CONTRIBUTIONS TO THE INTERNATIONAL BIOLOGICAL PROGRAM - YEAR II

A final technical report for Union Carbide Subcontract No. 3566 for the Eastern Deciduous Forest Biome, IBP, Lake George Site.

Ronald Stewart
Lake George

Eastern Deciduous Forest Biome
Memo Report #72-71

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Research supported in part by the Eastern Deciduous Forest Biome, U.S. International Biological Program, funded by the National Science Foundation under Interagency Agreement AG-199, 40-193-69, with the Atomic Energy Commission, Oak Ridge National Laboratory.

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CONTRIBUTIONS TO THE INTERNATIONAL BIOLOGICAL PROGRAM - YEAR II

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ABSTRACT

An analysis of climatological variables in and around the Lake George Basin. Data on wind, temperature, cloud conditions, solar radiation, precipitation, etc. have been prepared for computer storage. Also physical limnological data and/or analysis on: (1) water temperature, heat storage, and currents and (2) mathematical modeling of seiche as related to meteorological parameters. (Key words: meteorology, climatology, physical limnology, Lake George)

Lake George Climatology

Rainfall in the Lake George drainage basin was recorded at four stations during the entire two year project. A fifth gauge, Shelving Rock, was added in June, 1971. The primary objectives of this study were to determine whether rainfall within the basin differed significantly from the NOAA stations located near, but outside the basin. Secondly, we expected that if precipitation gradients exist within the basin, then our multiple gauges should pick this up. (See Colon, 1972, for description of gauge sites.)

With the understanding that two years' worth of data is not enough to analyze climatological variables, the analysis of the data thus far indicates:

1) Rainfall within the basin does not differ in any detectable fashion from that of adjacent cooperating stations such as, Ticonderoga, Whitehall and Glens Falls, in the Hudson and Champlain Valleys (Tables 1 and 2). While Lake George is actually located just within the Adirondack Mountains, the orographic effect, or the effect of the evaporation of Lake George itself, is not enough to create a precipitation anomaly for the Lake George basin.

Precipitation in the Lake George basin is similar to that received in the Hudson and Champlain lowlands and therefore lower than that received in the Adirondack Mountains.

2) There is no significant difference in long term (three months or more) total precipitation between the five stations within the Lake George drainage basin (Figures 1-8).

3) The greatest precipitation anomolies occur during the apparently random summer thunderstorm downpours. These thunderstorms at times drop rain on the basin with daily anomolies between stations of one or two inches or more (Figures 9-10). Just one of these thunderstorm days such as that depicted in Figure 10, August 27, 1972, will tend to distort seasonal and even yearly precipitation totals so as to give fluctuations in the total precipitation for such short-term data. No significant differences may be suggested dependent upon elevation or the direction of exposure of a gauge.

Reference

Colon, Emilio M., Jr.: Hydrologic Study of Lake George, New York. Ph.D. Thesis, Rensselaer Polytechnic Institute, Troy, New York, 190 pp.

TABLE I

Precipitation Totals 1970 & 1971

Station	Location	Precipitation 1970	Precipitation 1971	1971-1970
Edgecomb Pond	Lake George Basin		37.86	
NW Bay Brook	Lake George Basin	34.16	36.50	+1.34
Sabbath Day Point	Lake George Basin	30.92	35.37	+4.45
Top of the World	Lake George Basin	31.50	42.01	+10.51
Glens Falls FAA	Hudson Valley	27.80	32.82	+5.02
Glens Falls Farm	Hudson Valley	36.84	44.66	+7.82
Whitehall	Champlain Valley	33.19	38.30	+5.11
Ticonderoga	Champlain Valley	30.31	34.57	+3.26
Warrensburg	Adirondack Mountains	47.13	48.30	+1.17
Albany	Hudson Valley	30.50	39.57	+9.07

TABLE II

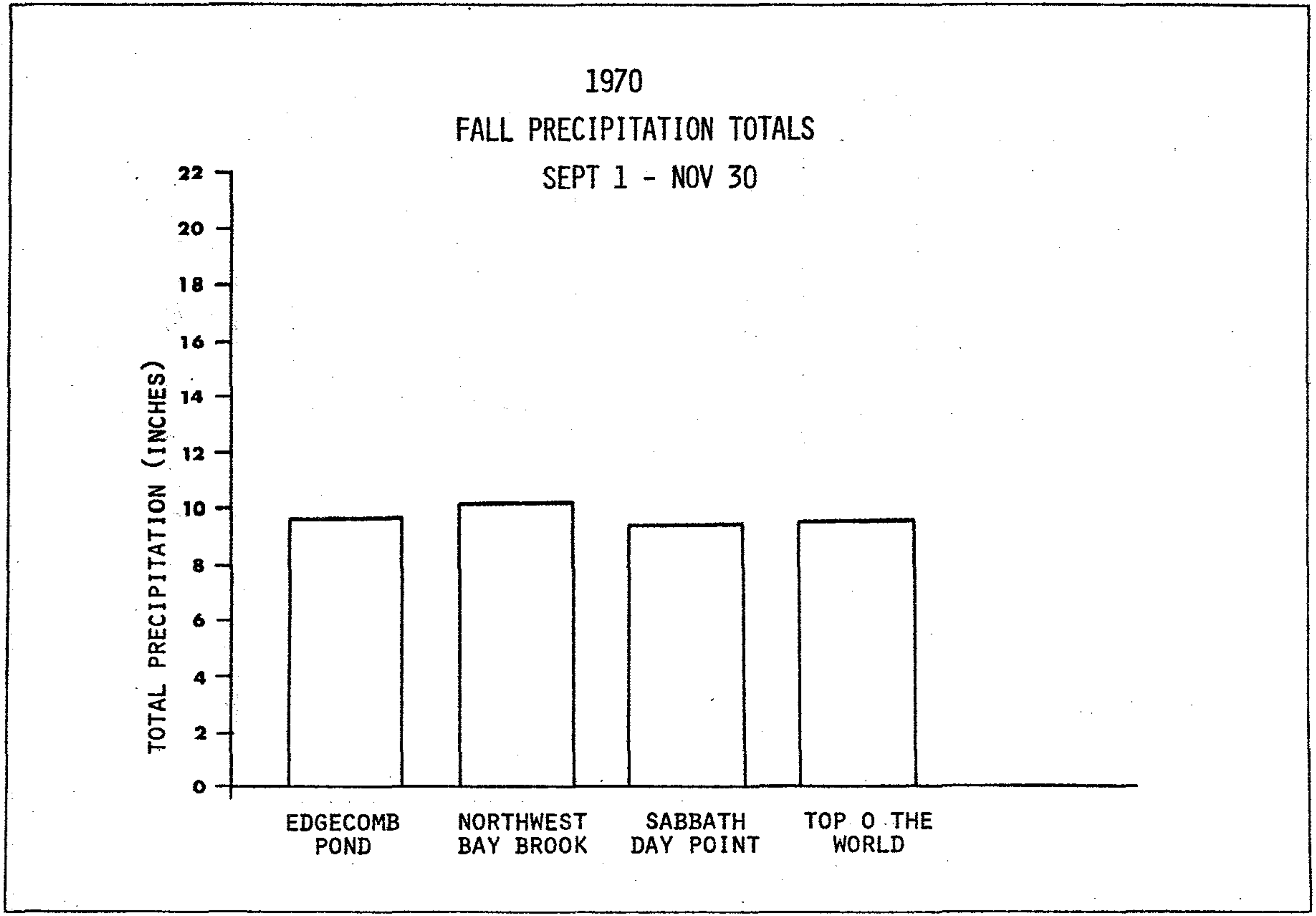
Monthly Temperature and Precipitation Averages

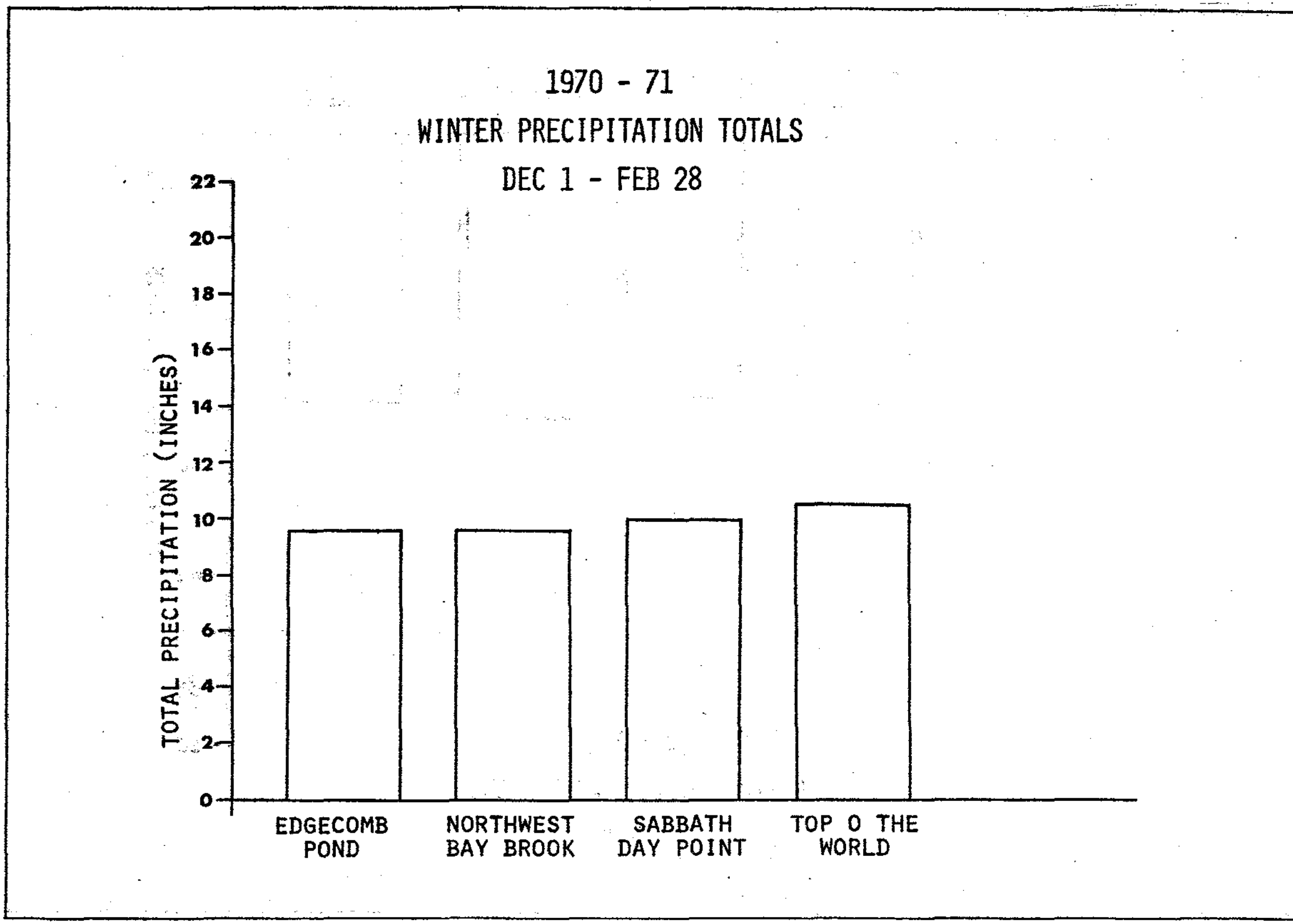
Glens Falls, New York

September 1970 - August 1972

Month	Mean Temp.	Normal Temp.	Departure from Normal	Precip.	Normal Precip.	Departure from Normal
S	59.7	59.4	+0.3	2.74	2.61	+0.13
O	50.2	49.1	+1.1	2.48	2.38	+0.10
N	40.4	38.1	+2.3	1.82	3.04	-1.22
D	20.2	24.8	-4.6	2.89	3.09	-0.20
J	12.6	18.9	-6.3	1.38	2.48	-1.10
F	24.8	21.4	+3.4	3.85	2.49	+1.36
M	29.6	31.1	-1.5	2.78	2.73	+0.05
A	44.6	45.3	-0.7	2.35	3.16	-0.81
M	55.7	55.5	+0.2	2.09	2.91	-0.82
J	66.2	65.4	+0.8	1.28	2.87	-1.59
J	68.3	69.8	-1.5	5.00	2.99	+2.01
A	66.7	67.6	-0.9	5.61	3.11	+2.50
S	63.8	59.4	+4.4	1.35	2.61	-1.26
O	53.9	49.1	+4.8	1.42	2.38	-0.96
N	34.7	38.1	-3.4	2.70	3.04	-0.34
D	26.5	24.8	+1.7	3.08	3.09	-0.01
J	19.1	18.9	+0.2	1.91	2.48	-0.57
F	17.5	21.4	-3.9	1.97	2.49	-0.52
M	28.8	31.1	-2.3	4.58	2.73	+1.85
A	38.7	45.3	-6.6	2.40	3.16	-0.76
M	57.9	55.5	+2.4	5.18	2.91	+2.27
J	E 64.4	65.4	E -1.0	E 5.71	2.87	E +2.84
J	E 70.6	69.8	E +0.8	E 3.49	2.99	E +0.50
A		67.6			3.11	

