MARINE SCIENCES RESEARCH CENTER
STATE UNIVERSITY of NEW YORK
STONY BROOK, N.Y.

FLOATABLES AND MEDICAL TYPE WASTES ON THE REGION'S BEACHES 1989 vs. 1988 What Were the Differences and Their Causes?

15 December 1989

J.R. Schubel
Project Director

Doreen M. Monteleone
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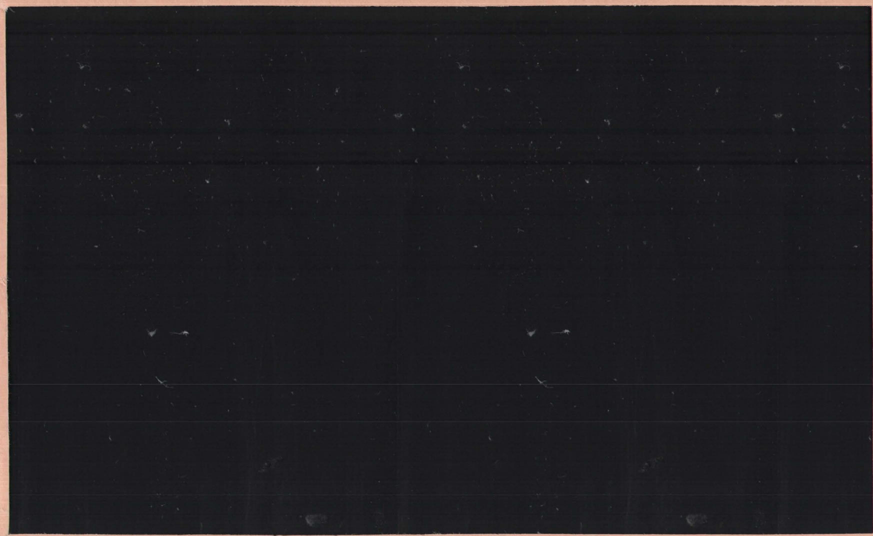

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J.R. Schubel, Director

ACKNOWLEDGMENTS

We thank Melissa Beristain of New York State Sea Grant Extension and Sheila Charnon and Jeri Schoof of the Marine Sciences Research Center for providing additional information regarding this meeting.

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INTRODUCTION

J. R. Schubel,

COAST Institute, Marine Sciences Research Center, SUNY

The Foes of Floatables and Medical Type Waste met on October 24, 1989 at the New York State Urban Development Corporation in New York City, New York. The meeting was sponsored by the Marine Sciences Research Center's COAST and Waste Management Institutes of the University at Stony Brook. The meeting was a follow-up to the Floatables Management Plan (MSRC 1989).

Approximately 40 people participated in the meeting (Appendix A).

OBJECTIVES

The objectives of the meeting were:

* To review the floatable and medical-type waste events in the region during the summer of 1989.
* To review the reasons for the differences -- real and perceived -- between the floatable and medical type waste events during the summers of 1988 and 1989.
* To identify the most important actions to take next to gain and to maintain control over those factors that contribute to floatable and medical-type wastes in the region's water and on its beaches in the short-term and long-term.

COAST Institute

AGENDA
October 24, 1989

URBAN DEVELOPMENT CORPORATION

Main Conference Room
1515 Broadway - 52nd Floor
(between 44th and 45th Street)

Welcome and Introductions Overview of What We Expect to Achieve Today	J. R. Schubel, COAST Institute Marine Sciences Research Center
A Status Report of the Summer of 1989 and Lessons for the Future	
How much floatable material was collected?... from the harbors, from back bays, from our beaches?	Paul Molinari, US Environmental Protection Agency Alan Dorfman, US Army Corps of Engineers
Meteorological and oceanographic conditions--what was different from 1988? Was Mother Nature on our side this year?	R. L. Swanson, Waste Management Institute, Marine Sciences Research Center
Reporting of Data and Information Exchange: how can we enhance these critical activities?	Ronald Foley, New York State Office of Parks, Recreation and Historic Preservation
Education and Educational Materials: how can we get the word out more effectively?	Roberta Weisbrod, New York State Department of Environmental Conservation
Are we addressing the causes of the problems or only the symptoms?	Harold Berger, New York State Department of Environmental Conservation
Discussion and Wrap-Up	J. R. Schubel, COAST Institute Marine Sciences Research Center

A STATUS REPORT OF THE SUMMER OF 1989 AND LESSONS FOR THE FUTURE

Paul Molinari,

United States Environmental Protection Agency

The agencies that implemented the New York Bight Floatable Action Plan were the New Jersey Department of Environmental Protection (NJDEP), New York City Department of Sanitation (NYCDOS), New York State Department of Environmental Conservation (NYSDEC), U. S. Army Corps of Engineers (USACOE), U. S. Coast Guard (USCG), and U. S. Environmental Protection Agency (USEPA). The four elements of the Action Plan are surveillance, regular debris clean-up after new and full moon tides, non-routine clean-up of debris slicks spotted in the New York-New Jersey harbor complex and a communication network.

Rainfall in Central Park in the summer of 1989 was twice the long-term average summer rainfall (Table I). In May and June 1989 rainfall was three times the long-term ensemble average for those two months. As a result, combined sewers overflowed and significant amounts of sewage, sewage-related wastes and street debris were discharged into the coastal waters. However, only two stretches of ocean beaches were closed during the bathing season as a result of debris washing ashore which occurred on July 20 in Cape May County and August 18-20 in Sandy Hook National Park, New Jersey.

The U. S. Army Corps of Engineers collected 544 tons of debris with 461 tons captured on floatable days (new/full moon

TABLE I

MONTHLY RAINFALL, SUMMER 1989

CENTRAL PARK, NEW YORK
(inches)

	MAY	JUNE	JULY	AUG	SEP (thru 9/15)	TOTAL
1989	10.72	8.76	5.14	8.44	1.80	34.86
NORMAL	3.36	3.23	4.03	3.76	1.83	16.21
PERCENT ABOVE NORMAL	285	271	127	224	(98)	210

high tides and non-routine clean-up days) (Table II). The collected material contained approximately 90% wood (by volume) and 10% other floatable material (plastic, tires, paper, etc.). NOAA computers were used to predict outcomes of three events (Table III). The model accurately predicted dispersion/landfall of slicks which were detected on May 23, August 10 and 17, 1989. The last coincided with a full moon and lunar eclipse. Sandy Hook ocean beaches were closed from the afternoon of August 18 to August 20.

The New York Bight Floatable Action Plan contributed to a prevention of a repeat of the summer of 1988. Also, Operation Clean Shore, implemented by the N. J. Department of Environmental Protection, resulted in the removal of 3,000 tons of beach debris and, thus, contributed significantly to a successful summer. The New York Bight Floatable Action Plan should be reenacted for next summer until long-term solutions to the problem are implemented.

TABLE II

SUMMARY OF NUMBER OF SLICKS REPORTED THROUGHOUT THE SUMMER TO THE ENVIRONMENTAL PROTECTION AGENCY FLOATABLE COORDINATORS -- 1989*

LOCATION	no.
Upper Harbor	47
Newark Bay	40
Verrazano Narrows/Lower Harbor	36
Kill van Kull	19
Arthur Kill	12
Raritan Bay	5
Rockaway - Sandy Hook Transect	3
Jamaica Bay	1
Newtown Creek	1

* Through 4 September 1989

TABLE III

USCG/NOAA

COMPUTER PREDICTIONS OF

FLOATABLES DISPERSAL/STRANDING DURING 1989

DATE	LOCATION	SYNOPSIS OF COMPUTER PREDICTIONS	ACTUAL OBSERVATION
May 23	Slick moving out of harbor through Verrazano Narrows	Debris would disperse and remain within lower harbor	No ocean beaches closed, debris dispersed
Aug 10	Narrow slick (1-2 mi long) 3 mi due east of Sandy Hook	Debris may wash-up on eastern shore of Sandy Hook	No ocean beaches closed, slick couldn't be located due to weather conditions on Aug 11
Aug 17	Large slick (10 mi long) escaped harbor through Verrazano Narrows	Debris would landfall on Sandy Hook during Aug 18	Gateway National Park-Sandy Hook (ocean) closed its beaches at 4pm on Aug 18 and reopened Aug 20

Alan Dorfman,

United States Army Corps of Engineers

The U. S. Army Corps of Engineers' participation in the New York Bight Floatable Action Plan began two days before its intended start (May 17 instead of May 19, 1989) because of heavy rains.

Thirty-eight floatable days were recorded by the Corps. Floatable days are the day before, during and after a full or new moon (when extreme tides occur -- 26 scheduled) and days of strong rain events or sightings (12 unscheduled). When tides are higher than normal, debris is carried off the beaches and shorelines and into the water.

Over 304 vessel overtime hours were used by the Corps to collect floatables under the New York Bight Floatable Action Plan. The four floatable nets (designed by the Corps) which were used to collect floatables have 1.5 inch mesh made of steel wire rope. The nets were fastened over the Corps standard drift nets, which have 5.5 x 5.5 inch mesh. This arrangement proved effective in collecting floatables other than wood without excessive drag on the vessel. These nets were paid for with funds from the States of New York and New Jersey.

