CIRCA 1955

MEASUREMENT AND CERTIFICATION OF OTTER TRAWL COD ENDS.

Report on Work Project No. 27-G

Hoy, DWIGHT

This report covers the work done on the measuring and certification of new dry nets at the various gear lofts in Boston and Gloucester, Mass., and wet, after-use, mesh measurements on trawlers at Boston, Mass. The requirements for new twine before use are 5.625 inches per mesh from knot center to knot center for four-ply fifty-yard twine and 5.500 inches per mesh from knot center to knot center for four-ply eighty-yard twine. Wet after-use requirements are 4.500 inches between knots on all twines.

During the early stages of this program, it was thought that tapered cod ends, utilising two or three different size meshes, would enter into the picture. This thought came about because of the variations in stretch and shrinkage in different areas of strain, the greater strains falling on the smaller meshes from the splitting strap to the end of the cod end. However, due to the fact that the fishermen, when attaching a new cod end to the net, do not notice which is the upper or lower end, they lose any benefits that may be gained from the use of such gear. Because of this and the slight added cost of the tapered cod end, its use has been discouraged and the straight untapered cod ends are now the only ones used.

The number of sizes of twine used in haddock fishing in the Boston, Gloucester, and New Bedford area has decreased to two, primarily; these being four-ply fifty-yard twine on the large otter trawlers and four-ply eighty-yard twine on the smaller medium trawlers. The basic reasons for these twine selections are economy, and the horsepower required to tow the different sizes

of twine. The general idea is to tow the heaviest gear possible without overloading the power plant and causing a loss in ground covered.

Dry Cod End Measurements:

From the latter part of April, 1954, to the end of the year 1954, seven hundred and one (701) manila cod ends of various size twines were measured and tagged.

At the time of the conversion from pre-regulation mesh sizes a mesh size of five and seven-eighths inches before use was selected for twines of all weights. This caused great consternation among the fishermen, due to the fact that the lighter twines stretched to great lengths in comparison to the heavier twines. To overcome this great variation, mesh sizes were set more in line with the weights of different sizes of twines.

The second phase found a mesh size of five and five-eighths inches for forty-five and fifty-yard twines and a mesh size of five and one-half inches for seventy-five and eighty-yard twines for certification. Because there is such a slight difference between the forty-five and fifty-yard twines, most cod ends are now made of fifty-yard four-ply manila. The same holds true with the seventy-five and eighty-yard twines. The use of seventy-five yard twine has been practically discontinued. The cod ends mentioned in this report were manufactured of either four-ply fifty-yard or four-ply eighty-yard twines, but with varying numbers of meshes in length and width.

The procedure followed in measuring new dry cod ends is described as follows:

The first half mesh or starter mesh is not considered in the measuring, nor is the last half mesh or finisher mesh because of their distortion.

The practice of measuring all new twine under two hundred (200) pounds tension is used on twines of all sizes throughout this report.

Of the five hundred fifty-six (556) four-ply fifty-yard cod ends measured, seventy-two percent were fifty-one meshes long, of which fifty meshes were measured. This group averaged 5.60 inches per mesh. These were practically all manufactured at Grimsby, England. Twelve percent of the total were fifty meshes, over-all, forty-nine meshes measured and averaged 5.65 inches per mesh. These were manufactured mostly in Holland. Nine percent of the total measured were forty-five meshes over-all of which forty-four meshes were measured. These averaged 5.55 inches per mesh. This was a mixed group, some having been manufactured in Holland and some in England. Seven percent of the total were forty-two meshes over-all, forty-one meshes being measured. These averaged 5.68 inches per mesh. This group was manufactured in England. The average per mesh of the entire lot was 5.61 inches or slightly under required dry specifications. See Graph No. 1.

One hundred forty-five (145) four-ply eight-yard twine cod ends were measured. One percent of the total was fifty-one meshes over-all with fifty meshes measured, averaging 5.10 inches per mesh. This twine was manufactured in Holland and was treated with a preservative, which was the probable cause of the small mesh size. Sixty-one percent of the total number were forty-five meshes over-all, forty-four meshes measured, and came from both Holland and England and averaged 5.57 inches per mesh. Twenty-four percent of the total number were forty-four meshes over-all and forty-three meshes measured. These were manufactured in England and averaged 5.49 inches per mesh. Fourteen percent of the total number were forty-three meshes over-all with forty-two meshes measured, averaging 5.71 inches per mesh. The over-all average for the

total number was 5.56 inches per mesh or slightly over requirements of 5.50 inches per mesh. See Graph No. 1A.

The greatest problem in trying to measure new cod ends comes from the irregularities caused by hand braiding. One worker will tighten his knots reasonably tight while another in the same loft will have his knots looser to a certain degree, which has a bearing on the final over-all measure and the distortion of some of the meshes.

