region of mountains estimated to rise in peaks of from five to eight thousand feet, the source of numerous important rivers, whose mouths are often separated by great distances, and whose courses trend to almost every point of the compass, from the mountain reservoirs where they take origin.

Late advices from Zanzibar state that the four explorers sent to the Ussagara by the German colonization society have been very unfortunate. They halted between Mpuapua and Condoa, where one died. Dr. Peters and Herr Baumann, stricken with malignant fevers, were obliged to return to Zanzibar in a serious state, while the leader of the party was left alone on the spot in a condition of great destitution. Aid was immediately despatched by the German traders of Zanzibar, which, it is hoped, will ameliorate his condition.

Two other German explorers, the brothers Denhart, sent by the Berlin geographical society, had arrived at Zanzibar, where they were joined by Herr Schlumke, for the last five years an explorer with Dr. Fischer.

The party intend to visit Samburo Lake, and explore the region of the Borani Gallas, as well as to explore the geology and botany of the upper parts of Kilimanjaro and Kenia.

The death of King Mtesa is confirmed. Those interested in the civilization of the country believe his successor will be more likely to assist in the process than the late king, whose volatility and caprice more than undid the good resulting from his occasional favors. Mirambo, sometimes known as the negro Napoleon, is also dead. He was noted for his courage, great intelligence, and semi-civilization. His death is likely to plunge the population of a vast region into anarchy; for by his ability, in spite of his humble birth, he had brought into submission a large territory, and made all the neighboring sultans his vassals.

The Algerian fathers have selected a healthy spot for their mission on the west bank of Lake Tanganyika, at a village called Chonsa, in about latitude 7° 30′. The natives are friendly, and the country a safe one.

Lieut. Becker's expedition had not started, and the difficulty of getting a sufficient number of porters was very great. This seemed due to the famine, which continues to desolate the interior, and to the uncertainties connected with matters in the basin of the Kongo.

A rumor has reached Paris through Bolivia, from the Gran Chaco region, that certain country-people, travellers in the interior, had found in the forest bits of paper and linen on which one of the Crevaux party had written his name in blood, together with an appeal for succor, and the statement that he had been spared by the Tobas on account of his skill as a musician, and had been obliged to follow the band which held him captive in all their wanderings since the massacre. The story, which has found a place in the printed proceedings of the geographical society of Paris, is, nevertheless, probably an invention of the 'travellers in the interior.'

An important journey has recently been made by a party commanded by Feilberg on behalf of the Argentine Confederation. Their object was to explore the trade-route between that country and Bolivia *via* the Pilcomayo. They comprised sixty-two men, with flatboats towed by two small steamers, and were absent fifty-five days. The actual distance in a direct line was probably forty-five leagues; but, taking the sinuosities of the river into account, the party travelled about eighty leagues. Up to this point, the navigation was not bad except for snags and sunken tree-trunks in the channel, but here it became impossible on account of a series of rapids which descend over a rocky surface with only a few inches of water, though the river was in flood. The question of a trade-route by this way is therefore definitely settled in the negative. The party found that below the rapids, sixty leagues above the mouth, a large affluent came into the Pilcomayo, with as much water, or perhaps even more, but which is not found on any chart. It was obstructed by sunken trees, but otherwise showed no impediments, and was ascended for twelve leagues. Feilberg hopes to explore it farther. The country along these rivers appeared healthy, and rich with fine pasturage. It appears now to be certain that the only feasible trade-route will be one carried overland.

THE AMERICAN FISHERIES SOCIETY.

THE fourteenth annual meeting of this society was held in the lecture-room of the National museum at Washington, May 5–7; the president of the society, Hon. Theodore Lyman, in the chair. The attendance throughout was fair, and the papers were, for the most part, exceedingly interesting. The roll of membership now includes about a hundred and fifty names, twenty-four new members having been elected during the meeting.

