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WALLEYED PIKE EXPERIMENTS CONDUCTED AT THE LYDELL AND WOLF LAKE HATCHERIES DURING 1942.

by

W. F. Carbine

Walleyed pike have been propagated artificially in Michigan for many years. It has generally been the practice to plant walleyes as yolk fry. Despite the fact that billions of fry have been planted in lakes in past years, the results have not been at all favorable. Many lakes have received plantings of walleyed pike fry year after year without the slightest sign of success. Occassionally though, during a period of years, one planting out of many may be successful in a certain lake. Why this should be we do not exactly know. But even though this particular stocking may have been successful it does not mean that the species necessarily will become established in the lake. In fact, we have records that indicate that successful reproduction does not occur in certain lakes and that the only walleyes present are of the same general size which increases each year as the fish decrease in numbers. This points to the success of one planting.

It is generally considered (though not proven) that plantings of fingerling trout have yielded better results than plantings of fry, and it has been shown that plantings of legal-sized fish are more productive than plantings of fingerlings in all streams and most lakes. Necessarily the mortality relationship will vary widely according to the species planted and the waters that are stocked. It stands to reason that the tiny, delicate yolk fry are subject to high mortality due to handling, transporting, planting and predation. The trend during the past few years has been to stock larger fish of all species, with greater emphasis placed on rational planting rather than on the number planted.

The problem of planting larger fish is not a question as to whether natural reproduction is adequate or not, but whether the results obtained will be commensurate with the cost. There may be some bodies of water where fry plantings would be satisfactory, but every lake or stream has to be treated separately according to the biological and physical factors involved. Some lakes would never be able to maintain a population of walleyes because spawning facilities or food conditions are not adequate. In others it would be a mistake to introduce them because the existing good bass or bluegill fishing might be jeop-

ardized. However, there are a number of lakes where the addition of another desirable, predatory species appears to be needed to control stunted panfish or because the game fish are so heavily parasitized that they are not attractive to fishermen. The walleye may answer this need.

Other states have conducted experiments in the culture of walleyed pike, but few accounts have been reported in the literature. Most of the information contained in the literature is incomplete. In the past the hatchery personnel have not generally appreciated the necessity for compiling accurate, complete and dependable information on the various experiments that were conducted.

Two articles that have appeared in the Progressive Fish-Culturist by Mr. E. B. Speaker (November, 1936 and February-March, 1938), have given us a great deal of information on certain phases of walleye propagation. But as is the case in many reports of this nature some important items such as the kind and amount of fertlilzer used, the number of forage fish stocked per acre, etc., were not given. Speaker found that in general, the percentage survival was greatest in those years when the stocking was lowest. He obtained his best results from stockings of 25 to 50 thousand fry per acre.

During the Fisheries Conference held at Higgins Lake in 1942, it was decided that experiments in the rearing of walleyed pike to larger sizes should be attempted at several hatcheries. Mr. Jay Marks, surpervisor of Fisheries Operations, located at the Wolf Lake Hatchery, and Mr. Claude Lydell, supervisor of Fisheries Operations, located at the Lydell Hatchery, proposed to devote a part of their pond space to walleyed pike experiments. The urgent need to reduce travel and the loss of personnel prevented more frequent check-ups on these experiments. As a result the data are not as complete as would be desired. Most of the information on these experiments that is contained in this report has been taken from the monthly reports, memoranda and letters sent to the Institute by Messrs. Lydell and Marks. Any discrepancy between the data contained in this report and that furnished by Messrs. Lydell and Marks are due to minor errors in their reports. The writer wishes to express his appreciation to these gentlemen for furnishing the Institute with the information contained in this report.

Experiments Conducted at the Lydell Hatchery

Pond No. 19 was used as an experimental pond for the rearing of walleyes at the Lydell Hatchery. This pond has a surface area of 0.8 of an acre and a maximum depth of 6 feet.

On March 30, 1942, two large brush shelters were placed in Pond No. 19. On March 31, a total of 39 minnow nest boards were installed in the pond for bluntnosed minnows to spawn on. The pond was filled with water between March 31 and April 4 and the water was shut off on April 4 except for enough to maintain a constant level. A total of 1,275 bluntnosed minnows (brood stock) weighing 3 pounds were placed in the pond on April 5.