While the U. S. Army Corps of Engineers' wood collection program gathers 6,500 tons (600,000 cubic feet) of floating wood debris per year, New York City generates 28,000 tons of garbage each day. The worst areas for floating debris were Arthur Kill to Bergen Point, Bay Ridge Channel into the Narrows, Passaic River after heavy rains and Upper Bay off the Battery extending into the East River (Fig. 1).

The total weight of floatables collected in 1989 was 544 tons. Of this, 461 tons of floatables were collected and put into New York Department of Sanitation scows and transported to the Fresh Kills Landfill on Staten Island. Eighty-three tons were transferred to Corp's barges and either burned at sea, recycled or transported to the Meadowland Landfill in Hackensack, NJ. The weight of floatables collected during the same period of time in 1988 was 452.1 tons and in 1987, 254.3 tons.

The floatables collected in 1989 were broken down into six categories with the major portion being wood (Table IV).

FIGURE 1

MAP OF NEW YORK CITY REGION

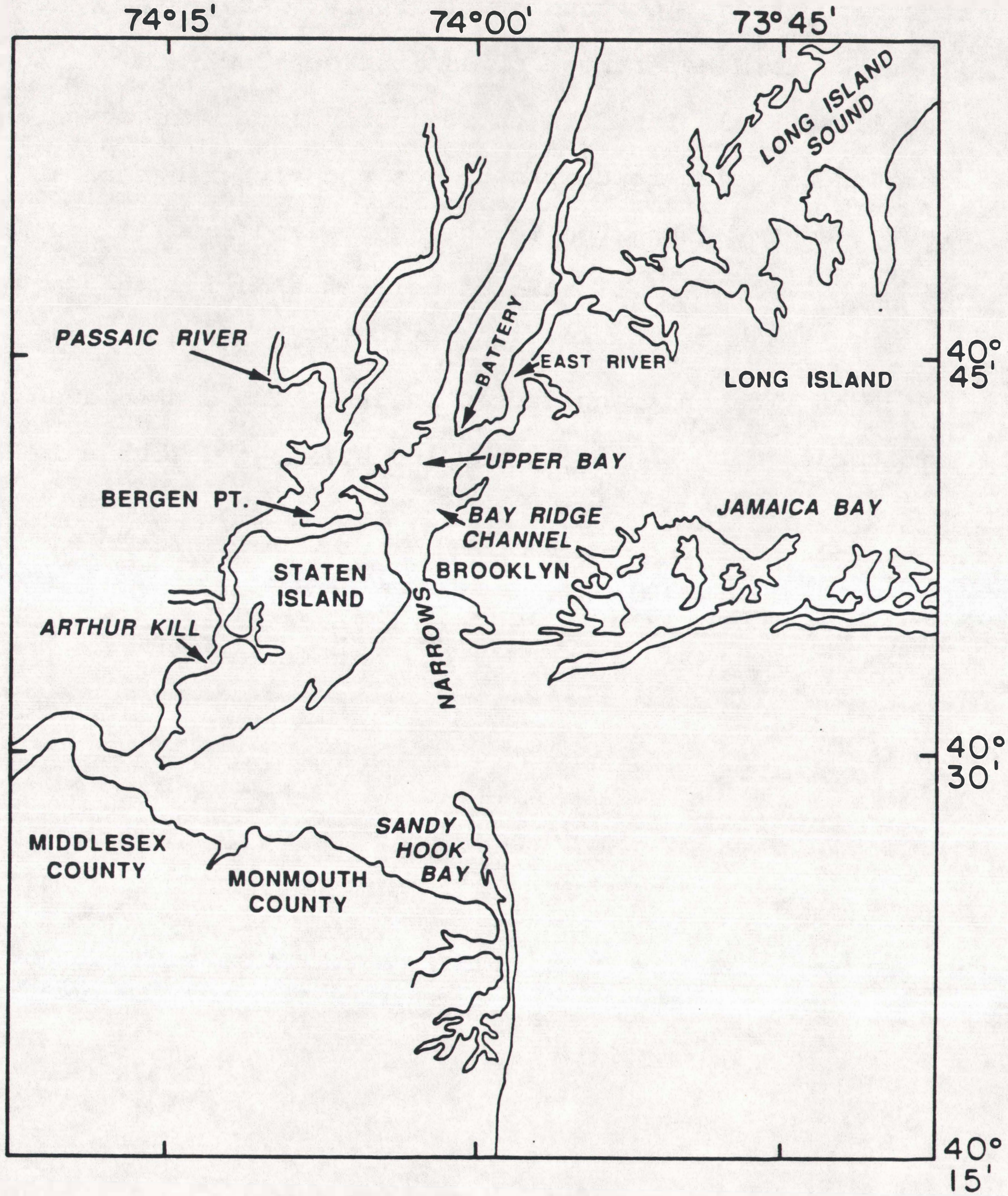

TABLE IV

CATEGORIES OF FLOATABLE WASTES

(by volume)

COMPONENT	PERCENT
Wood	85
Construction wood	5
Plastics	4
Tires/rubber	3
Sea grass	2
Styrofoam	1

R. Lawrence Swanson,

Waste Management Institute, Marine Sciences Research Center, SUNY

During the summer of 1989, the beaches of Long Island and New Jersey were relatively free of floatable debris compared to the previous two summers. The extensive rainfall recorded in this period (twice the long-term average amount for summer months) must have contributed large amounts of floatable wastes to the New York Bight. However, the wind characteristics (speed, direction, constancy, and energy) were such that they distributed the floatables offshore and away from the coasts of Long Island and New Jersey.

When compared to the climatology of the summers of 1987 and 1988, the summer of 1989 was found to be unusual in relation to its high precipitation (22.3 inches), its low wind constancy (a constancy of 19-21% for this time indicates variable winds, a number close to 100% indicates unidirectional persistent winds) and its lower air mean temperature (1.5^{O}F lower than normal). These conditions are not those generally associated with major floatable problems. Consequently, the floatable collection program implemented in the New York-New Jersey Harbor estuary did not get a rigorous test with regard to keeping area beaches open. It is important that the New York Bight Floatable Action Plan be kept in place until it can be shown that it is either not effective or a long-term solution is in place.

See Swanson and Valle-Levinson (in review) -- Appendix B for additional information.

Ronald Foley,

New York State Office of Parks, Recreation and Historical Preservation

The 1989 summer beach season was remarkably uneventful in terms of impact from floatable debris appearing on Long Island beaches. Of a potential of 300,000 plus beach days (number of beaches x number of days in the season, Memorial Day through Labor Day) available, none was lost to closings because of floatable debris. However, 565 beach days were lost due to high bacteria levels in swimming waters (Appendix C). The primary cause of the high bacteria levels was excessive rainfall that caused non-point source pollution of nearshore bay waters. Most closures were bay beaches, not ocean beaches, and most closures would not have occurred if the standard of 400 coliform bacteria per milliliter had been in place earlier, rather than the 200 standard that applied.

It is reasonable to conclude that our joint educational efforts served to mitigate the perception that the presence of small amounts of floatable wastes is a health hazard. Beach employees who were more knowledgeable of the true implications of floatable debris helped reassure the wary public. The print media were obviously more sensitive to the impact of dramatic reporting and most preseason stories were reflective of the reporters' greater understanding of the facts. Attendance at State Park beaches was 5,711,249 in 1989, significantly higher than 4,670,753 in 1988 (a difference of 1,040,493) (Table V) and

TABLE V

ATTENDANCE COMPARISON

JONES BEACH STATE PARK

1988 - 1989

MONTH	1989	1988
MAY	822,597	829,798
JUNE	1,010,380	1,258,495
JULY	1,899,373	1,317,921
AUGUST	1,243,184	861,533
SEPTEMBER	735,715	403,009
TOTAL	5,711,249	4,670,756

probably would have been even greater if we had not suffered one of the wettest seasons in history.

Isolated syringes were reported to the Beach Information Network (BIN), but were not a source of alarm (Table VI). The BIN works as a collection point for information and as a source of information for those registered with the system. Greater enrollment in the network would improve the network. To become a BIN member, contact Joseph Lescinski at (516) 785-1600.

The idea of an information sharing network for beach operators was conceived during winter conferences. The system is computerized and housed at Jones Beach. It was activated May 10, 1989 and has a 24-hour access by telephone.

