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TAGGING STUDY OF WINTER FLOUNDER TAKEN IN BARNEGAT BAY

Progress Report for the Period
August 1979 through June 1980

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for

JERSEY CENTRAL POWER AND LIGHT COMPANY

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Tagging Study of Winter Flounder Taken in Barnegat Bay

Donald J. Danila

INTRODUCTION

Winter flounder consist of geographically localized stocks associated with individual estuaries or specific coastal areas (Lobell 1939, Perlmutter 1947, Saila 1961, McCracken 1963, Poole 1966, Howe and Coates 1975). Adults are found in the ocean from late spring through early fall, but return to their natal estuary for spawning during winter.

A tagging study was initiated at the Oyster Creek Generating Station (OCGS) in December 1978 (Danila and Byrne 1979) to determine the spatial distribution and movements of the Barnegat Bay winter flounder stock. The location of recaptured winter flounder in late 1979 and early 1980 should indicate the extent of the stock's range. This information will be vital in assessment of OCGS impacts upon Barnegat Bay winter flounder.

MATERIALS AND METHODS

All procedures concerning the tagging of winter flounder and handling of returns were detailed by Danila and Byrne (1979).

RESULTS

A total of 971 winter flounder (776 females, 193 males, 2 unknown) were tagged and released from 12 December 1978 through 2 February 1979 and Danila and Byrne (1979) reported that 76 were recaptured from late December 1978 through 10 July 1979 (Table 1, Fig. 1). Most of these were

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taken by Barnegat Bay fishermen (n=42) during the spring emigration of winter flounder from the Bay. Other returns were from a Barnegat Bay fyke net fisherman (22), 8 were reimpinged on the OCGS screens, and 4 were taken during spring and summer by commercial trawl fishermen off Manasquan and Asbury Park, New Jersey.

A total of 32 tags (3.3% of all winter flounder tagged) were returned from August 1979 through June 1980 (Table 2, Fig. 2). Sixteen were received from sport fishermen (including one from a fish caught in March 1979), 12 from a Barnegat Bay fyke net fisherman, and 4 from commercial trawl fishermen or fish markets.

The earliest two returns in fall 1979 were from commercial trawl fishermen during October in the same area off central New Jersey as commercial returns earlier in 1979. Two returns were from fish markets during November (Point Pleasant, New Jersey and New York City); the actual location of capture is unknown but the fish were probably also caught off central New Jersey.

The earliest sport fishing return was from the Manasquan River on 27 October. Two fish were taken in Barnegat Inlet in late November. Three fish were caught in Oyster Creek from the Route 9 bridge and one in Double Creek during December and early January. As expected, no fish were caught by sport fishermen during the winter flounder spawning season from mid-January through early March as winter flounder cease feeding during this time. Four of the eight returns from mid-March through early April were from the approaches to Barnegat Inlet; one was from Double Creek, two from the Intracoastal Waterway adjacent to Long Beach Island, and the last tag return was from Barnegat Bay off the mouth of Oyster Creek.

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Twelve winter flounder were taken by a commercial fyke net fisherman from 1 December 1979 through 15 January 1980; the date of each capture was not recorded. All fish were caught just south of Oyster Creek near the Holiday Harbor Marina entrance.

Some 27 of the winter flounder tag returns in late 1979-early 1980 were females (87%) and 4 were males (13%). The mean length at time of tagging of winter flounder was 289 mm for females and 251 mm for males. Females taken by commercial trawl fishermen averaged 320 mm, 279 mm for those by the fyke net fisherman, and 286 mm for those by sport fishermen. The mean length of three males taken by fyke net was 251 mm and the only male taken by sport fishing was 250 mm at time of tagging. The length information which should have been received with tag returns and would have indicated rate of growth was generally missing or considered unreliable.

DISCUSSION

To date, 11% of the winter flounder tagged at OCGS were returned. This is far less than the 32.5% and 36.5% returns in tagging studies reported by Saila (1961) and Howe and Coates (1975), respectively. The latter, however, noted that returns from various tagging areas ranged from 5 to 67% and both studies reported on tag returns received over several years. Also, most of the returns reported by Saila (1961) and Howe and Coates (1975) were from commercial fishermen, whereas most of the Barnegat Bay returns were from sport fishermen. Sport fishing effort can be highly variable and the total effort much less than that for commercial fishing. Most winter flounder fishing is done over a relatively short period in winter and early spring and inclement weather, common at

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this time of year, can greatly reduce fishing effort. The relatively low percentage of returns was probably also due to the lack of cooperation by some fishermen despite poster advertising, newspaper publicity, and the reward offered for the return of tags. At least two instances are known when tags were discarded, several at a fish market and one by a sport fisherman.

Natural mortality, differential mortality due to tagging, and loss of tags reduce the number of returns received each year. One-third as many sport fishing returns were received in 1980 as in 1979. The 1979-80 fyke net catch of tagged winter flounder was about one-half that in 1978-79, but partly because of reduced fishing effort. Because of large amounts of macroalgae in the Bay, only one net was fished in 1979-80 from December to mid-January. In 1978-79 several nets were fished from December through February (N. Dupont, personal communication). In addition, OCGS was not in operation from January through May and no adult winter flounder were impinged in 1980. The lack of a heated discharge in Oyster Creek after OCGS shutdown also eliminated a popular winter sport fishery for winter flounder at the Route 9 bridge.

In general, winter flounder movements in and out of Barnegat Bay are similar to those reported for other northeastern estuaries. Movements of adult winter flounder are temperature-related and relatively short in distance. Adults leave the estuary when the water temperature is about 15 C. They are most abundant in the ocean at a water temperature of 12 to 15 C and this is probably their preferred temperature (McCracken 1963). Adult winter flounder left Barnegat Bay in spring and based on tag returns

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from commercial vessels spent the summer in the ocean northeast of Barnegat Inlet in an offshore area from Point Pleasant to Asbury Park. This apparent northeastern movement may be biased because of the believed greater commercial fishing effort in that region.

In response to decreasing fall water temperature adult winter flounder move inshore to spawn in natal estuaries. The recapture location of fish in late 1979 and early 1980 indicated that most adults return annually to Barnegat Bay, with some probably entering other New Jersey estuaries. Barnegat Inlet is the major migratory pathway and this is noteworthy because the summer grounds are apparently off Shark River and Manasquan inlets.

The distribution and concentration of winter flounder within Barnegat Bay cannot be ascertained from the tag returns because most fishing effort was concentrated in and near Oyster Creek and in Oyster Creek and Double Creek channels, the two Intracoastal Waterway approaches to Barnegat Inlet. Although Danila (1978b) reported some of the largest densities of winter flounder in the Bay from Forked River mouth to Goodluck Point, only one return was received from that area (Danila and Byrne 1979). In a study of the recreational use of Upper Barnegat Bay (defined as from Barnegat Inlet to Bayhead), Halgren (1973) reported that most (65%) boat fishing activity occurred from Barnegat Inlet to Goodluck Point but remarked that within this area most fishermen utilized Oyster Creek and Double Creek channels.