Fertilization.

On April 6, six medium wheelbarrow loads of horse manure were scattered about the shallow water of the pond. Ground goldfish was also used as fertilizer as follows: April 11 - 15 pounds; April 14 - 39 pounds; and May 11 - 40 pounds (total of 94 pounds). Horse manure was again placed in the pond on June 1 when 4 small wheelbarrow loads were scattered over the bottom of the pond in water that varied in depth from 1 to 3 feet.

The pond was stocked with 26,400 (at a rate of 33,000 per acre) walleyed pike fry on April 30. Mr. Lydell estimated the number of fry by counting the number contained in one fluid dram, and multiplying this by eight which gave 4,400 per fluid ounce. A total of 6 ounces was measured out and placed in pond No. 19.

Feeding

The date of the first feeding has not been recorded but we presume that it was around May 28. A fifty per cent mixture of clam meal and Rowena dog biscuit was used at first at a rate of five pounds daily, except Sunday. This mixture was discontinued on June 5. From June 6 on, ground horse meat (3 pounds per day) was fed to the fish six days per week.

On July 7 and 8, Mr. Lydell said that there was some indication that the walleyes were feeding on the prepared food, but he was not certain of it. On August 21, Mr. Lydell made the following remark in his monthly report: "The small walleyes in display pond did not eat first few days, but are now feeding on horse meat, not all of them feeding, but more school up at feeding time each day and feed. Ones that are feeding now look good. They act very frightened at any movement, and hang on or close to the bottom of the pond. When feeding they dart away when food strikes the surface of the water, but when food has submerged 6 to 8 inches or more below the surface they will come back and feed, picking all food up before any of it reaches the bottom of the pond. To date none have been seen to feed at the surface of the water, most feeding done at one foot below surface and deeper, in depth of water of 3 feet." Although all of this prepared food was not eaten by the walleyes, it at least helped fertilize the pond.

Forage fish

Besides the 1,275 bluntnosed minnows that were placed in the pond as brood stock, a large number of minnows (called shiners by Mr. Lydell - probably all lake emerald shiners) were placed in the pond at intervals as forage for the walleyes.

As there was a run of adult suckers close to the hatchery, Mr. Lydell was able to obtain 12 quarts of eggs that were hatched in battery jars. Mr. Lydell found that upon hatching the fry would not swim out of the jar, but would roll among the unhatched eggs until they died. Mr. Lydell finally decided that it would be necessary to place the fry on cheesecloth trays in the pond in order to save them. Consequently, on May 4, a total of 8 quarts (66.6% hatch) of

fry were placed on trays in Pond No. 19. A total of 256,000 sucker fry were placed in the pond (data on the number of eggs per quart has been calculated from work done earlier at the Drayton Plains Hatchery). On May 8, large quantities of daphnia and suckers were present about the pond. On May 28, Mr. Lydell sent in a sample of the walleyes and young suckers that were present in the pond. At this time there was also a good supply of baby crayfish and frog tadpoles about the pond. The crayfish had an over-all length of 3/4 of an inch. On this date the suckers averaged about 0.9 of an inch in length (the walleyes averaged 1.4 inches). Three of the walleyes in this collection each had a small sucker (about 0.8 inches in length) in their stomachs. Suckers were not observed or collected after May 28 and stomach examinations that were made on walleyes that were preserved as samples at later dates did not contain suckers.

It may be well at this point to discuss briefly the sucker experiments that were conducted at the Drayton Plains Hatchery in 1937. This information should be of assistance to others who attempt to raise suckers.

Six quarts of sucker eggs were obtained on May 2, 1937 from White Lake in Oakland County by Mr. A. T. Stewart, supervisor of Fisheries Operations. Ordinary stripping technique was employed and Mr. Stewart used corn starch to prevent the adhesion of the eggs. Observations that have been made since, indicate that this was an unnecessary precaution because the eggs are only slightly adhesive. According to Mr. Stewart there were 1,000 eggs in a fluid ounce (32,000 per quart) as he determined by counting two, 1-ounce samples. The eggs hatched in regular battery jars in 12 days at an average water temperature of 53° F. The fry, immediately after hatching remained at the bottom and along the sides of the jar and were unable to rise and leave the jars as walleyes do. The constant rolling probably occassioned the loss of a large percentage of the newly-hatched yolk fry. A total of three quarts of fry survived although better than 90 per cent of the eggs hatched. More of the fry could no doubt be saved by placing the eyed eggs, just before hatching on cheesecloth trays in ponds, or in regular trout hatching troughs.

