THE EFFECT OF DYNAMITE ON FISH LIFE.

In a report of the department of marine and fisheries, fisheries branch, Prof. A. P. Knight, M. A., M. D., of Queen's University, Kingston, Ont., deals exhaustively on the effects of dynamite explosions on fish life. Prof. Knight says in part:

LAKE ONTARIO EXPERIMENTS.

The first experiments were made in Kingston harbor, in water about 18 feet deep. Two cartridges were used, the detonation striking our boat like a huge sledge hammer. It stirred up a great deal of mud, and discolored the water to a radius of six or eight feet, gradually widening to 30 or 40 feet. At first we thought that no fish had been killed, but after waiting for about two minutes they began coming to the surface, and inside of 15 or 20 minutes, 130 perch and one small black bass had been lifted into the boat. About three dozen more were left floating; all were not dead; some appeared to be only stunned.

Post-mortem examination of a large number of these fish all showed similar effects: great capillary haemorrhage from branches of the mesentric arteries, congestion of the liver and spleen, and invariably rupture of the swim bladder. Portions of the intestines were usually forced dorsally into the cavity of the swim bladder, where, of course, there was also much blood. In rare cases, there was rupture of the venous sinuses feeding the auricles.

VARIATIONS IN DESTRUCTIVENESS.

The first explosion and its results were typical of all the work done last summer. Of course the results were not constant, for obvious reasons. The destructiveness of the explosive varied according to easily recognizable conditions. It varied with (a) the charge of dynamite used, (b) with the depth of the water, (c) with the number of fish present in the neighborhood of the explosion, (d) with their distance away, and (e) with the kind of fish.

That the destructiveness varies with the weight of dynamite exploded, needs no demonstration. This is probably true of all explosives. Many different charges were used, usually varying from one cartridge up to eight. The larger charges did not always result in bringing up the larger number of fish. The number killed depended more upon the number of fish in the neighborhood than upon any other condition. For example, a charge of 1½ lbs. exploded in the Kingston harbor, west of Garden Island, did not bring up a solitary fish, while one cartridge of ¼ lb. weight in St. John harbor, New Brunswick, killed over 800 fish.

The depth of the water was another important condition affecting the destructiveness of dynamite. Explosions were effected at depths varying from 1½ to 300 feet. It produced little, if any, destruction of fish life at shallow depths, say, less than 10 to 12 feet. The reason of this probably is, that at slight depths, the pressure resulting from the explosion is not sufficiently great to rupture the swim bladder. One blast at 18 inches under the surface, sent up a column of water about 100 feet high; another blast about 3 feet below the surface, sent up a narrow column about 60 or 70 feet high. In neither case were fish killed, though some must have been present. At 10 or 12 feet below the surface, the explosion lifted a broad cone or mound of water 6 or 8 feet high. At increasing depths, the surface disturbance became less and less marked, until at 45 fathoms or thereabouts, the only evidence of the explosion, after the noise and the tremendous blow on the bottom of the boat, was the appearance of a vast number of small bubbles of gas covering a diameter of from 40 to 60 feet. There was no upheaval of water. Evidently the large volume of gas generated at these depths is, on its way towards the surface, broken up into a large number of distinct bubbles, which separate as they ascend.

It is difficult to say whether in No. 1, 2, and 3 there were no fish present, or the pressure was insufficient to kill them. The probable explanation of the difference between the number killed in No. 4, as compared with those in No. 5, is that many more fish were present in the vicinity in the former case than in the latter.

No. 6 illustrates another variation in the effects of a dynamite explosion. In this instance not a single fish came up where the explosion occurred. About 30 yards away, seven or eight sunfish were killed outright—not a movement in one of them when picked up. A few moment's later a batch of perch and a few rock bass were seen coming to the surface about 60 yards away. Clearly, therefore, the number of fish killed varies directly with the number present, and varies also with their distance away from the site of the explosion.