The third phase came about because of the fact that there was to be no tolerance allowed in the measuring and certification of dry cod ends. Prior to this notification, some tolerance was being allowed on a give and take basis, so that there would be no ill will created. One twine dealer, being disturbed, asked if he could tighten knots to what would be considered reasonably tight before FWS agents measured the twine. Since there was nothing in the law that stated otherwise, he did just that. Having made the knots reasonably tight, an experiment was run to find what effect humidity would have on the over-all measure of the cod ends. A graph (No. 2) taken from his data is being submitted with this report. Because the humidity and temperature readings are taken out of doors at the Weather Bureau at Logan Airport, a distance of about one mile from his loft, there should be differences in the readings at the twine loft, his measurements having been taken inside of his loft under somewhat controlled conditions. However, the points brought out show that humidity does apparently affect the measurements.

The manufacturers were notified by each respective dealer that cod ends had to meet the required specifications or they would not be certified. This led to an increased mesh size in order to insure certification by our agents. The cod ends from Grimsby were braided on a five and five-eights inch block; thus, making sure that upon tightening of the knots the humidity,

unless extremely high, would have little bearing on the measurements in the U. S. by our agents. These cod ends were made of four-ply eighty-yard twine and one mesh less in count on the over-all length. This was done to keep the original over-all length of the cod end somewhere near the same, due to the increased per mesh measure. Graph No. 3 is attached comparing measures made at Grimsby against those made in this country by our agents on this type cod end. There were no four-ply fifty-yard twine cod ends received from Grimsby during this time with which to make comparisons. The Holland manufacturers, on the other hand, increased their specifications to an extreme. All cod ends received from them during this time were braided on a five and seven-eighths inch block, using four-ply fifty-yard twines. When measured by FWS agents, these cod ends meshes ranged from 5.80 inches to 6.18 inches. Graph No. 4 shows comparisons of this size twine received and measured during the second phase of this report against twines received during the third phase.

Wet Mesh Measurements

The measuring of wet twine aboard the trawlers to obtain after-use data presents quite a problem. Unless the twine is free of ice and frost, true measurements cannot be made. Because of these difficulties, wet measuring is discontinued throughout the winter months and started again in the early spring when weather conditions are more favorable.

Of the one hundred eighty-four (184) wet measured cod ends identified, very few could be traced throughout the entire life of the twine. During late spring, before large catches of scrod haddock prevailed, the entire length of a recognized cod end could be measured. As the catches increased, the working loads on the cod ends increased, thus stretching the twine more quickly. This led to the wholesale cutting of the lower part of the cod end and

replacement with new twine. The lower part is considered that part from the splitting strap to the extreme end, a piece of twine about twenty or twenty-five meshes long. This new piece of twine would be attached to the older or upper portion of cod end already on the net. Upper cod end twines would be used three trips and as many as five trips against the continuous changing of the lower meshes, (probably every trip or so) to take advantage of smaller mesh sizes. Because of the differences in tension, upper meshes stretch very little in comparison to the lower meshes. The lacing of lengths of nine or twelve-thread rope on the bias and up and down the stretch of the twine was also used (see drawing). This practice does not obstruct the meshes; nor does it let the twine stretch as it will without these "helpers", as they take up a large portion of the tension. An example of this cutting is demonstrated in the following table, showing the use of one cod end through its average life:

Original Average	Average After Use	No. Trips	Size Twine	Areas Fished	Trip Hailed
5.62	4.53	1	4/50	Geo.	106.3 lbs.
"	4.62	2	"	"	84.5 lbs.
Replaced 25 meshes new lower end with helpers	4.28	3	"	"	78.3 lbs.