Prof. R. E. C. Stearns read a paper on the giant clams of Puget Sound. He referred to Glycimeris generosa as the 'boss clam' of North America. It was first described by Dr. Augustus A. Gould from specimens (probably of the shells only) obtained by the Wilkes exploring expedition, 1838–42. The distribution of this clam extends southerly along the west coast of America to San Diego, where it has been found by Mr. Hemphill; and it is more abundant in its northern than in its southern habitat. It is an excellent article of food, and is called by the Indians *geoduck*. It has been known to attain a weight of sixteen pounds, and a length of from one and a half to two feet.

A paper by Dr. James A. Henshall, on the hibernation of the black bass, was read by Mr. Mather. The writer advanced the theory that hibernation was a voluntary act, and did not necessarily involve a state of profound torpidity. He admitted that other fish were active in the same waters where black bass were hibernating, but accounted for this by saying that there was no supply of food for the bass. In the

extreme south, where crawfish were abundant, it did not hibernate; so that he considered hibernation to be the result of lack of food, rather than of temperature. Mr. Goode, in discussing this paper, regarded hibernation as purely a matter of physical cause and effect, holding that the hibernation or non-hibernation of the black bass in a given latitude depended entirely upon the temperature of the warmer retreats accessible to the fish. Black bass always hibernate in shallow bodies of water in cold climates.

Mr. Fred. Mather, in a paper on smelt-hatching, gave an account of some experiments in hatching the smelt Osmerus mordax, which seemed to indicate that quiet, almost stagnant water, and the presence of slime and fungus, were beneficial rather than detrimental to the proper and rapid development of the eggs.

Mr. F. W. True read a paper on the porpoise fishery of Cape Hatteras. This fishery was regarded as in its infancy in this country, and capable of great development if the animal could be taken in sufficient quantities to secure the introduction of its oil and leather into the markets. The company recently formed at Cape Hatteras by a party of Philadelphia capitalists hoped to utilize the meat of the porpoise for food. It is estimated, that, at the close of the present season, not less than four thousand porpoises would have been captured by this company. Mr. Goode thought, that, if the flesh could in some way be divested of its oily taste, it might be a very palatable article of food. He had while in London, in 1883, tasted some whale-flesh (put up in Norway in hermetically sealed cans), and spoke of its resemblance in flavor to beef *à la mode*. The oil he considered superior, for lubricating-purposes, to any other animal oil, but thought that its present high price would prevent it from coming into general use. He also said that in Europe boots made from porpoise leather were held in high esteem, and cost from fifteen to twenty dollars a pair. He considered the leather as most desirable for belting and lacing purposes. Mr. Lyman expressed his belief that the products of the porpoise fishery might be made of considerable commercial value, provided the animal could be taken in sufficient quantities.

Mr. Frank N. Clark gave some results of artificial propagation and planting of white-fish in the Great Lakes.

Mr. A. Nelson Cheney submitted a paper entitled 'Does transplanting affect the food or game qualities of certain fishes?' This was followed by a paper by Mr. J. S. Van Cleef, on 'How to restore our trout-streams.'

Dr. Tarleton H. Bean exhibited a nearly complete series of salmon and trout of North America, showed a species of Oncorhyncus, Salmo, and Salvelinus. He said that the species could be, for the most part, very well identified by a single character. In the genus Oncorhyncus, O. chouicha might be known by its very large number of branchiostegal rays, and the numerous pyloric coeca; O. nerka, by its large number of gill-rakers, usually about forty; while none of the other species have more than twenty-seven. O. kisutch has but few pyloric coeca, — seventy to eighty. O. gorbuscha has very small scales; so much smaller than any other species of this genus, that this character alone will suffice to distinguish it. O. keta, the last species, resembles O. chouicha in most respects, but has a smaller number of branchiostegal rays.

The species of Salmo are easily divided into two groups, one of which has hyoid teeth, the other having none. Of the first group there are two small-scaled species, — S. Gairdneri; and its fresh-water form irideus, in which the scales are never in more than a hundred and fifty longitudinal rows. The small-scaled form S. spilurus, with its offshoot S. pleuriticus, has sometimes as many as two hundred scales in the longitudinal series. The group with hyoid teeth includes Clark's trout, S. purpuratus, with its varieties, Bouvieri, stomias, and Henshawi.