BIN began with 23 organizations representing 69 beaches. By the end of August 1989, the system included 34 organizations and 118 ocean, lake, sound and bay beaches in Long Island, New York City and New Jersey (Appendix D). The BIN was used for the following:

* received and distributed reports of beach soilings, closings. reopenings;
* received reports of oil slicks and initiated advisories to beaches in the area;
* dispelled rumors of garbage slicks;
* tabulated information concerning closings and causes;
* tabulated quantities of medical debris recovered at various member beaches;
* tracked a major oil spill near Massachusetts and issued

TABLE VI
SYRINGES COLLECTED IN 1989 AND REPORTED TO THE BEACH INFORMATION NETWORK (BIN)

DATE	LOCATION	NUMBER
May		
31	Jones Beach	1
June		
3	Jones Beach	1
5	Robert Moses	1
5	Jones Beach	1
6	Sunken Meadow	1
9	Gateway National Park	16
11	Sunken Meadow	3
12	Jones Beach	1
14	Jones Beach	1
17	Jones Beach	1
18	Jones Beach	1
19	Seagate Police	6
20	Jones Beach	1
22	Sunken Meadow	1
23	Jones Beach	2
24	Jones Beach	1
24	Jones Beach	1
24	Smith Point Beach	2
24	W. Babylon Beach	1
25	Jones Beach	2
25	Town of Brookhaven	1
29	Sunken Meadow	2
30	Sunken Meadow	1
July		
1	Seagate Police	2
2	Seagate Police	2
2	Sunken Meadow	1
3	Jones Beach	2
6	Town of Brookhaven	1
6	Jones Beach	2
7	Sunken Meadow	1
7	Seagate Police	18
8	Jones Beach	1
8	Sunken Meadow	1
9	Town of Islip	5
9	Jones Beach	1
11	Town of Brookhaven	1
12	Breezy Point Coop*	14
12	Fire Is. Nat. Seashore**	13
12	Seagate Police	6
12	Jones Beach	1
13	Jones Beach	1
14	Seagate Police	2
14	Jones Beach	1
16	Breezy Point Coop	1

DATE	LOCATION	NUMBE
July		
16	Seagate Police	1
16	Hither Hills	1
17	Seagate Police	3
17	Sunken Meadow	1
18	Seagate Police	5
19	Seagate Police	1
20	Sunken Meadow	1
21	Breezy Point Coop	1
21	Seagate Police	13
22	Seagate Police	6
23	Seagate Police	5
23	Robert Moses	1
24	Seagate Police	2
25	Seagate Police	8
27	Breezy Point Coop	1
27	Sunken Meadow	1
28	Robert Moses	3
28	Silver Pt. Beach Club	2
28	Jones Beach	1
30	Breezy Point Coop	1
30	Hither Hills	1
31	Breezy Point Coop	2
Aug		
2	Town of Brookhaven	2
2	Breezy Point Coop	1
3	Sunken Meadow	1
4	Breezy Point Coop	1
5	Breezy Point Coop	1
6	Breezy Point Coop	1
8	Town of Islip	1
9	Sunken Meadow	1
12	Sunken Meadow	1
18	Sunken Meadow	2
22	Islip	1
23	Sunken Meadow	1
27	Town of Brookhaven	2
27	Sunken Meadow	1
29	Jones Beach	1
31	Jones Beach	1
31	Sunken Meadow	1
Sep		
1	Jones Beach	1
2	Jones Beach	13
3	Sunken Meadow	1
4	Jones Beach	1

* since 1 May 1989, ** since 15 February 1989, Total Number = 223

advisories to the north shore of Long Island;

* served as a data base for New York State Tourism Hotline (1-800-CALL-NYS).

The system seems to have served the purpose for which it was intended and became an effective network for sharing information among beach operators. During the course of the summer, BIN received 146 reports and issued 4 formal advisories. The access codes protected the integrity of the system whenever unauthorized callers attempted to use the system (three times over the course of the summer). The network worked especially well with health departments in Nassau and Suffolk Counties and has been established as a credible source of information on the operating status of member beaches.

Suggested ways of improving data collection and sharing included the following:

* encourage those organizations which have not yet joined the system to do so;
* provide all BIN members with a written summary of BIN experience so that they understand the ways in which various beach operators have successfully made use of the system;
* reemphasize the importance of reporting medical debris wash-ups (regardless of quantities) to BIN so that reliable data are available for analysis by DEC -- only a few state beaches and one federal beach actually reported such debris recoveries to BIN during the summer of 1989;
* survey BIN members for their input on ways the system was

helpful and ways in which it can be improved;

* share BIN listings of closings from this past summer with all BIN members to prevent any feelings of isolation and to further encourage prompt and forthright reporting to BIN;
* review with EPA the results of helicopter surveys during the past summer since no reports of their findings were ever shared with BIN throughout the summer months (It would be helpful to share with beach operators information such as whether garbage slicks are routinely escaping from New York Harbor, what track they followed this year,what additional collection methods are planned for 1990 in view of sightings, and how much garbage was actually netted by the Army Corps this past summer within the harbor as a result of the multi-agency action plan.)

Roberta Weisbrod,

New York State Department of Environmental Conservation

National beach clean-up day was held on September 24, 1989. Participants were informed about the beach clean-up through major press as well as local newspapers and environmental organizations' newsletters. About 1000 people, representing 50 groups, participated. A total of thirty beaches in New York City, Long Island, Westchester and Rockland Counties were cleaned of 4.5 tons of debris (Table VII).

This project was designed to determine the distribution of debris on beaches, its composition and to chronicle changes from year to year to gain a measure of the effectiveness of prevention methods. Volunteers checked off a list of the 80 types of debris they collected to determine trends in composition. In 1988, only 9 beaches were cleaned and for every mile of beach there were an average of 6 syringes. Although 1989 data are not yet completely analyzed, about two-thirds (by number) of the items collected were plastics.

The plan for 1990 is to have a bigger and better beach clean-up. Beach clean-up day is scheduled for September 23, 1990. The volunteers of last year and others who have already expressed interest will be recruited and media coverage will be increased.

In 1990, Marine Pollution Treaty V (MARPOL V) will be implemented at marinas as a pilot project in New York and New Jersey. The Environmental Protection Agency has funded NYS

TABLE VII

BEACH CLEAN-UP DAY 1989

BEACH	# PEOPLE	DISTANCE CLEANED (ft)	AMOUNT (lbs)
Coney Island	35	2000	382
Breezy Point	30	5280	785
Plum Beach	25	2000	1000
Inwood Point			
South Beach	7		281
DuBos Point	7	1320	500
Long Beach	26	2400	233
Jones Beach	70	7920	1501
Fire Island	26	?	80
Ponquogue	16	3000	260
Park/Mattituck	4	200	80
Jamesport			
Shell	12	800	80
Flying Point	24	950	88
Atlantic	15	300	25
Mashomack	17	8900	174
Pelham Bay	35	1000	350
Sunken Meadow	90	10560	750
City Island	21	320	1650
Manor Haven	14	1320	212
Huntington	18	123	435
Rye Playland	38	825	800
Rye Marshland	38	1400	310
Glen Island	39	467	230
Manor Park	30	3000	
Mamaroneck	44	4000	
Read	6	300	76.5
Hudson Park	17	477	
Piermont	34	500	320
Stony Point	30	300	150
Total	768	59662 (11.3 mi)	10752.5 (5.4 tons)

Note:
This is an incomplete list and totals are underestimates

Department of Environmental Conservation projects at three marinas. The project includes providing waste receptacles, as well as vessel waste reuse and recycling and an educational component.

Harold Berger,

New York State Department of Environmental Conservation

We should be concerned with the causes of floatable wastes. In the past, New York City has had poor housekeeping methods at New York City transfer stations, during barge transport to the Fresh Kills Landfill and at the Fresh Kills Landfill. New York City's housekeeping has improved considerably.

The public has a fear of contracting the AIDS virus from syringes washing up on the beaches and shorelines. In 1988, when syringes were found at the beaches, the media were over zealous and magnified the situation. People were apprehensive about going to beaches because of a fear of contracting AIDS. Since then, there has been little, if any, government effort to educate the public of the transfer of the AIDS virus.

The presence of syringes as floatable wastes implies that there is inadequate education of the general public by the medical profession. Health departments should educate individual diabetics on how to properly dispose of syringes. There is a lack of adequate disposal facilities for medical wastes on Long Island and in New York City. Incinerators are vital. Presently, it costs $0.35 - $1.00 per pound to dispose of medical waste.

The New York Bight Floatable Action Plan must be kept in place and we must be creative and ambitious in a search for long-term solutions to the floatable waste problem.

CONCLUSIONS AND RECOMMENDATIONS

J. R. Schubel,

COAST Institute, Marine Sciences Research Center, SUNY

The group concluded the session by formulating the conclusions and recommendations listed below:

* The group should be maintained and should be reconvened by the COAST Institute to brainstorm strategies to deal with the fundamental, underlying causes of the problem of floatables, and medical-type wastes in the environment.
* The importance and power of economic forces should not be underestimated in creating the problems of floatables and medical-type wastes in the environment, and they should be exploited in the search for solutions to these problems.
* The group should promote the preparation of a NOVA-type show to formulate the underlying causes of the floatables and medical-type waste problem, to identify the full range of alternative ways of dealing with the problems, and to assess the advantages and disadvantages of these strategies individually and in different combinations.
* Environmental education modules should be developed and incorporated into curricula at all levels, K-12.
* New York State should enhance its efforts to work with other states in the northeast U. S. to promote recycling -- to ensure a stable supply of recyclable materials of known quantity, to develop and sustain new markets, to attract and retain industries that manufacture goods from recycled

materials, and to promote education at all levels of the need for recycling.

* The group should clarify the connection of clean streets in New York City to floatables and medical-type wastes in the environment and on the region's beaches, and should speak out on the importance of enhancing the City's street cleaning efforts.
* Fines imposed for illegal dumping and for failure to comply with state and local regulations concerning waste disposal should "fit the crime". Fines collected should go into a dedicated fund which should be used for research, education and management activities targeted at improving the management of society's wastes.
* Volunteerism should be promoted to clean-up debris from back bay areas. Celebrities should be recruited to make participation more attractive to the public.

REFERENCES

Marine Sciences Research Center. 1989. Floatables Management Plan. COAST Institute and Waste Management Institute, State University of New York at Stony Brook. Special Report 86, Reference Number 89-4.

