had to be taken out; a slight error in these calculated weights, or the presence of bilge water in either ship, might affect the results sufficiently to account for the difference.

In any case, it is reassuring to know that in respect of her seaworthiness the "New Orleans" is indorsed both by naval constructors and by the line officers who have sailed her in every kind of weather. The captain of a ship is always particularly alive to anything in the motions of his vessel in a seaway that betokens a lack of stability. He has a quickness of perception, born of long experience, which would detect this unpardonable fault at the first indication of its existence; yet we are assured by those who have had charge of her that even in the light condition she has shown ample evidence of stability.

## DOUBLE-DECK TURRETS.

We understand that at the last meeting of the Naval Board of Construction it was decided, after exhaustive discussion, to adopt the double-deck turret, as installed on the "Kentucky" and the "Kearsarge," for the three new 13,500-ton battleships whose construction was authorized by the last Congress. There is no feature of our battleships which has been the subject of more heated discussion among naval experts than this form of turret. Both in the Bureau of Construction and among the line officers are to be found those who ardently advocate and others who are bitterly opposed to the system.

As we expect to discuss this matter more fully in a subsequent issue, we will merely state just now the leading arguments for and against this type. It is argued in its favor that it enables an equal energy of all-round fire to be obtained from a smaller number of guns; that it affords an unusually complete protection for the ammunition hoists and turning gear of the 8-inch guns; and that it provides the same energy of gun-fire and protection for considerably less weight. On the other hand, it is contended that the placing of four heavy guns in a single structure is bad policy, on the ground that it is placing "many eggs in one basket," a single lucky shot being liable to put the whole four guns out of action. It is also urged that the 8-inch and 12-inch guns would be at all times trained upon one and the same part of the vessel, whereas it might be desirable to use the heavier guns for the attack of one part of the ship and the 8 inch guns for the destruction of parts less heavily armored.

We think that the board would have done better before arriving at a final conclusion of this most important subject if it had awaited the report on the trials of the double-deck turrets of the "Kearsarge," which are shortly to be carried out. Only the actual firing tests, carried out under all conditions of weather, can detect whether there are faults hitherto unsuspected in the double-deck system.

## INTRODUCING MARINE ANIMALS INTO GREAT SALT LAKE.*

BY H. F. MOORE.

The possibility of introducing into Great Salt Lake fishes and other animals of economic value which normally have their habitats in the salt and brackish waters of the sea and its estuaries has been called to the attention of the United States Fish Commission at frequent intervals, but until 1898 the opportunity to make the inquiry did not present itself.

It was recognized that the area which would possess the requisite physical characteristics could not be very extensive, and that there was little hope of introducing marine fishes, for Great Salt Lake holds salt water of a density which could not be endured by ordinary marine organisms. Where fresh water flows in there is formed a narrow zone of a density approaching that of the sea, lying between the fresh water on the one hand and the salt on the other. This zone occurs only near the mouths of streams, and its limits are so circumscribed as to allow but small latitude for the wandering of marine organisms possessing active powers of locomotion, and they would be restricted in one of their most important functions, and be in constant danger of wandering into the surrounding water, where the conditions would be fatal.

The oyster, on the other hand, is a sessile organism and, if its immediate surroundings be favorable, a restricted area does not prohibit oyster culture of a certain character, except insomuch as it restricts the number of oysters which it is possible to raise. Oysters will live in water of a density or specific gravity between 1·002 and about 1·0024, but near the limits mentioned they are inferior in quality and of but little value as food. In water of low density they become poor, flabby, and tasteless, while near the upper limits of their adaptability they become small and almost worthless, as may be seen in the mangrove oysters in certain parts of the South and in some of the West Indies. To raise oysters of the best quality it is necessary to have the water of such salinity as will give a specific gravity of between 1·010 and 1·020. Preliminary experiments had shown that diatoms, which constitute the chief food of the oyster, would grow in Salt Lake water when it was reduced in density within the limits in which the oyster would thrive, and it was believed that they would be actually found in the lake under the same density conditions. This assumption was afterward verified by the investigation.

