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Distribution of ammonia nitrogen in the lower York River, Virginia : Spring, 1961

Bernard C. Patten

Virginia Fisheries Laboratory

Virginia Institute of Marine Science

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SPECIAL SCIENTIFIC REPORT NO. 25

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DISTRIBUTION OF AMMONIA NITROGEN IN THE LOWER YORK RIVER, VIRGINIA, SPRING 1961

Bernard C. Patten and John R. Lacey

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DISTRIBUTION OF AMMONIA NITROGEN IN THE LOWER YORK RIVER, VIRGINIA

SPRING, 1961

Data on the distribution of two forms of nitrogen (ammonia and nitrate) in the lower York River are reported for the period from February 16 - April 22, 1961. This work was conducted by Mr. John R. Lacey, undergraduate at the College of William and Mary, under the supervision of the Planktology Research Section. The study was undertaken in response to (i) prior revelation of frequent NO_3-N deficiency in the lower York and lower Chesapeake Bay (VFL Special Scientific Reports Nos. 20 and 23), and (ii) a recent report (Harris and Riley 1959) of considerable levels of standing NH_4-N in Long Island Sound. It was desired to establish whether or not absence of NO_3-N would constitute grounds for regarding nitrogen to be a limiting nutrient to growth of planktonic populations.

Six stations were occupied at approximately weekly intervals. Station locations (Fig. 1) and mean low water depths were:

1) 37°14'31", 76°29'43"; 26 ft.

2) 37°12'59", 76°28'11"; 5 ft.

3) 37°13'39", 76°25'05"; 6 ft.

4) 37°14'47", 76°23'33"; 38 ft.

5) 37°15'39", 76°25'45"; 5 ft.

6) 37°14'29", 76°27'29"; 20 ft.

The sampling routine consisted of collection of water samples from surface and bottom, and determination of surface and bottom temperatures (Table 1) using either a thermistor or a thermometer.

Upon return to the laboratory, extinction coefficients (Table 2) were determined colorimetrically for "white" light (GE incandescent lamp CDJ-100W) using a neutral filter, and the samples assayed for salt, NO_3-N and NH_4-N. Chlorinities (Table 3) were titrated with silver nitrate. Nitrate (Table 4) was determined by the strychnidine method. Ammonia was distilled off, nesslerized, and its concentration measured colorimetrically; details of the method follow.

Free ammonia may be recovered quantitatively only when the distillation mixture is alkaline. pH was adjusted at 9.5 by adding 0.25 N NaOH to a subsample containing thymolphthalein indicator. An equivalent amount of alkali was then added to 300 ml of sample just before distillation. Distillation was carried out in a 500 ml Kjeldahl flask with a large trap and a vertical condenser. The following procedure was employed: (i) add 300 ml ammonia-free water (ammonia adsorbed by shaking 1 gal water with 10 g Folen's ammonia permutit) to flask containing Todd backing stones (for prevention of bumping); (ii) steam apparatus until ammonia-free water is collected; (iii) empty flask, add pH-adjusted sample; (iv) collect 50 ml of distillate; (v) add 2 ml Nessler's reagent (APHA); (vi) prepare blank by adding 2 ml Nessler's to 50 ml ammonia-free water; (vii) allow 10 minutes for color development; (viii) determine absorbancy relative to blank using no. 42 filter; (ix) convert absorbancies to ammonia concentrations using standardization curve (Fig. 2).

Distribution of this report does not constitute publication, and the data are subject to correction and/or revision.

LITERATURE CITED

Harris, E. and G. A. Riley 1959. The nitrogen cycle in Long Island Sound. Bull. Bingham Oceanogr. Coll. 17:31-65.