APPENDIX A

LIST OF PARTICIPANTS

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APPENDIX B

Meteorological Conditions That Kept the Beaches of Long Island and New Jersey Free of Floatables During the Summer of 1989[1]

R. Lawrence Swanson and Arnoldo Valle-Levinson

Waste Management Institute
Marine Sciences Research Center
State University of New York at Stony Brook
Stony Brook, NY 11794-5000 U.S.A.

Keywords: *floatable; Long Island; New Jersey; summer 1989; New York Bight; wind constancy; resultant wind vector*

During the summer of 1989, the coasts of Long Island and New Jersey were relatively free of floatable debris washing ashore on their beaches as compared to the previous two summers. The extensive rainfall recorded in this period (twice as much as the normal amount) must have contributed as an important source of floatable wastes to the New York Bight. However, the wind characteristics (speed, direction, constancy and energy) were such that they distributed the floatables offshore and away from the coasts of Long Island and New Jersey.

When compared to the climatology of the summers of 1987 and 1988, it is found that the summer of 1989 was unusual in relation to its high precipitation (567mm), its low wind constancy (19-21%) and its lower air mean temperatures (1°C lower than normal). These conditions are not those generally associated with major floatable problems. Consequently, the floatable collection program implemented in the New York-New Jersey Harbor Estuary did not get a rigorous test with regard to keeping area beaches open.

[1]Contribution Number XXX of the Marine Sciences Research Center, SUNY, Stony Brook,

INTRODUCTION

The southern coast of Long Island and the coast of New Jersey (Fig.1) are exposed to undesirable events of floatable material washing ashore when appropriate wind conditions prevail over these areas. Such conditions, consisting of persistent southerly and south-southwesterly wind for the southern coast of Long Island, and east to southeasterly and south-southeasterly wind for the coast of New Jersey, mainly occur during the summer months. June, July and August are also the months when the beaches are most frequented by visitors, thus bringing a great deal of support to the economy of these areas. The wash up of floatable wastes drove many visitors away from the coast of New Jersey in the summer of 1987, and from the coast of Long Island in the summer of 1988. The absence of people from the beaches translated into considerable damage to local economies (Swanson and Zimmer, in press).

For the summer of 1989, the U.S. Environmental Protection Agency in cooperation with the Corps of Engineers, the U.S. Coast Guard, the states of New York and New Jersey, and the city of New York, implemented a short term Floatable Action Plan. The objective of the plan was to skim floatable debris form surface waters at its source, the New York-New Jersey Harbor Estuary, and hopefully to keep the coastal beaches free of wastes washing ashore. The Corps collected in the Harbor approximately 535 metric tons of debris from mid-May through Labor day. Nearly 90% of the debris collected was wood (Paul Molinari, personal communication). The beaches of Long Island and New Jersey were relatively clean of floatable wastes in 1989 in comparison to the previous two summers. During this period, there were two New Jersey beach closures as a consequence of the wash up of floatables (Paul Molinari, personal communication). The purpose of this paper is to provide an assessment of the summer (June, July and August) 1989 meteorological conditions, describe their relationships to the wash ups of floatable wastes on ocean beaches in the New York Bight, and compare them to the conditions in the summers of 1987 and 1988.

In the summer of 1987, the New Jersey Department of Environmental Protection indicated that the wash up of floatable material was prevalent during the periods of 27 May to 29 May, and 13 August to 16 August. These events were caused by the combined action of the spring freshet of the Hudson River (May), timely rains (August) and winds that blew from the east to southeast during at least one week before the wash ups. The normal southerly to southwesterly wind field was less persistent and less energetic than normal. Winds from the east and northeast interrupted the normal wind field and enhanced the northeasterly to southwesterly flow of surface waters in the New York Bight (Swanson and Zimmer, in press).

The summer of 1988 was quite peculiar in the sense that south-southwesterly winds persisted throughout July and carried floatable wastes to diverse locations of the southern coast of Long Island over much of that period. The first wash up reported consisted of stranding of medical wastes at Long Beach and Lido Beach on 6 July. Similar incidents were consistently reported at numerous beaches on the south shore of Long Island until 27 July (Swanson and Zimmer, in press). This floatables event was comparable to that of June 1976 (Swanson *et al.*, 1978). For a discussion of the sources and why certain types of debris may be increasing in the New York Bight region see Swanson *et al.*, 1978; Steinhauer *et al.*, 1988; and Swanson and Zimmer, in press.

OBSERVATIONS

Local observations of wind speed and direction as well as rainfall data were compiled for analysis. Hourly wind data were used to construct progressive vector diagrams (PVDs), to calculate constancy and energy values for June, July and August 1989. Constancy values C were estimated from the relationship:

$$C = \{\bar{U}/|u|\}\ 100,$$

for the monthly mean vector wind speed $\overline{U}$ and the monthly mean scalar wind speed $|u|$. Energy values E were obtained from:

$$E = |u|^2/|u_{norm}|^2 \times 100.$$

The term in the numerator represents the monthly mean kinetic energy of the wind, while the denominator indicates the average monthly mean kinetic energy over 30 years (1959-1988)(Swanson and Zimmer, in press).

Daily rainfall values were employed to construct precipitation graphs for each of those months. The PVDs helped to describe the wind behavior and to identify times of potential wash ups of floatable debris on the south coast of Long Island or the coast of New Jersey. The constancy indicated the persistency of the wind to blow from a given direction. The precipitation graphs served to identify periods of possible storm sewer and combined sewer overflows to the New York-New Jersey Harbor Estuary. The estimated time lag between an overflow event and an initial wash up on ocean beaches is 3-5 days.

Wind data from John F. Kennedy airport were used since they are the most readily available data reflecting oceanic conditions. They were provided by the National Weather Service, Eastern Region. Rainfall data for Central Park in New York City were used since they represent conditions close to the major sources of floatable wastes, namely the Harbor Estuary. These data were obtained from the daily reports in the New York Times.

Reports on Floatable Incidents and Anecdotal Information

During June, July, and August 1989, there were two New Jersey beach closures as a consequence of the wash up of floatables. One, accompanied by high coliform counts, was in the vicinity of Ocean City. The other closure occurred at Sandy Hook. There were no reported incidents of ocean beach closures in Long Island due to floatables. Chronological anecdotal information consisted of:

a) in early to mid-June few floatables were observed from 2-8 km off the south shore of Long Island;

b) grease balls of varying sizes washed ashore in the vicinity of Atlantic Beach, Long Island the weekend of 24, 25 June;

c) dead algae with trash and sewage related items mixed in were observed off Avon By Sea, NJ on the weekend of 24, 25 June;

d) large quantities of debris including dunnage, pallets, and timber were observed up to 90-112 km offshore. Much of it appeared as if it had been in the water for a short period of time. There was also a considerable amount of plastic debris at sea;

e) plastic and floatable debris, oil-grease balls, as well as needle and crack vials were collected at Atlantic Beach, Long Island on 2 July;

f) a garbage slick that caused the beach closure for 6 hours at Ocean City, NJ, was reported on 21 July;

g) some needles, needle covers and crack vials were found at Atlantic Beach, Long Island from 26 to 28 July;

h) floatable debris caused the closure of the beach at Sandy Hook, NJ from 18-20 August.

i) floatable debris was observed at Atlantic Beach, Long Island on 1 September, a day with very strong southerlies.

The Winds of the Summer 1989

The winds in early June (Fig. 2) were extremely varied with the net drift after the first 15 days being close to zero while the average speed was 4.9 $m \cdot s^{-1}$. On the 16th however, the winds began to blow out of the south and southeast until 25 June at which time they shifted to the west-southwest and then to northerly on the 29th. West-northwesterly winds are very nearly parallel to the general trend of the Long Island coast. These winds would tend to hold floatable debris offshore. The vector mean speed was 1.6 m s^{-1} out of 192°T for the period of 16-30 June.

Over the entire month, the vector mean speed was 0.8 m s^{-1} from 196°T and the mean speed was 4.4 m s^{-1}. This compares with the 1959-1988 climatological norm for June of 1.4 m s^{-1} from 208°T. Wind constancy was 19%, considerably less than the norm which is 34%. Wind energy as a percent of normal was 70. Thus, for the month as a whole, wind conditions were not favorable for a major wash up of floatable debris. Yet for the period 15-24 June it would not have been surprising if a significant wash up had occurred on the south shore of Long Island, if there had been a source of material. After 26 June floatables should have been transported offshore.

In early July, the winds had a southerly component (Fig. 3). The average speed for the first week of the month was 4.3 m·s^{-1} and the vector mean speed was 1.7 m·s^{-1} out of 190°T. The winds had a noticeable westerly component from the 9th to the 11th, an easterly component during the 20th and 21st, and a southwesterly component from the 22nd through the 27th.

Over the entire month, the vector mean speed was 0.9 m·s^{-1} from 225°T and the mean speed was 4.2 m·s^{-1}. The 1959-1988 climatological norm for July is a vector mean speed 1.9 m·s^{-1} from 210°T. The wind constancy was 21%, considerably less than the norm for the month of July which is 41%. Wind energy as a percent of normal was 78. Thus, for the month as a whole, wind conditions were not favorable for a major wash up of floatable debris on the coast of Long Island. The most likely periods for wash ups in New Jersey would have been the small windows between 3-5 July and 20-21 July.