Lastly the number killed depends upon the kinds of fish. Those with a thin, delicate texture of the swim bladder are more easily killed than fish possessing a thick, tough membrane. Pollock were easily killed for this season; cunner very cult.

Stated mathematically, the energy of the exploding dynamite varies directly with the amount exploded, and diminishes with the distance away, according to an undetermined law, which probably depends upon the relative position of the exploding charge to the bounding water surfaces, upon the nature of the bottom, and possibly also upon conformation. So far as fish are concerned its effects upon them were found to vary (a) with the numbers near the site of explosion, (b) apparently with their depth beneath the surface, and (c) with the strength of their tissues, especially the walls of the swim bladder, and the sensitiveness of the nervous system, though this last was difficult to demonstrate.

CAUSE OF DEATH.

As already indicated, the immediate cause of death is rupture of the swim bladder, and internal haemorrhage. The rupture is evidently due to pressure. When an explosion occurs, there is a sudden liberation of gas tending to produce compression of the water at the site of the explosion. The wave of compression travels outwards in all directions—upwards, downwards and sideways. The direction of least resistance is, of course, always towards the surface of the water—hence the upheaval which follows an explosion. Quite frequently we found three other marked injuries, especially in large fish like pollock. Often in these the liver was compressed into fragments, the ribs were detached from the vertebrae along the whole length, and the flesh (temporal muscle) over the skull, after the skin had been cut, could be raised from the surface of the bone, leaving it as smooth and clean as a piece of polished ivory. Here again, the cause of the dislocation of these structures was pressure. The fish is veritably flattened between the compression wave of the explosion on the one side, and the unyielding water on the other; the ribs are torn from their attachments, the liver crushed to pieces and forced backwards into the extra-peritoneal cavity, and the flesh raised clean off the flat bones of the head. The surgeon sometimes meets with a similar experience in accidents due to crushing.

SINKING FISH.

Very early in the investigation it became evident that besides those fish which came to the surface and floated, a number were merely stunned, and subsequently escaped, or were killed outright and sank to the bottom. This was important. The destructiveness of dynamite took on a wider aspect than that of merely counting the slain. The wounded and missing had, if possible, to be acounted for. If one could put off a blast in a large pond, count those killed at the surface, drain the pond dry and then count the living and dead lying on the bottom, the investigation could soon be closed, but this was not the way in which the problem was presented. Accordingly other methods of investigation had to be planned. A simple method, and one likely to throw some light upon these points, was to use the water telescope. This was done in some of the narrow channels off Canso. Cunner abound in the shallow waters along these shores and between the islands, and after some expert knowledge had been gained by using, first a stove pipe and then an old eaves pipe for an aquatic telescope, we put off a blast, and counted our 'spoil.' Twenty-five dead floated belly up: that was one fact, or collection of facts, if you please. Then by the presevering use of our improvised telescope, one observer counted seven, and another of our party counted eleven dead cunner lying on the bottom. We recovered two of these. Post-mortem examination failed to show particularly why they had sunk. There was great visceral congestion, and profuse hemorrhage. In one, the swim bladder was much torn, while in the other the rupture was so small that no air could be found escaping, except when the whole animal was placed under water and swim bladder compressed. The smaller animals generally floated; the larger ones sank.

These results were, however, not satisfactory. In shallow water, explosions always stirred up the mud, and our crude telescope was useless. We determined, therefore, to make a tremendous 'slaughter of the innocents,' and with this end in view selected a small bay, nearly west of Grassy Island, and there, set off the largest blast of dynamite which was used during the season—ten cartridges. The noise was loud enough to have awakened the spectral inhabitants of the old French island. There was a tremendous upheaval of water and mud, and in ten minutes wind and tide had spread the dirty water all over the little bay. Twenty-eight dead came to the surface. On returning next morning, we could find only three dead fish lying on the bottom, near where this explosion had occurred; that is, less than ten per cent. had sunk in this experiment; in the previous one about thirty per cent.