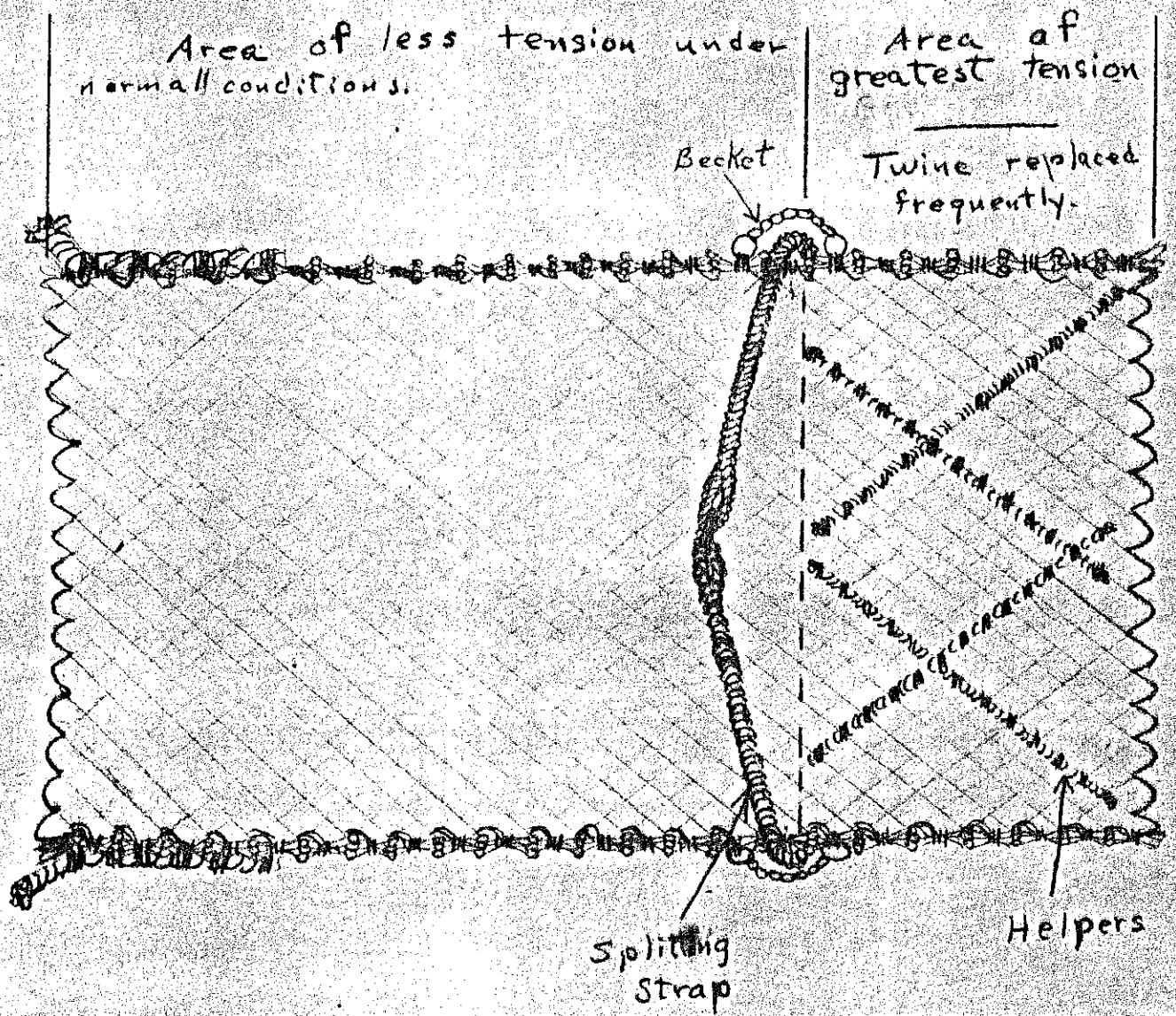
These averages were arrived at by measuring fifty consecutive meshes in one row.

Some four-ply fifty-yard manila twine from Holland, having a light preservative treatment, was tried by several of the boats. This was soon discontinued, because of added cost without appreciable lengthening of life. No comparison of English and Holland manila twines was made as the quality, twist, and lay of the twines is practically the same.

Of the total number of cod ends that could be identified, fifty-six percent were under four and one-half inches and forty-four percent were over

four and one-half inches after use. All of these cod ends were four-ply fifty-yard twines.

The following table shows individual mesh measurements taken after use on fifteen cod ends. These cod ends were selected, because, as far as could be ascertained, they had not been cut to replace lower meshes. This table also gives one a cross-sectional illustration as these nets range from one trip, which is not a true picture in most cases, to three trips or the average life of a cod end under reasonable loads.


Area of less tension under normal conditions.
Area of greatest tension
Twine replaced frequently.
Becket
This end attached to net.
Splitting Strap
Helpers

Mesh sizes in inches	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
3.750					1						2			2	
3.875	1				1					1			1	5	
4.000	8				5		5			3	5	6		8	1
4.125	15	1	2	4	2		5	3	2		2	3	2	13	6
4.250	13	8		5	1	10	5	8	5	5	7	3	5	7	11
4.375	8	6	3	10	9	11	12	10	9	9	11	7	6	9	6
4.500	5	7	11	14	11	12	12	12	12	14	14	10	9	2	10
4.625	1	10	8	5	15	7	6	7	8	10	1	10	7	2	8
4.750		9	12	6	4	3	2	2	6	4	1	5	6	1	1
4.875			6	6	3	1		1	4		1	3	8		
5.000			1				2		1	2		1	1		1
5.125			1				1					1			
5.250										1					
5.375								1				1			
5.500										1					
Av. after use	4.218	4.509	4.642	4.507	4.480	4.487	4.415	4.460	4.541	4.510	4.338	4.457	4.555	4.176	4.397

Individual mesh measurements of fifteen cod ends after use (4/50 yard 5.625 inches Manila cod ends)

The over-all average is 4.446 inches per mesh.

Observations

During the early spring when the scrod haddock run was reasonably light, there was considerable objection to the large mesh cod ends by the fishermen. As the season progressed, the run of scrod increased abnormally, causing fishermen to remark that the large mesh was the best thing that ever happened. This pertained only to the large trawlers out of Boston, haddock being their principal species. The medium size trawler fishermen continued to complain because their trips are made up of all sizes and species of fish from haddock on down to ocean perch. Their argument is that when haddock are scarce, they could supplement a trip with ocean perch, if the mesh size were smaller.

