SPECIAL ARTICLES

OCEANOGRAPHIC INVESTIGATIONS IN THE INSHORE WATERS OF THE GULF OF MAINE

IN the summer of 1929 a study of the biological, chemical and physical conditions of the inshore waters of the Gulf of Maine, in the vicinity of Mt. Desert Island, Maine, was undertaken by the Buffalo Museum of Science in cooperation with the Mt. Desert Island Biological Laboratory and Brown University.

The general plan of the work was divided and carried out by the various investigators as follows: Biological oceanology by Charles J. Fish; chemistry by Norris W. Rakestraw, and physical oceanography by H. R. Seiwell. Mrs. Charles J. Fish and Mrs. H. R. Seiwell assisted in the laboratory examinations of field data.

The field observations extended over the period from July 8 to August 21; investigations were made from Dyers Bay on the east (station 14) to Penobscot Bay on the west (station 18), and from the head of Frenchmans Bay on the north (station 2) to a point about fifteen miles south of its mouth (station 11).

The most intensive study was conducted at the eight stations established in Frenchmans Bay, four complete and two partial cruises being made in this region. Two sets of observations were made over the section extending from the head of the bay (station 2) to a point about fifteen miles south of the mouth (station 11). The small bays lying to the east were visited only once as also was Sommes Sound, and two sets of observations were taken each in Blue Hill and Penobscot Bay.

The arrangement of stations in the region was (Fig. 1): stations 1 to 8 were in Frenchmans Bay; stations 9 to 11 were to the south of Frenchmans Bay and were, together with stations 2, 7 and 8 of Frenchmans Bay, included in the north-south hydrographic section; stations 12 to 14 were in the smaller bays to the east of Frenchmans Bay, and stations 16 to 18 were in Sommes Sound, Blue Hill Bay and Penobscot Bay, respectively, to the west of Frenchmans Bay. In all a total of eighteen stations were worked at least once and usually twice or more, at which a total of 228 hydrographic observations were made. In addition ninety plankton collections were made from the surface and bottom water of the stations.

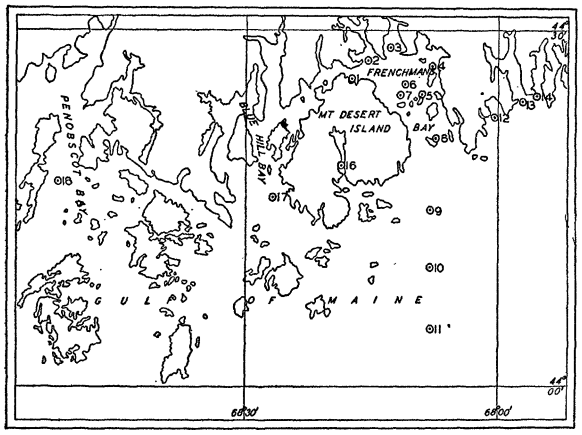

FIG. 1. Region of hydrographical investigations in the vicinity of Mt. Desert Island, Maine, July and August, 1929. Hydrographic stations marked thus— ⊙

The hydrographic observations embodied the collection of temperature data and water samples for chemical analyses, from the surface, intermediate and the bottom depths. After a little experimentation it was found desirable to make all vertical hydrographical observations whenever possible at depths of 0, 5, 10, 25 meters and the bottom. All water samples were collected with Greene-Bigelow reversing water bottles to which were attached Negretti and Zambra deep-sea reversing thermometers. Six-millimeter wire was wound on a hand reel and passed over a Bergen Nautik meter wheel for measuring the depth of observation. All observations were conducted after the methods adopted by deep-sea oceanographers. Field headquarters were established during the summer at the Mt. Desert Biological Laboratory at Salisbury Cove, Mt. Desert, Maine. A small open boat, about eighteen feet in length, the property of the laboratory, was used for field operations.

The following is a very brief summary of the results of the physical observations made while the survey was in progress. The temperature is expressed in degrees centigrade and the salinity in grams of total salt per liter of sea water, represented by 0/00.

HYDROGRAPHICAL OBSERVATIONS IN FRENCHMANS BAY

Temperature.—Depth at stations, 12 to 86 meters. The average surface temperature ranged from 12.6° on July 8 to a maximum of 14.1° on July 31 and then to 12.0° on August 6; the average of all surface temperature observations was 12.8°. The maximum variation of surface temperature during the season was from 10.3° to 15.4° and the lowest temperature, 7.0°, was recorded at the bottom near the center of the bay. The water at the head was warmer than that at equal levels at the mouth of the bay. The average temperature of the whole bay from surface to bottom during the period of observation was 10.5°.

Salinity.—The average surface salinity increased from 31.73 0/00 on July 8 to 32.09 0/00 on July 31 and decreased to 32.04 0/00 on August 6; the average

surface salinity of the whole bay was 31.91 0/00. The maximum variation of surface salinity during the season was from 31.51 0/00 to 32.25 0/00, and the highest salinity recorded, 32.45 0/00, was near the bottom at the mouth of the bay. The least saline water occurred at the head and the most saline at the mouth of the bay, but the variation at any one time was never of very great magnitude, the maximum recorded being 0.54 0/00. The average salinity from surface to bottom of the whole bay during the season was 32.04 0/00.