The species of Salvelinus divide themselves into two great groups, the first of which has a tooth-bearing crest on the vomer. This is represented by namaycush and its variety siscowet. All of the other Salvelini are red-spotted, and have no crest on the vomer. These are again divided into two great classes, one having hyoid teeth, and the other having none. The Salvelini with hyoid teeth are oquassa, naresi (which is a near relative of oquassa), arcturus (the most northerly salmonoid known), malma, the Pacific red-spotted char, and salvelinus (which has been introduced into New England from Bavaria). The group without hyoid teeth includes fontinalis, known in the searun condition as immaculatus, and in its northern habitat varying into hudsonicus of Suckley. It is a giant in this genus, reaching a weight of fifteen pounds. This Labrador form has a larger number of gill-rakers than the common fontinalis, and there seem to be fewer tubes in the lateral line; so that we may be obliged to consider it as a species distinct from fontinalis. The last species of this group is S. stagnalis, a Greenland species, which reaches a large size, and is distinguished by its greatly elongate form.

The three species recently introduced from Europe into America are Salvelinus salvelinus (already mentioned), Salmo levenensis (the Loch Leven trout of southern Scotland and northern England), and Salmo fario (the river-trout of central and northern Europe and England).

The species of Salvelinus, both eastern and western, attain their greatest development in the northern portion of their habitat. Thus the S. malma of the west coast is represented in the national museum by examples more than two feet in length from Alaska; and the Labrador form of the eastern brook-trout bears more resemblance in size to a Maine salmon than to any thing else. Another noticeable fact about our salmonoids is that almost all of the western forms are black-spotted, while all but one of the indigenous eastern forms are red-spotted.

Col. McDonald, in a discussion of the 'Objective points in fish-culture,' presented an argument for a more extended application of the methods of scientific research, showing how exceedingly valuable to fish-

culture would be a more perfect knowledge of embryology, of the physical conditions of the waters, and the influence of temperature upon the movements of fish, etc.

Mr. W. V. Cox gave the audience a 'Glance at Billingsgate,' describing the location and general arrangement of this celebrated fish-market, and the daily methods of transacting business. He called attention to the fact that there was a great need for the introduction of a system of cold storage similar to that employed in the United States.

Mr. Fred. Mather gave an account of his work at Cold Spring Harbor. Statistics were presented showing the numbers of the various species hatched out under his direction, and a brief explanation as to his methods of operation was added.

Mr. Eugene S. Blackford read a paper on the oyster-beds of New York, containing a very instructive account of the present condition of the oyster industry of New York. In the course of his remarks, it was made to appear that the supply of oysters was much greater at present than ten or twelve years ago, and that, by a careful continuance of the methods of protection and planting, there was not the slightest doubt that the most successful oyster industry in the world would become developed in the waters of Long Island Sound.

Mr. John A. Ryder presented a paper on some of the protective contrivances developed by, and in connection with, the ova of various species of fishes. He classified the eggs of fishes into four divisions, — 'buoyant,' 'adhesive,' 'suspended,' and 'transported;' this last including such eggs as are hatched in the mouth, or in receptacles especially developed on the outside of the abdomen, or under the tail of the parent fish (usually the male), such as are hatched in nests built by the males, or are viviparously developed in the ovary or the oviduct of the mother. The egg of the cod was the type of the first division, buoyant, but without an oil-drop. The egg of the Spanish mackerel, bonito, cusk, and many other marine fishes, is buoyant, and with an oil-drop opposite the germinal pole, where the embryo develops. The second group was represented by the egg of the goldfish, which adheres singly to plants and weeds. The blennies lay eggs in radiating, adherent groups. The gobies, gobieso, yellowpeids, and many other forms, belong to this group. As an example of 'suspended' eggs, he referred to the common oviparous ray, which has four filamentous horns, one at each corner, which wind around plants, and suspend the eggs to weeds; so that as the tide sweeps by these horns, which have openings in them, fresh water is carried into the egg-case to aerate the embryo, and favor its incubation. In the Scombresocidae the entire egg-membrane is covered with strong filaments, which intertwine with those of contiguous eggs; and thus masses of eggs are suspended, sometimes several inches in length. The Apeltes, or four-spined stickleback, was cited as an example of the fourth group. The male has a pouch on the right side of the rectum, from which is poured out a viscid secretion, and which is spun out into threads fitfully by the animal, as he goes round a bunch of waterweeds, like a bobbin, to build a little basket-like nest for the eggs. Callichthys also builds a nest, while Antennarius and fishing-frogs of the deeper ocean deposit their eggs on masses of sargossa-weed. Reference was made to the number of salmonoids that prepare beds for the better protection of their eggs. This was also done by the black bass, sun-perch, and lampreys.