The opinion of one of the larger boat operators of Boston is that the mesh size should be five and one-half inches dry before use. He maintains that the meshes under the present specifications of five and five-eighths inches stretch to an oversize dimension too quickly from the splitting strap down. This causes the fisherman to discard the cod end while it is still serviceable. He says that the cost of gear has risen twenty-five percent due to this factor. Other than the rising cost of operation, this operator believes that the mesh regulation is a good thing; the reason being, larger size scrod which bring higher prices.

The consensus of opinion of those people engaged primarily in the haddock fishery is that the mesh size regulation is good. It is only those fishermen who are engaged primarily in the catching of ocean perch who frown on this mesh regulation.

Capt. William E. Westerbeke of the Westerbeke Fishing Gear Co. of Boston, who has cooperated with us to the fullest, has submitted a letter with

observations he has made. (Copy of his letter attached.) Because of the loosening of knots due to humidity, and handling in transit, true measure cannot be made merely by unbaling the cod ends and stretching. The knots made on manila twine of any size will not tighten unless they are cross-stretched, while tension is being applied lengthwise. Stretching in this manner will allow a gain of as much as twelve inches or better.

Due to the fact that no tolerances are allowed, manufacturers are increasing the mesh sizes to insure certification (as much as three-eighths of an inch). This is creating the danger of extreme over-size meshes that existed during the early stages of the regulation. This also applies to the four-ply eighty-yard twine which has a five and one-half inch specification. The meshes in a cod end made of four-ply eighty-yard twine would stretch to great extremes from the splitting strap down as the hoisting tensions in this area, under normal fishing are about the same as those placed on four-ply fifty-yard twine.

Recommendations:

1. The procedure of measuring new dry twines before use under two hundred (200) lbs. tension be continued.

2. The present mesh sizes of five and five-eighths inches for four-ply fifty-yard twine and five and one-half inches for four-ply eighty-yard twine should be retained, pending further study.

3. Experiments should be run on a specific number of four-ply fifty-yard and four-ply eighty-yard cod ends to determine the changes in mesh size from new dry twine to wet used twine.

2

4. That only wet after-use cod ends, able to be identified in their original lengths, be measured for comparisons.

5. Experiments be started to determine the proper certifying measurements for four-ply one hundred twenty-five yard twines. No measurements have been made on this size twine which is used in the New Bedford area.

6. Determine variation in cod end length due to humidity and tightness of knots and allow a certain tolerance to compensate for possible shrinkage.

Use a correction factor for humidity?

Feb. 10, 1955

WESTERBEKE FISHING GEAR CO., INC.
279 Northern Avenue
Boston, 10, Mass.

LARGE MESH MANILA CODENDS
Observations And Recommendations

Being one of the suppliers of large mesh codends to the New England haddock trawlers, we are very much concerned with the law and regulations pertaining to these codends.

To manufacture a codend with meshes of a specified minimum average size and not have the meshes much larger than the specified minimum, is quite difficult. To keep the meshes to the size they were when manufactured, until they are officially inspected, a month or two later, is impractical. From observations and experiments we have found that the variation in humidity causes a variation in the mesh size (as much as .115") and loosening of the knots, caused by handling, packing, and in transit, results in a much smaller mesh. Enclosed is a sheet of measurements showing the extent loose knots affect mesh size.

Codends should be inspected under about the same conditions prevailing when they were manufactured (normally tight knots and normal humidity). When codends are inspected wet and after use, two conditions mentioned above are constant - the knots are tight and the codend wet. If the original experiments conducted (to determine that 5-5/8" stretched mesh in new codends resulted in 6" inside mesh measurements wet and used codends) were on codends with knots more or less loose and the variation in humidity not considered, the results of the experiments cannot be accurate.

Manufacturers are making codend meshes as much as 3/8" over the specified minimum size, so that they will pass official inspection when the knots are loose and the humidity, high. Is it any wonder that we hear more frequently that 3" mesh liners are being used in codends while fishing?

We wish to make the following recommendations:

1. That more experiments be conducted to determine the size mesh necessary in new codends, to result in the size mesh required when the codends are being used.

   That the knots be normally tight when the new experimental codends are measured and that the humidity be normal when they are measured.

2. That codends not be rejected unless the average mesh size is below the required minimum when the knots are right and the humidity, normal.

WESTERBEKE FISHING GEAR CO., INC.

Wm. E. Westerbeke

Wm. E. Westerbeke, President

FEBRUARY 9, 1955

WESTERBEKE FISHING GEAR CO., INC.