In early August, the winds had a west-southwesterly component (Fig. 4). The average speed for 1 August through 6 August was 4.4 m·s^{-1} and the vector mean speed was 2.4 m·s^{-1} out of 240°T. The winds were out of the south from the 12th to the 16th, had an easterly component during the 18th and 19th, before resuming a generally west southwesterly flow from the 20th through the 23rd. The strong easterlies led to the beach closure at Sandy Hook on 18-20 August. The rest of the month the winds were quite variable from day to day.

Over the entire month, the vector mean speed was 0.8 m·s^{-1} from 263°T and the mean speed was 4.3 m·s^{-1}. The 1959-1988 climatological norm for August is a vector mean speed 1.3 m·s^{-1} from 216°T. The vector mean wind direction for August 1989 was shifted to the west more than one standard deviation from the norm. The wind constancy was 19%, considerably less than the norm for the month of August (33%). Wind energy as a percent of normal was 90. Thus, for the month as a whole, wind conditions were west-southwesterly and were not favorable for a major wash up of floatable debris on the coast of Long Island or New Jersey. The most likely periods for wash ups in New Jersey would have been the small window between 17-19 August and for Long Island between 11-16 August and 26-29 August.

Rainfall in the Summer 1989

Rainfall for the months of June, July and August 1989 as recorded in Central Park, are shown in Figs. 5,6 and 7 respectively. The record rains recorded in May 1989 persisted into mid-June. In the latter half of June the rains continued but they were not as severe as earlier in the month. The total rainfall for the month was approximately 2.7 times greater than normal. In July, the heavy rains of May and June tapered off although heavy downpours were registered on the 5th and on the 16th. The last week of the month was relatively dry but the monthly accumulation was 130mm (New York Times). compared to the normal of 96mm. In August, heavy rains occurred between the 11th and the 17th. The last half of the month was relatively dry although the monthly accumulation was 214mm (New York Times) compared to the normal of 93mm.

ANALYSIS OF THE SUMMER 1989 OBSERVATIONS

The floatable load in the New York Bight throughout the month of June was most likely large. The intense rains early in May undoubtedly contributed to the problem, as did the fact that the debris collection program under the Floatable Action Plan was not initiated until mid-May. Much of this material was probably widely distributed. A considerable quantity actually washed ashore prior to the opening of the beach season on 26 May and was removed by beach cleaning operations.

By June, because of the heavy rains and flooding in May, the potentially refloatable material on shorelines and the garbage and trash typically associated with storm sewers was probably less than normal. But the rains in June caused frequent bypassing of sewage treatment plants through the combined sewer overflows (CSOs)(see Swanson and Zimmer, in press for discussion). Estimated days that overflows occurred are shown on Fig.8. These were determined using the New York City Department of Environmental Protection Agency's approximation that overflows result when rainfall intensities exceed 10mm in 6.67 hours. This estimation indicates that out of the 53 days on which rain was recorded, 17 days (one third of the time it rained) had overflows.

During the first half of the month, floatables escaping the collection program were probably well dispersed in the ocean with some of the materials sinking, others degrading. However, it is likely that a portion of the floatables released with the mid-month rains could have begun washing ashore on Long Island beaches a few days after the commencement of southerly winds on June 16th (Fig. 8).

The easterly component of the winds for the period of 20-24 June could also have been expected to cause an impact on the New Jersey coast. These conditions could explain the occurrence of some sewage related items on both the New Jersey and Long Island ocean beaches around the period 24-25 June.

At the beginning of July the floatable load in the New York Bight was probably sizeable because the heavy rains of early to mid-June caused flushing of storm sewers and considerable bypassing of sewage treatment plants. The small floatable incident at Atlantic Beach, Long Island on 2 July can probably be attributed to the normal loading of Bight waters from the Hudson-Raritan Estuary and the strong southerlies of the 1st and 2nd. Following the heavy rain of the 5th, the winds were predominantly from the west until 15 July (off of the New Jersey coast and parallel to Long Island's southern coast). These conditions must have transported and dispersed offshore, material that was bypassed through the CSOs and that escaped the floatable collection program. The wash up of 21 July near Ocean City, NJ followed easterlies commencing about the 16th and which blew intensely on 20 and 21 July. The rains of mid-July may have helped to create the source of material from CSOs in the harbor and storm sewers along the New Jersey shore. It also is conceivable that the origin of some of the material was Delaware Bay. The small wash up at Atlantic Beach, Long Island in late July was clearly associated with the southwesterlies over the period of 22-27 July.

In mid-August the floatable load in the New York Bight was probably sizeable because the heavy rains from the 11th through the 17th caused considerable bypassing of sewage treatment plants. These rains followed by the strong easterlies of the 18th and 19th led to the wash up on Sandy Hook between the 18th and 20th. The small wash up at Atlantic Beach in early September was clearly associated with the strong southerlies over the period of 27-29 August and 1 September.

Overall for the months of June, July and August 1989, the ocean beaches of New York and New Jersey should have been free of floatables based on what is known about their sources and transport. Casual observations and newspaper accounts generally support this.

The summer climatology as a whole was quite unusual. This was one of the wettest summers on record. At Central Park, the normal June, July and August rainfall is 271 mm. This summer 567 mm were recorded, more than twice the normal amount. Corresponding to the wet conditions, the summer was generally cooler than normal. July and August mean air temperatures were about 1°C below normal. These cooler months were accompanied by winds that were more out of the west than the typical southerly to south-southwesterly flow. Wind energies were much less than normal and the very low wind constancies reflect the generally variable nature of the winds throughout the months.

Based on our past experiences, this would not have been a summer when floatable wash ups would have been a problem. To create a floatable problem the proper sequencing of rainfall and persistent winds from a specific sector of the compass are required. These did not occur during the summer of 1989. The short term floatable action plan undoubtedly further guaranteed that this would not be a problem year.

COMPARISON OF THE SUMMER OF 1989 TO THOSE OF 1987 AND 1988

The summer of 1989 distinguished itself from the previous two in the sense that the beaches of the coasts of southern Long Island and the coast of New Jersey remained relatively free of major floatable incidents. The resultant wind vectors for each month (Fig. 9a) clearly show the winds of June 1976 and July 1988 as being the most likely to drive floatables to the southern coast of Long Island (resultant speed of 2.8 and 2.4 $m \cdot s^{-1}$ out of 200°T and 210°T). The constancies (Fig. 9b) of 55% and 58% are much greater than the other values and than the norm for those months (34% and 41%). August 1988 also featured potential for producing wash ups on the southern coast of Long Island. The magnitude of its resultant wind vector was 2.1 $m \cdot s^{-1}$ (slightly less than July) out of the same direction (210°T) and a constancy of 44%. The absence of beach closures during that month was due to the little rainfall and the absence of floatable sources to the New York Bight (Swanson and Zimmer, in press).

The wash ups of August 1987 on the coast of New Jersey are explicitly reflected in the weak magnitude of the resultant vector (0.6 $m \cdot s^{-1}$) and its low constancy value (13%). This is an indication of variable winds counteracting the normal southerlies or southwesterlies. The wash ups were associated with easterlies. It is also very clear that the magnitudes of the resultant wind vectors for the summer of 1989 and their energy (Fig. 9c) were rather weak, their direction broadly variable and their constancy very small to account for the lack of any floatable incident on the coast of southern Long Island. Their characteristics (magnitude, direction, constancy and energy) are quite different from those of the preceding summer (1988). As compared to the summer of 1987, the magnitude of their resultant wind vectors and their constancies are similar but the brief periods of easterlies were extremely timely in 1987.

These distinctive sets of meteorological conditions during the summers of 1987, 1988 and 1989 leads to a better understanding of the conditions under which a floatable event should be expected on either of the coasts of New Jersey or southern Long Island. Considered along with the major floatable event of 1976, we have an excellent history of the problem and its causes which should guide our actions for seeking solutions.

CONCLUSIONS

The climatological conditions affecting the coasts of New Jersey and Long Island during the summer of 1989 were quite uncommon. This was one of the summers of highest rainfall on record. The total accumulation for Central Park was more than twice (567 mm) the normal amount (271 mm) for the months of June, July and August. That amount of rain created an overload of floatable debris to the Harbor estuary and the New York Bight. However, only two beach closures as a consequence of floatable wastes were reported throughout the summer. The scarcity of these events is explained by the general offshore transport of the floatable wastes, to high variability (low constancy) in the wind direction during the summer 1989 and to the floatable collection program.

Past experiences indicate that the summer of 1989 would not have been a period for which floatable debris washing ashore would have constituted a threat to close ocean beaches. The short term floatable action plan further curtailed such threat. Nevertheless, this summer cannot be considered a reliable test for the suitability of the short term floatable action plan. Many summers may pass before such a summer may occur. It is important however to not be lulled into thinking that because no wash ups occurred that we necessarily have found a solution. Equally important, we should not think that summers similar to 1976 and 1988 on Long Island or a summer similar to 1987 in New Jersey can not occur again and so divert resources, now being used to clean the Harbor, to other purposes. Unless the Harbor skimming operation can be shown to be ineffective, it is important to keep it operational until long term solutions are found and set in place.

ACKNOWLEDGEMENTS

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This was part of SUNY's endeavour along with many other institutions, agencies, organizations, and public interest groups to contribute to helping to resolve this environmentally and economically significant regional problem. We thank Dr. Susan Zevin and George Dick of the National Weather Service for assisting in providing data as requested and in particular Messrs Richard Carlson, Sal DePrete and David Foose the Meteorologists in Charge at Kennedy, LaGuardia and Bridgeport Weather Stations. We also thank Barbara Vallely for helping to prepare this report and other associated reports in a timely fashion.

