 8 30 ,, ...	April 12–13, September 1–2
East	March 21, September 23
S. 8° 30′ E.	February 27–28, October 15–16
,, 16 20 ,, ...	November 8, February 4
,, 21 30 ,, ...	November 30, January 13–14
,, 23 30 ,, ...	December 23

Half-quarters of the Older Octave.

Date	Dedication	Character of Festival
November 30	Andrew	All Hallows
January 13...	Hilary	Winter solstice
February 28	Oswald	Candlemas
March 1 ...	David	
April 15 ...	Oswald	Vernal equinox
June 1... ...	Tekla	May day
July 15 ...	Swithin	Summer solstice
,, 17 ...	Kenelm	
September 1	Giles	Lammas
October 15...	Ulfrann	
,, 17...	Etheldreda	Autumnal equinox
,, 18...	Luke	

When the older octave only was marked in a calendar, such a calendar was doubtless a lunar one, and sometimes the interval between two festivals exactly corresponds with the solar interval only in a lunar reckoning. For instance, January 13–April 13 represents in the Roman lunar calendar the exact interval between the winter solstice and the vernal equinox, both dates being also Ides.

The intermediate year is clearly a May one, the first quarter, November–February, being rounded by the patron saints of Scotland and Wales. There is abundant evidence of St. Andrew's having been observed as New Year's Day. The interval between St. David's Day and St. Andrew's corresponds to the length of the vegetation year pure and simple. I think St. Patrick's Day, March 17, represents, like St. David's, a Candlemas festival, by a lunar calculation like that of the Coligny calendar. That date about the ninth century coincided with the vernal equinox, when it seems to have been given an equinoctial significance in connection with the commemoration of St. Patrick; but the shamrock, like the date, is reminiscent of a Candlemas festival (NATURE, July 25, 1907, p. 295).

In one parish in Glamorgan—namely, Llangeinor—the complete sexto-decimal year was, until recently, observed by holding a court every three weeks. The patronal day is October 8, three weeks before All Hallows, but originally an autumnal equinox festival.

There is much evidence to show that the Scandinavian and German invaders of England, on the one hand, and the Welsh-speaking invaders of Wales from the north in post-Roman times, are chiefly responsible for fixing permanently the intermediate year in our calendar. So much is indicated by the list of saints commemorated, but more particularly by the association in Wales of half-half-quarter fairs with traces of northern and Scandinavian settlements

While in Wales generally hiring fairs are held in May and November, in districts like South Pembroke, known to have been occupied by Scandinavians, the hiring fairs are in April and October, and they represent an old equinoctial division of the year.

JOHN GRIFFITH.

MARINE INVESTIGATIONS IN NORWAY.[1]

THE work done by the Norwegians takes a foremost place amongst the fishery and marine investigations which have been carried out in recent years under the general guidance of the International Council, which was established in 1901 to coordinate the researches of the different countries bordering on the North Sea. The present report gives a general review of this work in readable form, without being burdened with any excess of detail, such detail being reserved for special memoirs, some of which are already published.

The introductory account of the plan and organisation of the work is written by Dr. Johan Hjort, the director of the investigations, and sets forth in the clearest way that effective combination of precise and accurate scientific investigation with practical developments of commercial fisheries which has always specially characterised the work of this investigator. Hydrographical investigation, plankton research, the study of the bottom fauna, each has received its due share of care and attention equally with the study of the natural history of fishes and the experiments which have led to the establishment of new fisheries for cod and for deep-sea prawns off the Norwegian coast.

In one important respect Norway has been especially fortunate, that is in having had the use of a research steamer, the *Michael Sars*, designed and built for the particular work of fishery research, an advantage which a parsimonious Government has denied to those who have to carry out similar work in England and Scotland. A detailed description of this vessel and her special equipment is given by Dr. Hjort, and the efficient and seamanlike way in which she must have been used could not have been better brought out than by the illustration showing the arrangement adopted for working two Petersen young-fish trawls and five tow-nets at the same time, and each at a different water-level. Equally striking are the successful results obtained by working a 50-foot otter trawl at depths of from 400 to nearly 700 fathoms.