The next attempt that was made to throw fresh light on this important point was in St. John harbor, New Brunswick. As a preliminary to the real test, a visit was made to one of the salmon weirs at low water. In one compartment of the weir were found two full-grown salmon, one 'fiddler' (small salmon), and ten or twelve adult gaspereaux. The time was noon of August 10th. That evening, of course, there was a full tide, and next morning another, so that there were these two chances for additional fish to join their fellows in the weir. At 8.30 next morning, the weir was visited in company with the two fishermen who owned it, and one cartridge was exploded in the compartment which we had previously examined. The two salmon at once floated to the top, also six or eight gaspereaux. But the deadly effect of the explosive was brought out in another, and rather unexpected way. Almost simultaneously with the occurrence of the explosion, an immense number of young gaspereaux leaped from the water, and then fell back almost motionless upon the surface. They varied in size from 2½ to 5 inches in length. They came partly from inside the weir, but chiefly outside the inclosure, stretching away up towards the city. Evidently a school of these young fish was making its way up into the harbor, or they were leaving it. We counted over 800 of them being driven away by the wind and tide, and estimated that as many of them sank as floated; but this was, of course, mere guess-work.

After rowing along the path of these floating fish for half an hour, we returned to the weir, and awaited the falling of the tide. The tide in this harbor goes out so far that the floors of many of the weirs are left almost dry. We had no difficulty, therefore, in determining the exact number of fish which sank. There they were, 27 gaspereaux varying from 7 to 12 inches in length, lying dead on the bottom; 7 others somewhat larger on the average were swimming around in the scanty water remaining in the weir, and in company with these 2 lively dog-fish which semed to know perfectly well that they were in a trap. Here were the results which we had been looking for—8 or 10 killed and floating, 27 killed and sunk, and 9 alive. If the dynamite killed the young gaspereaux in the same proportion outside the weir, as inside, then 2,500 of them lay dead at the bottom of the harbor in addition to the 800 which we had counted at the surface.

CAUSE OF FLOATING.

Nearly all the fish floated belly up; the sunfish lay more upon their side; lake trout on their back, but with the tail end deep in the water and head above it. Rupture of the swim bladder and escape of its gas ventrally so as to displace the centre of gravity, was probably the cause of the fish floating on their back. But a physiologist can scarcely escape the conviction that the nervous mechanism for the maintenance of equilibrium must have been paralyzed in all of them. Fish would die in water from other causes than concussion, say, from suffocation or from poison, lose their power of maintaining the vertical position, and in these cases they lie on their back because of muscular (i.e., nervous) inability to balance themselves.

WOULD IT PAY.

An attempt was made to see whether a large catch of fish could be obtained in the open sea by means of dynamite. The fishermen at Grand Manan were said to have made it pay during the summer of 1900, and better still in 1901. At any rate, a young seaman whose acquaintance I made through Mr. C. H. Whitman at Canso, claimed to have used dynamite at Grand Manan during June and most of July, 1901. He said that 'whereas only half a dozen vessels had used dynamite in 1900, there were about 90 using it in 1901. It was exceedingly effective with pollock, when they were plentiful and following the red shrimp. They used only one stick of dynamite and exploded it by a detonator and fuse two or three inches long. Then men lighted the short fuse with a match or the burning tobacco of their pipes, and then threw the cartridge into the sea from the boat. They judged that the explosion took place about six feet below the surface, but could not say exactly to what depth the cartridge sank before exploding. Hundreds of pollock were killed by one explosion. He was of the opinion that from one-half to one-third of the fish sank and were lost. Other fish were killed besides the pollock. When the shrimps are all eaten up or disappear, the pollock begin feeding upon herring and squid, and consequently separate widely from each other. Under these circumstances, it was not found profitable round Grand Manan to continue the practice—too few being killed to pay for the dynamite and the men's time in collecting the scattered fish. Asked upon what grounds he had formed the opinion that from one-half to one-third sank, he answered that he had come to that conclusion on two grounds: first, by watching the fish sinking after an explosion; and secondly, because on one occasion at Digby inlet he had seen a blast put off beside the wharf in order to kill pollock. After the tide went out they counted as many dead fish on the bottom as they had collected at the surface.