On May 16, one quart of the sucker fry (approximately 32,000) was placed on a cheesecloth tray in a small experimental pond that had a surface area of about one-tenth of an acre. It was not considered necessary to add fertilizer to the pond. Feeding was attempted over about a two-week period during August to determine whether the suckers would take artificial food. Finely ground sheep liver, ground dog biscuit, or a mixture of these two were fed once daily during this two-week period. Observations disclosed that the suckers would take artificial food off the bottom of the pond.

Observations during the latter part of June revealed that fishes other than the sucker were present in the pond. Seining yielded a number of walleyes, perch and horned dace. These fish were evidently placed in the pond with the sucker fry, probably having entered the jars containing the sucker eggs, with the water from the jars from the same battery containing the eggs of these other species. These walleyes, perch and horned dace undoubtedly consumed some of small suckers. The walleyes averaged about 3 inches and the perch about 2 inches in total length. All of these predatory species were removed from the pond.

The pond was drained on November 17, 1937. At the time of draining a total of 2,775 suckers (8.67 per cent survival) weighing 28.75 pounds were removed. This production was at the rate of 27,750 fish, and 287.5 pounds per acre. The suckers averaged 86.5 mm (3.4 inches) in total length and ranged from 54 mm (2.1 inches) to 163 mm (6.4 inches).

The following plantings of minnows were made in Pond No. 19 at the Lydell Hatchery during the summer.

Date	Number planted	Total weight	Average length (inches)
June 5	5,200	3.25	1.00
June 8	1,600	1.00	1.00
June 17	2,500	2.00	1.25
	21,333	40.00	2.25
June 21	450	0.84	2.37
Total	31,083	47.09	....

It is presumed that most of the minnows planted were lake emerald shiners, although Mr. Lydell did not definitely state that they were. On June 8, Mr. Lydell wrote Dr. Hazzard a letter which is quoted as follows: "Where do we go from here and what do we do next. Our walleyed pike have eaten up everything in the pond except the brush piles and won't take artificial food, at least not on short notice. We have been trying them on horse meat but they don't seem to care for horses. I am afraid cannibalism will start and if it does, when we end up this fall we will have one nice walleye.

"Do you know of anything that has been fed them artificially at any other station? There is no use trying to seine minnows for them we tried it. We put 5,000 small shiners in the pond in the afternoon and the next morning could not find a minnow. So that was that, figures mean nothing to them."

After the minnows were planted on June 17, Mr. Lydell watched the walleyes eat them. Many of these shiners were really too large for most of the walleyes, but could probably be eaten by the "hogs". One July 7, Mr. Lydell made a collection of walleyes. At this time he noted that a few large lake emerald shiners (3 inches in length) were also present in the pond. Large shiners were again taken on July 21 when Mr. Lydell made a collection of walleyes. On August 4, Mr. Lydell took one shiner about 2 inches long in two hauls made with a 40 x 6 foot bob-net seine.

On August 11 when Pond No. 19 was drained a total of 1,730 shiners, weighing 8 pounds 14 3/4 ounces was recovered. Apparently then, a total of 29,353 shiners was consumed by the walleyes.

At the time of draining, 645 adult bluntnosed minnows were recovered. This would mean that a loss of 630 of the original brood stock was sustained. Some

of the 630 must have died, and some undoubtedly were eaten. The bluntnosed minnows must have spawned during the summer, but the chances are that the fry were consumed by the walleyes soon after hatching. The writer has observed that largemouth bass fingerlings ate the young of fathead, and bluntnosed minnows and golden shiners soon after they emerged from the egg.