FIGURES


1970
FALL PRECIPITATION TOTALS
SEPT 1 - NOV 30
TOTAL PRECIPITATION (INCHES)
0
2
4
6
8
10
12
14
16
18
20
22
EDGECOMB POND
NORTHWEST BAY BROOK
SABBATH DAY POINT
TOP O THE WORLD

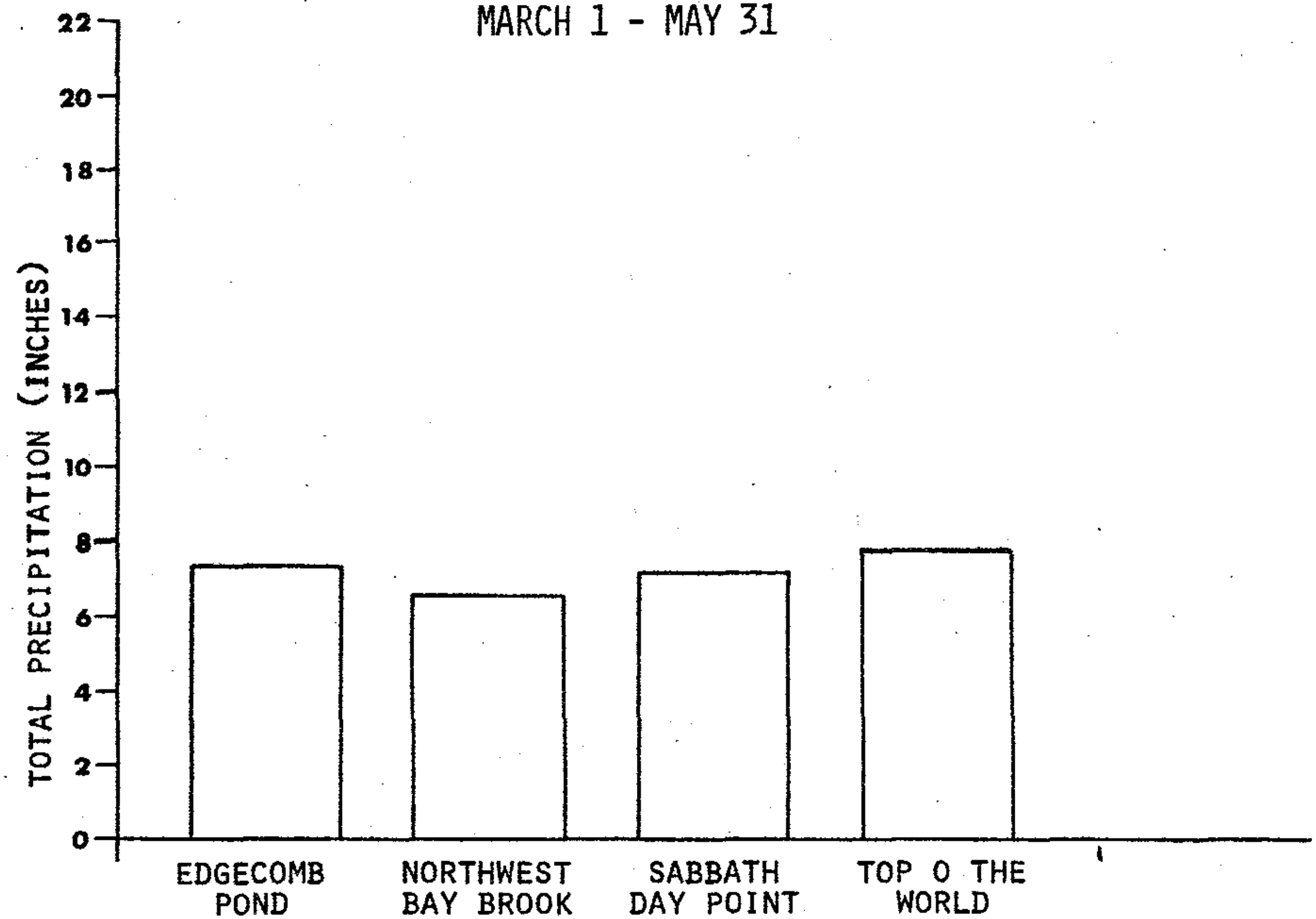


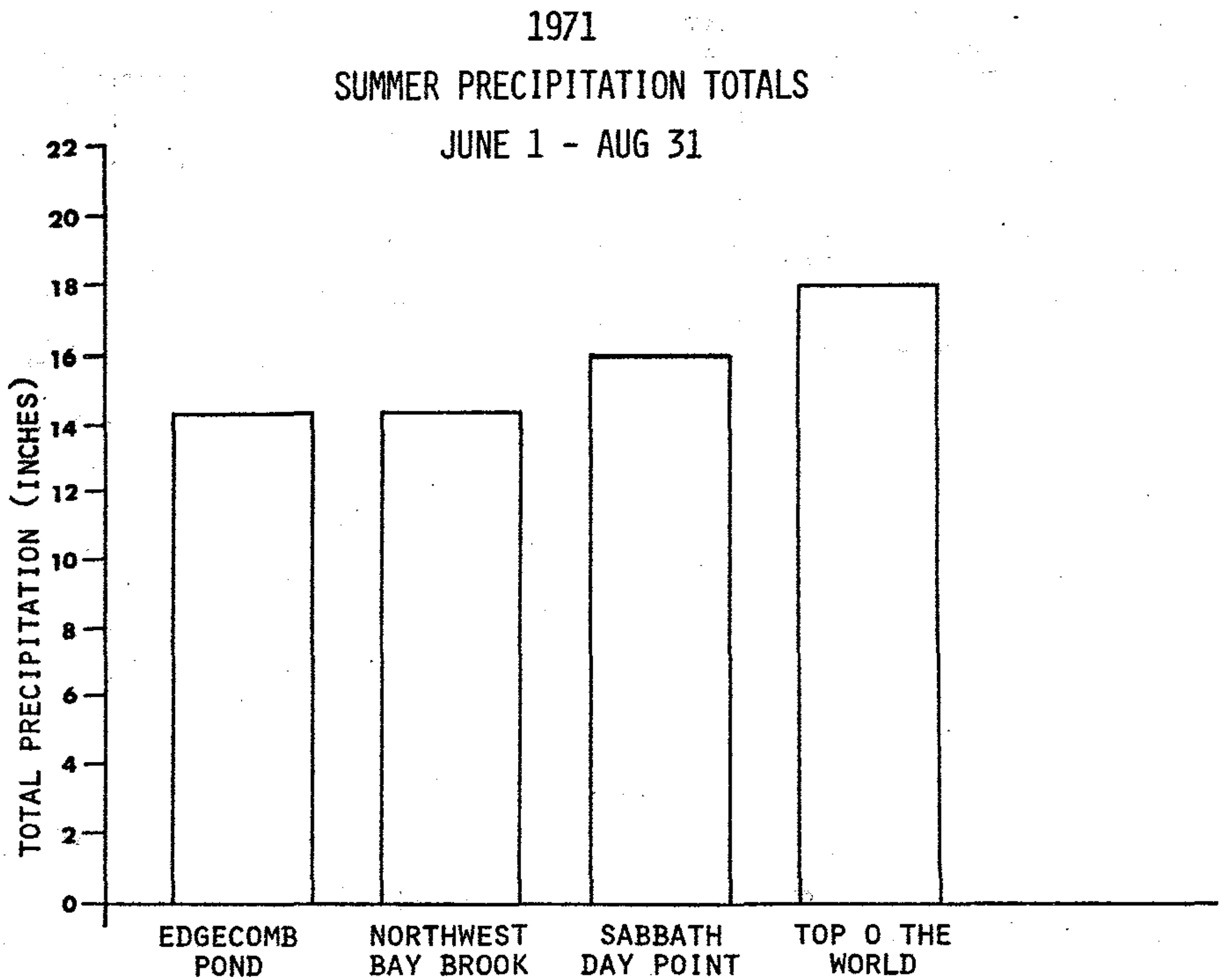
1970 - 71
WINTER PRECIPITATION TOTALS
DEC 1 - FEB 28
TOTAL PRECIPITATION (INCHES)
0
2
4
6
8
10
12
14
16
18
20
22
EDGECOMB POND
NORTHWEST BAY BROOK
SABBATH DAY POINT
TOP O THE WORLD