CRUISE DATES

Cruise No.	Dates
1	16 February 1961
2	24 February 1961
3	3 March 1961
4	10 March 1961
5	17 March 1961
6	27 March 1961
7	7 April 1961
8	14 April 1961
9	22 April 1961

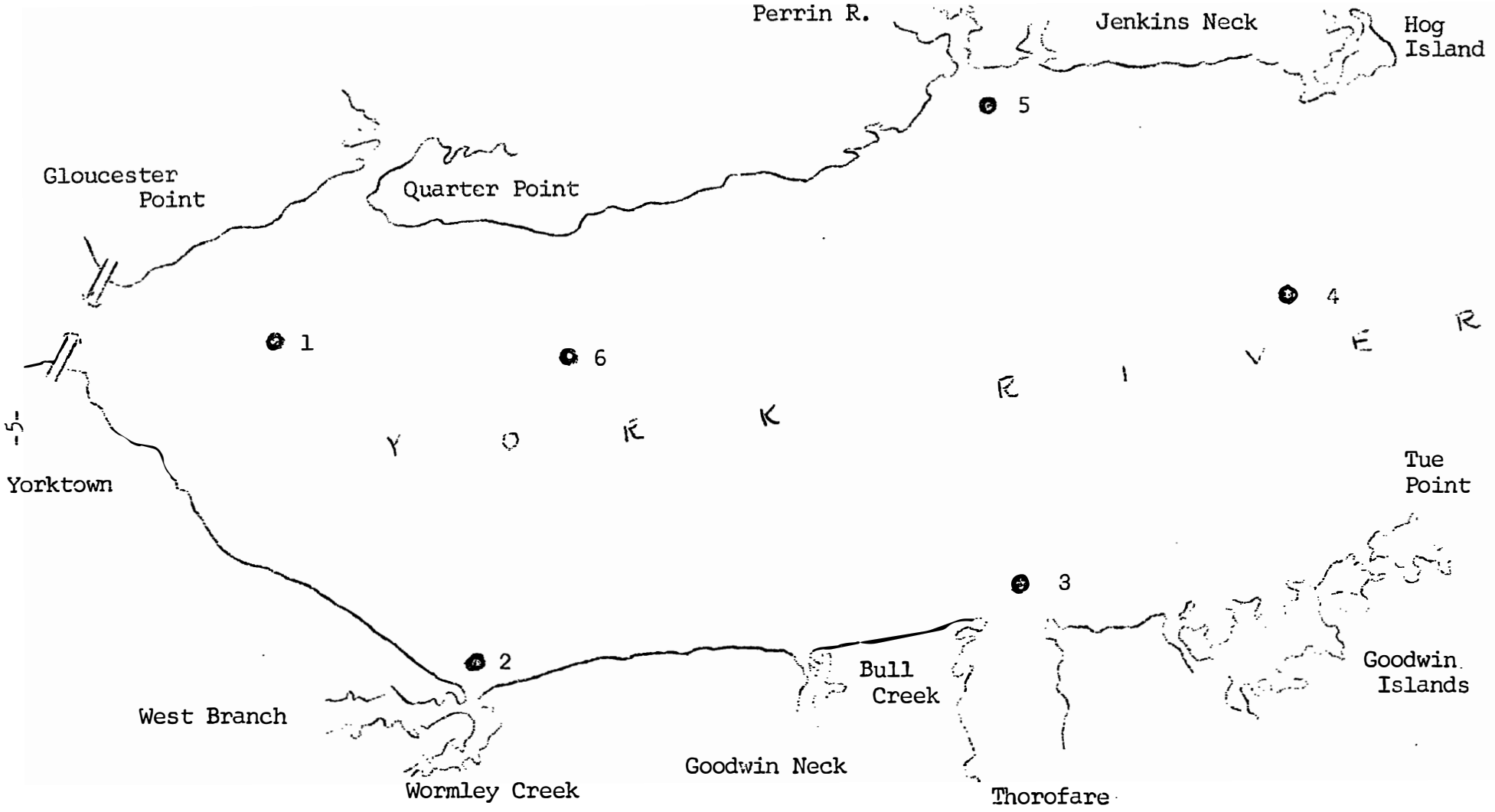
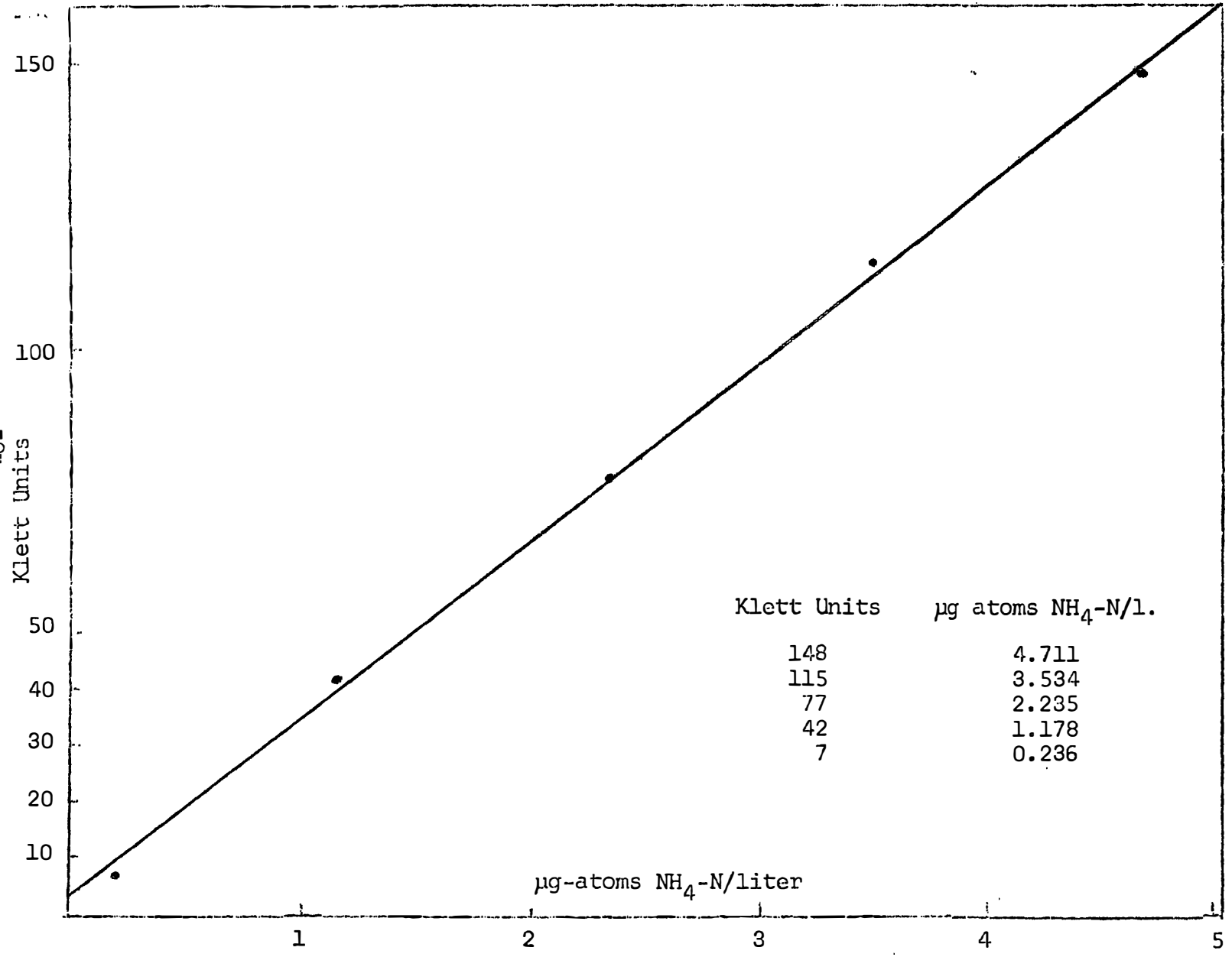