Growth and survival

On August 12 a total of 1,838 walleyed pike was recovered from Pond No. 19 upon draining. This represents a survival of 6.96 per cent of the 26,400 fry with which the pond was stocked. Of the 1,838 walleyes, 1,652 were small-sized and 186 were cannibals or "hogs". The cannibals made up 10.12 per cent of the total population. A total of 120 of the small-sized walleyes and 9 of "hogs" died, escaped or were saved for samples. The remainder of the fish were placed in two other ponds at the hatchery (the "hogs" in Pond No. 15, and the small fish in a large display pond) and fed horse meat until planting time. On September 30, only 54 of the "hogs" had survived. This represents a loss of 70.65 per cent between August 12 and September 30. When the display pond was drained on October 30, only 800 of the small-sized walleyes were recovered. This represents a loss of 47.78 per cent between August 12 and October 30. This loss was probably due to cannibalism, death and bird predation. Great blue herons were observed feeding about the ponds on several occassions. Length measurements were not made on these fish.

The growth of the walleyes in Pond No. 19 between April 30 and August 10 is presented in the following table.

Date of sample	Number of fish measured	Average total length in inches	Average weight in ounces
May 28	11	1.37	....
June 9	6	2.11	....
June 23	8	2.35	0.06
July 7	14	2.44	0.07
July 21	15	2.68	....
August 4	17	2.67	0.07
August 12[1]	74	2.69	0.08
August 12[2]	74	6.48	1.30

[1] - Small-sized walleyes
[2] - "Hogs"

Up to June 9 the walleyes grew at a rate of better than one millimeter per day (25.4 millimeters to the inch), which is fairly rapid growth. During the period of June 9 to 23, the growth was just about one quarter of that of the preceding period. From June 23 until the pond was drained on August 12, the average amount of growth was negligible. The cannibals showed an average

growth of about 1.6 millimeters per day (0.06 inches) during the course of the experiment. The almost complete cessation in growth of the small-sized walleyes probably occurred soon after the disappearance of the last of the suckers. The addition of quantities of minnows apparently had little or no effect upon the growth of the small-sized walleyes but probably did aid the "hogs". If the number of walleyes taken at the time the pond was drained is representative of the number present at the various times when minnows were planted, then there were just under 30,000 minnows for 1,838 walleyes, or about 16 minnows for each walleye. That number of minnows would not make many meals for one walleyed pike. Apparently tremendous numbers of minnows need to be continuously supplied to the walleyes to maintain good growth and to prevent cannibalism. As was stated in a previous section, the young of the bluntnosed minnows were consumed as soon as they hatched or soon after hatching.

Most of the walleyes that were preserved as samples by Mr. Lydell were in rather poor condition. Many of the fish were thin and had large heads. Only one of the fish in the July 7 sample appeared normal and the stomach of this fish contained a large leech. One of the fish taken on July 21 had eaten a small crayfish. The stomachs of the rest of the fish in these two samples were empty. Perhaps it would be better in the future to figure out the coefficient of condition for the fish at each collection date.

Experiments Conducted at the Wolf Lake Hatchery

Mr. Marks used Ponds No. 9 and 11 for the walleyed pike experiments conducted at his station. The area of Pond No. 9 was 1.72 acres and that of Pond No. 11 was 1.34 acres.

No attempt was made to fertilize either of these ponds.

The fish in these two ponds were fed Balto and sheep liver once daily from June 1 until the ponds were drained but Mr. Marks states that the fish were never observed taking it.

Neither of the ponds were stocked with minnows. On May 2, Mr. Krumholz and the writer were unable to obtain enough fatheaded minnows for the experimental ponds, but did collect some that were placed in a small pond at the Wolf Lake Hatchery to build up a brood stock for another year.

The ponds were stocked with walleyed pike fry on May 1, 1942. Both ponds were stocked at the rate of about 100,000 per acre. Pond No. 9 received 170,000 fry and Pond No. 11 received 130,000 fry. Mr. Marks did not state the method used to estimate the number of fry.

Growth and survival

Data on the growth and survival of the walleyes in the two experimental ponds at the Wolf Lake Hatchery are presented in the following table. The ponds were drained on or about October 24.

Date of Sample	Pond number	Number of fish in sample	Average total length (inches)	Average weight (ounces)	Number fish recovered	Per cent survival
June 30	9	27	2.00	....	....	....
October 24	9	103	3.37	0.14	10,000[2]	5.95
October 24	9	27	10.63	6.60	116[3]	
June 30	11	31	1.80	....	....	....
October 24	11	?	4.00	?	45[2]	0.08
October 24	11	?	11.00	?	60[3]	
October 24	10	17[1]	11.80	7.30	....	....