The section of the review dealing with hydrographical investigations, by Dr. B. Helland-Hansen, summarises the results which have been reached by a study of the salinities, temperatures, and currents of the Norwegian Sea. In the concluding paragraphs of the section attention is directed to a series of striking correlations between the hydrographical conditions prevailing in the Norwegian Sea and various climatic, fishery, and other phenomena, which appear to be affected by these conditions. Evidence is given for thinking that the amount of heat which the Gulf Stream conveys into the Norwegian Sea has a controlling influence on the winter climate of Scandinavia. From the amount of warmth in the water, recorded as early as the month of May, the author considers that it should be possible to tell whether the succeeding winter will be warmer or colder than usual. For the years 1902–6, in which the investigations took place, a low temperature in the Gulf Stream in the southern portion of the Norwegian Sea in May was followed by an early fishing for cod in Lofoten in the next winter, and *vice versa*. Other correlations of a similar character are also described.

In dealing with the plankton investigations, Dr. Damas gives an interesting account of his observations on the distribution of the medusa, *Cyanea capillata*, which is of considerable importance from its intimate association with the fry of the haddock, whiting, and cod. The fry of these fishes shelter themselves under the disc of the jelly-fishes, and are borne along with the latter in their passive wanderings. Shoals of these Cyanea have been traced from the shores of Jutland into the Skagerak, and thence along the coast of Norway to the north, carrying the young fish with them. Another medusa, *Cyanea lamarcki*, which has its home in the temperate Atlantic, occasionally reaches the west coast of Norway, accompanied by the fry of southern gadoid fishes, poor-cod, pout, and pollack.

But in addition to the more indirect, though not therefore less important or less fruitful, ways of approaching fishery problems, represented by the hydrographical and plankton investigations just mentioned, the Norwegians have devoted very considerable attention to the natural history of the fishes themselves. Dr. Damas writes on the distribution of the eggs and young stages of the gadoids, and gives also many results of the greatest significance concerning the age and growth of these fishes. By an examination of the scales it is now possible to determine with considerable certainty the age of each individual fish. Many catches of cod and haddock were examined in detail in this way, and the number of fish belonging to each year-group was ascertained. The important fact has been determined that fishes born in certain years largely preponderate in the catches, and the effect of these favourable breeding years can be traced in the catches year after year. Similar results have been obtained by Knut Dahl in the case of the herring. Thus in a sample of spring herring examined in the spring of 1907 the eight-year-old fish were in remarkable abundance. The same year-class, in the autumn of 1907, was the most numerous of all the thirteen year-classes which composed the large herring of the coast of Helgeland. In the spring of 1908 several thousand spring herring were examined, and the nine-year-old fish were conspicuously abundant. In the autumn of 1908, in a large sample of herring from Kristiansund, it was found that the 9½-year-old fish were more numerous than either the preceding or succeeding year-classes. In samples from the North Sea and Skagerak the data appear to indicate that here, also, the same year-class predominated. It is clear that knowledge of this kind, if regularly and systematically collected, will enable estimates of the yield of the fisheries to be made some years before the fishing actually takes place, a result which cannot but be regarded as a triumph for the scientific method of approaching fishery problems.

Space has only allowed us to touch upon a few of the more striking features of this report. One would imagine that a perusal of it must convince the most sceptical of the value of the new knowledge which is now being rapidly made available as the result of the labours of the International Council for the Study of the Sea. Unfortunately, in this country the continuation of the work still, to some extent, hangs in the balance, but it is to be hoped that our Government, representing as it does by far the largest fishery interest of the countries bordering on the North Sea, will be induced to take a broad view of its responsibilities.

[1] "Review of Norwegian Fishery and Marine Investigations, 1900–8." Report on Norwegian Fishery and Marine Investigations, vol. ii., 1909, No. 1.