

ANNUAL CYCLE OF GONAD-SOMATIC INDICES AS INDICATORS OF
SPAWNING TIMES FOR FIFTEEN SPECIES OF FISH COLLECTED
FROM THE NEW YORK BIGHT, JUNE 1974 TO JUNE 1975

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INTRODUCTION

The Sandy Hook Laboratory of the National Marine Fisheries Service began a systematic survey during June 1974 of benthic fishes occurring in the New York Bight and Sandy Hook, Lower, and Raritan bays. This study was designed to provide a comprehensive life history data base for current and anticipated research needs. This report summarizes gonad-somatic data as indicators of spawning times for the following 15 species of fish: alewife, Alosa pseudoharengus; offshore hake, Merluccius albidus; silver hake, Merluccius bilinearis; red hake, Urophycis chuss; spotted hake, Urophycis regius; ocean pout, Macrozoarces americanus; black sea bass, Centropristis striata; butterfish; Peprilus triacanthus; northern searobin, Prionotus carolinus; striped searobin, Prionotus evolans; summer flounder, Paralichthys dentatus; fourspot flounder, Paralichthys oblongus; windowpane, Scophthalmus aquosus; yellowtail flounder, Limanda ferruginea; and winter flounder, Pseudopleuronectes americanus. In addition, the literature pertinent to the aforementioned species is reviewed to provide a basis of comparison throughout the range of each species.

These data, when compared with historical and future data sets, will ultimately contribute a significant portion of the material needed to detect and understand natural and man-induced changes in the reproductive cycles of fishes occurring in the New York Bight.