1971

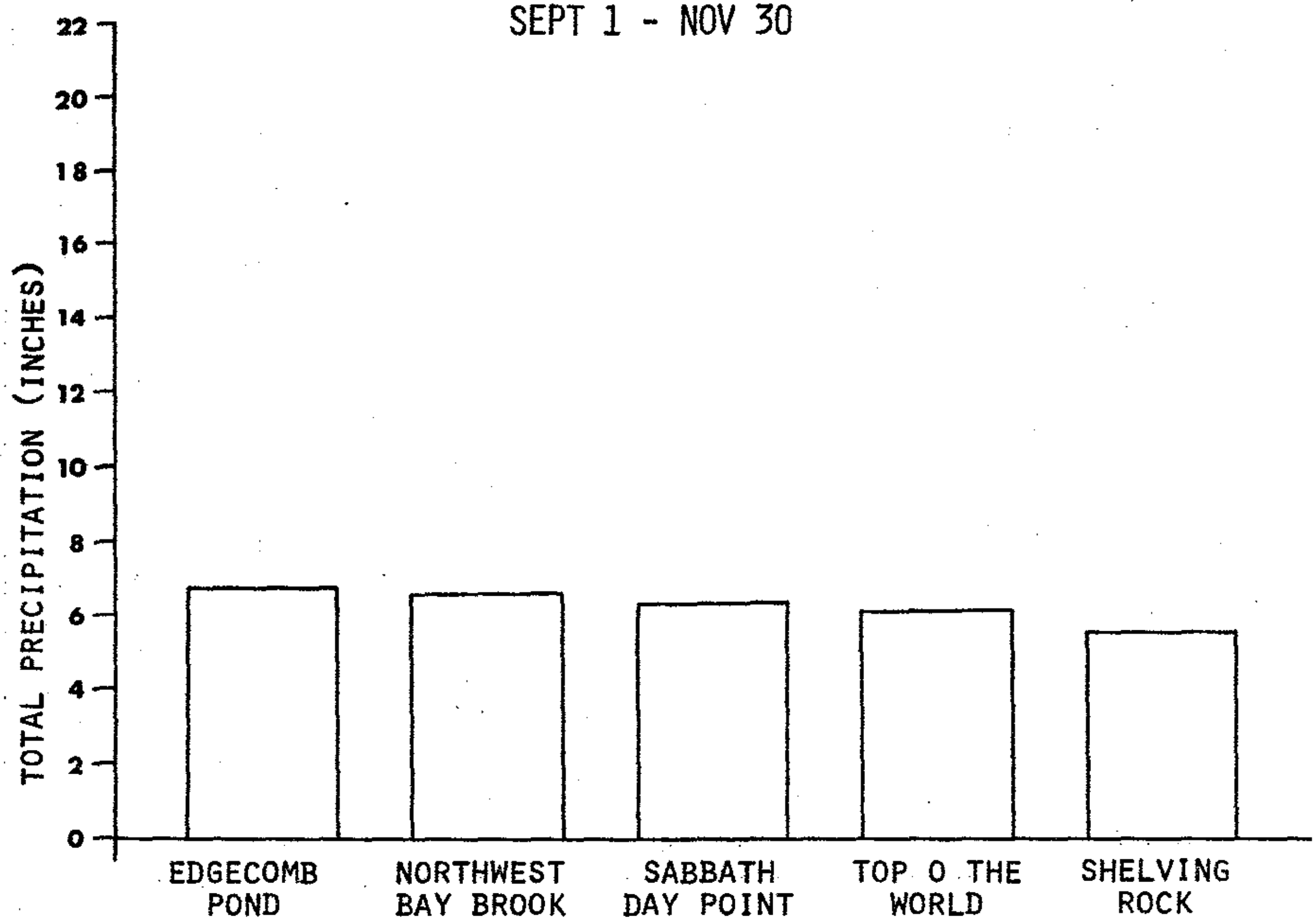
SPRING PRECIPITATION TOTALS

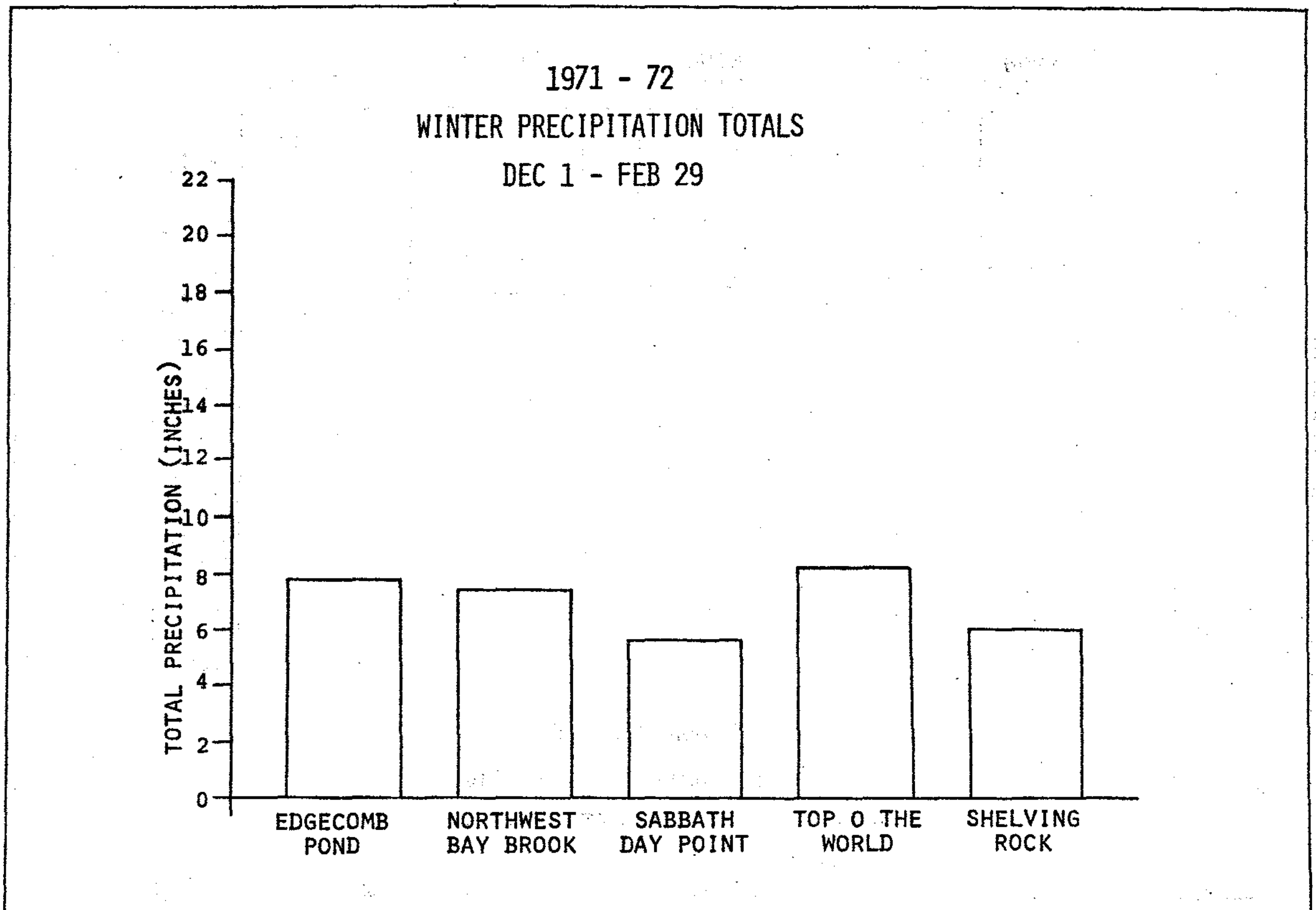
MARCH 1 - MAY 31

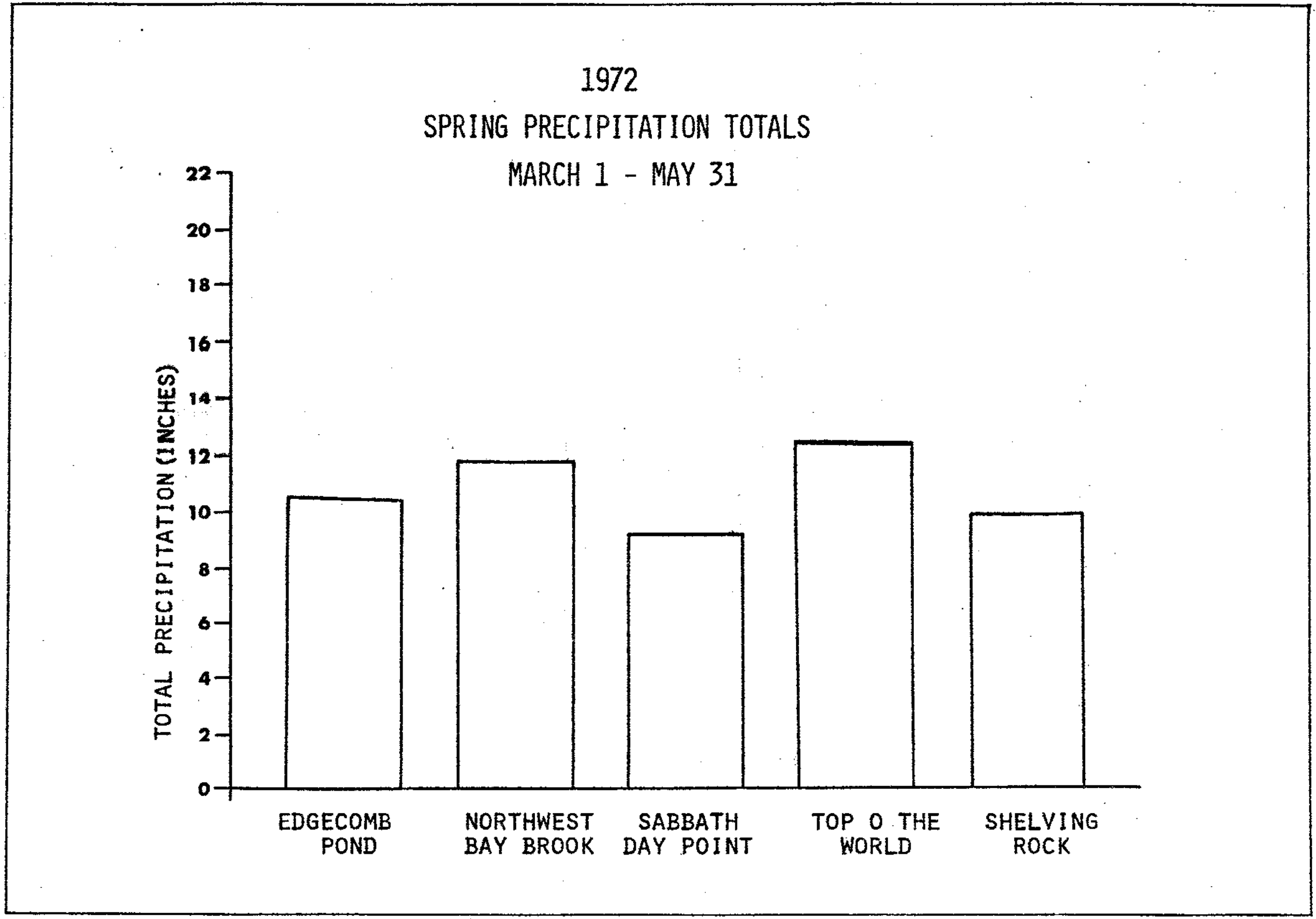



1971
SUMMER PRECIPITATION TOTALS
JUNE 1 - AUG 31
TOTAL PRECIPITATION (INCHES)
22
20
18
16
14
12
10
8
6
4
2
0
EDGECOMB POND
NORTHWEST BAY BROOK
SABBATH DAY POINT
TOP O THE WORLD

1971
FALL PRECIPITATION TOTALS
SEPT 1 - NOV 30



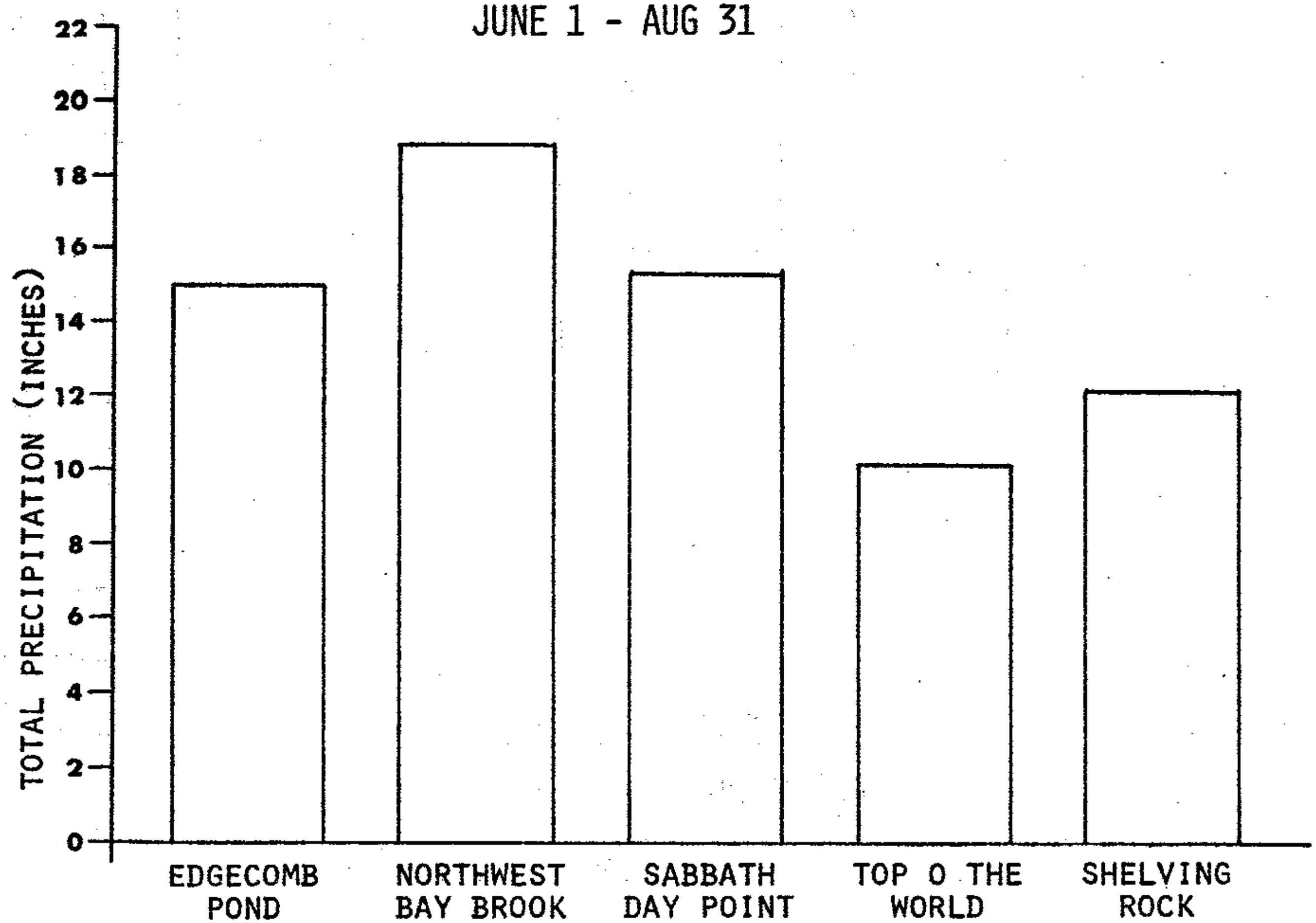

1971 - 72
WINTER PRECIPITATION TOTALS
DEC 1 - FEB 29
TOTAL PRECIPITATION (INCHES)
22
20
18
16
14
12
10
8
6
4
2
0
EDGECOMB POND
NORTHWEST BAY BROOK
SABBATH DAY POINT
TOP O THE WORLD
SHELVING ROCK


1972
SPRING PRECIPITATION TOTALS
MARCH 1 - MAY 31
TOTAL PRECIPITATION (INCHES)
0
2
4
6
8
10
12
14
16
18
20
22
EDGECOMB POND
NORTHWEST BAY BROOK
SABBATH DAY POINT
TOP O THE WORLD
SHELVING ROCK