279 Northern Avenue
Boston, 10, Mass.

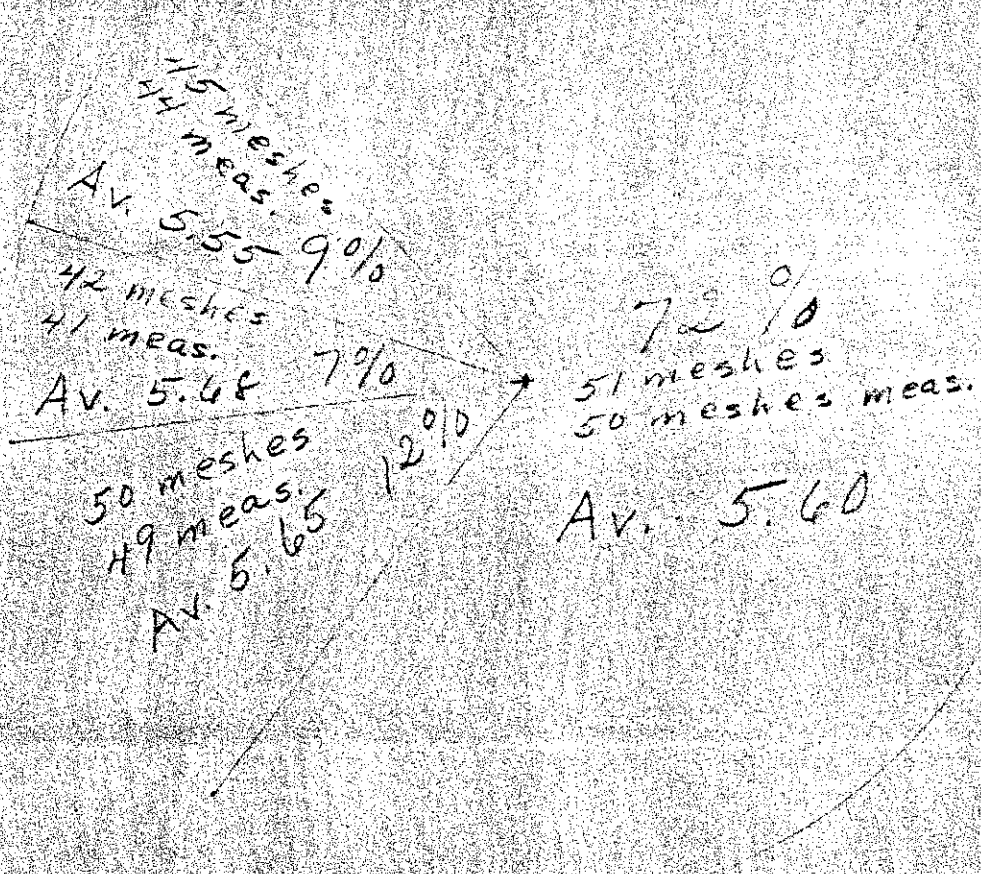
Nine of our No. 41 Large Mesh Codends were measured by Government Inspectors today. When they were finished we tightened the knots in these codends and measured them again, using the same method of measuring as the inspectors used.

Following are the results:-

INSPECTORS' MEASUREMENTS of 49 Meshes			OUR MEASUREMENT (Knots Tight)	GAIN IN LENGTH	AVERAGE SIZE MESH (Knots Tight)	GAIN IN AVERAGE SIZE MESH
Length Inches	Equivalent Ft.-Inches	Average Size Mesh Inches	Ft.- Inches	Ft.- Inches	Inches	Inches
281	23 - 5	5.73	24 - 1/2	7½	5.89	.16
285	23 - 9	5.81	24 - 5	8	5.98	.17
282	23 - 6	5.76	24 - 5	11	5.98	.22
281	23 - 5	5.73	24 - 1½	8½	5.90	.17
282	23 - 6	5.76	24 - 10	1 - 4	6.08	.32
284	23 - 8	5.80	24 - 4	8	5.96	.16
287	23 - 11	5.85	24 - 3½	4½	5.95	.10
281	23 - 5	5.73	24 - 2½	9½	5.92	.19
279	23 - 3	5.67	24 - 5	1 - 2	5.98	.29

