symposium on deep sea biology was included, since it has been rather neglected in the United States during the last few decades. It covered a wide variety of aspects, however, with a common denominator—adaptation to the deep sea. N. B. Marshall (London, England) discussed the variation of the anatomy with depth. Swim bladder and firm skeleton are characteristic for mesopelagic fishes. However, the disappearance of swim bladder and reduction of skeleton weight seem to be related to a food-poor environment. These classic types of deep sea fishes do not undertake vertical migration. The development of drumming muscles on the swim bladder seems to be restricted to benthic fishes populating the depth from 150 to 1000 meters, since mesopelagic and benthic fishes from great depths do not produce sound using the swim bladder.

G. L. Voss (University of Miami) pointed out the decrease of muscle tissues with depth and their replacement by gelatinous material. The light organs increase and are more specialized, and the feeding mechanism changes. It was pointed out that the larvae live in the surface layers, squids in the surface, and octopods close to the thermocline. Thus size increases with depth. Donald F. Squires (Smithsonian Institution) also pointed out the reduction of skeleton in corals with depth. He studied the specification and dispersal from the Cretaceous period and pointed out the tendency toward greater depth during development.

In the session on the behavior patterns in tropical waters W. Wickler (Germany) made understandable the meaning, in many cases, of highly conspicuous and varied colorations, as well as the bizarre structural forms found among many tropical marine fishes. Wickler's report was greatly enhanced by a number of films which stressed various points covered during the presentation. Neil R. Foster (Academy of Natural Sciences, Philadelphia) reported his studies on the behavior pattern of killifishes. He could show that the male of 35 killifish species have three components in their reproductive behavior: head flicking, contacting, and visual display. Of these visual display seems to be most important, since it is the only component in some extremely sexually dichromatic and dimorphic species. Foster's study pointed to an important shift in the behavioral evolution of the group. This shift was from expelling and fertilizing all ovulated eggs during a single clasp to expelling and fertilizing eggs singly. This apparently increased courtship behavior and thereby the importance of sexual selection in the evolution of these fishes.

The increased effort in fisheries in tropical areas was the topic for two sessions which the conference held jointly with the annual meeting of the Gulf and Caribbean Fisheries Institute.

The high seas fisheries session centered on the world's most important fisheries, namely tuna and anchovy. T. Kamenaga from Japan and A. V. Freyre from Peru accounted for the remarkable developments these two leading nations had experienced in the last decade. Among the attributable growth factors are the relaxation of government regulations, exploitation of new fishing grounds, technical improvements, and market expansion. H. Kasahara (Special Fund of the United Nations, New York) pointed to the west coast of Africa as the area promising greatest expansion, while W. B. Chapman (Van Camp Foundation, San Diego) predicted substantial future exploitation of the eastern Pacific and the world, based on the calculation of a possible yield of 2 billion tons, only 51.6 of which are harvested today. M. Ruivo (FAO, Rome, Italy) conservatively substantiated this theory, stating that fish catches might double by the year 2000.

Complimenting this session was a discussion of the economics of tropical fisheries. The vast potential of the developing African West Coast and the eastern Pacific having been forecast, J. L. Dibbs (FAO, Rome, Italy) and J. A. Storer (U.S. Bureau of Commercial Fisheries, Washington, D.C.) analyzed the many problems, such as the difficulties in moving traditional fishing tribes into industrial fishing operations. A solution appears to be creation of a new fishing fleet and, in some cases, additional modernization of the small-boat fisheries. However, J. Crutchfield's paper, read by A. D. Scott, stressed the importance of marketing methods. The problems seem to be to find the best way between acceptance of the undeveloped status of these fisheries and a rapid economic development of them where the fishing industry underwrites the burden of the overhead costs of roads, storage, and refrigeration. Storer also stressed the point that easy entry into marine fisheries seems to have undesirable effects which are generally felt too late, that is, when the fishery is fully developed. In synthesizing the fishery economics, Scott postulated that although fisheries in general provide useful contributions to food supplies and to exports, they are unlikely to provide the foundation for national economic development, having rarely served as catalysts that have initiated or sustained economic growth of an area.

The International Conference on Tropical Oceanography was a most appropriate addition and climax to the dedication of an important oceanographic research center. The proceedings of this meeting are to be published as part of the series of *Studies in Tropical Oceanography* of the Institute of Marine Science. The volume is expected to be available during the summer of 1966, and requests should be directed to the Proceedings Editor. (Travel support from NSF grant GP-4773, Office of Naval Research.)

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Speleology

The present-day pursuit of knowledge in cave-related phenomena by scientists of many disciplines has many roots in the 18th century study of Yugoslavian caves and karst. The very word karst derives from the Kars district of Slovenia and has become an international term describing many limestone landscapes. It was therefore especially appropriate that the Fourth International Congress of Speleology met in Ljubljana, Yugoslavia for a full program of excursions, special lectures, and technical sessions. The official period of the congress, 12–26 September, was preceded by excursions which gave participants an opportunity to inspect in detail several karst areas of Slovenia having special interest. One excursion consisted of a three-day walking trip into the Julian Alps; another, largely a bus tour, visited the Classic Karst between Postojna and Triest. For the more adventuresome, trips were also conducted into some of the large river cave systems.