The northern limit of the Barnegat Bay stock of adult winter flounder is at least Toms River and probably Bayhead. Danila (1978b) did not sample north of Goodluck Point in a population survey for winter flounder but

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McClain (1973) took winter flounder at all of a continuous series of trawl stations throughout the Upper Bay. The relative numbers of adults and juveniles taken in his study are not known, however. At times salinity in the Upper Bay in the Lavellette-Silver Bay area may be a barrier to adult winter flounder movements in the uppermost portion of the Bay. When most winter flounder disperse from estuaries during March and April salinity there is about 12 to 13 ppt (Makai 1973). In surveys made in Great Bay and other estuarine waters near Little Egg Inlet from 1972 through 1975 adults were not taken at a salinity below 17 ppt, although young were taken at a salinity near 0 in tidal fresh water (Danila 1978a). The lethal salinity for winter flounder (presumably adults) was reported as about 8 ppt by McCracken (1963).

The only outlet to the ocean from northern Barnegat Bay besides Barnegat Inlet is via the Point Pleasant Canal to the Manasquan River and Manasquan Inlet. The collection of two individuals from the Manasquan River and Inlet indicated that a few winter flounder used this passage during migration or that a mixing occurred with the Manasquan estuary stock. The uppermost Bay may contain fish from both stocks. Howe and Coates (1975) reported that numerous winter flounder were taken in or moved through the Cape Cod Canal which connects Buzzards Bay and Cape Cod Bay, Massachusetts.

The southern limit of the Barnegat Bay stock of winter flounder is also unclear but may be Manahawkin Bay. A few winter flounder were taken south of Manahawkin Bay in Little Egg Harbor but these may have been outmigrants that would have used Beach Haven-Little Egg Inlet. No winter flounder were recaptured south of Beach Haven in 1979 or 1980. Himchak (1976) reported considerably more man-days of fishing effort in

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the Manahawkin Bay-Little Egg Harbor system (defined as from Harvey Cedars to Little Egg Inlet) than Halgren (1973) did for Upper Barnegat Bay. If a continuous population of winter flounder existed from Barnegat Bay through Little Egg Harbor more returns would have been expected from the latter area. Manahawkin Bay may be an area where mixing occurs between the Barnegat Bay and Little Egg Harbor populations. Poole (1966) described the winter flounder of several adjacent, interconnected bays in Long Island as separate populations with different growth characteristics.

Additional returns in 1981, although expected to be sparse, should provide additional information as to the movements and range of Barnegat Bay winter flounder.

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Table 1. Summary of all winter flounder tag returns from late December 1978 through 10 July 1979 by method of recapture.

	Tag No.	Length	Sex	Date Released	Date Recaptured	Days at Large	Place Recaptured[b]	Distance Traveled from OCGS (km)	Major Compass Direction of Movement	Rate of Travel (km/day)
Impingement Sampling[a]	?	?	?	15 - 29 December	3 January	5 - 19	OCGS	10.0	Circular	0.53 - 2.00
	191	291	F	19 December	19 January	31	OCGS	10.0	Circular	0.32
	633	320	F	24 January	25 January	1.5	OCGS	10.0	? Circular	6.67
	448	355	F	4 January	26 January	22	OCGS	10.0	Circular	0.45
	797	252	F	29 January	1 February	3	OCGS	10.0	Circular	3.33
	637	281	F	? 24 January	1 February	< 8	OCGS	10.0	Circular	> 1.25
	637	281	F	1 February	27 February	26	OCGS	10.0	Circular	0.38
	391	245	F	28 December	2 February	36	OCGS	10.0	Circular	0.28
Sport fishing	664	299	F	24 January	28 January	4	OC - Rt 9 bridge	0.8	E	0.20
	108	281	M	19 December	5 February	48	OC - Rt 9 bridge	0.8	E	0.02
	868	305	F	29 January	18 March	48	BB - off OC mouth	3.7	E	0.08
	133	275	F	22 December	20 March	88	BB - Mud Channel	7.6	E	0.09
	856	350	F	30 January	22 March	51	OC Ch	6.6	SE	0.13
	890	255	F	29 January	22 March	52	Barnegat Light	10.1	SE	0.19
	656	289	F	24 January	23 March	58	LEH - Peahala Park	27.4	S	0.47
	273	309	F	22 December	29 March	97	LEH - Beach Haven	35.3	SW	0.36
	992	310	F	2 February	29 March	55	BB - Harvey Cedars	16.5	SW	0.30
	422	289	M	4 January	30 March	85	Shark River Inlet	60.4	NE	0.71
	333	290	F	28 December	31 March	93	OC Ch	7.2	SE	0.08
	926	323	F	30 January	31 March	60	Barnegat Light	11.1	SE	0.19
	944	319	F	30 January	31 March	60	BB - off Barnegat	13.6	SW	0.23
	478	259	M	4 January	7 April	93	Toms River	20.0	NE	0.22
	896	311	F	30 January	? 8 April	? 68	LEH - Beach Haven	33.5	SW	0.49
	277	278	F	22 December	? 15 April	? 114	Barnegat Light	11.1	SE	0.10
	839	300	F	30 January	15 April	75	DC Ch	8.2	SE	0.11
	034[c]	?	?	15 December	18 April	124	BB - Gulf Point	11.7	SW	0.09
	049	298	F	19 December	20 April	123	OC Ch	7.9	SE	0.06
	468	312	F	4 January	20 April	106	OC Ch	7.9	SE	0.07
	465	326	F	4 January	21 April	107	OC Ch	7.9	SE	0.07
	472	292	F	4 January	21 April	107	DC Ch	8.2	SE	0.08
	905	390	F	30 January	21 April	81	DC Ch	9.5	SE	0.12
	924	312	F	2 February	21 April	78	DC Ch	8.2	SE	0.11
	947	270	M	2 February	21 April	78	Barnegat Inlet	11.7	SE	0.15
	339	273	F	29 December	22 April	114	OC Ch	5.5	SE	0.05
	065	300	F	19 December	23 April	125	DC Ch	8.8	SE	0.07
	974	343	F	30 January	23 April	83	OC Ch	7.9	SE	0.10
	824	304	F	30 January	23 April	83	Barnegat Light	12.4	SE	0.15
	114	300	F	19 December	24 April	126	OC Ch	7.2	SE	0.06
	030	333	F	15 December	25 April	131	LEH - Westecunk Creek	28.7	SW	0.22
	460	272	F	4 January	26 April	112	BB - off OC mouth	4.7	E	0.04
	739	309	F	29 January	26 April	87	OC Ch	7.9	SE	0.09
	475	293	F	4 January	28 April	114	LEH	32.8	SW	0.29
	444	310	F	4 January	29 April	115	DC Ch	8.4	SE	0.07
	732	284	M	29 January	29 April	90	BB - off FR mouth	5.3	NE	0.06
	723	284	F	29 January	4 May	95	OC Ch	7.2	SE	0.08
	322	310	F	28 December	6 May	129	BB - Harvey Cedars	16.5	SW	0.13
	359	312	F	28 December	7 May	130	BB - Harvey Cedars	16.5	SW	0.13
	043	326	F	15 December	10 May	146	Manasquan Inlet	49.8	NE	0.34
	829	257	F	30 January	10 May	100	Ocean - off Seaside	33.6	N	0.34
	245	321	F	22 December	15 May	144	Ocean - off Harvey Cedars	15.1	S	0.10

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Table 1. (Cont.)