2-1

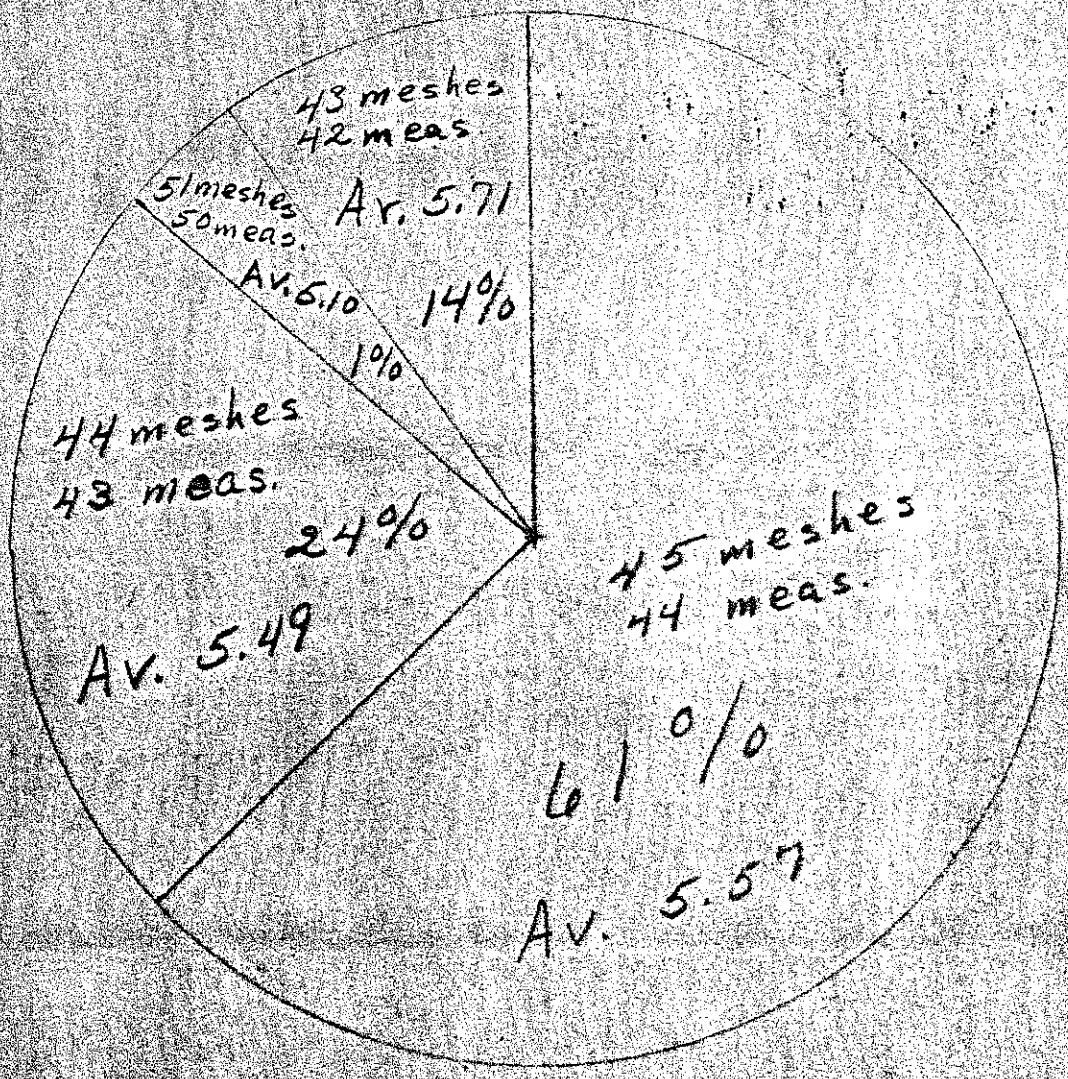
#/50 Twines measured under 200 lbs. Tension



Overall average 5.61 inches per mesh.

No. 1A

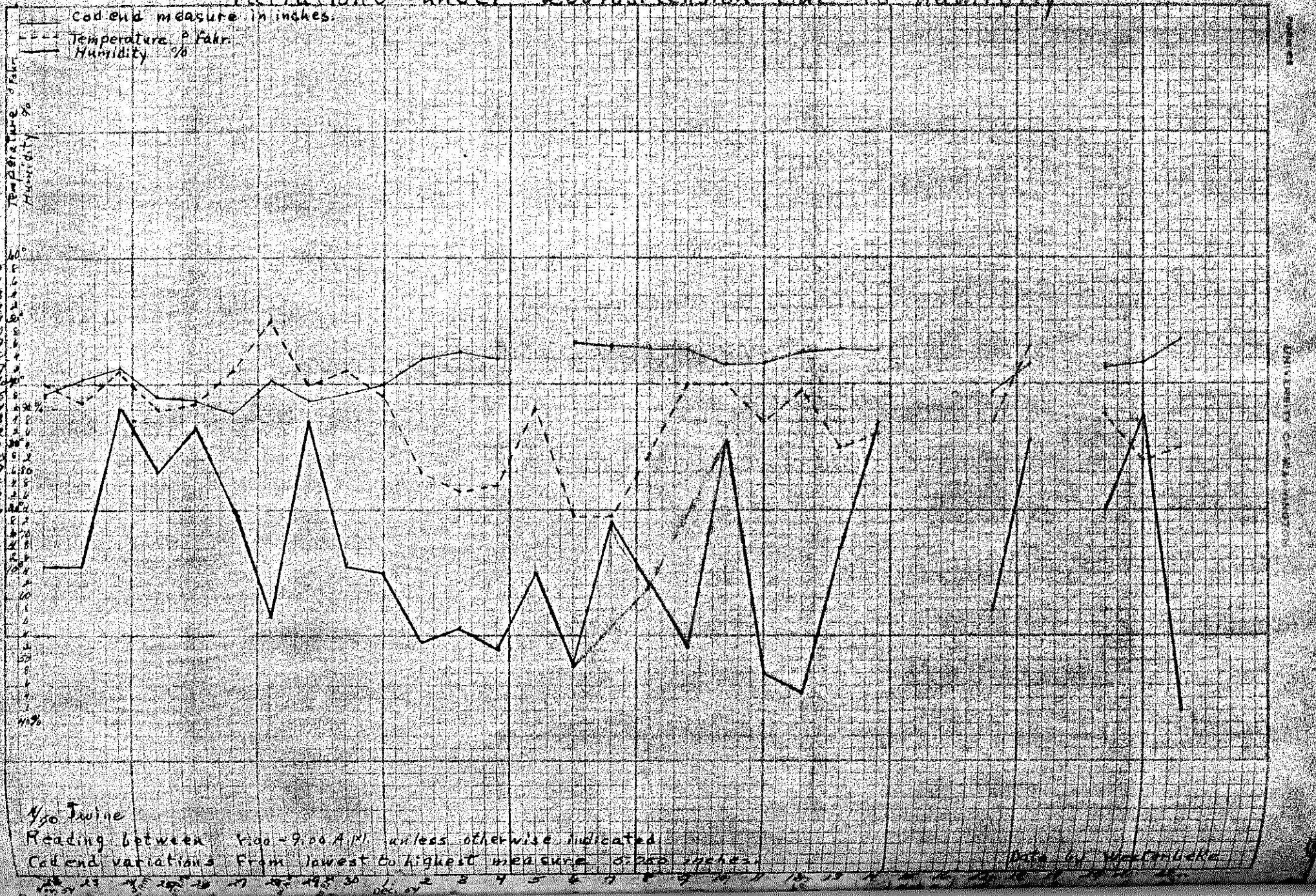
4/80 Twines measured under 200 lbs. Tensions.