Prof. O. T. Mason, in a paper describing the use of the throwing-stick by the Eskimo in fishing, said that the most interesting of modern ethnological studies is the tracing of human arts from their birth through the different stages of their evolution. Many savage devices live on in civilization; but there is one, the Eskimo throwing-stick, which is not only one of the most ingenious of aboriginal devices, but one which has not survived in more highly cultured peoples. An account was then given of the manufacture, use, and distribution of this implement.

Professor Theodore Gill presented a paper entitled 'The chief characteristics of the North-American fish fauna.' He restricted his remarks to the fresh-water forms alone. He described America north of Mexico as a primary, terrestrial-aquatic realm, variously designated as the North-American, nearctic, and Anglogaean region or realm. It is one of the very richest in fresh-water types, more than six hundred species living exclusively, or nearly so, in the rivers and lakes. These species represent a hundred and fifty genera, and about thirty-five families. The North-American fish fauna may be segregated into two primary categories: 1°, arctogaean, including those families which are shared with Europe and northern Asia; and, 2°, those peculiar to this continent, which are the Amiidae, Hyodontidae, Percopsidae, Amblyopsidae, Aphredoderidae, Elassomidae, Centrarchidae, and several sub-families, as the Etheostominae, Hoplodinotinae, and Hysterocarpinae. Of the fresh-water species and genera of most of the families, some are anadromous; others inhabit salt and fresh water almost indifferently; and still others are catadromous, as the eel, which appears to breed only in the sea. The number of genera common to Europe and North America is extremely small. It is noteworthy that the number of the types peculiar to America are distinguished by the care which the parents take of their young, whereas the European forms are generally indifferent. The care of the eggs and young seems to be accompanied by an apparent diminution of the number of eggs; and in this respect there is a kind of analogy between fish-culturists and parents. The fish-culturists assume the part which, in nature, is exercised by the attentive parent; and the eggs and young, being provided for, stand less danger of destruction, and consequently in such the ratio between the eggs laid and fertilized, and the young matured, is very much less than that between the number of eggs of indifferent parents, and that of other progeny matured.

On Thursday, at noon, the members of the society, through the courtesy of Professor Baird, went on the U. S. fish-commission steamer Fish-hawk, for a trip down the Potomac River, to visit the shad-hatching

station at Fort Washington, and some of the Potomac fishing-shores. Col. McDonald, in charge of the fish-hatching station, displayed the apparatus for, and explained the process of, hatching shad and herring eggs at all the various stages. After the roe is taken from the fish and cleaned, it is put into glass tanks, through which the water is allowed to flow constantly. About forty-eight hours are required to hatch out the eggs. A shad a day old looks like a hair with two black spots attached to the end. When two days old, they measure about one-fourth of an inch in length. In twelve days the whole body is distinguishable. The spawn are not, as a rule, kept at this hatching-station more than thirty-six hours; at the end of which time, just previous to hatching, the eggs are placed in crates, and brought to the principal station at the armory building, near the national museum, where the final stages of incubation occur. The commission has this year hatched five million shad-eggs. The herring yield has been much larger, as the catch of this fish in the Potomac has been unusually abundant; nor are so many eggs of the herring destroyed during the process of hatching as of shad. The commission employs eighteen men at Fort Washington, who are constantly kept busy preparing the spawn and eggs for transportation. The day before the party visited this station, sixty thousand shad-eggs were taken. After the hatching process had been explained to the visitors, they were summoned to refreshments, which had been provided in one of the frame buildings belonging to the commission. The principal dish was 'planked' shad. By this process four fish are fastened to a board, and held towards a hot fire. Whilst cooking, the fish are constantly basted with a preparation made of butter, salt, and other ingredients. At a meeting on board the vessel, the commissioner of agriculture made some remarks on fish-culture in the west, and Col. Marshall McDonald offered an address on our fishing interests in general, and the work of the society in particular.