Figure 1. Diagram of the lower York River, showing locations of stations 1-6.



Klett Units	µg atoms NH_4-N/l.
148	4.711
115	3.534
77	2.235
42	1.178
7	0.236

Figure 2. Standardization curve for relating absorbancy (Klett units) to NH_4-N concentration (µg atoms $liter^{-1}$).

Table 1. Surface (S) and bottom (B) temperatures, °C.

Cruise No.	Station 1		Station 2		Station 3	
	S	B	S	B	S	B
1	3.61	2.85	3.66	3.61	3.23	-
2	8.26	4.70	8.44	8.42	8.94	7.16
3	8.15	5.58	10.02	6.82	7.86	6.59
4	7.44	7.04	7.95	7.96	7.88	7.88
5	9.0-	8.8-	9.0-	8.8-	9.0-	9.0-
6	11.0-	8.5-	11.5-	10.5-	11.0-	9.9-
7	12.0-	10.9-	11.5-	11.7-	13.8-	12.5-
8	11.5-	10.5-	13.1-	11.5-	12.5-	12.0-
9	13.5-	12.5-	14.0-	13.8-	14.6-	14.3-
$\bar{x}$	9.38	7.93	9.91	9.23	9.79	9.92

	Station 4		Station 5		Station 6	
	S	B	S	B	S	B
1	-	-	-	-	-	-
2	7.88	4.05	8.62	7.81	8.52	4.21
3	7.17	5.30	9.17	8.12	7.60	5.50
4	7.59	6.16	7.39	7.41	7.48	6.29
5	9.0-	8.5-	9.0-	9.0-	9.0-	8.8-
6	11.5-	8.0-	10.5-	11.0-	11.5-	8.5-
7	11.2-	9.5-	11.2-	10.3-	11.6-	10.0-
8	12.5-	10.5-	12.7-	12.4-	12.0-	11.0-
9	14.0-	12.0-	14.5-	14.0-	14.0-	12.5-
$\bar{x}$	10.10	8.00	10.42	10.00	10.21	8.35

Table 2. Surface (S) and bottom (B) extinction coefficients.

Cruise No.	Station 1		Station 2		Station 3	
	S	B	S	B	S	B
1	4.26	6.56	2.88	3.68	2.53	2.76
2	1.38	3.56	1.38	1.38	0.81	1.26
3	1.27	9.89	1.38	1.38	0.69	1.73
4	2.99	4.03	3.57	3.57	4.49	4.19
5	3.91	6.56	2.19	2.19	2.65	2.99
6	1.50	5.64	1.38	1.38	1.38	1.38
7	1.27	32.43*	1.84	1.50	1.50	6.90
8	2.65	13.57*	1.27	2.88	1.38	1.15
9	1.50	2.30	1.38	1.38	1.38	1.04
$\bar{x}$	2.30	9.39	1.92	2.15	1.87	2.60

	Station 4		Station 5		Station 6	
	S	B	S	B	S	B
1	-	-	-	-	-	-
2	1.04	1.04	0.81	0.58	1.38	2.07
3	0.69	0.69	1.15	4.72	1.50	3.57
4	1.61	1.96	2.76	4.14	2.30	36.80*
5	0.81	1.38	0.35	0.35	1.96	5.18
6	1.38	1.04	1.04	1.04	1.50	11.04
7	6.90	6.90	1.04	1.04	1.89	8.17
8	1.04	2.88	1.15	1.50	1.04	1.96
9	1.04	1.64	1.04	6.60	1.15	33.35*
$\bar{x}$	1.81	2.19	1.17	2.50	1.59	12.77

* May be in error due to stirring of bottom when sampling.

Table 3. Surface (S) and bottom (B) chlorinity, °/oo.

Cruise No.	Station 1		Station 2		Station 3	
	S	B	S	B	S	B
1	10.71	10.98	10.61	10.55	11.01	11.06
2	7.53	10.66	6.40	6.50	7.74	9.23
3	7.91	10.72	8.01	9.11	7.96	9.61
4	9.47	10.56	8.24	8.17	8.91	8.91
5	9.41	9.86	9.41	9.32	9.64	9.65
6	7.02	13.21	7.51	7.72	7.36	8.02
7	7.89	9.13	7.30	7.30	8.32	7.81
8	8.57	9.12	8.43	8.61	8.62	8.58
9	6.72	9.35	7.65	7.63	7.15	7.27
$\bar{x}$	8.36	10.40	8.17	8.32	8.52	8.90