145 nets:
overall average 5.56 inches
per mesh.

No. 2

Variations under 200 lbs. tension due to humidity



9/20 Twine

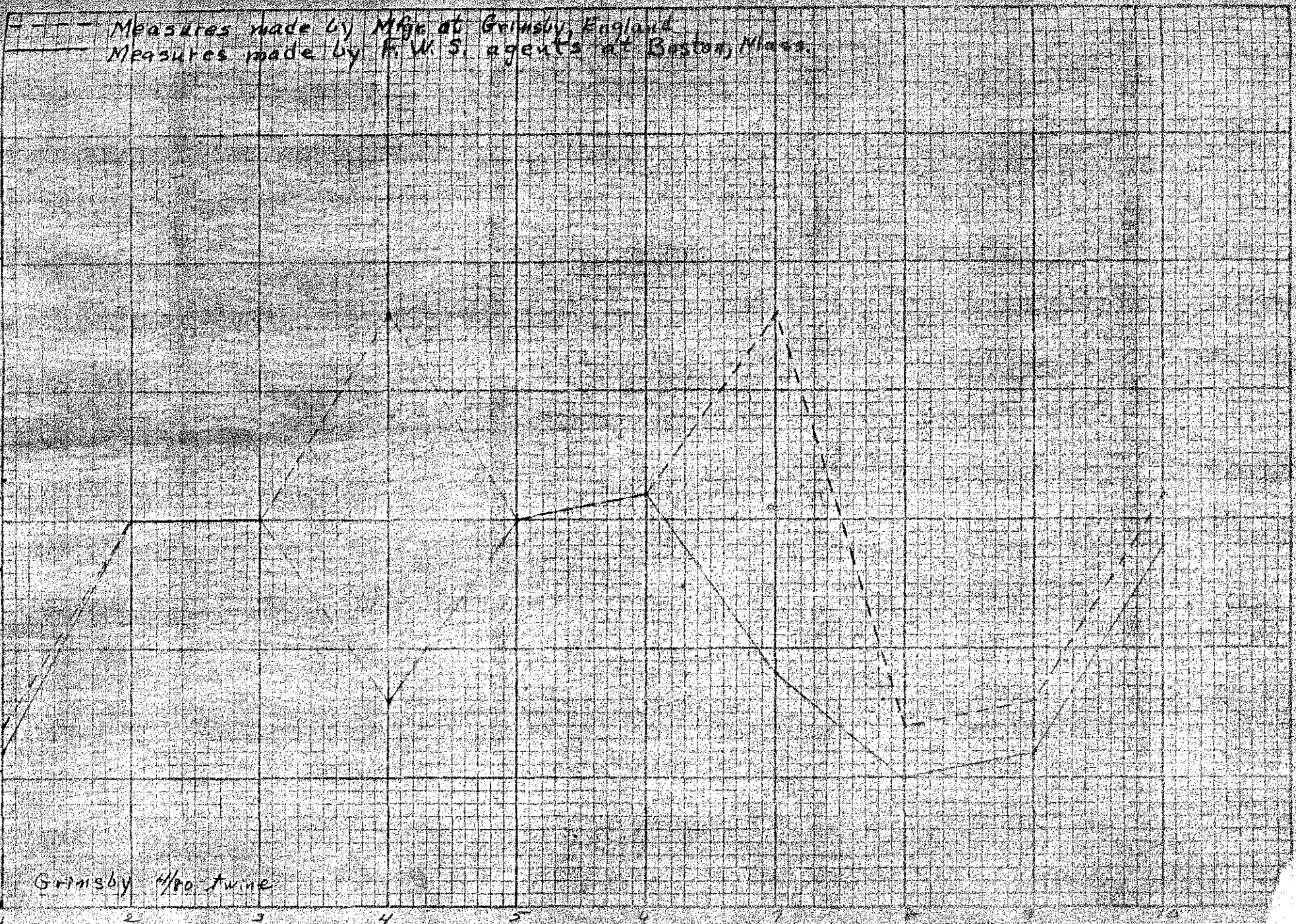
Reading between 8.00 - 9.00 A.M. unless otherwise indicated.