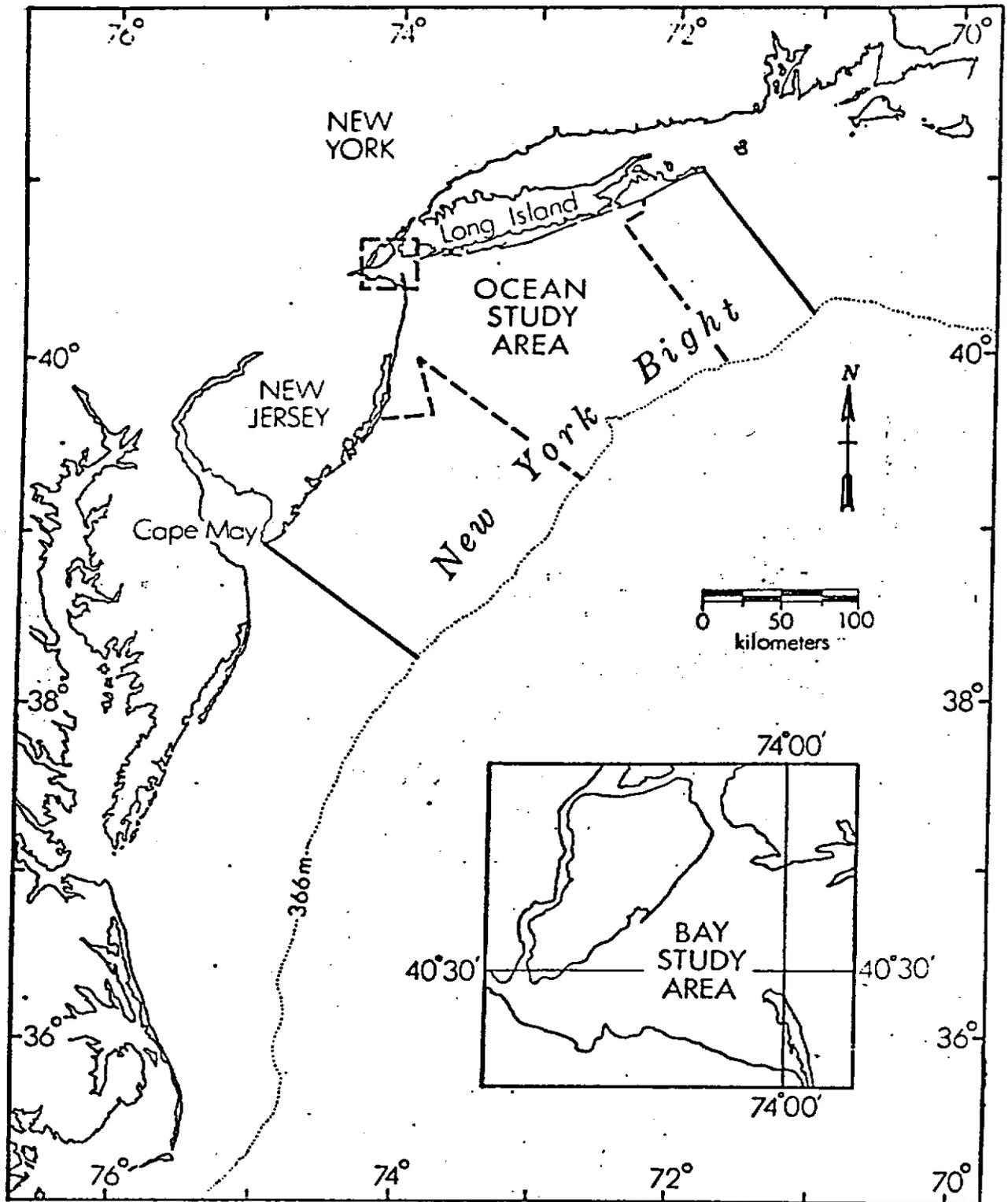


FIGURE 1. Middle Atlantic continental shelf with outlines of the New York Bight (solid lines) and the survey areas (dashed lines) within the Bight.