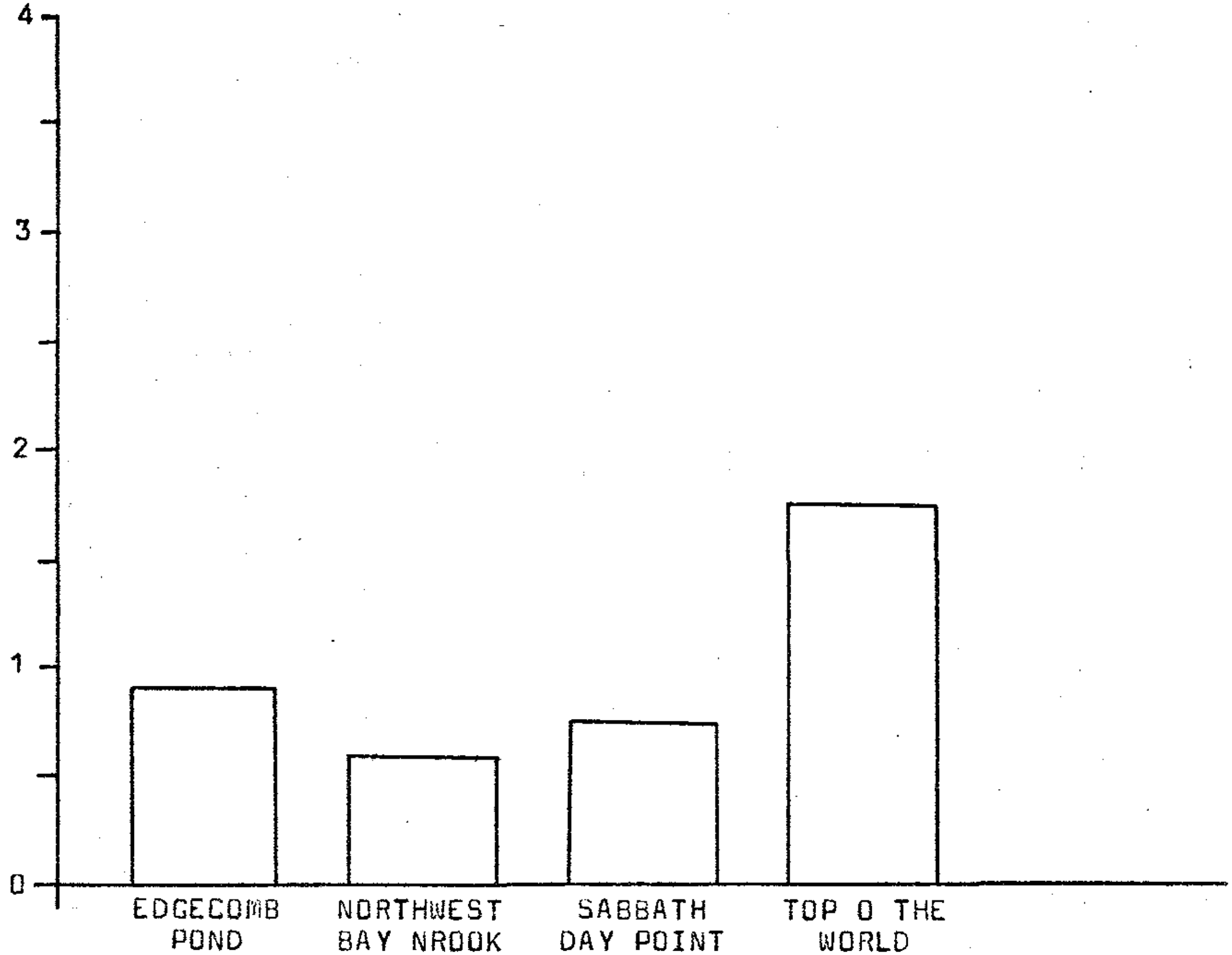
1972

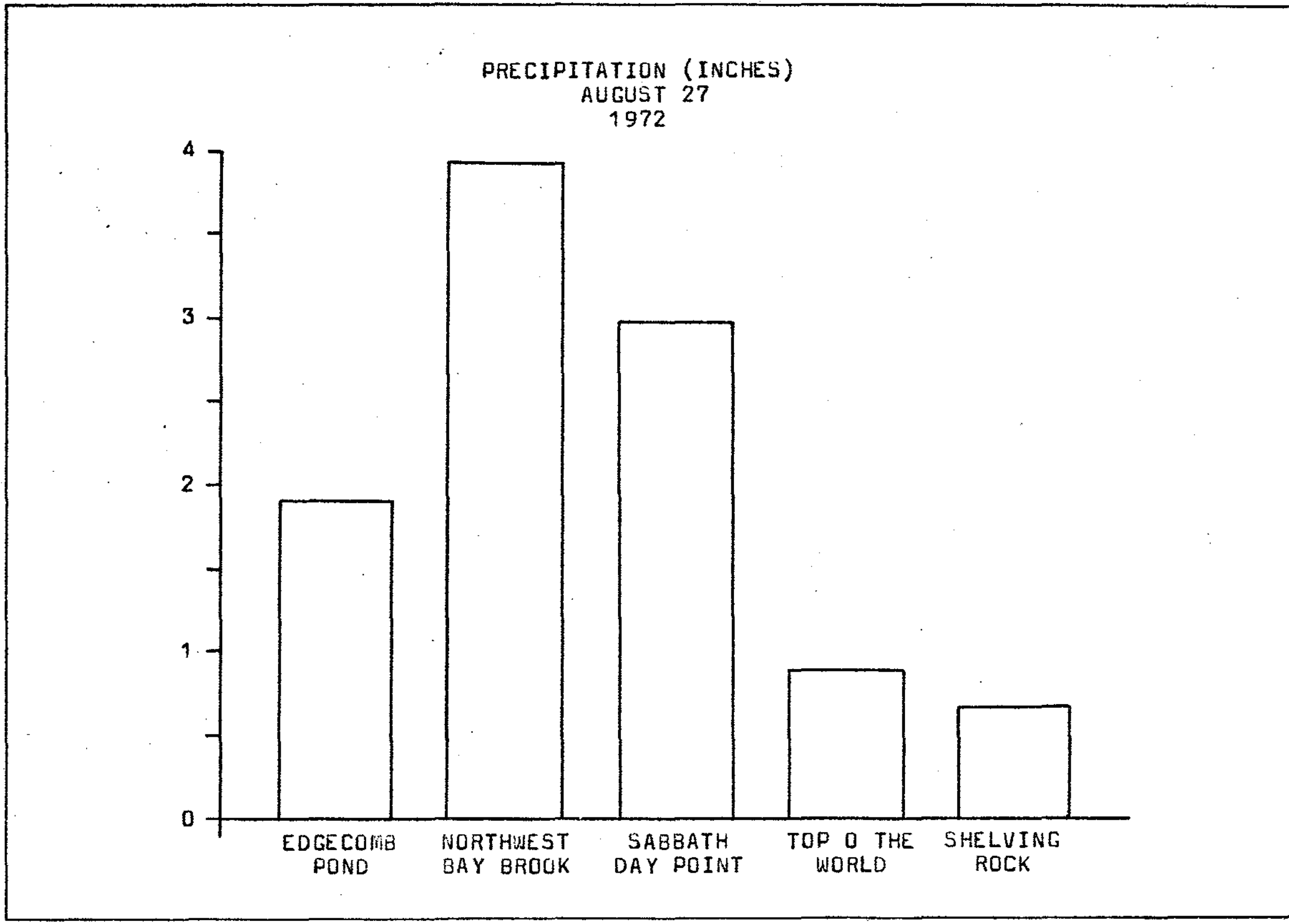
SUMMER PRECIPITATION TOTALS

JUNE 1 - AUG 31



PRECIPITATION (INCHES)
JUNE 25,
1971




PRECIPITATION (INCHES)
AUGUST 27
1972
4
3
2
1
0
EDGECOMB POND
NORTHWEST BAY BROOK
SABBATH DAY POINT
TOP O THE WORLD
SHELVING ROCK

Temperature

Temperature data were recorded in the South Basin of Lake George at two stations. One station was located in Lake George Village at the shoreline of the lake, the elevation being 320 feet. The other station was located in Timetown on an eastward facing slope on the west shore of Lake George; the elevation here was 600 feet. A third station at Diamond Island had been discontinued previously due to theft of the equipment. The daily minimum temperatures for these two stations were then compared.

The analysis showed that the Lake George shore station evidenced generally higher minimum temperatures in the winter and very similar although slightly higher minimum temperatures from April 14 through July. During February, there was one period of seven days in which Lake George evidenced substantially lower minimum temperatures than did Timetown. This was a period of very cold, calm, clear weather. These conditions for a similar duration were not repeated for the remainder of the winter. Variations in minimum temperatures for less sustained periods of time (one or two days) showed no correlation between temperature, sky cover, wind direction and wind speed. The greater differences in minimum temperatures for the winter than for the summer could not be correlated with sky cover, wind direction or wind speed.

The minimum temperatures for the two stations show the same pattern of warmer Lake George temperatures in winter. The first half of the summer season, however, shows a reversal of this effect apparently due to the influence of the cool lake waters (Tables 1, 2 and 3).

A summary of incoming solar radiation is included in Table 4 for the period July 1971 to August 1972.

TABLE 1

TEMPERATURES

	FEBRUARY		MARCH		APRIL		MAY		JUNE		JULY	
	LG	TT	LG	TT	LG	TT	LG	TT	LG	TT	LG	TT
AVG MAX	28	23	36	32	47	45	64	65	68	69	76	78
AVG MIN	6	3	19	14	28	25	45	45	54	53	60	59
AVG MEAN	17	13	27	23	37	35	54	55	61	61	68	68

Stations
LG Lake George Village
TT Timetown

LAKE GEORGE TEMPERATURES:
+ DEGREES WARMER THAN TIMETOWN
- DEGREES COLDER THAN TIMETOWN
0 EQUAL

	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY
AVG MAX	+5	+4	+2	-1	-1	-2
AVG MIN	+3	+5	+3	0	+1	+1

TABLE 2

FEBRUARY						
	LG MIN TEMP*	LG MIN TEMP: + DEGREES WARMER THAN TIMETOWN; - DEGREES COLDER THAN TIMETOWN; 0 EQUAL	GLENS FALLS			
			WIND SPEED	WIND DIRECTION	SKY COVER (⊗ FOG; ⊕ .9-FULL; ⦷ .5-.9; ⦶ .1-.5; ○ CLEAR)	
					DAY	NIGHT
1	7	+5	2	N	⦷	⊕
2	12	+6	6	NE	⦷	⊕
3	21	+7	4	NE	⊕	⊕
4	17	+7	12	SW	⊕	⊕
5	8	+9	11	W	⦷	⊕
6	6	+9	5	NW	⦷	⦷
7	-8	-2	6	NW	⦶	⊗
8	-14	+1	6	SW	⦶	○
9	-5	-5	3	S	⦶	○
10	-5	-4	1	N	○	○
11	-6	-1	1	N	○	○
12	-3	-6	2	NW	⦷	○
13	14	-5	5	NE	⊕	⦶
14	33	+6	6	NW	⊕	⊕
15	27	+6	9	SW	⦷	○
16	16	+6	9	W	⦷	⦷
17	9	+8	5	N	⦶	○
18	11	+2	5	NE	⊕	○
19	14	+7	11	NE	⊗	⊕
20	0	+9	12	NW	⦷	⊗
21	-10	+4	7	S	⊕	○
22	-11	+2	9	NW	○	⦷
23	-17	+3	3	N	⊕	○
24	10	+8	3	NE	⦷	⊗
25	-8	+7	5	NE	⦷	⊕
26	8	-1	7	N	⊗	⊗
27	-6	-4	5	S	⊕	○
28	25	+4	9	SW	⦷	⊕
29	22	0	3	NE	⊕	⊕

* DEGREES FAHRENHEIT
** MISSING DATA

TABLE 3

	LG MIN TEMP*	LG MIN TEMP: + DEGREES WARMER THAN TIMETOWN; - DEGREES COLDER THAN TIMETOWN; 0 EQUAL	GLENS FALLS WIND SPEED	GLENS FALLS WIND DIRECTION	GLENS FALLS SKY COVER (⊗ FOG, ⊕ .9-FULL, ⦷ .5-.9, ⦶ .1-.5, ○ CLEAR) DAY	GLENS FALLS SKY COVER NIGHT
JUNE						
1	49	M**	5	SW	⦷	⊕
2	M	M	5	SW	⦷	○
3	50	+1	5	SE	⦶	⊗
4	50	+1	7	SE	⊕	⊕
5	58	-1	6	NE	⦶	⊗
6	56	+2	4	NW	⊕	⦷
7	50	0	6	N	⦷	⦷
8	48	0	7	S	⊕	○
9	46	0	10	SW	⦷	⊗
10	56	+2	12	N	⊕	⦶
11	48	+4	9	NW	⦶	○
12	42	+7	8	SW	⦷	⦶
13	62	0	1	S	⊕	⊕
14	56	0	7	S	⊗	⊕
15	58	-2	9	S	⊗	⊗
16	64	0	4	S	⊕	⊕
17	56	-1	5	NE	⦶	⦶
18	56	+2	4	NE	⦷	⦷
19	54	+2	5	S	⊕	⊕
20	60	+2	8	SW	⦷	⊕
21	64	0	3	N	⊕	⊕
22	62	+2	8	NE	⦷	⊗
23	56	+3	7	NE	⦷	⊕
24	55	+2	4	S	⊕	⊕
25	54	+2	2	S	⊕	⊕
26	53	+1	4	SW	⊕	⊗
27	52	0	3	SW	⦷	⊗
28	54	+2	3	NW	⊗	⊗
29	58	-1	4	N	⦷	⊗
30	58	0	4	NW	⊕	⊕

* Degrees Fahrenheit
** Missing Data

April	399
May	435
June	400
July	472
August	449

For daily data in July, August, and September please refer to Eastern Deciduous Forest Memo Report No. 71-124, Contributions to the International Biological Program.