The inquiry embraced the question of the feasibility of introducing not only the oyster, but also crabs and fishes.

From its configuration, and from the information which it was possible to acquire by correspondence, Bear River Bay was selected as the first and principal point for investigation, although, after the unfavorable result of the examination there, inquiry was directed to all other places which offered any promise of success.

The proportional constitution of the saline contents of the waters of Great Salt Lake is not vastly different from that of salt water. Great Salt Lake is salt, and not alkaline. The physiological effect of its waters probably would not seriously differ from that of seawater were it not for its high density, but to attempt to introduce marine animals into water having a specific gravity of 1·168, when they have become adapted by nature to a density of but 1·025, would be an utter waste of effort.

During the writer's visit to Great Salt Lake, he several times heard the opinion expressed that the extraction of salts from the lake through the several agencies acting in that direction would, in time, result in a reduction of its density to a degree which would solve the problem of the introduction of marine forms. Seeing the great quantities of salt at the salt ponds, and not appreciating the vast stores of the lake, the mistake is not unnatural. About 50,000 tons of salts are annually taken from the lake for commercial purposes, but less than 84 per cent, or about 42,000 tons, of this is sodium chloride. Basing the calculation upon Gilbert's estimated accumulation period of twenty-five thousand years, the annual influx of salt from the tributaries is about 16,000 tons, making the net loss about 26,000 tons. The lake at present holds about 400,000,000 tons of common salt with a water density of 1·168. A greater density than about 1·020 is not favorable to the oyster, and to reduce the lake to that degree of salinity, its volume remaining unaltered, would necessitate the extraction of about 360,000,000 tons of sodium chloride, and at the present rate of loss this would require a period of nearly fourteen thousand years. It is not considered that the prospect is such as to require very serious attention at present and the niceties of computation have been neglected.

It is evident that as Great Salt Lake rises during an annual or a non-periodical elevation, the general density of the lake water must decrease, for the increased volume is due to the addition of fresh water, and the total quantity of salt in the lake remains practically the same. During a period of subsidence the contrary is true.

Even should there be found a limited area where the density conditions were such as could be endured by the adult oyster, it would, nevertheless, be impossible to establish self-sustaining beds—that is, beds annually replenished by young oysters produced thereon. The young oyster is, for the first few days of its independent existence, a delicate free-swimming organism, extremely sensitive to sudden changes in its environment. A density variation of but a few degrees is sufficient to kill it, and the eggs are not even capable of efficient fertilization in water differing very much in salinity from that in which the parents lived. It can be readily seen that with an organism so fatally responsive to changes of environment there could be practically no hope of securing a successful set of young oysters, and the bed could only be maintained by annual importations from the seacoast.

The objections to the planting of fish, oysters, etc., in Great Salt Lake are based on physical rather than biological conditions. There is an abundant food supply, the water teeming with brine shrimps and insect larvæ. The available fish food exceeds in quantity that usually found in the sea, its abundance being largely due, no doubt, to the fact that there are no fish to consume it. The lake is also exceedingly rich in minute plants, especially diatoms, which constitute the chief food of the oyster, but from a practical point of view this fact has no value when we are confronted by the absolutely prohibitive physical conditions which the present examination disclosed.

There is much greater probability of attaining valuable results by introducing cat-fish into the fresh sloughs near the mouths of the rivers than by attempting the introduction of marine species into the lake.

* Condensed from a Report to the United States Fish Commission, entitled: "An Inquiry into the Feasibility of Introducing Useful Marine Animals into the Waters of the Great Salt Lake." Report for 1899, pp. 229 to 250, with map.

## DEATH OF PROF. EDWARD ORTON.

We regret to note the death of Prof. Edward Orton, who died at his home on October 16. Prof. Orton was one of the foremost of American geologists. It will be remembered that he was President of the American Association for the Advancement of Science for the current year, the meeting being held at Columbus, Ohio, last August. We gave an extended biography and portrait of Prof. Edward Orton in the SCIENTIFIC AMERICAN for August 19, 1899.