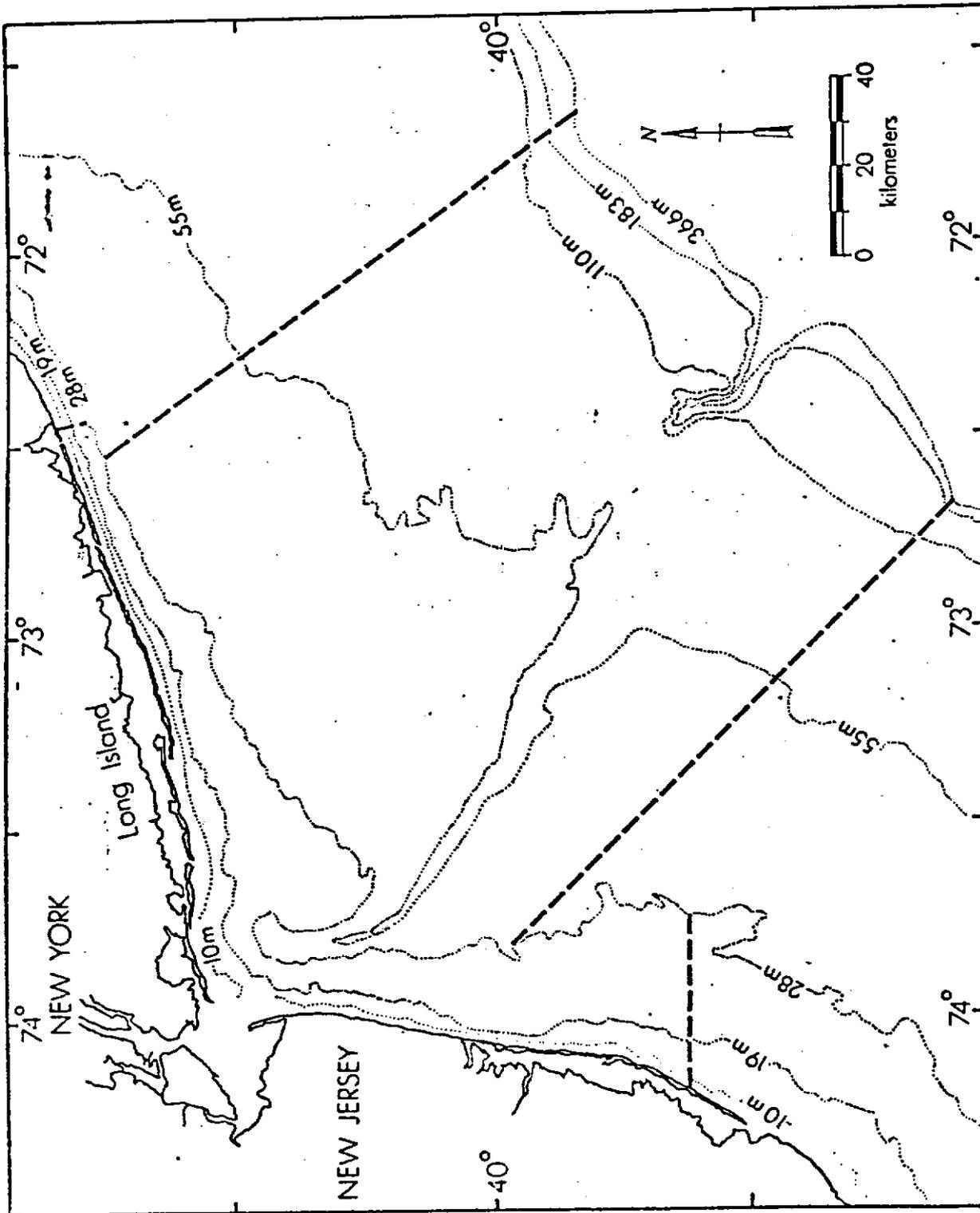


FIGURE 2. Ocean study area divided into depth strata where finfishes were sampled during an otter trawl survey, June 1974 to June 1975.

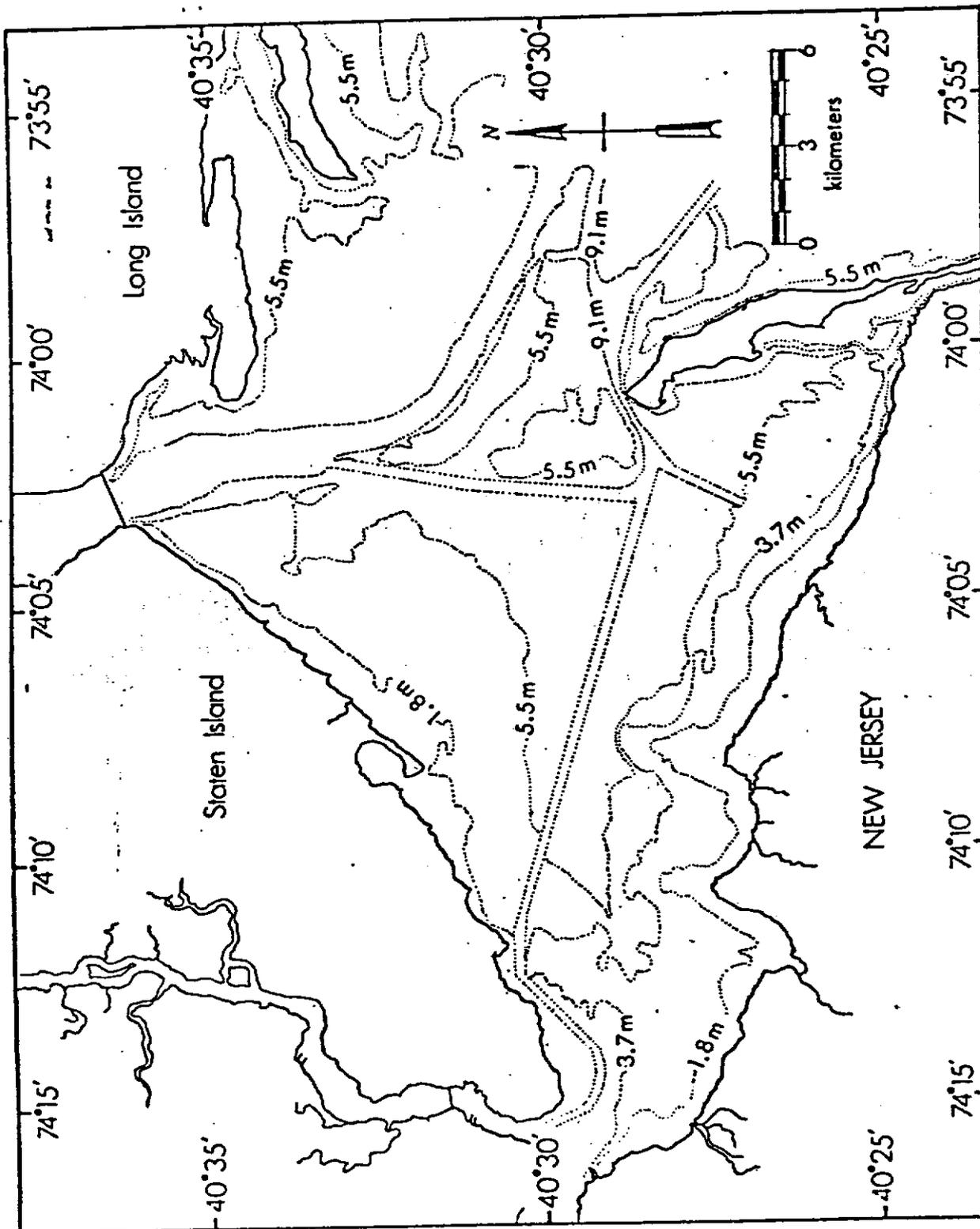


FIGURE 3. Bay study area where finfishes were sampled during an otter trawl survey, June 1974 to June 1975.