Heat Storage (cal cm^{-2}) at the

Diamond Island Site in Lake George, New York

Sep. 29, 1971	25869
Oct. 6	25130
Oct. 13	23533
Oct. 20	23339
Oct. 27	22758
Nov. 3	22341
Nov. 10	19004
Nov. 17	16604
Nov. 24	14356
Dec. 1	11801
Dec. 8	9474
Dec. 15	8835
Dec. 22	7048
Dec. 29	5251
Jan. 12	1894
Jan. 19	656
Jan. 26	1202
Feb. 2	680
Feb. 9	35
Feb. 16	-336
Feb. 23	-522
Mar. 1	-1043
Mar. 8	-1147
Mar. 15	-1460
Mar. 22	-350
Mar. 29	30
Apr. 4	250
Apr. 12	638
Apr. 19	2544
Apr. 26	4223
May 3	6706
May 12	9004
May 17	10813
May 24	14501
May 31	12762
Jun. 7	16681
Jun. 14	18019
Jun. 21	18937
Jun. 28	21158
Jul. 5	23680
Jul. 12	24327
Jul. 19	25499
Jul. 26	28654
Aug. 2	28516
Aug. 9	26378
Aug. 16	27042
Aug. 23	26702
Aug. 30	28789

Basin Bay Currents

Basin Bay is a small (0.9 km x 1.4 km) inlet on the western side of Lake George, north of Bolton Landing (Figure 1). Due to its shallow nature (mean depth approximately 6 m) and development along the shoreline, exchange of water mass with the main basin is necessary if nutrients are to be flushed out of the bay. Fortunately Lake George has a series of seiches which tend to aid in this process. The 34 minute seiche is most prevalent in this area and may be expected to have an amplitude of 1 cm. Roughly this would mean that a typical 34 minute seiche would add less than 1% to the volume of the bay and then remove it again. Based on a 10% mixing and exchange of the water which enters and leaves the bay it would take over 1000 oscillations (theoretically) to provide for a complete exchange of the bay with the main body of Lake George. Based on the observed occurrences of the 34 minute seiche 1000 oscillations could occur over a 40 day period. During that same period rainfall would contribute approximately 5% to the volume including runoff, with evaporation removing some of the volume dependent upon climatic conditions.

A series of metallic cylindrical drogues were prepared (35 cm high by 30 cm diameter) and set to drift at 1, 3, and 5 meter depths at position A near the mouth of Basin Bay and a second set at 1 and 3 meter depths at position B (Figure 1).

The general outflow at 1 and 3 m was being affected by the 34 minute seiche, but the 5 m drogue did not show the return flow until halfway through the study. Thus the wind action was creating a lowering of the general water level while the seiche was superimposed on this action (Figures 2a and b). An average outflow of 2 cm/sec in the top 3 meters represents about 50 m^3 of water displaced per second out of the bay. This is balanced in part by the inflow below 3 m.

Dunham's Bay Region

The Dunham's Bay Region (Figure 1) is subjected to some of the same seiche action as Basin Bay, as they are both connected directly with the main south basin of Lake George. The main difference seems to be in the type of setup experienced. A northwest wind tends to pile water into the region and this should cause more mixing than in Basin Bay. During such cases the water level in Harris Bay may rise 7-10 cm at the landlocked end (Figure 3). This represents an influx of 10^5 m^3 into the bay and sets a series of current motions which drives the water back into the Kattskill Bay Region and eventually back into the main basin of the lake. Some exchange will take place through the inlet between South Island and Assembly Point, but exact data is not available. However, as the inlet has a cross section of only 3-400 m^2 currents would have to be over 100 cm/sec to have a substantial effect on the volume of water exchanged between Harris Bay and Dunham's Bay. Research will continue in this area.