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Swanson, R.L. and R.L. Zimmer. 1988. Meteorological conditions leading to the 1987 and 1988 wash ups of floatable wastes on New York and New Jersey beaches and comparison of these conditions with the historical record. *Estuarine, Coastal and Shelf Science.* In Press.

FIGURE CAPTIONS

Figure 1. New York Bight area showing the coasts of Long Island and New Jersey.

Figure 2. Progressive wind vector (km) at JFK Airport, NY for the month of June 1989.

Figure 3. Progressive wind vector (km) at JFK Airport, NY for the month of July 1989.

Figure 4. Progressive wind vector (km) at JFK Airport. NY for the month of August 1989.

Figure 5. Rainfall (mm) at Central Park, NY for June 89.

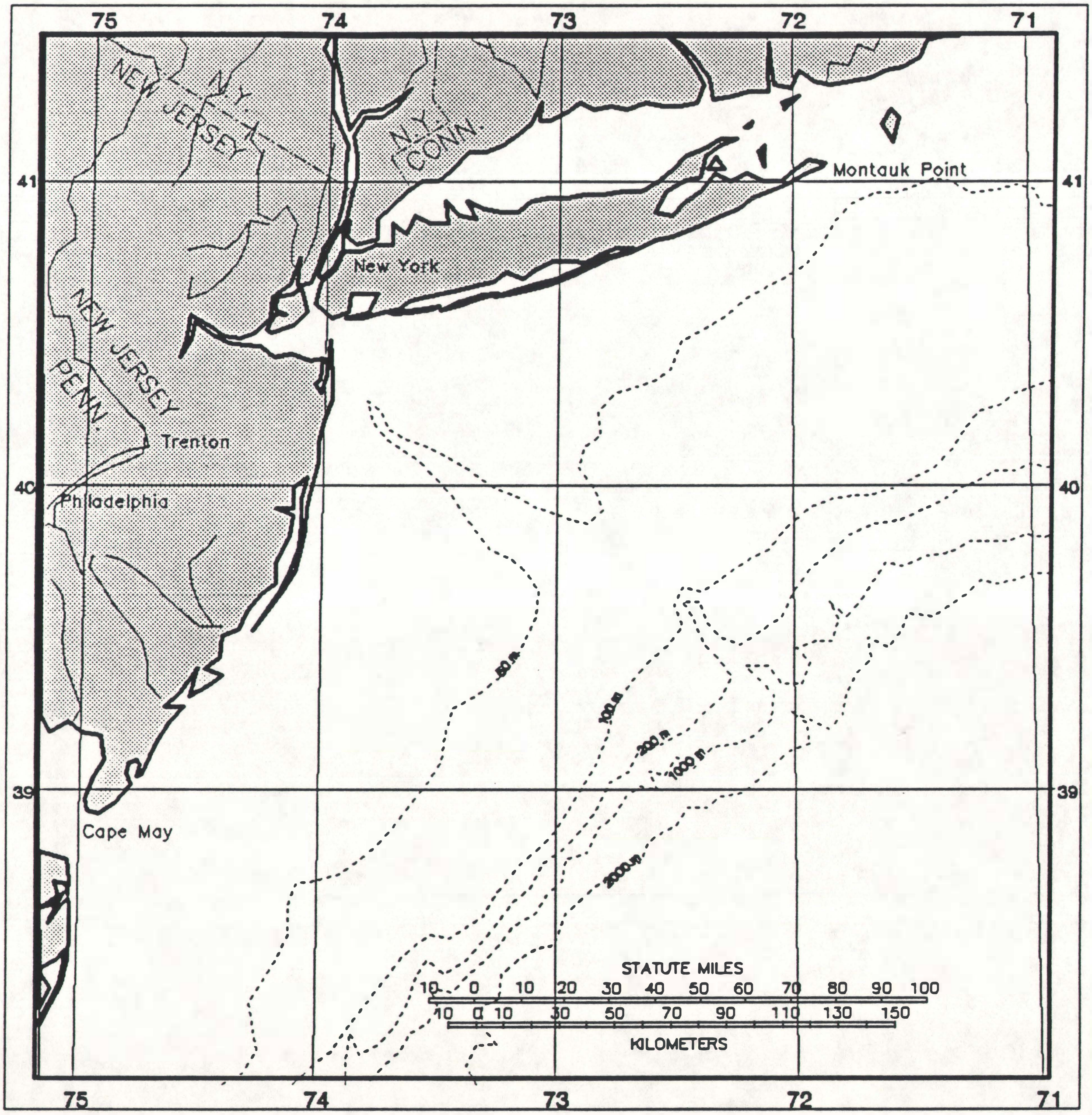
Figure 6. Rainfall (mm) at Central Park, NY for July 89.

Figure 7. Rainfall (mm) at Central Park, NY for August 89.

Figure 8. Summary of events for the summer of 1989. Bold lines on the wind stick diagram indicate events referenced in the text. Overflows are estimated to occur when rain accumulates at a rate of 10 mm in 6.67 hours.

Figure 9. a) Resultant wind vectors for June (JN), July (JL), August (AU) of 1987, 1988, 1989, June of 1976 and the norms for those months. JN76 and JL88 represent wind conditions most likely to drive floatables to the coast of Long Island. The resultant wind vectors in the summer of 1989 are comparatively of small magnitude and from an inappropriate direction to drive floatables ashore. b) Wind constancy values as in a). Note the low constancy for the summer of 1989 as compared to the norms and the summer of 1988 and June 1976. c) Relative wind energy values as in a) and b). The norm for all months is 100%. Observe the low energy values for the summer of 1989 as compared to the others.