	Tag No.	Length	Sex	Date Released	Date Recaptured	Days at Large	Place Recaptured	Distance Traveled from OCGS (km)	Major Compass Direction of Movement	Rate of Travel (km/day)
Fyke Net[d]	28	300	F	15 December	December - February	?	FR through WT	< 5.5	NE - SW	?
	57	325	F	15 December	December - February	?	FR through WT	< 5.5	NE - SW	?
	155	241	M	20 December	December - February	?	FR through WT	< 5.5	NE - SW	?
	179	263	F	20 December	December - February	?	FR through WT	< 5.5	NE - SW	?
	287	320	F	22 December	December - February	?	FR through WT	< 5.5	NE - SW	?
	358	270	F	28 December	December - February	?	FR through WT	< 5.5	NE - SW	?
	587	284	F	4 January	December - February	?	FR through WT	< 5.5	NE - SW	?
	588	308	F	4 January	December - February	?	FR through WT	< 5.5	NE - SW	?
	628	285	F	24 January	December - February	?	FR through WT	< 5.5	NE - SW	?
	632	321	F	24 January	December - February	?	FR through WT	< 5.5	NE - SW	?
	703	313	F	29 January	December - February	?	FR through WT	< 5.5	NE - SW	?
	712	299	F	29 January	December - February	?	FR through WT	< 5.5	NE - SW	?
	714	285	M	29 January	December - February	?	FR through WT	< 5.5	NE - SW	?
	738	250	F	29 January	December - February	?	FR through WT	< 5.5	NE - SW	?
	746	299	F	29 January	December - February	?	FR through WT	< 5.5	NE - SW	?
	758	257	F	29 January	December - February	?	FR through WT	< 5.5	NE - SW	?
	777	259	F	29 January	December - February	?	FR through WT	< 5.5	NE - SW	?
	815	318	F	29 January	December - February	?	FR through WT	< 5.5	NE - SW	?
	860	313	F	30 January	December - February	?	FR through WT	< 5.5	NE - SW	?
	883	310	F	30 January	December - February	?	FR through WT	< 5.5	NE - SW	?
	900	293	F	30 January	December - February	?	FR through WT	< 5.5	NE - SW	?
	968	287	M	30 January	December - February	?	FR through WT	< 5.5	NE - SW	?
Commercial Trawler	916	302	F	30 January	2 May	92	Ocean off Manasquan	59.2	NE	0.64
	971	267	M	30 January	31 May	122	Ocean off Manasquan	71.1	NE	0.58
	635	290	F	24 January	21 June	149	Ocean off Asbury Park	67.5	NE	0.45
	945	336	F	30 January	10 July	162	Ocean off Manasquan	65.7	NE	0.41

[a] Number of first impinged specimen not ascertained. All fish except No. 191 released again in good condition. No. 637 originally accidentally released or escaped from tagging mortality study. Actual date of first release unknown.

[b] Place name abbreviations:
BB - Barnegat Bay
DC Ch - Double Creek Channel
FR - Forked River
LEH - Little Egg Harbor
OC - Oyster Creek
OC Ch - Oyster Creek Channel
OCGS - Impingement Sampling Station
WT - Waretown

[c] Original data lost for this specimen.

[d] Exact dates and locations of fyke net returns are not known. Various nets were set along shore from Forked River to Waretown from December through February.

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Table 2. Summary of all winter flounder tag returns from August 1979 through June 1980 by method of recapture.

	Tag No.	Length	Sex	Date Released	Date Recaptured	Days at Large	Place Recaptured
Sport fishing	508	318	F	4 Jan 79	25 Mar 79[a]	80	Double Creek Channel
	180	279	F	20 Dec 78	27 Oct 79	311	Manasquan River-near Rt 70 bridge
	404	305	F	4 Jan 79	20 Nov 79	320	Barnegat Light
	143	300	F	19 Dec 78	25 Nov 79	341	Barnegat Inlet
	96	309	F	24 Jan 79	8 Dec 79	318	Double Creek
	806	260	F	29 Jan 79	10 Dec 79	315	Oyster Creek-Rt 9 bridge
	855	242	F	29 Jan 79	3 Jan 80	339	Oyster Creek-Rt 9 bridge
	610	308	F	24 Jan 79	3 Jan 80	344	Oyster Creek-Rt 9 bridge
	244	296	F	28 Dec 78	16 Mar 80	444	Oyster Creek Channel-Buoy 37
	922	286	F	30 Jan 79	16 Mar 80	410	Oyster Creek Channel-Buoy 37
	38	250	M	15 Dec 78	25 Mar 80	466	Beach Haven Crest-Light 43
	194	290	F	19 Dec 78	7 Apr 80	475	Double Creek Channel
	434	274	F	4 Jan 79	8 Apr 80	460	Ship Bottom-19th St
	189	253	F	19 Dec 78	12 Apr 80	480	Double Creek Channel?
	293	297	F	22 Dec 78	12 Apr 80	477	Double Creek
	504	309	F	4 Jan 79	13 Apr 80	465	Barnegat Bay-Buoy 66
Fyke net	3	300	F	19 Dec 78	1 Dec 79-15 Jan 80	348-395	Barnegat Bay-Off Holiday Harbor
	18	272	F	15 Dec 78	1 Dec 79-15 Jan 80	352-400	Barnegat Bay-Off Holiday Harbor
	81	275	F	15 Dec 78	1 Dec 79-15 Jan 80	352-400	Barnegat Bay-Off Holiday Harbor
	220	279	F	22 Dec 78	1 Dec 79-15 Jan 80	345-393	Barnegat Bay-Off Holiday Harbor
	226	265	F	22 Dec 78	1 Dec 79-15 Jan 80	345-393	Barnegat Bay-Off Holiday Harbor
	477	231	M	4 Jan 79	1 Dec 79-15 Jan 80	332-375	Barnegat Bay-Off Holiday Harbor
	517	259	M	9 Jan 79	1 Dec 79-15 Jan 80	327-370	Barnegat Bay-Off Holiday Harbor
	743	263	M	29 Jan 79	1 Dec 79-15 Jan 80	307-350	Barnegat Bay-Off Holiday Harbor
	749	268	F	29 Jan 79	1 Dec 79-15 Jan 80	307-350	Barnegat Bay-Off Holiday Harbor
	929	302	F	30 Jan 79	1 Dec 79-15 Jan 80	306-349	Barnegat Bay-Off Holiday Harbor
	970	269	F	30 Jan 79	1 Dec 79-15 Jan 80	306-349	Barnegat Bay-Off Holiday Harbor
	978	280	F	30 Jan 79	1 Dec 79-15 Jan 80	306-349	Barnegat Bay-Off Holiday Harbor
Commercial trawler	61	290	F	19 Dec 78	5 Oct 79	290	Ocean-Off Pt. Pleasant
	887	334	F	30 Jan 79	15 Oct 79	258	Ocean-Off Manasquan
	59	313	F	19 Dec 78	6 Nov 79	322	Ocean-?-Pt. Pleasant Seafood Market
	195	344	F	19 Dec 78	14 Nov 79	330	Ocean-?-New York City Seafood Market

[a]delinquent return-not reported in Danila and Byrne (1979).