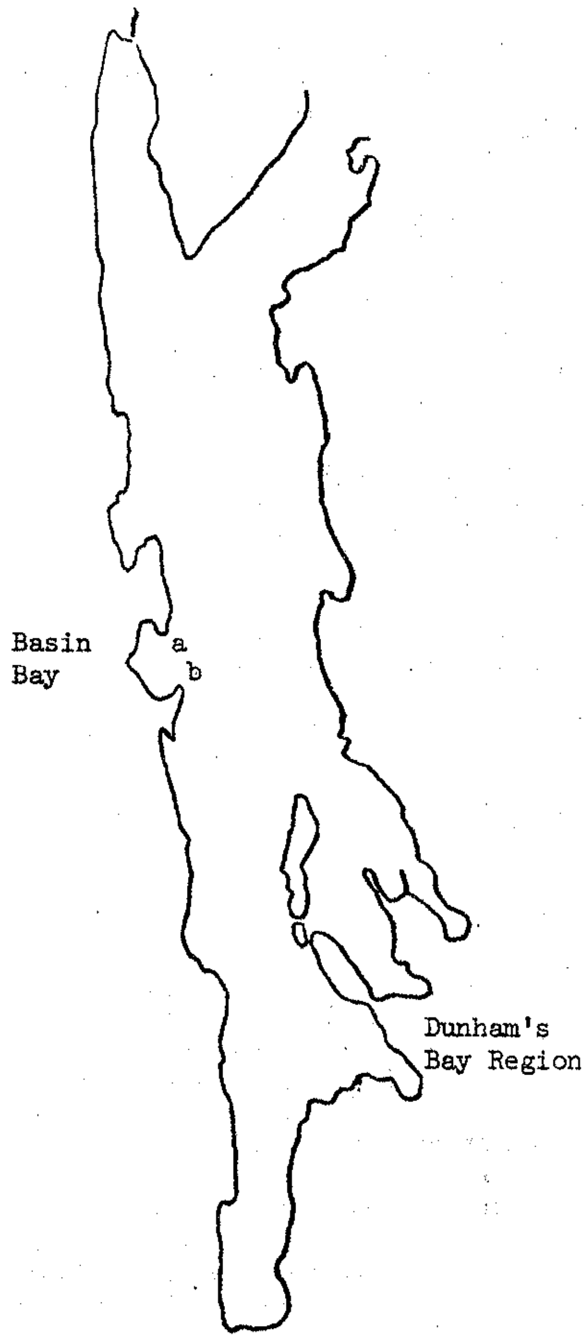


Figure 1. Lower Lake George

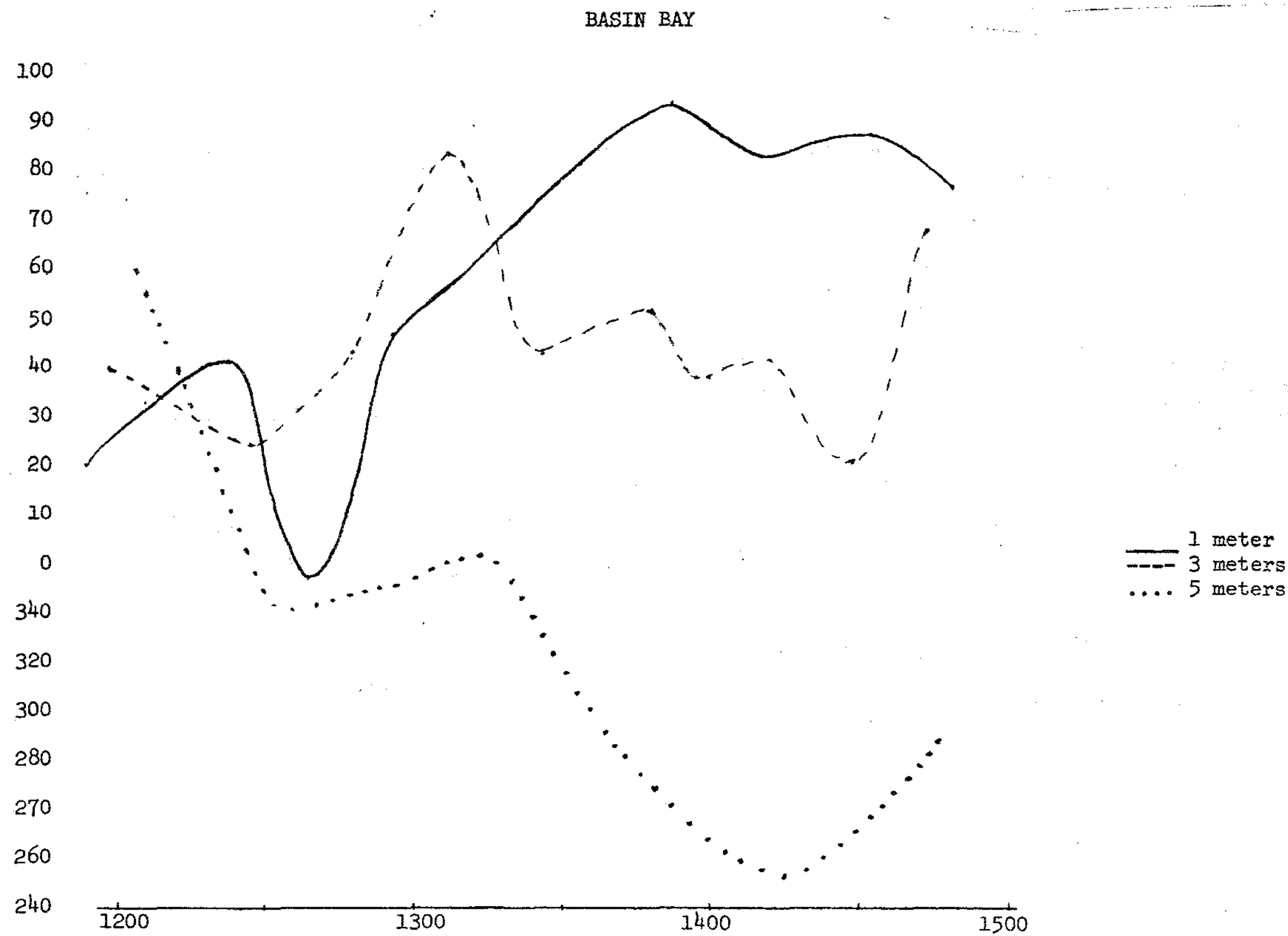


Figure 2a. Direction of Current at 1, 3, and 5 m on August 28, 1972

BASIN BAY

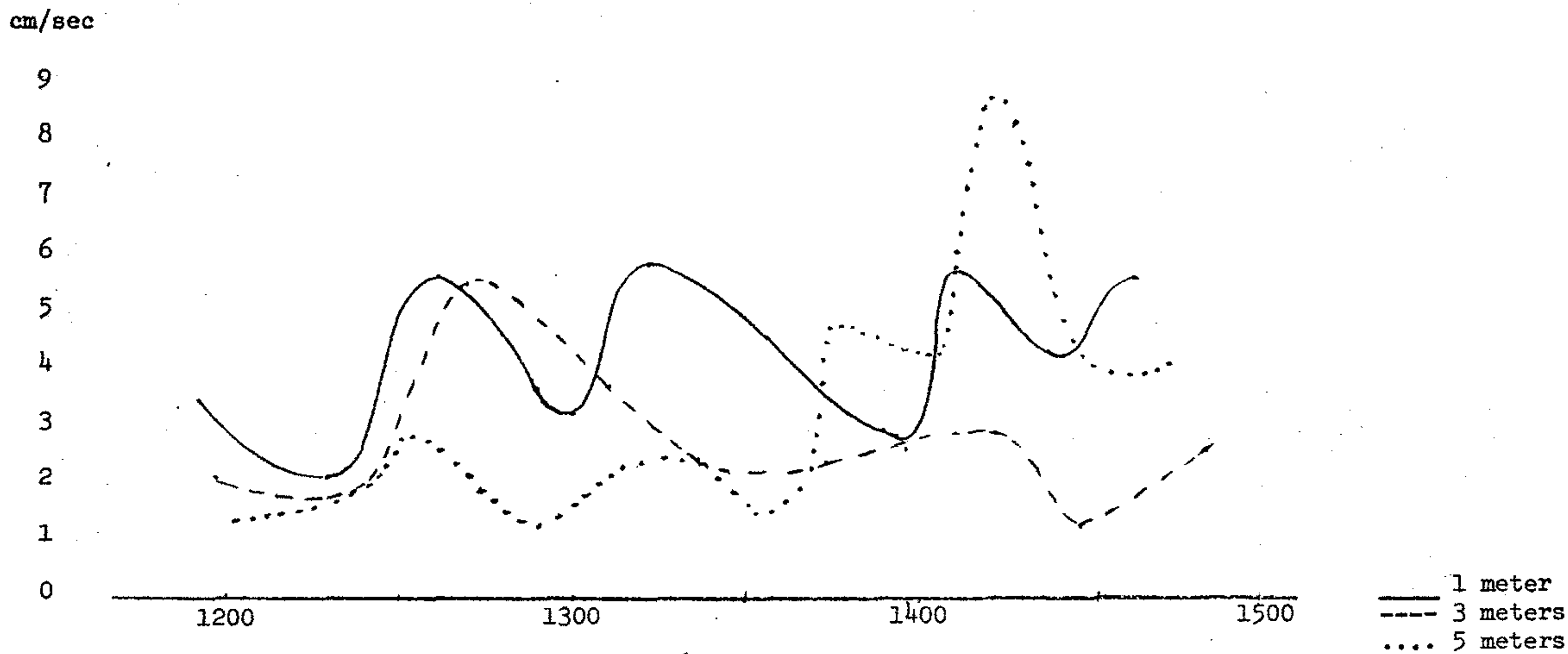


Figure 2b. Speed of the Current at 1, 3, and 5 m on August 28, 1972

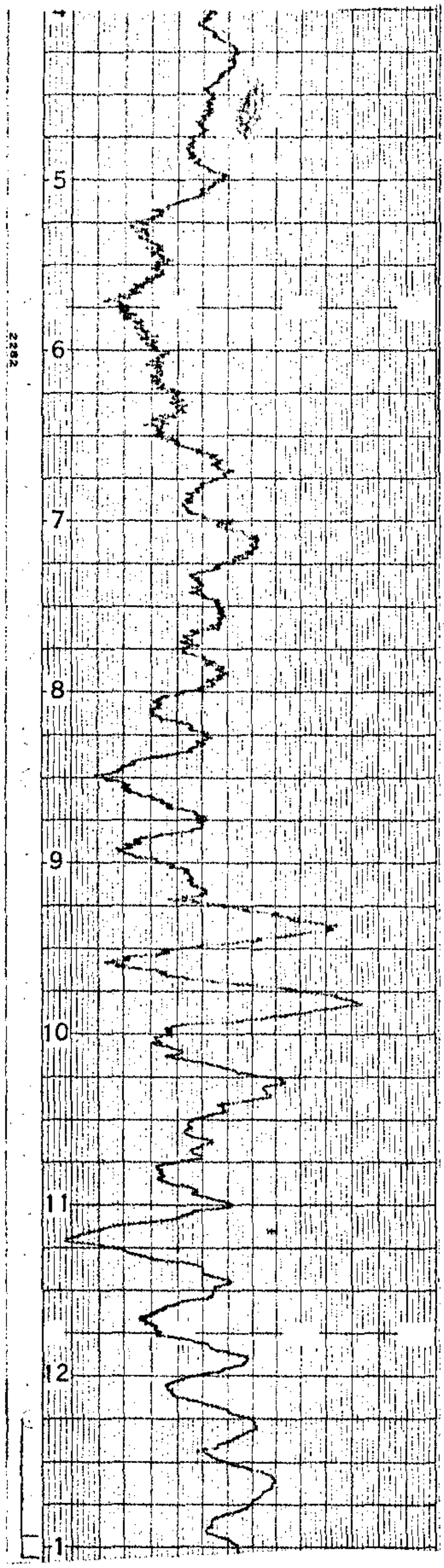


Figure 3. Example of seiche motion in the Dunham's Bay region. (Elliott Lawton Dock)

Modelling of Surface and Internal Seiche

Quickly reviewing the status of this research up to last year's report, an attempt had been made to describe the surface and internal seiche on Lake George, New York, with a Fortran model executed on the Univac 1108 at the State University of New York at Albany. Wind, friction, coriolis acceleration, atmospheric pressure gradients along the main axis of the lake, and rainfall gradients were all to be considered as modifying the generation and movement of disturbances on a two dimensional grid representing the surface of the lake and on a second grid representing the equilibrium position of the thermocline. The second grid was, of course, coupled to the first, and both grids would include, as much as possible, the natural irregular boundaries and bottom topography of the lake.

Assuming that (1) the two layers were homogeneous (no velocity or density gradients); (2) hydrostatic equilibrium existed at all times (the gravity force was more than an order of magnitude greater than other vertical forces); (3) stress at the interface of any layers, including air and bottom, was proportional to the relative velocity squared; and (4) the pressure distribution of the atmosphere is linear along the main axis of the lake; then (5) the following equations were written:

$$\frac{du}{dt} = -\frac{1}{\rho}\frac{\partial p}{\partial x} - fv - \frac{1}{\rho}\left(\frac{\partial \tau_{xz}}{\partial z} + \frac{\partial \tau_{xy}}{\partial y}\right)$$

$$\frac{dv}{dt} = -\frac{1}{\rho}\frac{\partial \rho}{\partial y} + fu - \frac{1}{\rho}\left(\frac{\partial \tau_{yz}}{\partial z} + \frac{\partial \tau_{yx}}{\partial y}\right)$$

$$\frac{dw}{\partial t} = 0 = -\frac{1}{\rho}\frac{\partial p}{\partial z} + g$$

where u, v, w were of the form

$$u = \frac{1}{h}\int_{o}^{h} u\ (z)\ dz$$

$\rho 1$ = density of epilimnion = constant
$\rho 2$ = density of hypolimnion = constant

and where stress terms of the form $\frac{\partial \tau}{\partial z}$ could be written $D(u_1-u_2)^2$ where D is similar to the drag coefficient and u_1-u_2 the relative velocity across the interface of the variable. t equals time and u, v, w are the components of the velocity along the x, y, and z axes respectively. The variable h is the depth of the layer and is a function of x and y. The variable p is the pressure (function of x, y) and is the sum of the atmospheric and water pressures at any depth. The constant f is the coriolis parameter and is only a function of latitude, assumed constant here. The constant g is the acceleration of gravity.

If there are no sources or sinks the following could be written:

$$\frac{\partial u}{\partial x} + \frac{\partial v}{\partial y} + \frac{\partial w}{\partial z} = 0$$

Several additional assumptions have been made such that the above equations, with the appropriate boundaries, could be combined into one equation resembling Poisson's equation. This then was solved iteratively to yield results which should have been similar to a two-dimensional Defant type of calculation. At that time, the friction and other external influences were not adequately considered.

Now the following assumptions have been included with those above:

$\frac{du}{dt} = \frac{\partial u}{\partial t}$, $\frac{\partial v}{\partial t} = \frac{dv}{dt}$, $\frac{dw}{dt} = \frac{\partial w}{\partial t}$, that the edge stresses are small compared to stresses at layer interfaces. Pressure is continuous across the thermocline which is a plane.

Now the equations for velocity in the two layers are

$$\frac{\partial u,v}{\partial t} = -\frac{1}{\rho}\frac{\partial pa}{\partial x,y} + f\ (-v,\ u) - \frac{\Delta F}{\rho} - g\,\frac{\partial \zeta 1}{\partial x,y}$$

for the upper layer, and for the lower may be written

$$\frac{\partial u,v}{\partial t} = \frac{1}{\rho 2}\ \frac{\partial pa}{\partial x,y} - g\ \frac{\rho 1}{\rho 2}\,\frac{\partial \zeta 1}{\partial x,y} - g(1-\frac{\rho 1}{\rho 2})\ \frac{\partial \zeta 2}{\partial x,y} + f\ (-v_2,u_2) - \frac{\Delta F2}{\rho 2}$$

where the ζ values represent a small displacement and pa the atmospheric pressure (a function of only x). Given the initial displacement, the fields may be found from which the new displacement array is computed from

$$\frac{\partial \zeta}{\partial t} = (\frac{\partial u}{\partial x} + \frac{\partial v}{\partial y})_h$$

The next velocity array is computed from the overage of this displacement and the previous one, etc. The ΔF values are friction terms as previously described.

The present program of 2500 Fortran statements occupying 51K of memory can solve the equations for fairly simple boundary conditions including bays emptying into deep oceans. Unfortunately, at the time of this writing, very rapid changes in boundary configuration, such as narrow peninsulas generate instabilities in the computation. If these can be eliminated, the main problem should be solved. Final results will be presented as a Ph.D. dissertation.

Wind Conditions

September 1971 - August 1972

Wind conditions for the period September 1971 - August 1972 are summarized in tabulated form on the following pages. Vector averages indicate that the wind flow maintains a southerly component seven months of the year with a northerly component evident in November, December, February, March, and April. The only easterly component evidenced was in May. The highest average winds were recorded in February and March with the lowest in October and July.

September 1971

DIRECTION IN DEGREES
NORTH=360, EAST=90, SOUTH=180, WEST=270

SPEED IN KNOTS	0-30	31-60	61-90	91-120	121-150	151-180	181-210	211-240	241-270	271-300	301-330	331-360	SUM OF SPEEDS
.0- .5	212	0	1	1	0	0	0	0	0	0	0	0	214
.5- 1.5	0	0	0	0	0	0	0	0	0	0	0	0	0
1.5- 2.5	0	0	0	0	0	0	0	0	0	0	0	0	0
2.5- 3.5	0	5	5	2	2	1	1	5	1	3	1	1	27
3.5- 4.5	0	8	5	6	3	4	14	7	8	5	2	4	66
4.5- 5.5	0	6	8	2	0	5	18	13	4	2	0	1	59
5.5- 6.5	0	5	5	1	0	2	6	9	2	1	1	1	33
6.5- 7.5	0	4	5	1	0	2	9	20	5	0	0	0	46
7.5- 8.5	0	4	4	0	0	1	28	24	3	5	0	1	70
8.5- 9.5	0	1	1	1	0	1	10	11	2	0	2	0	29
9.5-10.5	0	4	1	0	0	0	16	24	4	2	1	2	54
10.5-11.5	0	1	0	0	0	0	0	8	0	1	0	0	10
11.5-12.5	0	1	2	0	0	0	4	9	0	0	2	4	22
12.5-13.5	0	0	0	0	0	0	2	5	0	0	0	0	7
13.5-14.5	0	0	0	0	0	0	0	1	0	1	1	0	3
14.5-15.5	0	0	0	0	0	0	0	0	0	0	0	0	0
15.5-16.5	0	0	0	0	0	0	0	0	0	0	0	0	0
16.5-17.5	0	0	0	0	0	0	0	0	0	0	0	0	0
17.5-18.5	0	0	0	0	0	0	0	0	0	0	0	0	0
18.5-19.5	0	0	0	0	0	0	0	0	0	0	0	0	0
19.5-20.5	0	0	0	0	0	0	0	0	0	0	0	0	0
20.5-21.5	0	0	0	0	0	0	0	0	0	0	0	0	0
21.5-22.5	0	0	0	0	0	0	0	0	0	0	0	0	0
SUM(DIR)	212	39	37	14	5	16	108	136	29	20	10	14	

VECTOR AVERAGE VALUES

SPEED	DIRECTION	X-COMP.	Y-COMP.
1.67	198.4	-.53	-1.58

AVERAGE SPEED = 4.91

October 1971

DIRECTION IN DEGREES
NORTH=360, EAST=90, SOUTH=180, WEST=270

SPEED IN KNOTS	0-30	31-60	61-90	91-120	121-150	151-180	181-210	211-240	241-270	271-300	301-330	331-360	SUM OF SPEEDS
.0- .5	283	0	0	0	0	0	0	0	0	0	0	0	283
.5- 1.5	0	0	0	0	0	0	0	0	0	0	0	0	0
1.5- 2.5	0	0	0	0	0	0	0	0	0	0	0	0	0
2.5- 3.5	0	2	0	1	1	0	0	2	0	0	0	0	6
3.5- 4.5	0	4	3	3	1	3	9	5	2	4	0	2	36
4.5- 5.5	0	4	6	1	4	4	5	7	4	1	0	4	40
5.5- 6.5	0	1	13	2	0	5	8	9	7	4	1	3	53
6.5- 7.5	0	3	6	1	1	4	8	12	10	3	1	1	50
7.5- 8.5	0	6	6	2	0	2	8	17	7	2	0	5	55
8.5- 9.5	0	0	1	1	0	0	6	0	3	2	0	2	15
9.5-10.5	0	3	3	1	1	1	17	20	11	2	2	2	63
10.5-11.5	0	0	3	0	0	0	3	2	3	2	0	1	14
11.5-12.5	0	2	2	0	0	0	4	15	5	3	1	0	32
12.5-13.5	0	0	0	0	0	0	0	2	1	1	1	0	5
13.5-14.5	0	0	0	0	0	0	0	0	0	1	0	0	1
14.5-15.5	0	0	0	0	0	0	2	2	0	1	1	0	6
15.5-16.5	0	0	0	1	0	0	0	1	0	0	0	0	2
16.5-17.5	0	0	0	0	0	0	0	0	0	0	0	0	0
17.5-18.5	0	0	0	0	0	0	0	0	0	0	0	0	0
18.5-19.5	0	0	0	0	0	0	0	0	0	0	0	0	0
19.5-20.5	0	0	0	0	0	0	0	0	0	0	0	0	0
20.5-21.5	0	0	0	0	0	0	0	0	0	0	0	0	0
21.5-22.5	0	0	0	0	0	0	0	0	0	0	0	0	0
SUM(DIR)	283	25	43	13	8	19	70	94	53	26	7	20	