The congress was officially opened in a chandelier-lit chamber of the famous and beautiful Postojna cave

(once *Adelsberg* cave) where some 360 delegates and participants from 26 countries were greeted by the congress president, G. Novak (Yugoslav Academy of Sciences and Arts). The amenities and festivities of these and other nontechnical occasions were outstanding, even if seemingly irrelevant to the progress of a science as such.

The technical sessions were held at the University of Ljubljana. As in previous congresses, the general divisions were: general physical speleology and karst hydrology; regional speleology; biospeleology; paleontology and prehistoric speleology; and exploration techniques, documentation, and exploitation of caves. Over 200 papers were presented.

In the category of physical speleology were a heterogeneous display of work in cave topology or structure and relations to geological structure; fundamental work in the physical chemistry of limestone solution and its implications in karst and cave development; meteorology, or more properly climatology, of interior cave environments; and the mechanisms and mineralogy of secondary cavern deposits. A trend in studies in this area was indicated by a significant number of papers on the composition and tracing of water in caves and karsts. Attempts were made to relate these to local and regional processes.

Biospeleology is, and will remain, an area of intensive study. The adaptation, evolution, distribution, and habits of obligative troglobytes, in the near constant cave environment, bears significantly upon understanding these mechanisms in epigean organisms. Topics ranged from descriptions of the cavernicolous ensembles in particular cave systems to studies of circadian rhythms (apparently absent), and temperature preferences of related cave beetles. The question of how organisms adapted to the cave environment arose remains of central interest.

Caves have long been invaluable as preservers of remains of archeological and paleontological importance. These, however, cover such a wide span of time that one feels that some subdivision would be appropriate. Nevertheless, the consideration within one division of the congress presented extremely stimulating comparisons between paleolithic faunal and habitat remains; medieval relations between castles and caves; and modern "live" simulation of travel and illumination by Early Woodland American Indians in Kentucky caves.

All studies of caves are presented with a fundamental problem in logistics—how to get in, investigate, and return with safety and some elements of convenience and comfort. For this reason the efforts of the explorer are invaluable for the pursuits of the scientist. At the same time the introduction of the explorer or investigator into a cave system disturbs the environment to a lesser or greater extent. This fascinating interrelationship of man and cave, in all its multiple contexts, came under consideration in the form of such topics as cave tourism and its relation to both national economics and cave conservation; photographic and other methods of cave surveying; classification and terminology for cave and karst features; cave accidents, search, and rescues; and equipment for cave exploration, diving, rescue, and living.

During the sessions in Ljubljana a number of bus excursions were held to nearby areas of karst. For the period 17–26 September, participants went on tour again through the Dinaric Karst, with the official termination of the congress taking place in Dubrovnik.

The first three international congresses of speleology, held in France (1953), Italy (1958), and Austria (1961), as well as this one in Yugoslavia, were arranged by local committees. This will continue to be the procedure for future congresses. However, it was inevitable that from international meetings would come plans for international cooperation. In the past this has taken the form of commissions formed at one meeting and reporting at the next. In the interim such commissions carried on their activities by correspondence. Those meeting and reporting at the fourth congress were concerned with the longest and deepest caves of the world, cave dating (speleochronology), cave and karst terminology, and map symbols. Established at this congress were a commission for the study of problems of karst denudation and another on cave tourism which will take upon itself the organization of symposia on this subject at future congresses. The congress also gave the "Vereinigung für hydrogeologische Forschungen in Graz" (Austria) a mandate to hold a meeting in 1966 and otherwise proceed as necessary toward organizing sessions at the fifth congress on stream tracing in cave systems.

With this degree of existing continuity between congresses it had become apparent that an international body was needed to coordinate the work of commissions between meetings as well as to plan for an increasing cooperation between nations in many areas of speleology. For example, such a group could establish relations and cooperation with related international groups, such as the International Unions of Geography, Geology, the Quaternary Association; publicize the many speleological colloquia, symposia, and national meetings in each country; and obtain financial aid for the international congress. At this congress the assembled delegates passed a resolution to establish an International Union of Speleology (UIS). The first provisional officers were elected and seated at the closing plenary session, and the statutes of the Union were accepted.

The first president of the UIS is Bernard Geze (Institute of National Agronomy, Paris, France); the vice presidents are Gordon Warwick (University of Birmingham, England) and Stjepan Mikulec (University of Sarajevo, Yugoslavia). The general secretary is Albert Anavy (International College, Lebanon). The charter members are the national speleological bodies of Australia, Belgium, Bulgaria, Congo (Brazzaville), Czechoslovakia, Denmark, East Germany, France, Great Britain, Greece, Hungary, Ireland, Italy, Japan, Lebanon, Poland, Roumania, Spain, Sweden, Switzerland, Turkey, United States, U.S.S.R., West Germany, and Yugoslavia. (Austria abstained pending instructions from its Speleological Federation.) Each member delegation has two representatives in the General Assembly of the Union.

The Fifth International Congress of Speleology will be held in Stuttgart, Germany, in either 1968 or 1969 with the "Verband der Deutschen Hohlen und Karstforcher" as host. Further information about this and interim local speleological meetings may be obtained from the general secretary of the UIS, at Beyrouth. A.U.B.-P.O.B. 236-1340, Lebanon. The papers of the fourth congress will be published by the organizing committee, Fourth International Congress of Speleology, Ljubljana, Yugoslavia.

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