[1] - These fish were removed from Pond No. 10. They no doubt entered this pond from Pond No. 11, below. Measurements by Krumholz.
[2] - Fingerling fish
[3] - Cannibals

When Pond No. 9 was drained, a total of 10,116 walleyes were recovered which represents a survival of 5.95 per cent of the 170,000 with which the pond was stocked. (Mr. L. A. Krumholz was at the Wolf Lake Hatchery when this pond was drained. According to his records there were only 27 "hogs". Although there is quite a discrepency here, we are using the figures furnished by Mr. Marks because these are listed on the hatchery records.) Only 1.15 per cent of these (116 fish) were cannibals. Pond No.11 contained 105 fish when drained which represents a survival of only 0.08 per cent of the 130,000 walleyes which were planted. Out of the 105 fish, 60 were cannibals (57.14 per cent).

The percentage survival varied tremendously between the two ponds considering that they had been stocked with the same number of fry per acre and had both received the same type of treatment. Mr. Marks did not give any weights on the fish that were taken from Pond No. 11. If we assume that weights of the fish in Pond No. 11 were the same as the fish taken from Pond 9 we would have a production of 25.1 pounds of walleyes in Pond No. 11 as compared to 135.35 pounds for Pond 9. From observations that were made by Mr. Krumholz and the writer, Pond 9 contains more aquatic plants than does Pond No. 11. No explanation can be given by the writer to account for the variation in the survival of these two ponds, but it was probably due to one or more of the following: (1) mortality of the fry due to cannibalism, disease, etc.; (2) a better growth of aquatic plants, plankton, and insects in one pond with better survival of fry.

Mr. Krumholz and the writer took the only sample of walleyes from the experimental ponds between the time that the ponds were stocked on May 1 and when the ponds were drained on October 24. On June 30 when these samples were taken, the walleyes were thin and had rather large heads. The growth up to this time compared favorably with the growth of the fish at the Lydell Hatchery.

The walleyes raised at the Wolf Lake Hatchery are being held over winter for survival and growth studies. The 176 cannibals were placed in Pond No. 22

with some adult bluegills and the 10,045 fingerlings were placed in Pond NO. 9. One November 11 an estimated 330,000 lake emerald shiners weighing 400 pounds (22 pails each weighing 20 pounds), were placed in the pond. These shiners averaged about 2 inches in length. Mr. Marks states that the walleyes chased the minnows as soon as they were placed in the pond.

The plans for the spring of 1942 call for someone from the Institute to be at the Wolf Lake Hatchery when Ponds No. 9 and No. 22 are drained so that accurate weights, measurements and counts may be obtained. Mr. Marks should accurately record all further plantings of minnows in either of these ponds.

It is rather difficult to make any comparisons between the experiments conducted at the Lydell and Wolf Lake Hatcheries during 1942. A summary table has been prepared (Table 1) and an examination of this table should give a comparison between the experiments conducted at the two hatcheries. The number (2.6 times greater) and pounds (2.7 times greater) of fish produced in Pond No. 9 at the Wolf Lake Hatchery was much better than the pond at the Lydell Hatchery where a greater percentage survival occurred (1.01 per cent better). Except for the feeding, the ponds at Wolf Lake were not touched from the time the fish were stocked until draining, yet there is certainly a great difference between the survival rate and weight of the fish in the two ponds. The pond at the Lydell Hatchery was fertilized, the fish were fed both artificial food and minnows yet the production was barely superior to the ponds at Wolf Lake. So many things were tried at the Lydell Hatchery that it is impossible to tell what was responsible for the results.

It is doubtful whether artificial feeding should be attempted another year. From the observations that were made by Messrs. Lydell and Marks, very few of the fish actually partook of the food. Perhaps the fish derived more benefit from the fertilizing effect of the food than from eating the food itself. This problem should be worked out in more detail at some future time.

Recommendations for Experiments in 1943

Lydell Hatchery

If possible, two ponds should be used by Mr. Lydell in 1943. Both ponds should be fertilized as soon as the water is put in them in the spring.