STUDY AREAS

The New York Bight is that portion of the Atlantic continental shelf between eastern Long Island, New York, and Cape May, New Jersey (Figure 1). This study was conducted in the northern section of the New York Bight where the Long Island and New Jersey coastlines are nearly perpendicular.

Two study areas, ocean and bay, were designated to facilitate sampling and data handling. The ocean study area was delineated by two sets of imaginary lines and the 28- and 366-m isobaths (Figure 2). The first set of lines extends seaward from points on Long Island and New Jersey to the 28-m isobath; the second set from the 28-m isobath to the edge of the continental shelf (366 m). The bay study area included Sandy Hook, Lower, and Raritan bays (Figure 3).

STATION SELECTION

Station locations in the ocean survey area were selected by a stratified random sampling design (Steel and Torrie 1960). Strata boundaries were determined by depth, i.e., 0-10, 11-19, 20-28, 29-55, 56-110, 111-183, and 184-366 m (Figure 2). A minimum of two stations per stratum were randomly selected to be sampled during each cruise. Inshore strata (0-28 m) were sampled at a rate of approximately one station per 515 km² and offshore strata (29-366 m) at a rate of approximately one station per 1.030 km². Grosslein (1969) described additional details pertaining to this sampling method and design.

The bay survey area was divided into 103 sampling blocks. Except where interrupted by land, each block measured 1' of latitude by 1' of longitude, i.e., 1.8 km x 1.4 km (2.5 km²). Trawl stations for all bay cruises were selected randomly from these blocks at the beginning of the study and were retained as permanent stations throughout the study.

MATERIALS AND METHODS

Research vessels used during this study were the 10.4-m Xiphias and 19.8-m Rorqual from the Northeast Fisheries Center, the 47.2-m Delaware II and 57.0-m Albatross IV from the National Ocean Survey, and the chartered 27.4-m Atlantic Twin. Xiphias and Rorqual were used exclusively in the bay areas, Delaware II was used in both the ocean and the bay, and Albatross IV and Atlantic Twin were used only in the ocean.

LORAN A navigation was the principal method used for positioning on ocean stations. Radar, land ranges, and visual sightings of buoys were used to position vessels on bay stations and some of the inshore ocean stations.

Fish collections were made with otter trawls towed at approximately 6.5 km/h for 15 min at bay stations and 30 min at ocean stations. The trawl used aboard Xiphias and Rorqual had a 9.1-m footrope, a 7.6-m headrope, and 7.6-m legs. A Yankee #36 trawl with a 24.4-m footrope, an 18.3-m headrope, and 9.1-m legs was used on Delaware II. The Albatross IV also used the #36 Yankee trawl as well as a #41 trawl with

a 30.5-m footrope, a 24.4-m headrope, and 19.8-m top and 18.3-m bottom legs. The Atlantic Twin used a 3/4 Yankee trawl with a 16.5-m footrope, an 11.9-m headrope, 11.6-m legs, and 16.5-m ground cables. All trawls were fitted with 12.7-mm stretch mesh cod end liners.

At the conclusion of each tow, the trawl was retrieved and emptied onto a sorting table where all fish species were separated and identified. All specimens of each species were weighed to the nearest whole pound and measured from the snout to the middle caudal ray in centimeters. All specimens of each species were usually measured except when subsamples of very large catches were measured. In such cases, an expansion factor (weight of total catch/weight of subsample) was applied to the number and length frequency of the total catch.

Samples of each bony fish species, up to 35 specimens, were frozen from each trawl station for subsequent laboratory study. If the total catch of a species exceeded 35 specimens, a size-stratified sample of 25 to 35 specimens was frozen.