Such was the substance of the man's story. It remained for us to see how far our experience would confirm his. At the outset, let it be said that although there were six men on board the Vulcan, two being experienced fishermen, and all watching eagerly for results, it was generally agreed that it was impossible (by merely watching the surface) to form an opinion as to the number which floated. We all saw one or two fish sink after some of the explosions, but not one of us from our own observations could confirm the young fisherman's opinion that one-half or one-third sank.

Our experience in St. John harbor with his in Digby inlet, showed that three times as many lay dead on the bottom, but they were not pollock.

KILLING OF SEAL.

An interesting result was obtained at St. John, N. B., at the instance of the fishermen. They often lose many salmon, through the depredations of seal-lions or seal. These animals regularly frequent weirs and kill numbers of the imprisoned fish. The fishermen naturally wished to know if seals could be killed by dynamite. Fortunately one of the animals happened to come up the harbor just as our other experiments were concluded. The men rowed out, and a blast of two cartridges was thrown toward the seal just as he dived, forty or fifty feet away. After disappearing under water he must have swam towards the explosion. When the tide went out, greatly to the delight of the fishermen, he was found dead sixty or seventy yards away. A deep hollow in the mud marked the site of the blast. Blood was oozing from the eyes, ears and nose of the animal. Evidently he had been killed by fracture of the skull.

CONCLUSIONS.

1. A serious result was clearly brought out in many of the experiments. Large numbers of immature fish were killed. Not one-third of those which came to the surface in fresh water could be sold the market. Of course, immature fish are killed in other ways. Thousands of young fish perish in weirs all along our coast after every outgoing tide. Fishermen frequently leave them to rot upon the shore. The responsibility for this terrible destruction of immature fish rests in the first place upon the apathy and cupidity of the fishermen, and in the second place upon the Dominion government for allowing the slaughter to continue. Fishermen should be compelled to return immature fish to the sea, because so long as this destruction of young fish is permitted in netting, it is manifestly unfair and inconsistent to prohibit dynamite fishing on the score of wasteful destruction of immature fish.

2. The second serious objection is the great waste due to the numbers which sink. It would be hardly fair to generalize upon the experiments at Canso and St. John. It is much safer to publish the facts, and the facts are that about one-third of the cunner sink, and that three gaspereaux sink for every one that floats. As regards pollock, cod, salmon and other marketable fish, further investigation is necessary if a general conclusion is worth having.

3. Further investigation is necessary also to determine more accurately the effects upon the microscopic life of our inland and marine waters, for such microscopic life is a necessary part of the sustenance of the finny tribes.

GOT DAMAGES FROM THE OLD GIRL WHO WOOED HIM

Lady Clark, Aged Sixty, Wanted to Marry a Boy—He Declined, and She Said Unkind Things About Him.

LONDON, June 15.—The Duke de Pieneuf has at last been awarded $1,250 by the courts for slander and libel by Lady Rose Horton Clarke. The action was begun in the high courts but the lady did not appear and the case was finally remitted for the assessment of damages.

Counsel stated that the duke became acquainted with Lady Clarke some time ago at Prince's skating rink. She claimed to be a distant relative of his, and the friendship developed until it became somewhat disagreeable, owing to the fact that her ladyship, a woman of sixty, and a strong-minded person as well, proposed to the duke, who was a young man of twenty-six.

The duke did not quite see his way to accept such a proposal and a feeling of coolness sprang up between them. Then it was alleged Lady Clarke made slanderous statements about the duke and sent several offensive post cards. The duke demanded an apology and this being refused he instituted proceedings.

The duke in his evidence described the growth of the friendship and Lady Clarke's proposal.

"What did you say?" inquired counsel.

"I smiled and told her that I was already engaged, and that I thought she was a little bit too old," the duke replied.

"Was she very indignant?"

"She was—very."