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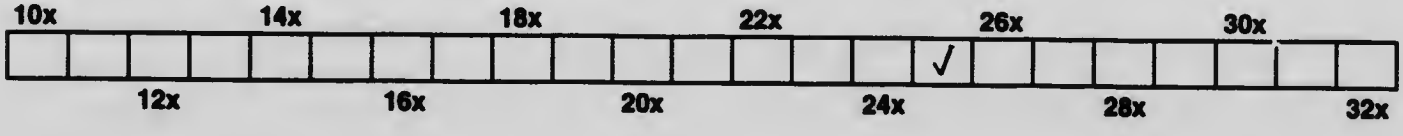

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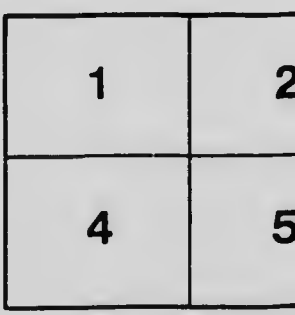

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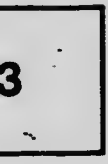

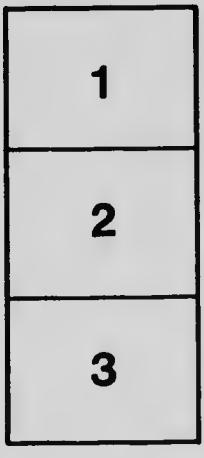

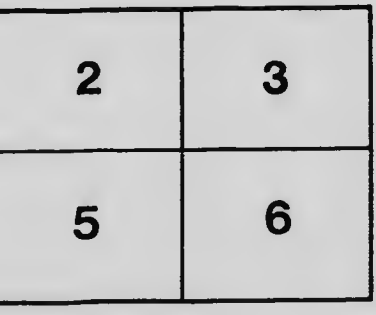

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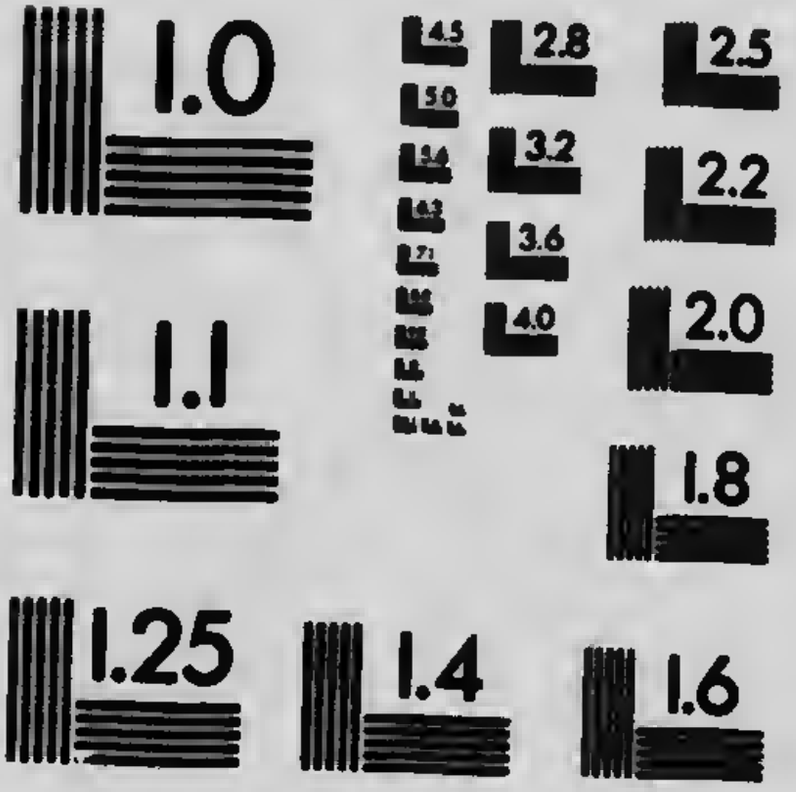

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SOME OBSERVATIONS ON HADDOCKS AND FINNAN HADDIES

Relating to the Bacteriology of Cured Fish

By Principal F. C. HARRISON, D.Sc., Macdonald College, P.Q.

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XI.

SOME OBSERVATIONS ON HADDOCKS AND "FINNAN HADDIES" RELATING TO THE BACTERIOLOGY OF CURED FISH.

By Principal F. C. HALLIGAN, D.Sc., Macdonald College, P.Q.