VECTOR AVERAGE VALUES

SPEED	DIRECTION	X-COMP.	Y-COMP.
1.48	206.2	-.65	-1.33

AVERAGE SPEED = 4.65

November 1971

DIRECTION IN DEGREES
NORTH=360, EAST=90, SOUTH=180, WEST=270

SPEED IN KNOTS	0-30	31-60	61-90	91-120	121-150	151-180	181-210	211-240	241-270	271-300	301-330	331-360	SUM OF SPEEDS
.0- .5	214	0	0	0	0	0	0	0	0	0	0	0	214
.5- 1.5	0	0	0	0	0	0	0	0	0	0	0	0	0
1.5- 2.5	0	0	0	0	0	0	0	0	0	0	0	0	0
2.5- 3.5	0	3	1	2	1	0	2	0	0	3	2	0	14
3.5- 4.5	0	5	10	6	1	1	4	0	3	3	4	1	38
4.5- 5.5	0	6	11	5	3	5	6	4	5	1	6	5	57
5.5- 6.5	0	8	4	1	1	5	8	7	4	0	1	4	43
6.5- 7.5	0	1	8	0	3	1	13	8	5	2	2	3	46
7.5- 8.5	0	9	10	2	2	0	9	8	3	5	3	1	52
8.5- 9.5	0	3	2	0	0	1	1	4	2	2	1	0	16
9.5-10.5	0	5	6	1	0	0	3	9	6	6	8	24	68
10.5-11.5	0	0	0	1	0	0	1	3	2	0	1	2	10
11.5-12.5	0	2	4	0	0	0	0	6	2	4	4	2	24
12.5-13.5	0	0	1	0	0	0	0	2	0	1	2	1	7
13.5-14.5	0	0	1	0	0	0	0	1	0	1	2	3	8
14.5-15.5	0	0	0	0	0	0	3	3	0	2	0	3	11
15.5-16.5	0	0	0	0	0	0	0	0	0	0	0	0	0
16.5-17.5	0	0	0	0	0	0	0	1	0	0	0	0	1
17.5-18.5	0	0	0	0	0	0	1	1	0	0	0	0	2
18.5-19.5	0	0	0	0	0	0	0	0	0	0	0	0	0
19.5-20.5	0	0	0	0	0	0	1	0	0	0	0	0	1
20.5-21.5	0	0	0	0	0	0	0	0	0	0	0	0	0
21.5-22.5	0	0	0	0	0	0	0	0	0	0	0	0	0
SUM(DIR)	214	42	58	18	11	13	52	57	32	30	36	49	

VECTOR AVERAGE VALUES

SPEED	DIRECTION	X-COMP.	Y-COMP.
1.13	308.5	-.88	.70

AVERAGE SPEED = 5.47

December 1971

DIRECTION IN DEGREES
NORTH=360, EAST=90, SOUTH=180, WEST=270

SPEED IN KNOTS	0-30	31-60	61-90	91-120	121-150	151-180	181-210	211-240	241-270	271-300	301-330	331-360	SUM OF SPEEDS
.0- .5	233	0	0	0	0	0	0	0	1	0	0	0	234
.5- 1.5	0	0	0	0	0	0	0	0	0	0	0	0	0
1.5- 2.5	0	0	0	0	0	0	0	0	0	0	0	0	0
2.5- 3.5	0	2	3	0	1	1	1	1	1	0	1	2	13
3.5- 4.5	0	5	5	6	1	1	6	2	5	2	2	2	37
4.5- 5.5	0	5	16	7	0	4	7	9	5	1	1	5	60
5.5- 6.5	0	6	7	4	0	0	2	8	2	4	2	1	36
6.5- 7.5	0	4	6	2	0	0	9	5	4	2	2	2	36
7.5- 8.5	0	10	20	5	1	0	5	7	13	6	2	4	73
8.5- 9.5	0	2	0	3	0	0	3	3	3	2	2	0	18
9.5-10.5	0	1	24	6	0	0	14	9	11	17	9	12	103
10.5-11.5	0	0	1	0	0	0	0	2	2	2	3	1	11
11.5-12.5	0	0	2	1	0	0	1	6	7	11	8	4	40
12.5-13.5	0	0	1	0	0	0	1	3	2	1	0	1	9
13.5-14.5	0	0	2	0	1	0	1	1	1	0	2	2	10
14.5-15.5	0	0	1	0	0	0	1	2	0	2	0	6	12
15.5-16.5	0	0	0	0	0	0	0	0	0	0	0	0	0
16.5-17.5	0	0	0	0	0	0	0	1	0	0	1	0	2
17.5-18.5	0	0	0	0	0	0	0	0	0	0	0	0	0
18.5-19.5	0	0	0	0	0	0	0	0	0	0	0	0	0
19.5-20.5	0	0	0	0	0	0	0	0	0	0	0	1	1
20.5-21.5	0	0	0	0	0	0	0	0	0	0	0	0	0
21.5-22.5	0	0	0	0	0	0	0	0	0	0	0	0	0
SUM(DIR)	233	35	88	34	4	6	51	59	57	50	35	43	

VECTOR AVERAGE VALUES

SPEED	DIRECTION	X-COMP.	Y-COMP.
1.09	291.5	-1.02	.40

AVERAGE SPEED = 5.69

January 1972

DIRECTION IN DEGREES
NORTH=360, EAST=90, SOUTH=180, WEST=270

SPEED IN KNOTS	0-30	31-60	61-90	91-120	121-150	151-180	181-210	211-240	241-270	271-300	301-330	331-360	SUM OF SPEEDS
.0- .5	229	0	0	0	0	1	0	0	0	0	0	0	230
.5- 1.5	0	0	0	0	0	0	0	0	0	0	0	0	0
1.5- 2.5	0	0	0	0	0	0	0	0	0	0	0	0	0
2.5- 3.5	0	0	1	2	0	0	1	0	3	1	1	1	10
3.5- 4.5	0	3	1	3	1	4	6	7	6	6	1	9	47
4.5- 5.5	0	3	4	3	0	0	8	6	11	3	2	2	42
5.5- 6.5	0	2	4	6	0	2	9	6	6	0	0	0	35
6.5- 7.5	0	3	5	2	1	2	7	13	6	2	0	0	41
7.5- 8.5	0	4	7	1	0	2	17	15	12	5	4	3	70
8.5- 9.5	0	0	2	1	0	2	4	5	3	1	1	1	20
9.5-10.5	0	4	9	2	0	0	20	25	26	11	11	9	117
10.5-11.5	0	0	1	0	0	0	0	2	4	2	0	1	10
11.5-12.5	0	1	6	0	0	0	6	8	13	7	2	5	48
12.5-13.5	0	0	3	1	0	0	0	1	2	1	1	1	10
13.5-14.5	0	0	1	0	0	0	1	0	0	3	4	2	11
14.5-15.5	0	0	0	0	0	0	2	1	3	5	4	0	15
15.5-16.5	0	0	0	0	0	0	0	0	0	0	0	0	0
16.5-17.5	0	0	0	0	0	0	0	0	0	0	0	0	0
17.5-18.5	0	0	0	0	0	0	0	0	0	1	0	0	1
18.5-19.5	0	0	0	0	0	0	1	0	0	0	0	0	1
19.5-20.5	0	0	0	0	0	0	0	0	0	2	2	0	4
20.5-21.5	0	0	0	0	0	0	0	0	0	0	0	0	0
21.5-22.5	0	0	0	0	0	0	0	0	0	0	0	0	0
SUM(DIR)	229	20	44	21	2	13	82	89	95	50	33	34	

VECTOR AVERAGE VALUES

SPEED	DIRECTION	X-COMP.	Y-COMP.
2.33	229.1	-1.76	-1.52

AVERAGE SPEED = 5.87

February 1972

DIRECTION IN DEGREES
NORTH=360, EAST=90, SOUTH=180, WEST=270

SPEED IN KNOTS	0-30	31-60	61-90	91-120	121-150	151-180	181-210	211-240	241-270	271-300	301-330	331-360	SUM OF SPEEDS
.0- .5	183	0	0	0	0	0	0	0	0	0	0	0	183
.5- 1.5	0	0	0	0	0	0	0	0	0	0	0	0	0
1.5- 2.5	0	0	0	0	0	0	0	0	0	0	0	0	0
2.5- 3.5	0	3	0	0	0	0	0	0	0	0	1	0	4
3.5- 4.5	0	6	4	5	2	2	4	3	0	0	1	5	32
4.5- 5.5	0	8	12	4	2	3	7	1	0	3	2	3	45
5.5- 6.5	0	4	11	3	2	4	7	2	0	1	0	3	37
6.5- 7.5	0	7	11	4	1	4	11	6	2	0	2	0	48
7.5- 8.5	0	5	12	0	0	1	7	6	4	4	4	3	46
8.5- 9.5	0	1	0	1	0	0	3	3	2	1	1	0	12
9.5-10.5	0	10	7	2	0	1	17	12	5	12	12	10	88
10.5-11.5	0	1	2	0	0	1	2	2	1	5	2	1	17
11.5-12.5	0	6	2	1	0	2	3	5	7	8	2	3	39
12.5-13.5	0	0	0	1	0	0	0	1	4	1	1	1	9.
13.5-14.5	0	0	0	0	0	0	1	2	2	2	0	1	8
14.5-15.5	0	1	0	0	0	0	3	0	5	5	3	7	24
15.5-16.5	0	0	0	0	0	0	0	0	2	0	0	0	2
16.5-17.5	0	0	0	0	0	0	0	0	1	0	0	0	1
17.5-18.5	0	0	0	0	0	0	0	0	0	1	0	1	2
18.5-19.5	0	0	0	0	0	0	0	0	0	0	0	0	0
19.5-20.5	0	0	0	0	0	0	0	0	0	2	0	4	6
20.5-21.5	0	0	0	0	0	0	0	0	0	0	0	0	0
21.5-22.5	0	0	0	0	0	0	0	0	0	0	0	0	0
SUM(DIR)	183	52	61	21	7	18	65	43	35	45	31	42	

VECTOR AVERAGE VALUES

SPEED	DIRECTION	X-COMP.	Y-COMP.
1.40	298.9	-1.23	.68

AVERAGE SPEED = 6.40

March 1972

DIRECTION IN DEGREES
NORTH=360, EAST=90, SOUTH=180, WEST=270

SPEED IN KNOTS	0-30	31-60	61-90	91-120	121-150	151-180	181-210	211-240	241-270	271-300	301-330	331-360	SUM OF SPEEDS
.0- .5	165	0	0	0	0	0	0	0	0	0	0	0	165
.5- 1.5	0	0	0	0	0	0	0	0	0	0	0	0	0
1.5- 2.5	0	1	0	0	0	0	0	0	0	0	0	0	1
2.5- 3.5	0	3	2	0	1	0	0	0	1	0	1	1	9
3.5- 4.5	0	7	7	4	0	0	3	1	1	1	2	6	32
4.5- 5.5	0	14	12	9	4	4	8	10	3	6	3	4	77
5.5- 6.5	0	10	18	3	0	1	7	5	2	1	0	5	52
6.5- 7.5	0	5	10	4	1	7	7	6	10	6	0	7	63
7.5- 8.5	0	5	4	2	0	1	14	12	1	7	9	8	63
8.5- 9.5	0	3	3	0	0	0	2	3	3	0	1	1	16
9.5-10.5	0	12	6	6	0	2	20	6	5	20	8	7	92
10.5-11.5	0	2	3	2	0	0	0	4	0	1	1	1	14
11.5-12.5	0	5	4	1	0	0	4	4	8	8	12	4	50
12.5-13.5	0	1	1	0	0	0	0	1	2	4	0	2	11
13.5-14.5	0	0	2	0	0	0	0	1	0	2	1	2	8
14.5-15.5	0	1	0	0	0	0	0	2	1	2	7	6	19
15.5-16.5	0	0	0	0	0	0	0	0	0	0	0	0	0
16.5-17.5	0	0	0	0	0	0	0	1	0	0	0	0	1
17.5-18.5	0	0	0	0	0	0	0	0	0	0	0	0	0
18.5-19.5	0	0	0	0	0	0	0	0	0	0	0	0	0
19.5-20.5	0	0	0	0	0	0	0	0	0	0	0	1	1
20.5-21.5	0	0	0	0	0	0	0	0	0	0	0	0	0
21.5-22.5	0	0	0	0	0	0	0	0	0	0	0	0	0
SUM(D(R))	165	69	72	31	6	15	65	56	37	58	45	55	