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Fig. 1. Location of recaptures (●) of winter flounder based on tag returns from late December 1978 through 10 July 1979. Digits indicate multiple returns from one location.

Fig. 1. (cont.)

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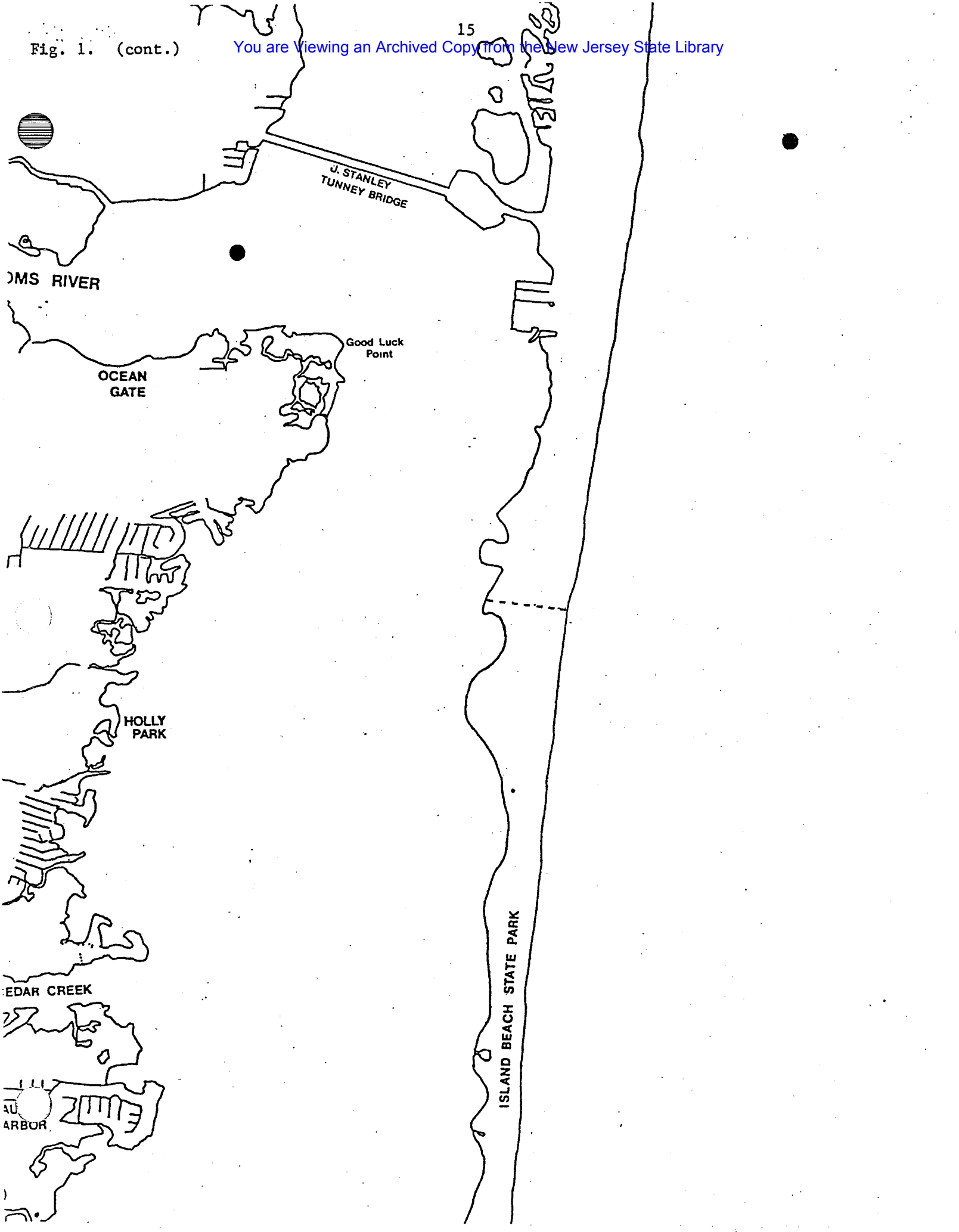

Fig. 1. (cont.)

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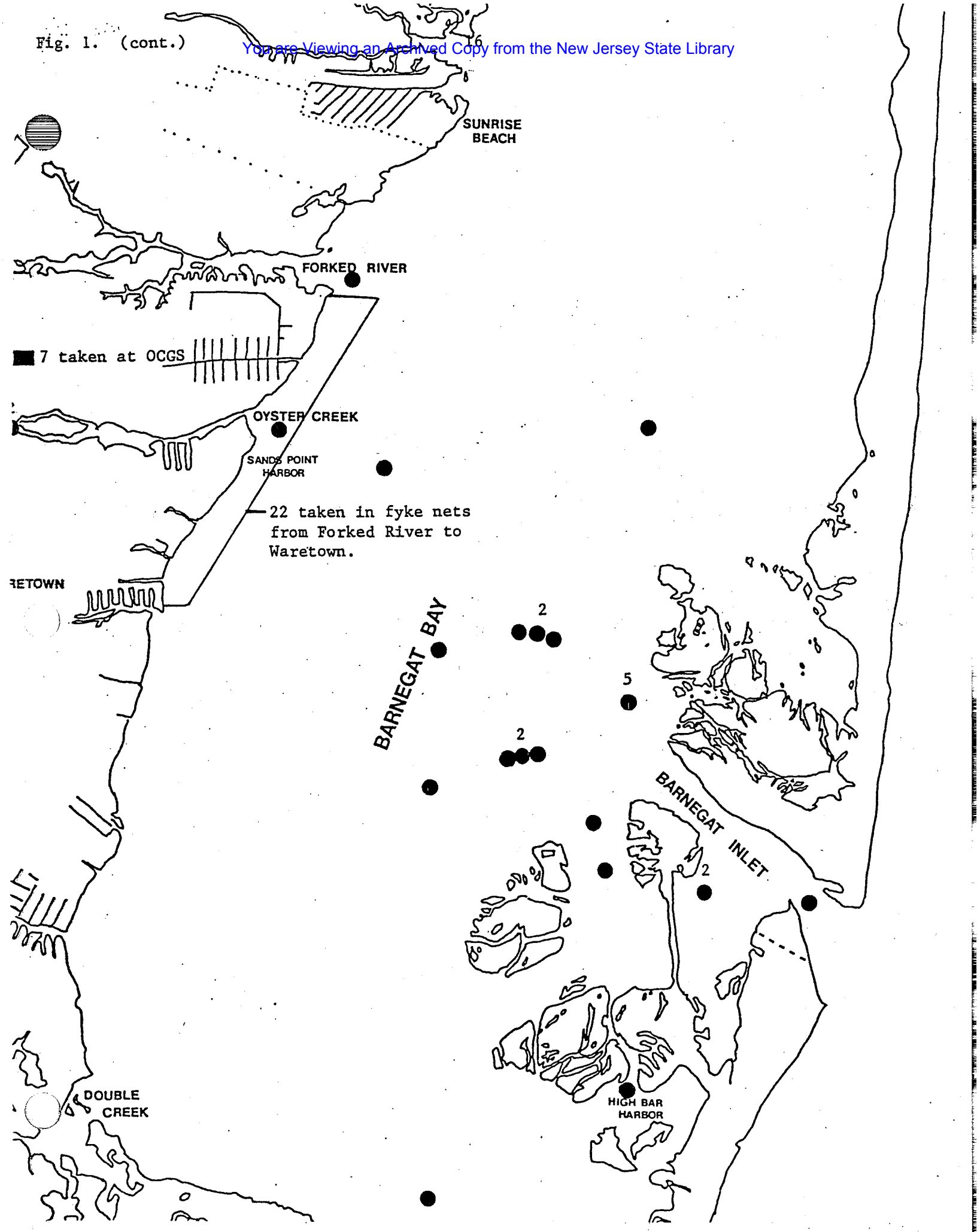