During the month of July, 1915, the writer whilst at the Biological Station, St. Andrews, N.B., examined bacteriologically the intestinal content of twelve haddocks. The haddocks were caught about a mile to two miles from the station, were brought to the laboratory, opened, and a portion of the intestine ligatured and removed. An opening was then cut into the piece with sterilized scissors, and a heated platinum needle thrust in, and the small amount adhering to the needle was transferred to about 5 c.c. of sterilized water and thoroughly shaken.

Plates were made from the dilution, from 1 to 3 drops being used for each plate. Plates were made with:—

Haddock sea water gelatine	12 per cent.
Beef peptone sea water gelatine	12 "
Lactose litmus sea water gelatine	12 "

In this manner the intestinal content of twelve fish was plated, and a large number of isolations made.

At the same time a microscopical examination of the intestinal contents was made. Smear preparations invariably showed numerous bacilli, mostly small forms, no cocci and no spirilla. The bacterial content of the twelve fish was similar. Ten different species of bacteria were isolated; of these four were liquefiers, and about 25 per cent of the total number of colonies from each fish belonged to this group. Many of the plates gave a strong odour of trimethylamine, and one or two of the pure cultures gave this odour. In the mixed cultures, however, in the plates the odour of this substance was much stronger.

The most common organism which was found in eight of the twelve fish was a small bacillus, motile, [illegible]ducing small depressions in gelatine plates, with numerous smaller colonies around [illegible] edge, rapidly liquefying, producing H_2S, indol, and trimethylamine, gas in gluc[illegible], but not in lactose, coagulating milk with digestion, and in short appearing to be closely related to *B. vulgaris* (Hauser).

This organism has the greater interest of all those isolated because it was found subsequently in the flesh, and on the surface of smoked haddock (finnan haddie) cured at the station, and also from some spoiled haddock received from a packer.

A short account of the methods employed in securing the fish may be of interest.

The fish were caught near the biological station, and as soon as landed they were split, salted for one and a half hours in brine of sufficient density to float the fish, and smoked for eighteen hours. For six days after smoking the fish were kept in the laboratory at a temperature ranging from 60° to 70° F., and then pieces were removed from different parts of the dried fish, each piece was thoroughly scorched and dropped into flasks containing haddock [illegible]e-water peptone broth.

Other pieces of fish were obtained thus: The backbone was cut near the tail, carefully raised, and a portion of the flesh beneath was cut out with a sterilized knife, the piece seized with sterilized forceps and held in the flame until well scorched on the outside, and then dropped into a culture flask.

All flasks thus inoculated were held at room temperature; twenty-four hours later all showed turbidity. Gelatine and agar plates were made from the various flasks, and the colonies which developed were isolated in the usual manner. From this source a number of organisms were secured, and of these four were similar to those previously obtained from the intestinal content of fresh haddies.

In October, 1915, a circular of inquiry was sent to a number of fish dealers and, in response to a request for spoiled fish, a box of spoiled "haddies" was received during the course of the winter. They were covered with a semi-slimy growth, giving a watersoaked appearance. At numerous places there were whitish points resembling bacterial colonies. The flesh was somewhat softened, and the fishy odour much intensified.

From gelatine plates made from this fish the writer secured the liquefying bacillus already mentioned, and large numbers of *Torulæ*.

The most significant fact, therefore, in this piece of work is the presence of liquefying bacteria belonging to the *B. vulgaris* group in the intestinal canal of fresh haddock, and the presence of this organism on and in the flesh of smoked haddocks, and smoked haddock that were spoiled.

The amount of salt and the duration of the smoking period to produce finnan haddies of good flavour are not sufficient to kill the organisms present on the fish after they are gutted, and the antiseptic action of salt and smoke is not sufficient to inhibit the slow growth of organisms.

The writer, after studying the methods of curing haddock, has been impressed with the general carelessness displayed in allowing fish to remain for many hours exposed to warm air and sunlight before gutting and salting. True, that these observations were made under summer conditions when comparatively few haddocks are cured; but the effect of such treatment results in a large increase in the number of bacteria present on the fish, and consequent quicker spoiling of the smoked article.

In winter these conditions would be better, and although the writer has never had the opportunity of studying winter conditions, he has been impressed by the great difference in flavour between fish salted and smoked at the biological station during the winter of 1915-16, and those bought from various dealers in Montreal.

From one or two experiments on the percentage of dry matter, total ash, and chlorides as NaCl made on a few fish sent to this laboratory, the writer suggests that such determinations should be made of a series of fish for which the amount of salt used, the salting and smoking period were known.

Further, from the bacteriological standpoint some work should be done on haddock smoked under winter conditions.

MAY, 1916.