At the laboratory each specimen was measured to the nearest millimeter (middle caudal ray) and weighed to the nearest gram. In addition, each mature specimen was sexed, development stage determined, and ovaries weighed to the nearest one-hundredth of a gram (0.01 g).

Collected data were recorded on appropriate data processing forms, transferred to punch cards, and incorporated into sorting, listing and statistical systems to simplify data recall and analysis.

RESULTS

Results pertinent to reproductive cycles are given in the form of figures and tables for each of the aforementioned 15 species. Figures 4-18 illustrate monthly mean gonad-somatic indices (ovarian weight ÷ fish weight x 100) over the entire 13 month survey for each species. Tables 2-16 give monthly summaries of gonad-somatic data for each species. These tables include number of observations; specimen size range; and mean, variance, standard deviation, and range of the gonad-somatic index for each month data were collected for a particular species.

In addition, Table 17 gives a summary of published literature relative to the reproductive cycles for each of the 15 species and contrasts these published results with those found during the present study.

TABLE 1. Summary of collecting intervals sampled during trawl survey of New York Bight, June 1974 to June 1975.

Date	Vessel	No. of Sta.	Gear Type	Study Area
<u>1974</u>				
June 3, 4, 6	<i>Xiphias</i>	15	9.1-m trawl	bay
June 3	<i>Delaware II</i>	3	#36 trawl	bay
June 3-17	<i>Delaware II</i>	43	#36 trawl	ocean
July 23-25	<i>Xiphias</i>	15	9.1-m trawl	bay
July 24	<i>Delaware II</i>	3	#36 trawl	bay
July 24-29	<i>Delaware II</i>	41	#36 trawl	ocean
August 14, 15, 21-23	<i>Rorqual</i>	16	9.1-m trawl	bay
August 16-21	<i>Delaware II</i>	45	#36 trawl	ocean
September 23-25	<i>Xiphias</i>	12	9.1-m trawl	bay
September 23	<i>Delaware II</i>	3	#36 trawl	bay
September 23-28	<i>Delaware II</i>	40	#36 trawl	ocean
October 22-24	<i>Xiphias</i>	19	9.1-m trawl	bay
October 22	<i>Delaware II</i>	3	#36 trawl	bay
October 22-28	<i>Delaware II</i>	40	#36 trawl	ocean
November 18-20	<i>Xiphias</i>	19	9.1-m trawl	bay
November 18	<i>Delaware II</i>	3	#36 trawl	bay
November 18-25	<i>Delaware II</i>	37	#36 trawl	ocean
<u>1975</u>				
January 3, 6, 9	<i>Rorqual</i>	14	9.1-m trawl	bay
January 31; February 3, 4	<i>Rorqual</i>	14	9.1-m trawl	bay
January 31	<i>Delaware II</i>	3	#36 trawl	bay
January 31; February 1-6	<i>Delaware II</i>	51	#36 trawl	ocean
March 6-8, 10	<i>Albatross IV</i>	19	#41 trawl	ocean
March 20-24	<i>Atlantic Twin</i>	27	3/4 Yankee trawl	ocean
April 1, 2, 7	<i>Rorqual</i>	15	9.1-m trawl	bay
April 1-3, 5-10	<i>Albatross IV</i>	48	#36 trawl	ocean
May 5, 6, 8	<i>Xiphias</i>	16	9.1-m trawl	bay
May 5	<i>Delaware II</i>	3	#36 trawl	bay
May 5-12	<i>Delaware II</i>	60	#36 trawl	ocean
June 3, 9	<i>Xiphias</i>	9	9.1-m trawl	bay
June 2-9	<i>Delaware II</i>	64	#36 trawl	ocean
TOTAL		700		

