

recognised. Pacific salmon received the attention of fish-breeders at a comparatively early date; and, on account of extensive fishing and the pollution of many of the rivers, it is mainly owing to artificial propagation that the supply of these fish is maintained on the western seaboard of the United States.

The description of the numerous forms of trout and charr met with in the fresh waters of North America falls to the lot of Mr. W. C. Harris, and constitutes (inclusive of the angling notes) more than half the contents of the volume. The author divides these fishes into salmon-trout (commonly called brook-trout in America) and charr-trout. That all the latter are specifically, if not generically, distinct from the true salmon there can be no doubt, although it has yet to be proved that this is the case with the members of the former group. On this point, however, the author is silent, although he admits the extreme difficulty of classifying these fishes in a satisfactory manner.

"The most prominent external marking by which the salmon-trouts and charrs may be distinguished apart," writes the author, "is the presence of red or crimson spots on the body, the only exceptions being the great lake trout, with greyish markings, and the Arctic trout (*Salvelinus arcturus*), upon which no reddish spots have been observed."

It was owing to the absence of these red markings that the great lake trout, which now typifies the genus *Cristivomer*, was formerly regarded as a true trout instead of a charr.

In addition to being a practical guide which should be in the hands of every angler in American and Canadian waters, this excellent little volume is a valuable manual of North American Salmonidæ. R. L.

GAS ANALYSIS.

Methods of Gas Analysis. By Dr. Walther Hempel. Translated from the third German edition and considerably enlarged by L. M. Dennis. Pp. xix + 490. (London: Macmillan and Co., Ltd., 1902.) Price 10s. net.

THE value of this well-known handbook on gas analysis has been increased by additions both by the author and translator, so much so that those who already possess a copy of the first English edition will probably consider it necessary to obtain also the present one. The original work was practically restricted to a description of operations which could be carried out with the apparatus devised by the author, and this character is still retained. The slight incompleteness thus entailed is more than compensated for by the extremely practical nature of the instructions; every process described has been thoroughly tested and will work. The author has found it advisable to abandon the division into technical and exact gas analysis because, as he states in the preface, apparatus originally intended for technical purposes may advantageously be employed for many purely scientific investigations, and, on the other hand, technical analyses must often satisfy the most exacting conditions as to accuracy. The chief additions to the first edition comprise new methods for exact gas

analysis and for the determination of combustible gases, the separation of argon from the atmosphere, improved methods for the determination of carbon monoxide in gas mixtures, the analysis of acetylene gas, the examination of gases produced by living bacteria, the simultaneous determination of fluorine and carbon dioxide, the determination of the heating power of gases, the estimation of sulphur in organic bodies and of carbon in steel, and the analysis of the gases evolved in the electrolysis of chlorides and the manufacture of bleaching powder. The method originally adopted by the author for the exact analysis of gases, although accurate, was somewhat cumbersome to work and expensive to set up. By adopting the principle of a compensation tube, slightly modified from the suggestion of Pettersson, the apparatus assumes a very practical form, gaining in convenience and cost without loss of accuracy. The determination of the heating value of gas, a determination which is rapidly increasing in importance on account of the extended use of gas for heating and power purposes and in the Welsbach incandescent burners, has been usually carried out in calorimeters of the Junker type. These are costly, require considerable amounts of gas, and must be carried to the place where the gas is being used. In the ingenious apparatus described by Prof. Hempel, a heating value can be determined on two litres, so that samples of gas can be brought from a distance in metallic receivers and examined in the laboratory.

In the analysis of combustible gases, it is shown by the translator that a modified Coquillion pipette, in which the combustion is carried out by an electrically heated platinum spiral, may in many cases advantageously replace the usual explosion method. The error due to the partial combustion of the nitrogen is avoided, and owing to the use of oxygen instead of air much larger quantities of gases can be burnt with a corresponding gain in accuracy, numerous test analyses being given in proof of this point. The only suggestion which can be made as to additions to this chapter is an investigation as to the possible errors introduced into indirect explosion analyses by the deviations of the various gases from Boyle's law. According to Prof. Leduc, the errors from this cause may amount in special cases to as much as 3 per cent. when the gases are measured at constant volume. In the determination of carbon monoxide, a large amount of space, some twelve pages, is devoted to a description of the hæmoglobin method, whilst the method of C. de la Harpe and Reverdin, in which the monoxide is burnt by contact with iodine pentoxide, is dismissed with a short mention, although this method has been shown by Nicloux, Gautier and others to be at least as sensitive as the most refined modification of the blood reaction, and is also applicable to coal gas. As it seems probable that this method will supersede the doubtful cuprous chloride method, it would appear to have been worthy of a more detailed examination. In this case, as in others in which criticism might be offered, the author has preferred to give prominence only to those methods with which he has had personal experience. The work as a whole is a most valuable addition to the very limited number of works dealing with the handling and analysis of gases.

G. N. H.