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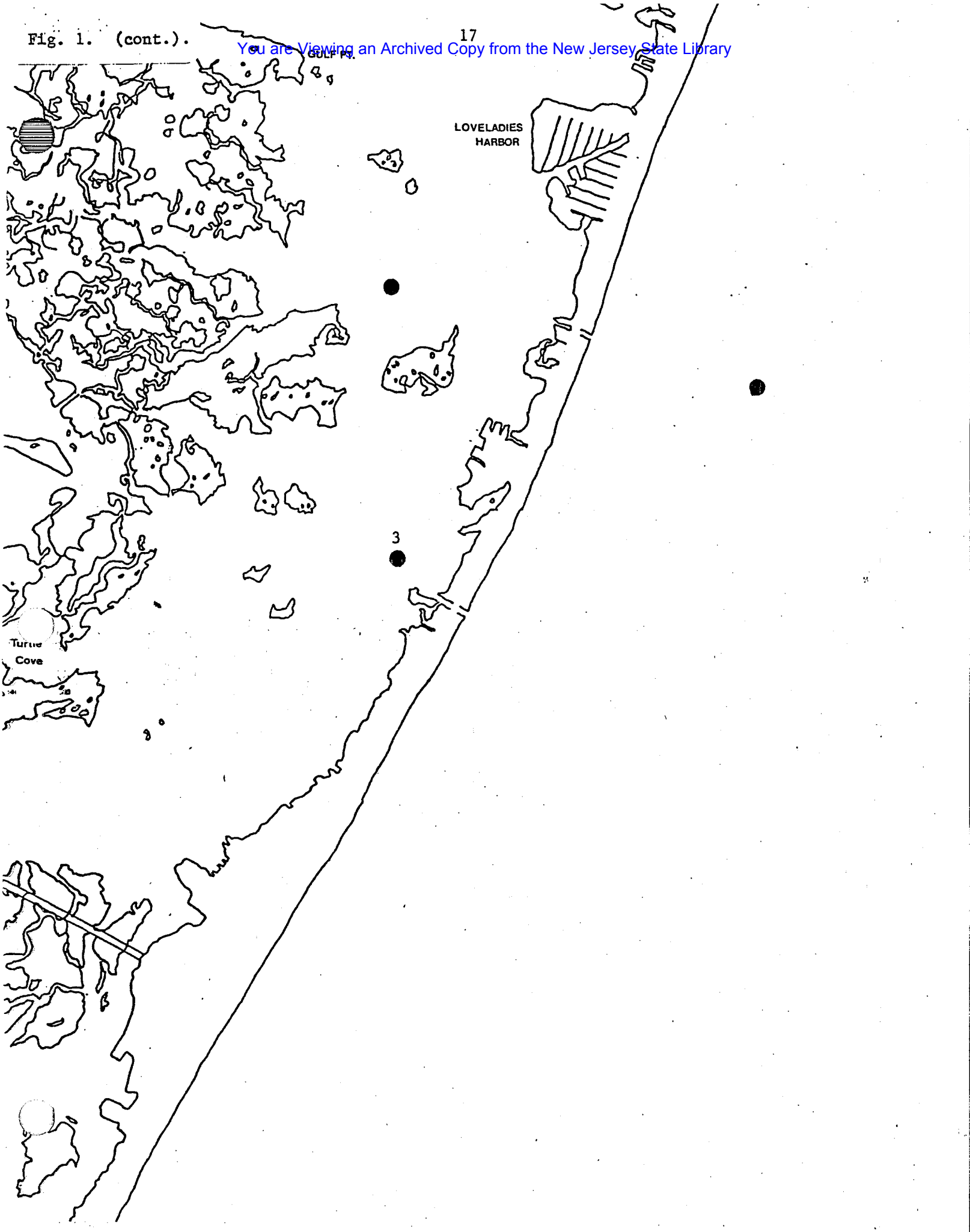

Fig. 1. (cont.)

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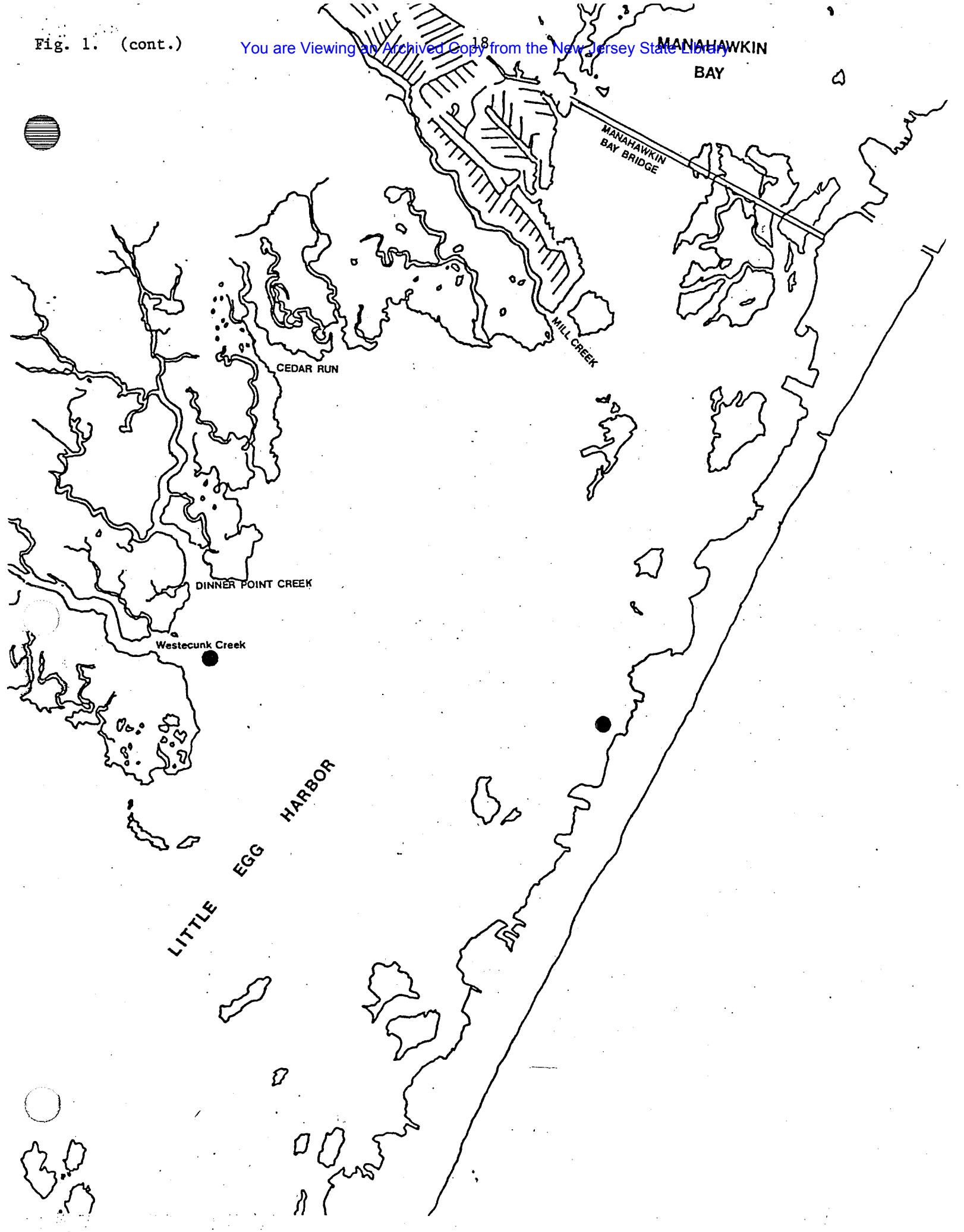