Figure 1. New York Bight showing Long Island and New Jersey



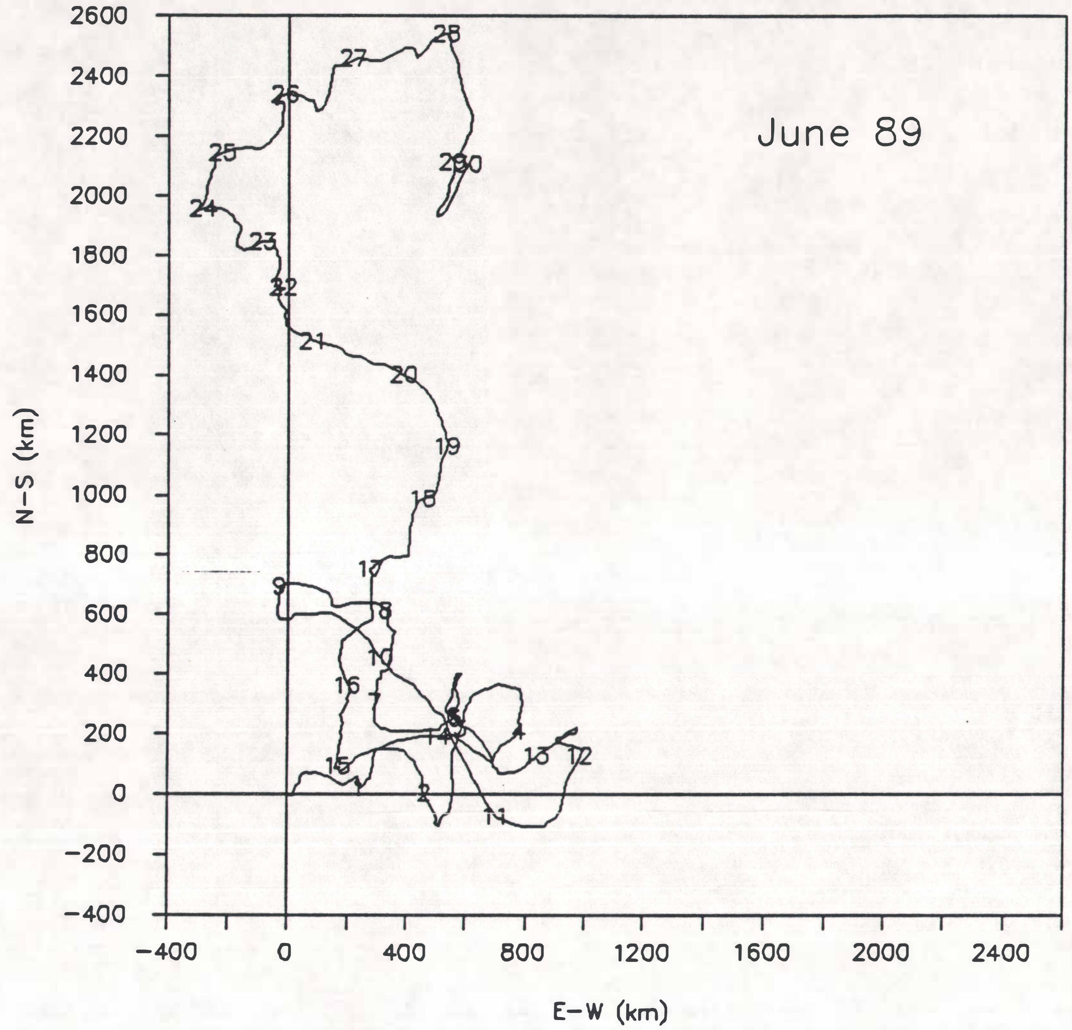
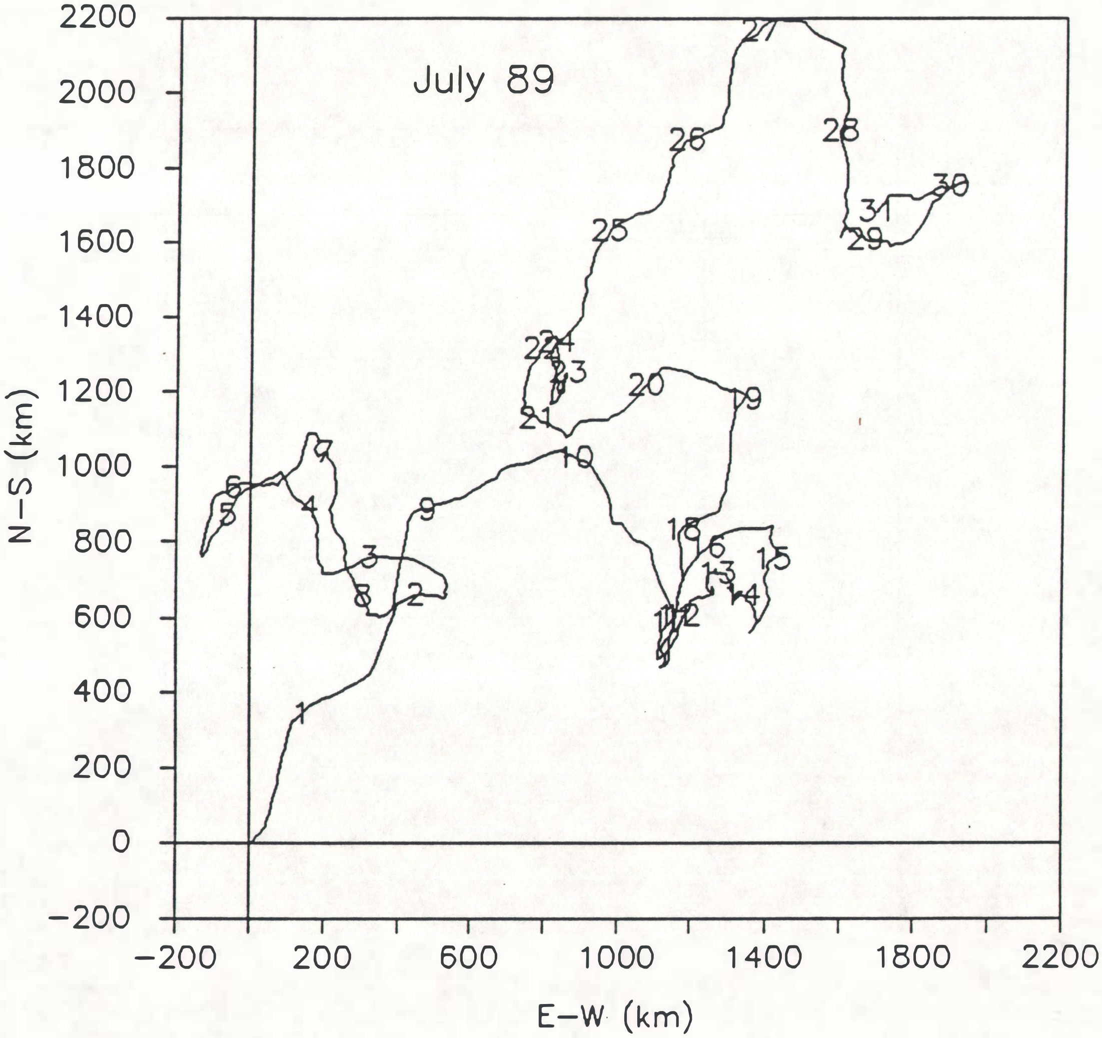
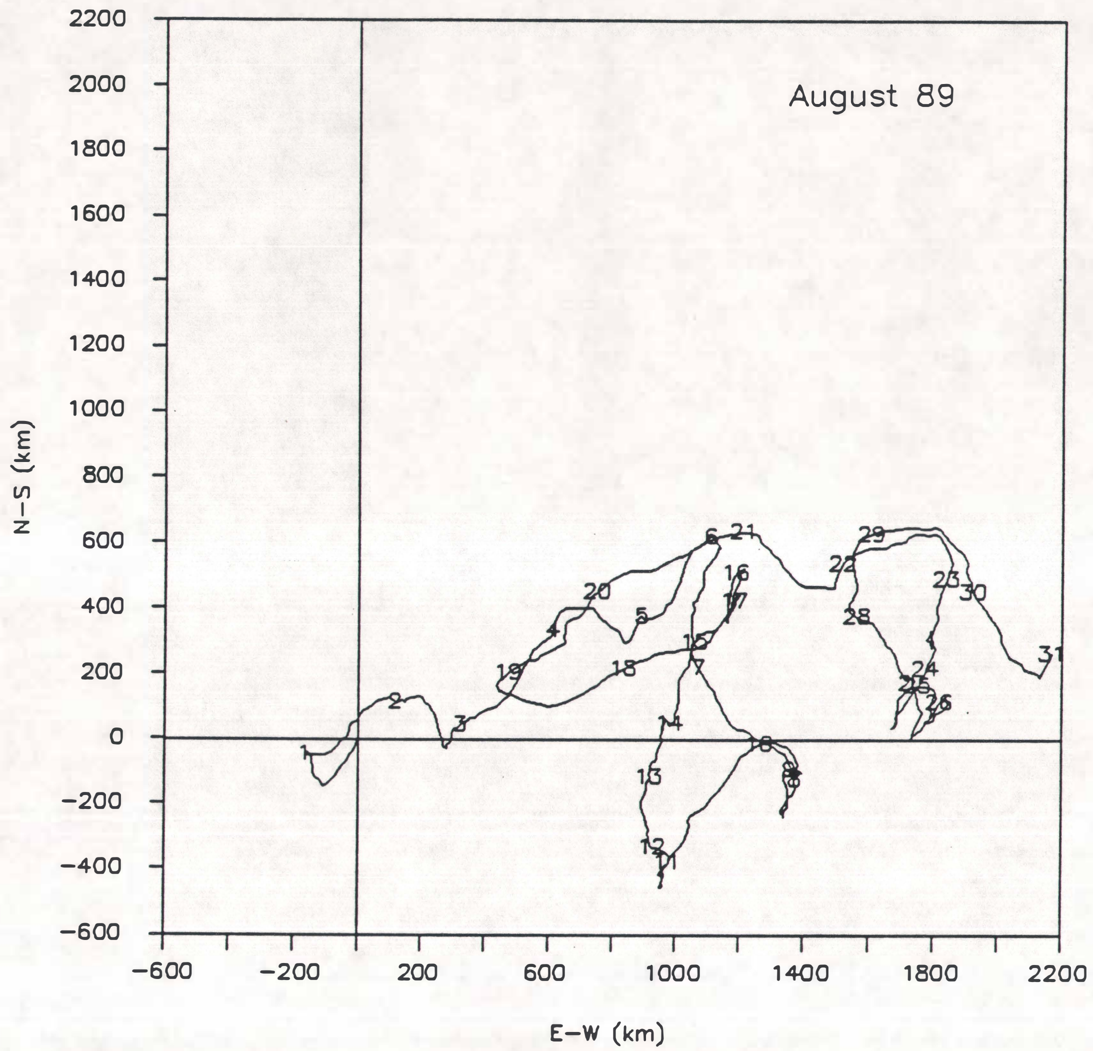

June 89
N-S (km)
E-W (km)
2600
2400
2200
2000
1800
1600
1400
1200
1000
800
600
400
200
0
-200
-400
-400
0
400
800
1200
1600
2000
2400