VECTOR AVERAGE VALUES

SPEED	DIRECTION	X-COMP.	Y-COMP.
1.34	301.3	-1.15	.70

AVERAGE SPEED = 6.37

DIRECTION IN DEGREES
NORTH=360, EAST=90, SOUTH=180, WEST=270

SPEED IN KNOTS	0-30	31-60	61-90	91-120	121-150	151-180	181-210	211-240	241-270	271-300	301-330	331-360	SUM OF SPEEDS
.0- .5	163	0	1	0	0	0	0	0	0	0	0	0	164
.5- 1.5	0	0	0	0	0	0	0	0	0	0	0	0	0
1.5- 2.5	0	0	0	0	0	0	0	1	0	0	0	0	1
2.5- 3.5	0	2	0	0	1	0	2	0	0	0	0	0	5
3.5- 4.5	0	5	5	4	3	1	3	8	3	6	3	5	46
4.5- 5.5	0	10	6	6	4	5	7	8	6	5	3	6	66
5.5- 6.5	0	5	9	1	1	2	7	4	2	5	1	1	38
6.5- 7.5	0	5	3	1	2	5	7	7	7	5	1	3	46
7.5- 8.5	0	7	3	1	1	6	8	10	11	2	5	7	61
8.5- 9.5	0	1	2	0	0	1	3	3	2	3	1	6	22
9.5-10.5	0	6	10	3	0	3	14	8	7	5	12	15	83
10.5-11.5	0	1	2	0	0	1	0	2	0	1	0	1	8
11.5-12.5	0	5	2	2	0	0	4	4	5	5	5	10	42
12.5-13.5	0	0	0	0	0	0	1	0	0	0	1	0	2
13.5-14.5	0	0	2	0	0	0	0	2	1	1	2	1	9
14.5-15.5	0	3	2	0	0	0	0	2	2	1	1	1	12
15.5-16.5	0	0	0	0	0	0	0	0	0	0	0	0	0
16.5-17.5	0	0	0	0	0	0	0	0	0	0	0	0	0
17.5-18.5	0	0	0	0	0	0	0	0	0	0	1	1	2
18.5-19.5	0	0	0	0	0	0	0	0	0	0	0	0	0
19.5-20.5	0	0	0	0	0	0	0	0	0	0	0	0	0
20.5-21.5	0	0	0	0	0	0	0	0	0	0	0	0	0
21.5-22.5	0	0	0	0	0	0	0	0	0	0	0	0	0
SUM(DIR)	163	50	47	18	12	24	56	59	46	39	36	57	

VECTOR AVERAGE VALUES

SPEED	DIRECTION	X-COMP.	Y-COMP.
.43	309.1	-1.11	.90

AVERAGE SPEED = 6.17

May 1972

DIRECTION IN DEGREES
NORTH=360, EAST=90, SOUTH=180, WEST=270

SPEED IN KNOTS	0-30	31-60	61-90	91-120	121-150	151-180	181-210	211-240	241-270	271-300	301-330	331-360	SUM OF SPEEDS
.0- .5	159	0	0	0	0	0	0	0	0	0	0	0	159
.5- 1.5	0	0	0	0	0	0	0	0	0	0	0	0	0
1.5- 2.5	0	0	0	0	0	0	0	0	0	0	0	0	0
2.5- 3.5	0	3	1	2	0	1	0	3	1	0	1	1	13
3.5- 4.5	0	8	2	2	0	1	1	5	5	4	4	5	37
4.5- 5.5	0	8	8	1	3	8	11	4	1	3	6	16	69
5.5- 6.5	0	6	7	0	1	6	16	9	3	2	0	6	56
6.5- 7.5	0	5	6	0	3	7	19	11	1	2	2	7	63
7.5- 8.5	0	8	6	2	5	8	30	14	1	0	1	8	83
8.5- 9.5	0	1	2	2	1	2	8	3	1	3	0	1	24
9.5-10.5	0	7	7	0	0	6	42	3	1	0	4	4	74
10.5-11.5	0	1	1	0	0	0	1	1	0	0	0	0	4
11.5-12.5	0	3	4	1	0	3	5	4	0	0	0	7	27
12.5-13.5	0	0	0	0	0	0	1	1	0	0	0	2	4
13.5-14.5	0	0	0	0	0	0	0	0	0	0	0	1	1
14.5-15.5	0	0	1	0	0	0	2	1	0	0	0	0	4
15.5-16.5	0	0	0	0	0	0	0	0	0	0	0	0	0
16.5-17.5	0	0	0	0	0	0	0	0	0	0	0	0	0
17.5-18.5	0	0	0	0	0	0	0	0	0	0	0	0	0
18.5-19.5	0	0	0	0	0	0	0	0	0	0	0	0	0
19.5-20.5	0	0	0	0	0	0	0	0	0	0	0	0	0
20.5-21.5	0	0	0	0	0	0	0	0	0	0	0	0	0
21.5-22.5	0	0	0	0	0	0	0	0	0	0	0	0	0
SUM(DIR)	159	50	45	10	13	42	136	59	14	14	18	58	

VECTOR AVERAGE VALUES

SPEED	DIRECTION	X-COMP.	Y-COMP.
.15	165.1	.04	-.15

AVERAGE SPEED = 5.80

June 1972

DIRECTION IN DEGREES
NORTH=360, EAST=90, SOUTH=180, WEST=270

SPEED IN KNOTS	0-30	31-60	61-90	91-120	121-150	151-180	181-210	211-240	241-270	271-300	301-330	331-360	SUM OF SPEEDS
.0- .5	150	0	0	0	0	0	0	0	0	0	0	0	150
.5- 1.5	0	0	0	0	0	0	0	0	0	0	0	0	0
1.5- 2.5	0	0	0	0	0	0	0	0	0	0	0	0	0
2.5- 3.5	0	2	0	0	0	0	0	0	0	0	1	0	3
3.5- 4.5	0	7	7	2	1	10	2	4	2	3	1	3	42
4.5- 5.5	0	3	14	2	4	7	22	10	6	2	2	4	76
5.5- 6.5	0	4	7	0	1	5	21	8	5	2	0	3	56
6.5- 7.5	0	6	4	3	1	2	28	16	5	0	0	2	67
7.5- 8.5	0	2	10	2	2	5	29	20	7	2	3	5	87
8.5- 9.5	0	0	3	0	0	2	9	12	5	0	0	0	31
9.5-10.5	0	10	12	2	1	5	18	7	3	6	1	2	67
10.5-11.5	0	0	1	0	0	0	1	3	0	0	1	0	6
11.5-12.5	0	2	2	2	1	2	12	8	2	1	3	3	38
12.5-13.5	0	0	0	0	0	0	0	0	0	0	1	1	2
13.5-14.5	0	0	0	0	0	0	1	0	1	0	0	0	2
14.5-15.5	0	0	0	0	0	0	4	1	1	0	2	0	8
15.5-16.5	0	0	0	0	0	0	0	0	0	0	0	1	1
16.5-17.5	0	0	0	0	0	0	0	0	0	0	0	1	1
17.5-18.5	0	0	1	0	0	0	2	0	0	0	0	1	4
18.5-19.5	0	0	0	0	0	0	0	0	0	0	0	0	0
19.5-20.5	0	0	0	0	1	0	0	1	0	0	0	3	5
20.5-21.5	0	0	0	0	0	0	0	0	0	0	0	0	0
21.5-22.5	0	0	0	0	0	0	0	0	0	0	0	0	0
SUM(DIR)	150	36	61	13	12	38	149	90	37	16	15	29	

VECTOR AVERAGE VALUES

SPEED	DIRECTION	X-COMP.	Y-COMP.
1.42	185.8	-.14	-1.41

AVERAGE SPEED = 6.15

July 1972

DIRECTION IN DEGREES
NORTH=360, EAST=90, SOUTH=180, WEST=270

SPEED IN KNOTS	0-30	31-60	61-90	91-120	121-150	151-180	181-210	211-240	241-270	271-300	301-330	331-360	SUM OF SPEEDS
.0- .5	213	0	0	0	0	0	0	0	0	0	0	0	213
.5- 1.5	0	0	0	0	0	0	0	0	0	0	0	0	0
1.5- 2.5	0	0	0	0	0	0	0	0	0	0	0	0	0
2.5- 3.5	0	3	0	1	0	1	1	1	0	0	1	0	8
3.5- 4.5	0	6	2	4	3	4	15	8	8	5	3	6	64
4.5- 5.5	0	4	16	6	3	14	32	24	12	5	5	10	131
5.5- 6.5	0	4	8	2	3	4	15	19	7	1	3	3	69
6.5- 7.5	0	3	5	3	0	1	12	20	7	2	7	4	64
7.5- 8.5	0	0	1	1	1	2	15	14	16	0	4	3	57
8.5- 9.5	0	0	0	0	0	1	6	7	3	0	0	1	18
9.5-10.5	0	0	0	1	1	1	17	17	6	1	4	3	51
10.5-11.5	0	0	0	0	0	1	1	5	0	0	0	0	7
11.5-12.5	0	0	0	0	0	0	6	1	1	0	1	0	9
12.5-13.5	0	0	0	0	0	0	1	2	0	1	0	1	5
13.5-14.5	0	0	0	0	0	0	1	0	0	0	0	0	1
14.5-15.5	0	0	0	0	0	0	0	1	0	0	0	0	1
15.5-16.5	0	0	0	0	0	0	0	0	0	0	0	0	0
16.5-17.5	0	0	0	0	0	0	0	0	0	0	0	0	0
17.5-18.5	0	0	0	0	0	0	0	0	0	0	0	0	0
18.5-19.5	0	0	0	0	0	0	0	0	0	0	0	0	0
19.5-20.5	0	1	0	0	0	0	0	0	0	0	0	0	1
20.5-21.5	0	0	0	0	0	0	0	0	0	0	0	0	0
21.5-22.5	0	0	0	0	0	0	0	0	0	0	0	0	0
SUM(DIR)	213	21	32	18	11	29	122	119	60	15	28	31	

VECTOR AVERAGE VALUES

SPEED	DIRECTION	X-COMP.	Y-COMP.
2.02	197.7	-.62	-1.93

AVERAGE SPEED = 4.67

August 1972

DIRECTION IN DEGREES
NORTH=360, EAST=90, SOUTH=180, WEST=270

SPEED IN KNOTS	0-30	31-60	61-90	91-120	121-150	151-180	181-210	211-240	241-270	271-300	301-330	331-360	SUM OF SPEEDS
.0- .5	213	0	0	0	0	0	0	0	0	0	0	0	213
.5- 1.5	0	0	0	0	0	0	1	0	0	0	0	0	1
1.5- 2.5	0	0	0	0	0	0	0	0	0	0	0	0	0
2.5- 3.5	0	2	1	1	0	0	1	1	1	1	1	6	15
3.5- 4.5	0	9	5	4	5	3	8	12	6	5	5	5	67
4.5- 5.5	0	17	8	4	7	8	17	14	9	6	2	9	101
5.5- 6.5	0	5	5	1	2	3	12	8	9	2	1	0	48
6.5- 7.5	0	5	7	5	1	4	11	14	6	2	2	2	59
7.5- 8.5	0	5	5	1	0	4	10	25	7	1	2	3	63
8.5- 9.5	0	1	0	0	0	0	4	9	3	0	1	1	19
9.5-10.5	0	2	4	0	0	0	19	12	12	8	1	1	59
10.5-11.5	0	0	1	1	0	0	2	4	0	0	0	0	8
11.5-12.5	0	0	0	0	0	0	2	2	3	0	1	0	8
12.5-13.5	0	0	0	0	0	0	0	0	0	0	0	1	1
13.5-14.5	0	0	0	0	0	0	0	1	2	0	0	0	3
14.5-15.5	0	0	0	0	0	0	0	0	0	0	0	0	0
15.5-16.5	0	0	0	0	0	0	0	0	0	0	0	0	0
16.5-17.5	0	0	0	0	0	0	1	0	0	0	0	0	1
17.5-18.5	0	0	0	0	0	0	0	0	0	0	0	0	0
18.5-19.5	0	0	0	0	0	0	0	0	0	1	0	0	1
19.5-20.5	0	0	0	0	0	0	0	0	0	0	0	0	0
20.5-21.5	0	0	0	0	0	0	0	0	0	0	0	0	0
21.5-22.5	0	0	0	0	0	0	0	0	0	0	0	0	0
SUM(DIR)	213	46	36	17	15	22	88	102	58	26	16	28	

VECTOR AVERAGE VALUES

SPEED	DIRECTION	X-COMP.	Y-COMP.
1.20	209.4	-.59	-1.04

AVERAGE SPEED = 4.74