## NEW YORK'S COAST DEFENSES.

The annual report of General Wilson, Chief of Engineers, which has just been issued, deals exhaustively with the plans for coast defense around New York. The large appropriations of recent years have permitted rapid progress. Some of the batteries are to be lighted by electricity, and a plant for this purpose has been established. The mines planted during the war with Spain have been taken up, cleaned and stored. The report states that the experience of last year makes it essential that the engineer corps should have authority to prevent trespass on mine fields in New York Harbor, by shipping. At the southern entrance to New York Harbor emplacements are almost completed for the accommodation of sixteen 12-inch mortars, two 12-inch breech-loading rifles on lifts, thirteen 10-inch and five 8-inch guns on disappearing carriages, besides minor artillery. The coast defense of the United States at present consists of the following: Of guns mounted, there are twenty-seven 12-inch, eighty-three 10-inch, fifty-nine 8-inch, forty-six rapid-fire guns and one hundred and seventy-six 12-inch mortars. Ready for armament, there are thirty-nine 12-inch, twenty-seven 10-inch, twenty-five 8-inch, one hundred and fifteen rapid-fire and sixty 12-inch mortars. Under construction there are nineteen 12-inch guns, eight 10-inch guns, ten 8-inch guns, one hundred and twenty-two rapid-fire guns and one hundred and eight 12-inch mortars. In addition to this there are twenty-five rapid-fire guns which are not yet begun. This will make, when all are completed and mounted, eighty-five 12-inch guns, one hundred and eighteen 10-inch, ninety-four 8-inch, three hundred and eight rapid-fire guns, three hundred and forty-four 12-inch mortars. It is assumed that $4,800,000 will be required for the defense at Porto Rico.

## A SEED-TESTING PLANT.

The Agricultural Department is putting the finishing touches on a plant whereby it will be able to more thoroughly protect itself, farmers, and seedsmen generally against dishonest or careless persons who impose on their customers by selling bad seeds. A seed-testing house is being erected, comprising a store and packing house 30 × 20 feet and a hothouse 80 × 18 feet, in which germination tests will be made. For years these tests have been made by the botanists in various parts of the department's main building; but the work has so grown in importance and magnitude that a special building has become necessary. According to Botanist F. V. Colville, "From tests in the past it is evident that there is great carelessness in planting and harvesting seeds, and also, undoubtedly, much sharp practice is indulged in by dealers, who mix seeds of very inferior grade or of an entirely different variety with good seeds and sell the stuff as the best quality of seeds." For example: "A lot of meadow foxtail seed from Germany was only 27·5 per cent pure; it cost 35 cents a pound and was adulterated with seed worth only 10 cents. Of seeds purchased in the open market, the tests showed orchard grass 53 per cent bad; redtop clover, 73 per cent; a lot of crimson clover, 98 per cent bad; and some Hungarian brome grass that failed to germinate at all." It is to defend our agriculturists against such frauds as this, especially, that the new system is being established.

## RECENT APPLICATIONS OF ELECTRO-METALLURGY.

In a paper on this subject, read before the British Association by Mr. Cowper-Coles, says The Journal of the Society of Arts, an electrolytic process for the manufacture of reflectors was described, suitable for making parabolic reflectors for search-lights. The process consists in using a glass convex mould, on which is chemically deposited a coating of metallic silver. The mould thus prepared is immersed in an electrolyte of copper sulphate, the mould being rotated in a horizontal position, the number of revolutions being about 15 per minute. The copper adheres firmly to the silver, and together they form the reflector, which is subsequently separated from the glass mould by placing the whole in cold or lukewarm water, and then gradually raising the temperature of the water to 120° Fahr., when the metal reflector will leave the glass mould, due to the unequal expansion of the two. The concave surface of the reflector obtained is an exact reproduction of the surface of the mould; it has the same brilliant polish, and requires no further treatment to answer all the purposes of a reflector, with the exception that it must be coated with a film of some suitable metal to prevent its tarnishing. Palladium is found to answer this purpose best, as a bright coating can be deposited rapidly to any desired thickness. Palladium resists tarnishing and the heat of the arc to a wonderful degree.