	Station 4		Station 5		Station 6	
	S	B	S	B	S	B
1	-	-	-	-	-	-
2	10.61	8.03	7.91	8.21	5.81	10.71
3	8.11	9.57	7.66	8.22	8.29	10.51
4	9.66	10.58	9.59	9.94	9.32	10.45
5	10.11	10.30	9.71	9.82	9.56	9.73
6	7.36	14.43	7.51	7.91	7.00	12.42
7	8.66	10.16	8.89	9.01	8.08	9.32
8	9.30	9.97	9.01	9.02	8.89	9.50
9	7.74	9.54	8.14	8.13	7.34	9.26
$\bar{x}$	8.94	10.32	8.55	8.78	8.04	10.24

Table 4. Surface (S) and bottom (B) nitrogen as nitrate, μg atoms liter^{-1}

Cruise No.	Station 1		Station 2		Station 3	
	S	B	S	B	S	B
1	0.3	0.3	0.3	0.4	0.6	0.3
2	0.9	0.1	0.4	0.4	0.2	0.2
3	0.7	0.8	0.3	0.3	0.6	3.5
4	2.7	0.3	0.5	0.5	0.5	0.5
5	1.8	1.3	2.3	0.8	0.7	0.7
6	0.2	0.1	0.0	0.0	0.0	0.0
7	0.0	0.0	0.0	0.0	0.0	0.0
8	0.0	0.0	0.0	0.0	0.0	0.0
9	0.3	0.4	0.4	0.5	0.3	0.4
$\bar{x}$	0.8	0.4	0.5	0.3	0.3	0.6

	Station 4		Station 5		Station 6	
	S	B	S	B	S	B
1	-	-	-	-	-	-
2	0.2	0.2	0.2	0.2	0.5	9.4
3	0.4	0.1	0.6	0.7	6.7	1.4
4	0.1	0.1	0.1	0.2	0.3	1.6
5	4.8	0.2	0.1	0.1	0.7	0.4
6	0.0	0.0	0.0	0.0	0.0	0.4
7	0.0	3.6	0.0	0.0	0.0	4.5
8	2.7	0.0	0.0	0.0	0.0	0.0
9	0.4	0.5	0.4	0.4	0.3	0.7
$\bar{x}$	1.1	0.6	0.2	0.2	1.1	2.1

Table 5. Surface (S) and bottom (B) nitrogen as ammonia, μg atoms liter^{-1}.

Cruise No.	Station 1		Station 2		Station 3	
	S	B	S	B	S	B
1	2.30	0.80	0.71	0.66	0.21	0.12
2	0.88	1.64	0.52	0.12	0.52	0.85
3	1.15	2.47	0.59	0.35	0.41	2.69
4	1.46	1.72	1.25	0.59	1.08	1.58
5	2.00	2.76	1.30	0.71	0.82	1.32
6	1.53	2.45	1.08	0.71	0.59	1.77
7	4.95	1.30	0.00	0.00	0.88	1.39
8	1.11	1.11	0.42	0.09	0.80	1.08
9	1.98	2.31	1.08	0.85	1.20	2.07
$\bar{x}$	1.93	1.84	0.77	0.45	0.83	1.43

	Station 4		Station 5		Station 6	
	S	B	S	B	S	B
1	-	-	-	-	-	-
2	0.17	0.09	0.66	0.85	1.34	2.19
3	0.38	0.24	0.53	0.90	0.31	0.12
4	0.71	0.71	0.54	0.99	0.57	0.52
5	0.78	0.59	0.49	0.78	0.33	0.16
6	0.57	0.32	1.86	1.46	0.26	0.71
7	1.01	2.90	0.75	0.57	0.23	0.94
8	0.50	1.53	0.59	1.30	0.75	1.23
9	1.27	1.70	3.04	1.46	3.42	1.41
$\bar{x}$	0.67	1.01	1.06	1.04	0.90	0.91