The following officers were elected for the present year. President, Col. Marshall McDonald, Washington. Vice-president, Dr. William M. Hudson, Hartford, Conn. Treasurer, Eugene G. Blackford, New York. Corresponding secretary, W. V. Cox, Ohio. Recording secretary, Fred. Mather, New York. Executive committee, G. Brown Goode, Washington; F. L. May, Fremont, Neb.; Roland Redmond, New York; J. A. Henshall, Cynthiana, Ky.; Frank N. Clark, Northville, Mich.; S. G. Worth, Raleigh, N.C.; George Shepard Page, Stanley, N.J.

INLAND NAVIGATION OF EUROPE.[1]

THE lower parts of the chief rivers of the United Kingdom are mostly arms of the sea, navigable at high water by ships of the largest burden. The principal waterway, the Thames, is navigable for about 194 miles, and is united by means of a grand network of canals with the Solent, the Severn, the Mersey, the Humber, and the Trent, being thus in direct communication not only with the English and Irish channels, but also with every inland town of importance south of the Tees. The estimated length of inland waterways in the United Kingdom is 5,442 miles, which has been constructed at a cost of £19,145,866.

Russia's principal highway is the Volga, the largest river in Europe, which affords, with its tributaries, 7,200 miles of navigation. Hitherto no permanent works have been undertaken to improve the navigation of the Volga, but dredging has been resorted to in the lower part of the stream; and recently a system of scraping by iron harrows has been employed, which has doubled the depth of water over certain shoals in a few days. Other important water communications in Russia are the Caspian; the River Don, 980 miles in length; and the Dnieper, with a course of 1,060 miles. Of secondary rivers, the Bug, the Dniester, the Duna, and the Neva are all navigable. In the case of the latter short but most important means of communication, a maritime canal 18 miles in length has recently been completed to unite Cronstadt with St. Petersburg. About 900 miles of canal have been constructed in European Russia. In most instances they have been built to connect the head waters of rivers which had their outlets at opposite extremities of the continent.

Sweden abounds with lakes; but none of the rivers are navigable except those which have been made so artificially, nearly all of them being obstructed by cataracts and rapids. Nevertheless, Sweden possesses remarkable facilities for internal navigation during the seven months that the country is free from ice, intercourse being carried on by means of a series of lakes, rivers, and bays connected by more than 300 miles of canals.

Germany owns parts of seven river-valleys, and three large coast-streams. Of these, the Weser is the only one which belongs wholly to Germany, while of the Danube but one-fifth part runs through her territory. The inland navigation of Germany is of the most advanced character, an immense trade being carried on by means of barges and rafts. In the case of the Elbe, the system of towing by submerged cable has taken a large development. As early as 1866 chain-tugs were running on 200 miles of its course; and in 1874 this mode of traction had been so increased that there were then twenty-eight tugs running regularly between Hamburg and Aussig. These tugs are 138 to 150 feet long, 24 feet wide, with 18 inches draught. On the upper Elbe the average tow is from four to eight large barges, and, taking the ice into consideration, there are about three hundred towing-days in the year. Although Germany possesses a length of nearly 17,000 miles of navigable rivers, or more than double the combined length of the navigable streams of the United Kingdom and France, it cannot be said to be rich in canals. In South Germany the Regnitz and Ludwig canals, from the Main at Bamberg to the Danube, were the only ones of importance until the annexation of Alsace-Lorraine.

[1] From a lecture by Sir C. A. HARTLEY before the Institution of civil engineers.