Figure 2



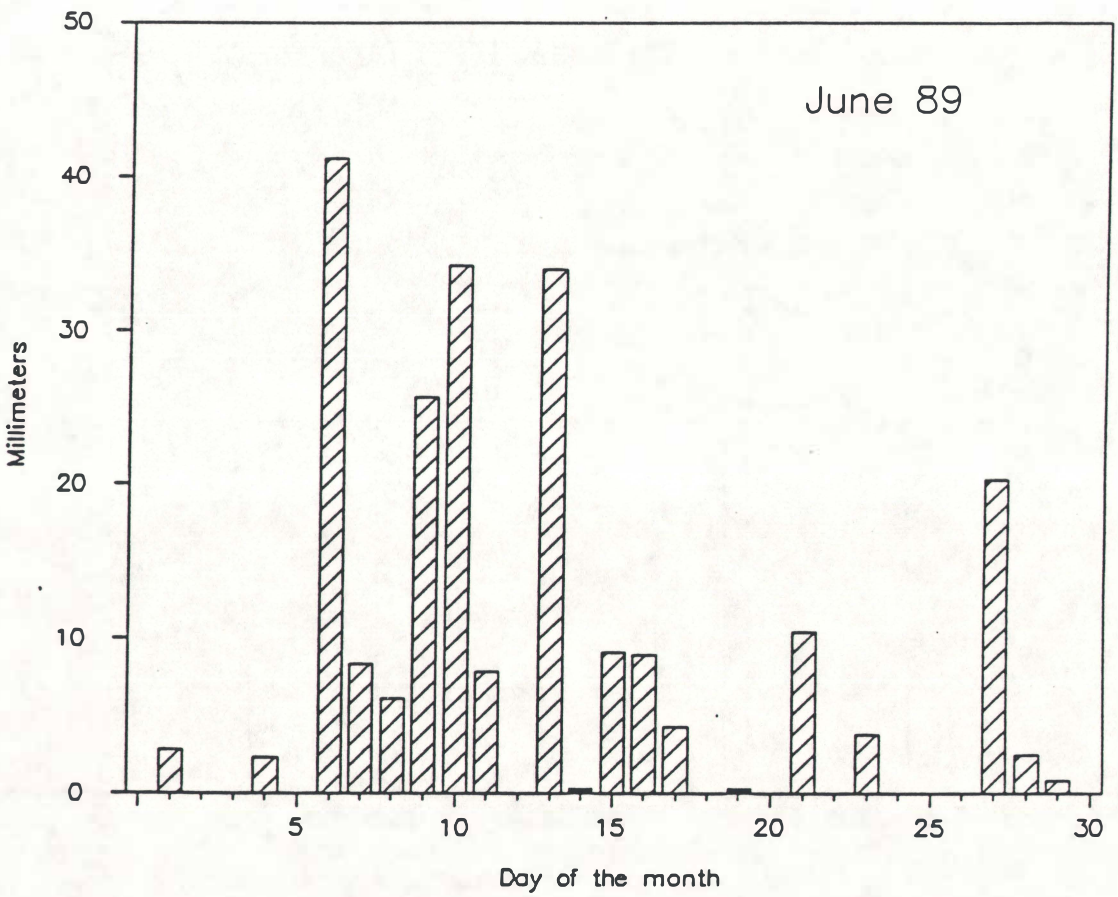
July 89
N-S (km)
E-W (km)
2200
2000
1800
1600
1400
1200
1000
800
600
400
200
0
-200
-200
200
600
1000
1400
1800
2200

Figure 3



August 89
N-S (km)
E-W (km)
2200
2000
1800
1600
1400
1200
1000
800
600
400
200
0
-200
-400
-600
-600
-200
200
600
1000
1400
1800
2200

Figure 4



June 89
Millimeters
50
40
30
20
10
0
5
10
15
20
25
30
Day of the month

Figure 5

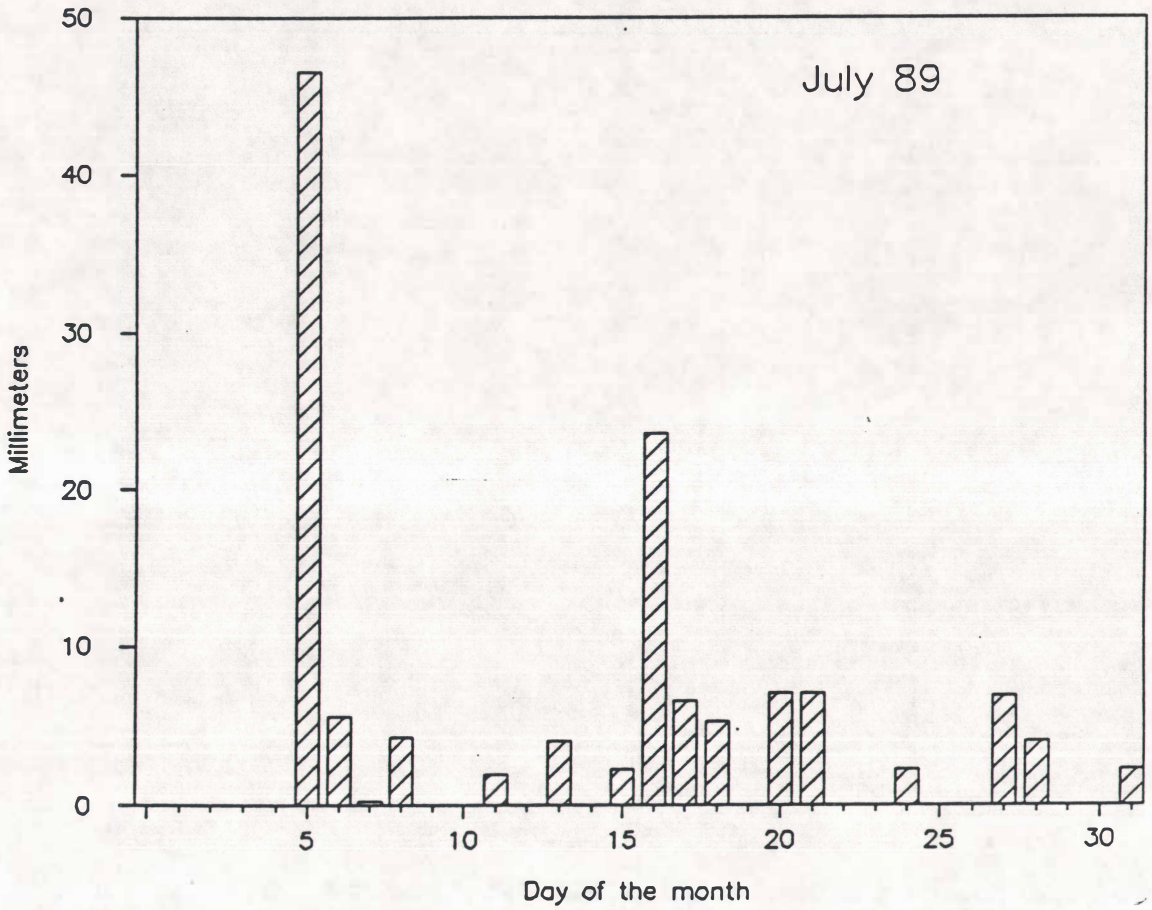

July 89
Millimeters
0
10
20
30
40
50
5
10
15
20
25
30
Day of the month

Figure 6.

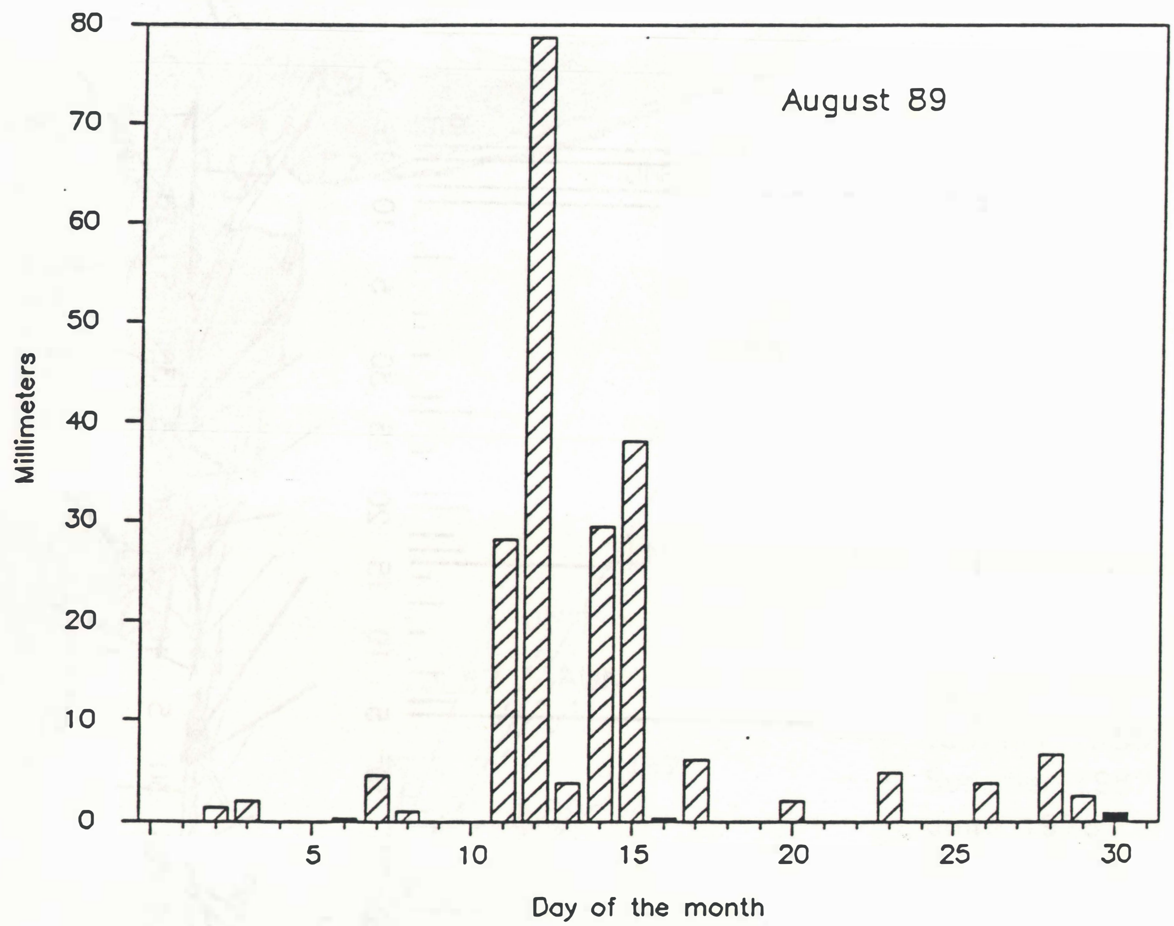

August 89
80
70
60
50
40
30
20
10
0
Millimeters
5
10
15
20
25
30
Day of the month

Figure 7.