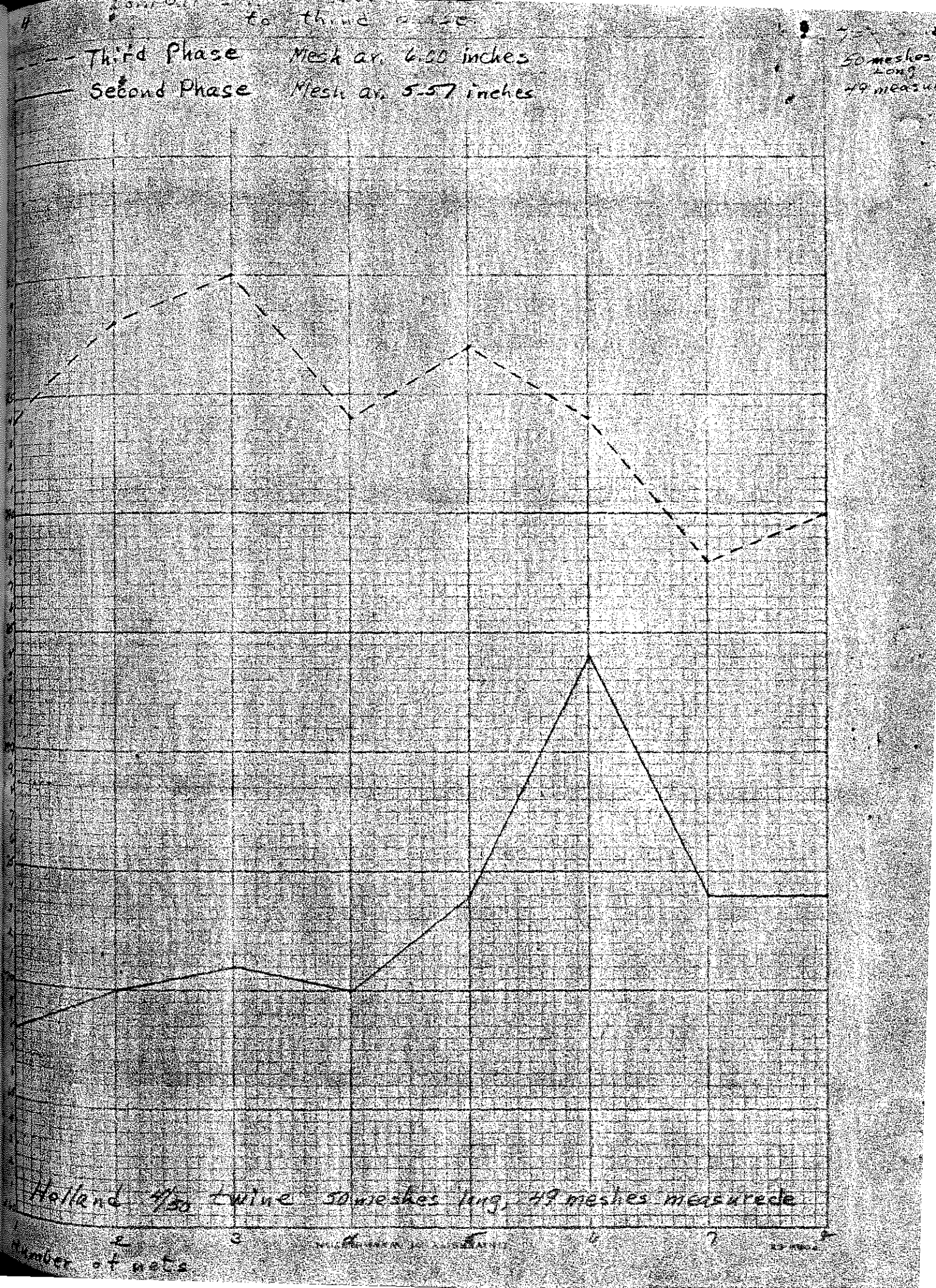
Cod end variations From lowest to highest measure 3.200 inches.

Data by McCandless

No. 3

Variations in measure under 200 lbs. tension




to third phase
Third Phase Mesh av. 6.00 inches
Second Phase Mesh av. 5.57 inches
50 meshes long
49 measu
Holland 4/50 twine 50 meshes long, 49 meshes measurede
2
3
4
5
6
7
8
Number of nets