HYDROGRAPHICAL OBSERVATIONS AT STATIONS WEST OF FRENCHMANS BAY

Blue Hill Bay (station 17) depth 80 meters. Temperature ranged, July 26, from 14.06° surface to 10.06° bottom, and on August 20, 13.81° surface to 11.10° bottom. The temperature below twenty-five meters was one to two degrees higher than in Frenchmans Bay. Salinity ranged, July 26, 31.60 0/00 surface to 32.12 0/00 bottom, and on August 20, 31.83 0/00 surface to 32.34 0/00 bottom. The surface salinity was about 0.50 0/00 lower than in Frenchmans Bay.

Penobscot Bay (station 18) depth 58 meters. Temperature ranged, July 27, 14.98° surface to 8.70° bottom, and on August 21, 13.07° surface to 10.0° bottom. The temperature below twenty-five meters was a little higher than in Frenchmans Bay. Salinity ranged, July 27, 27.72 0/00 surface to 31.98 0/00 bottom, and on August 21, 30.30 0/00 surface to 32.09 0/00 bottom. The surface salinity was the lowest observed in the region investigated and was 2.00 0/00 to 4.00 0/00 lower than in Frenchmans Bay.

Sommes Sound (station 16) depth 27 meters. Temperature ranged, July 26, 14.95° surface to 11.0° bottom, the temperature below five meters was a little higher than in Frenchmans Bay. Salinity ranged, 31.91 0/00 surface to 32.05 0/00 bottom, about the same as at the upper shallow end of Frenchmans Bay.

HYDROGRAPHICAL OBSERVATIONS AT STATIONS EAST OF FRENCHMANS BAY

Prospect Harbor (station 12) depth 16 meters. Temperature ranged, July 23, 12.59° surface to 9.11° bottom; salinity ranged 32.09 0/00 surface to 32.08 0/00 bottom. Both temperature and salinity were about the same as at the mouth of Frenchmans Bay.

Gouldsboro Bay (station 13) depth 18 meters. Temperature ranged, July 23, 12.86° surface to 10.40° bottom, the whole column of water was 0.3 to 1.3 degrees warmer than Prospect Harbor. Salinity ranged, 32.09 0/00 surface to 32.14 0/00 bottom, about the same as previous station.

Dyers Bay (station 14) depth 9 meters. Temperature ranged, July 23, 10.72° surface to 10.01° bottom; salinity 32.10 0/00 surface to 32.14 0/00 bottom. Temperature and salinity were about the same as at the mouth of Frenchmans Bay.

HYDROGRAPHICAL OBSERVATIONS AT STATIONS SOUTH OF FRENCHMANS BAY

On July 16 the surface temperature at station 10 was 10.42°, or about 1 degree lower than the temperature at the mouth of Frenchmans Bay lying ten miles to the north, while the temperature at 50 meters, 7.4°, was practically the same. On August 3, the surface temperature at station 11 was 10.0°, or 1.2 degrees lower than at the mouth of Frenchmans Bay lying fifteen miles to the north, while the temperature at 50 meters 8.1° was about 0.2° lower.

The surface salinity at station 10 on the former date was 32.10 0/00, or 0.06 0/00 lower, and the 50-meter salinity 32.52 0/00, or 0.18 0/00 higher than at the mouth of Frenchmans Bay. On the latter date the surface salinity at station 11 was 32.54 0/00, or 0.34 0/00 higher, and the 50-meter salinity 32.70 0/00, or 0.35 0/00 higher than at the mouth of the bay.

H. R. SEIWELL,
Curator, Invertebrates and Oceanography
BUFFALO MUSEUM OF SCIENCE

THE RELATION OF THE OXYGEN TENSION IN THE EXTERNAL RESPIRATORY MEDIUM TO THE OXYGEN CONSUMPTION OF FISHES

RECENTLY two American articles by Powers and Shipe[1] and F. G. Hall[2] have had the above relation as their subject, and in both cases the conclusion was drawn that the fish's oxygen consumption is proportional to the oxygen tension of the environment, even when a restricted range of the latter within the normal concentration of natural waters is considered. It is perhaps unnecessary to emphasize the theoretical and methodological importance of such a conclusion. Unfortunately it appears for a number of reasons quite certain that this conclusion can not be accepted without qualification.

Before demonstrating that this conclusion is unwarranted at the present time, let me hasten to say that, as would be expected, the respiration of fishes is undoubtedly depressed at low levels of oxygen tension of the environmental water. Such a depression of respiration as the oxygen tension approaches the asphyxial threshold by no means implies a depression of oxygen consumption brought about by deviations

[1] E. B. Powers and L. M. Shipe, *Publ. Puget Sound Biol. Sta.*, 5: 365–372, 1928.
[2] F. G. Hall, *Am. J. Physiol.*, 88(2): 212–218, 1929.