Fig. 1. (cont.)

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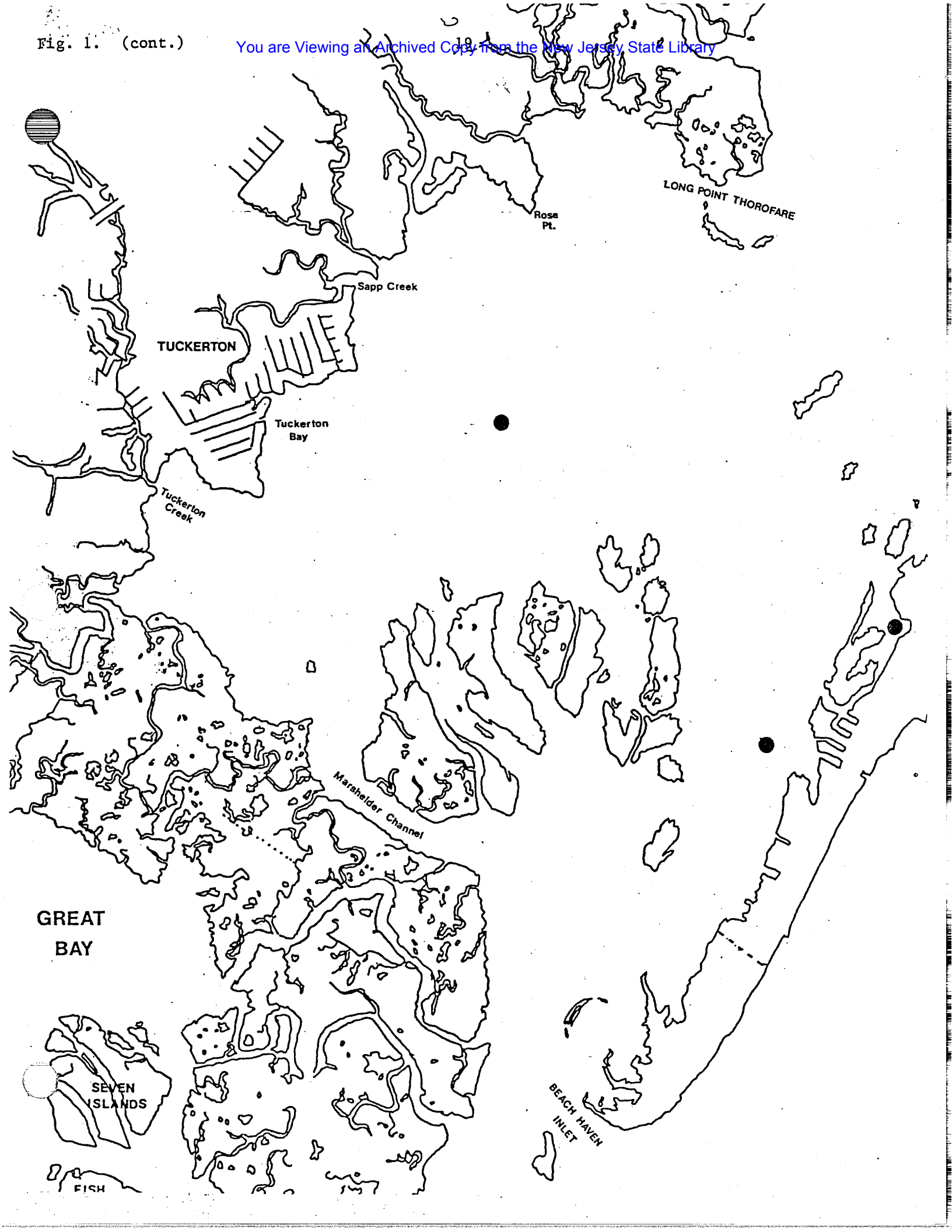

Fig. 1. (cont.)