Members of the Institute should be on hand to measure the walleye fry that are to be placed in each of the ponds. Both ponds should be stocked with the same number of walleye fry per acre. One pond should be left alone from the time it is stocked until it is drained. The other pond should be treated as follows:

1. Mr. Lydell should make a special effort to secure as many sucker eggs as possible. A portion of the sucker fry (at least 10 quarts), should be placed in the pond with the walleyes. The remainder of the sucker fry should be placed in a separate pond and held to be fed at intervals during the summer to the walleyes. Observations should indicate when to add additional suckers to the walleye pond. The purpose of this experiment is to keep the walleyes continuously supplied with food. Consequently as many suckers as possible should be placed in the sucker rearing pond. Each batch of suckers fed to the

walleyes should be accurately weighed and a sample of at least 50 of these suckers should be measured individually and the total weight of the 50 fish taken.

2. If it is not possible to obtain enough sucker eggs it would be necessary to have a pond in which golden shiners, bluntnosed minnows or some other forage minnow could be held in sufficient quantities to insure a continuous supply of minnows for the walleyed pike throughout the course of the experiment. If it is impossible to insure an ample supply of minnows or other forage fish, the experiments should not be started. The purpose of the profound experiments is definitely to ascertain whether a continuous supply of forage fish is necessary to decrease cannibalism and to provide for better growth. After the experiments on these two ponds have been conducted, we should be in a better position to answer this question. No such conclusive experiment has yet been conducted in rearing walleyes.

All samples and measurements of walleyes will be made by some member of the Institute staff. Monthly length measurements should be taken of the walleyes in these two ponds. This will be necessary to determine the growth, condition, and the available supply of forage fish.

Wolf Lake Hatchery

Mr. Marks has suggested using the large (38 acre) pond at the hatchery as an experimental walleyed pike pond. If this pond is used the following should be done:

1. Fill the pond with water as early as possible in the spring.

2. It would be well to fertilize the pond soon after it is filled but we realize that fertilizer may be difficult or impossible to obtain in 1943. If manure is available, two or three tons should be placed in the pond as early as possible in the spring.

3. As soon as there is enough water in the large pond to support fish life, the fatheaded minnow pond should be drained. Someone from the Institute should be on hand to count, weigh and measure these minnows. At least 100 fatheads per acre should be placed in the pond, and if available, 200 fatheads per acre would be desirable. If Mr. Marks does not have this number of minnows, an effort will be made to collect enough elsewhere for this experiment.

4. Approximately 1,000,000 walleye fry should be placed in this pond. This stocking would be at a rate of about 25,000 per acre. Someone from the Institute should be present to measure the walleye fry that are placed in the pond.

5. Monthly samples should be taken of the walleyes in this pond by members of the Institute.

INSTITUTE FOR FISHERIES RESEARCH

by W. F. Carbine

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Summary of the walleyed pike experiments conducted at the Lydell and Wolf Lake Hatcheries in 1942.

	Lydell Hatchery	Wolf Lake Hatchery	
	Pond No. 19	Pond No. 9	Pond No. 11
Size pond-in acres	0.8	1.72	1.34
Rate of stocking / acre	33,000	100,000	100,000
Number walleyes stocked	26,400	170,000	130,000
Fertilization-			
Kind, amount	Horse manure - 10 Wheel barrow loads. Ground goldfish-94 pounds	none	none
Minnows introduced-			
Kind, number, weight	Bluntnose breeders, 1,275. Suckers (8 quarts of yolk fry) approximately 256,000. Great lakes shiners, 31,083 weight 47.09 pounds	none	none
Artificial feeding-			
Kind, amount	50-50- clam meal and Rowena 5 pounds daily except Sunday from May 28-June 5. Ground horsemeat, 3 pounds daily except Sunday from June 6 to August 10.	Balto and Sheep liver once daily from June 1 to Oct. 20.	Balto and sheep liver once daily from Junelto Oct. 20.
Pond drained-			
Date	August 11	October 24	October 24
Number walleyes removed	1,838	10,116	105
Number fingerlings	1,652	10,000	45
Number "hogs"	186	116	60
Total weight	23.5 pounds	137.85 pounds	25.28 pounds[1]
Survival	6.96 per cent	5.95 per cent	0.08 per cent
Average length-fingerling	2.69 inches	3.37 inches	4.0 inches
Average length-"hogs"	6.48 inches	10.63 inches	11.0 inches
Production rate			
Number per acre	2,297	5,881	78
Pounds per acre	29.4	80.15	18.87

[1] - Estimated (see text)