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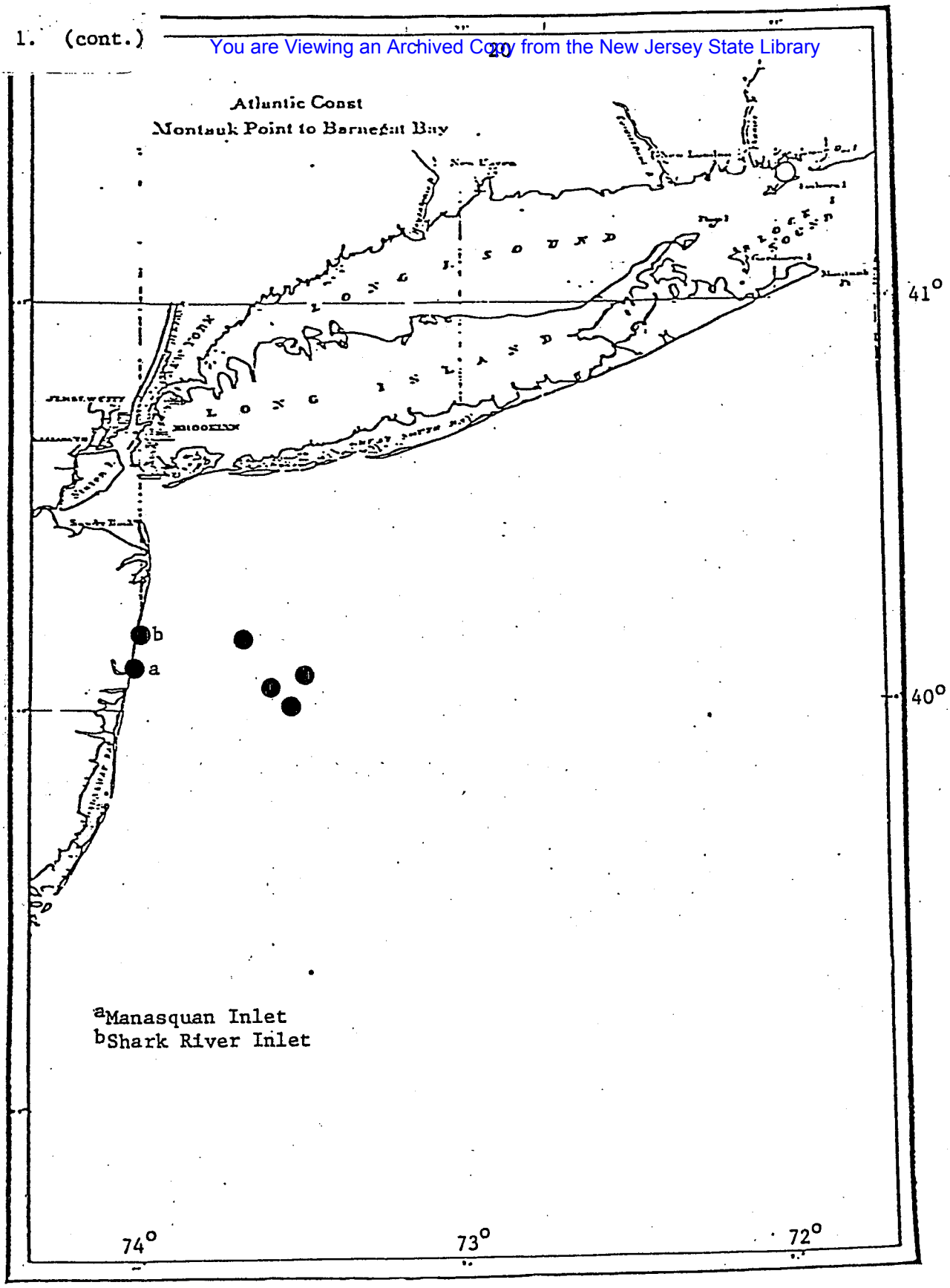

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Fig. 2. Locations of recaptures (●) of winter flounder based on tag returns from August 1979 through June 1980. Digits indicate multiple returns from one location.

Fig. 2. (cont.)

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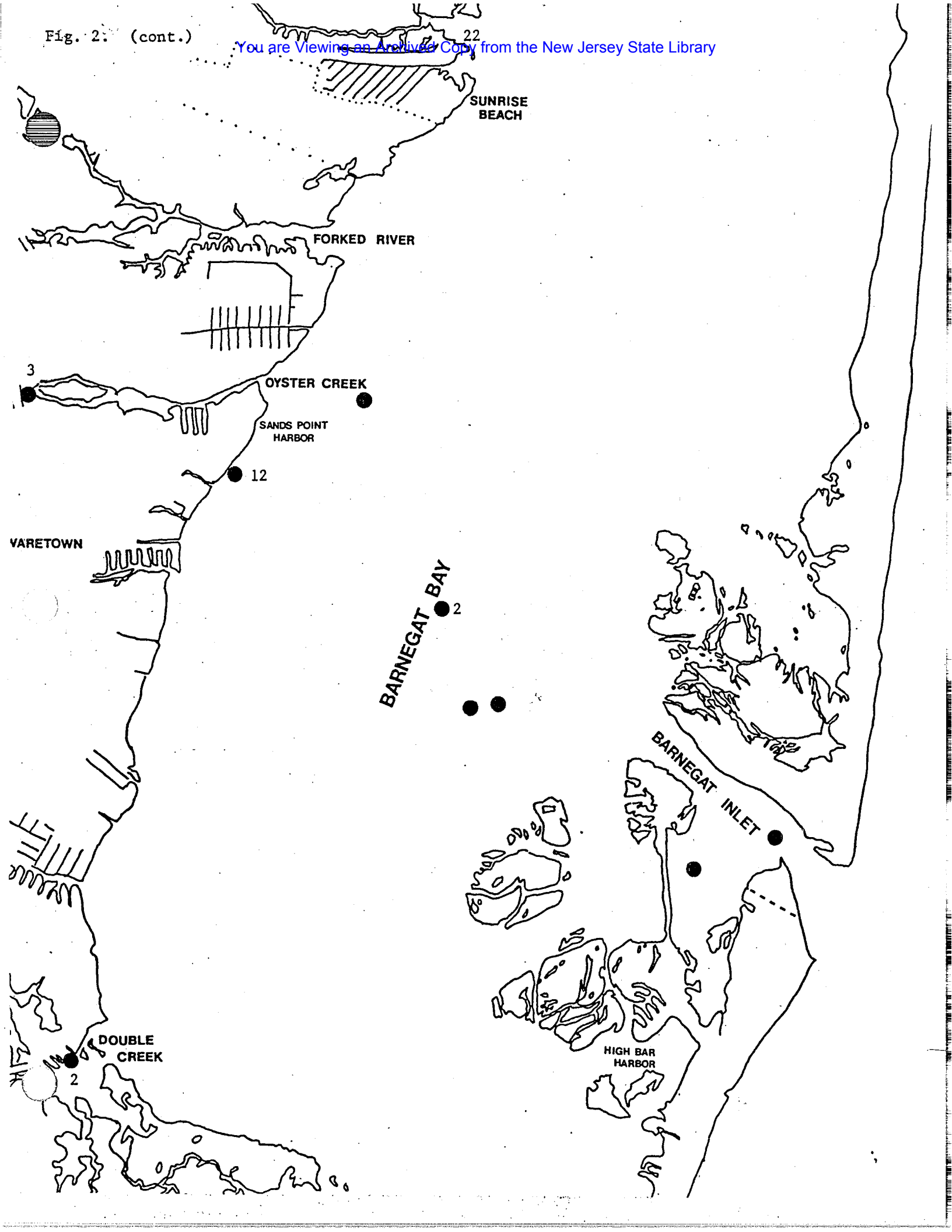

Fig. 2: (cont.)

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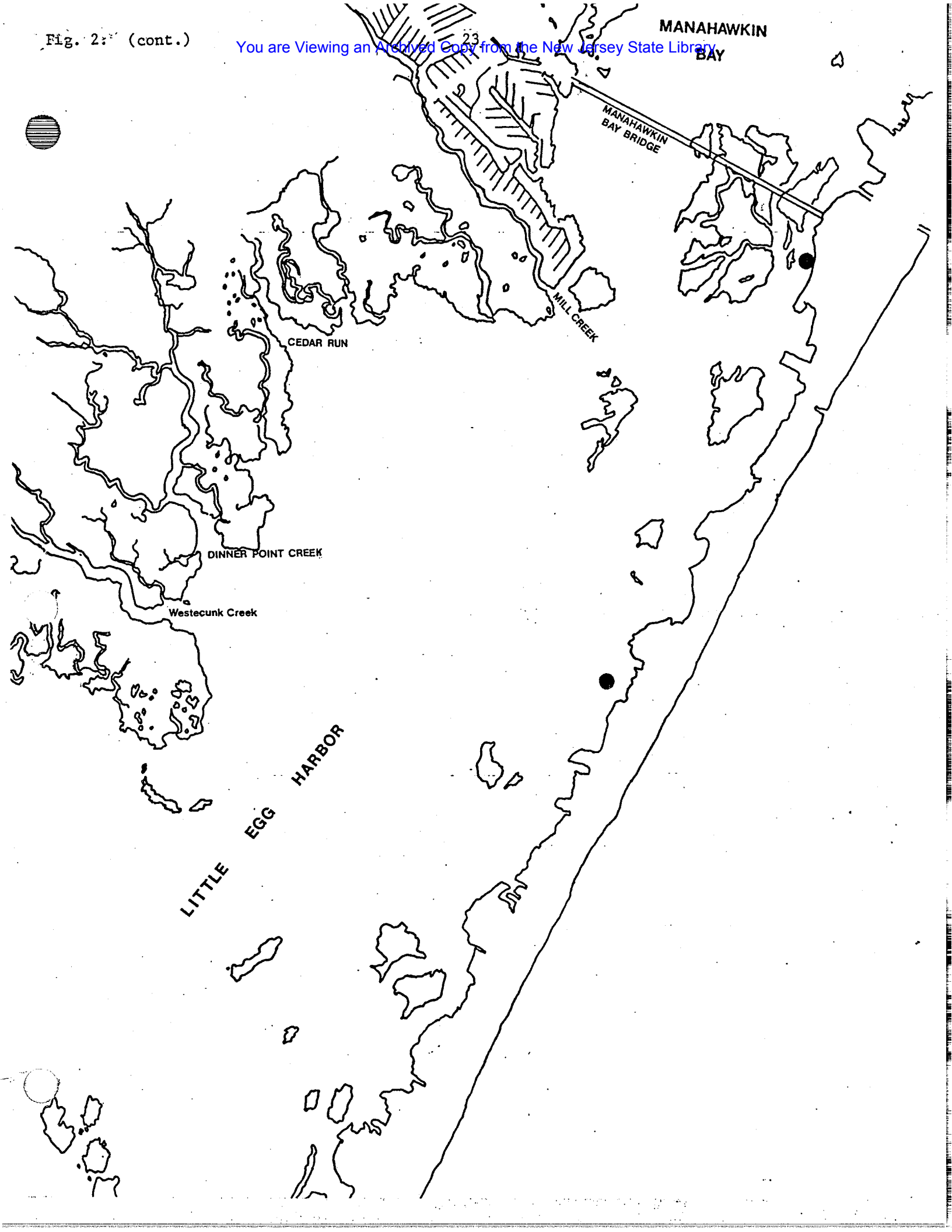

Fig. 2. (cont.)

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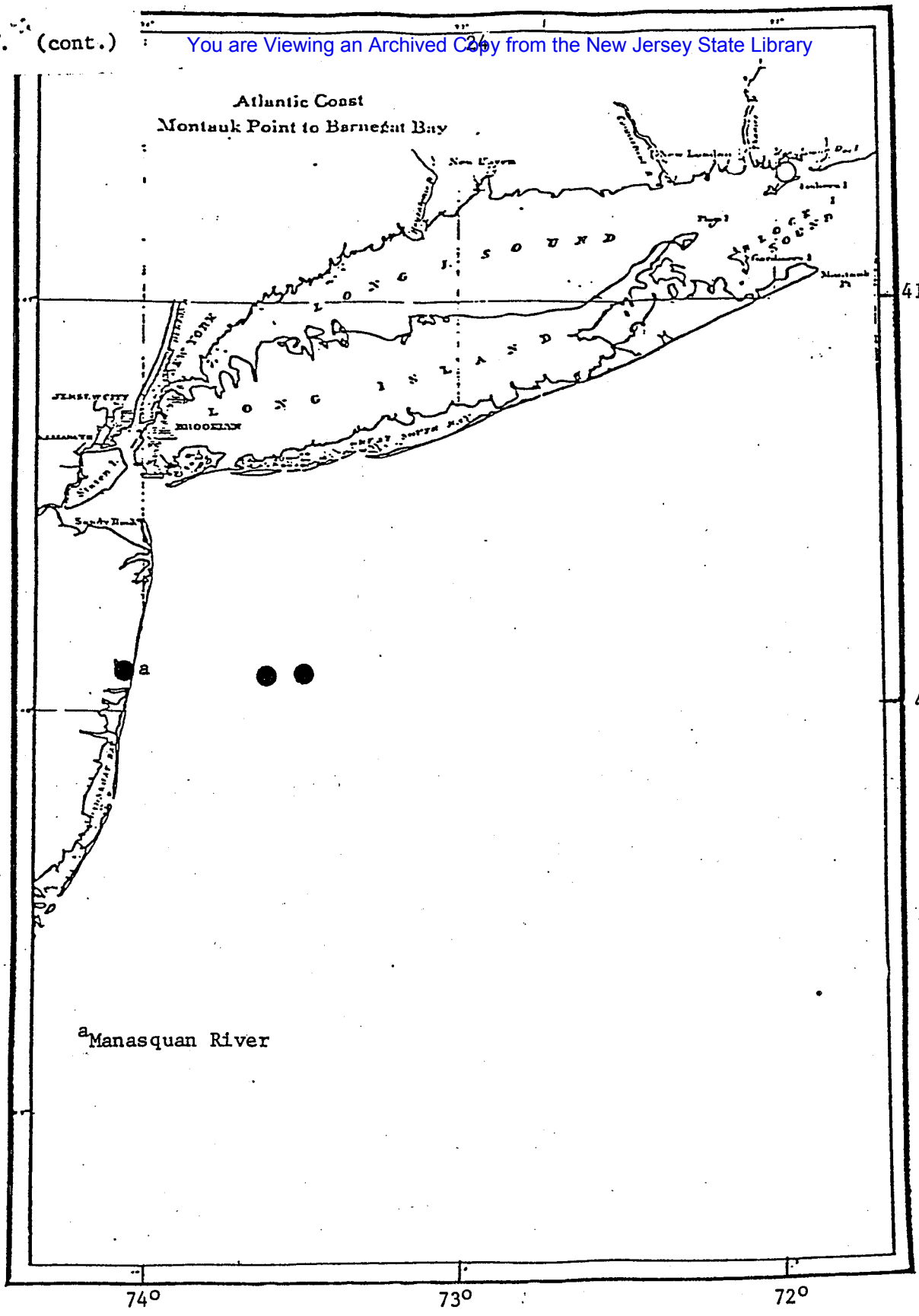

[a]Manasquan River