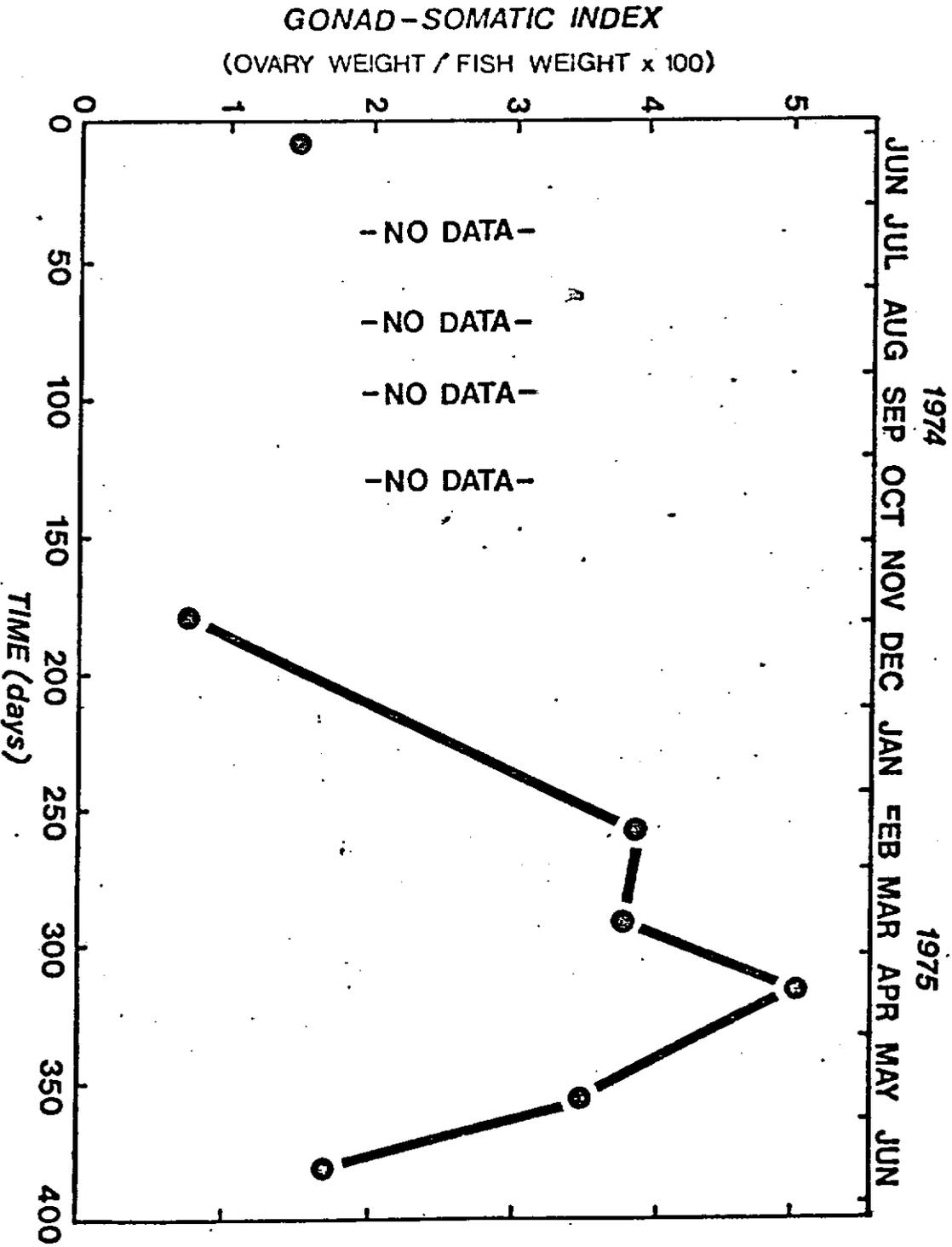


FIGURE 4. Monthly gonad-somatic indices for alewife (*Alosa pseudoharengus*) collected in the New York Bight, June 1974 to June 1975.

TABLE 2. Monthly summary of gonad-somatic data for alewife (*Alosa pseudoharengus*) collected in the New York Bight, June 1974 to June 1975. A dash (-) indicates no data available.

Survey Month	Number of Observations	Specimen Size Range (mm)	GONAD-SOMATIC INDEX			
			Mean	Variance	Standard Deviation	Range
<u>1974</u>						
June	1	232	1.45	-	-	1.45
July	-	-	-	-	-	-
August	-	-	-	-	-	-
September	-	-	-	-	-	-
October	-	-	-	-	-	-
November	3	156-167	0.77	0.01	0.09	0.72- 0.87
<u>1975</u>						
February	83	168-345	4.04	7.26	2.69	0.13-12.44
March	19	208-298	3.85	7.52	2.74	0.75-11.78
April	29	154-269	4.99	24.20	4.92	0.41-15.00
May	40	142-289	3.54	24.38	4.94	0.46-15.67
June	6	236-273	1.88	2.15	1.46	0.96- 4.83

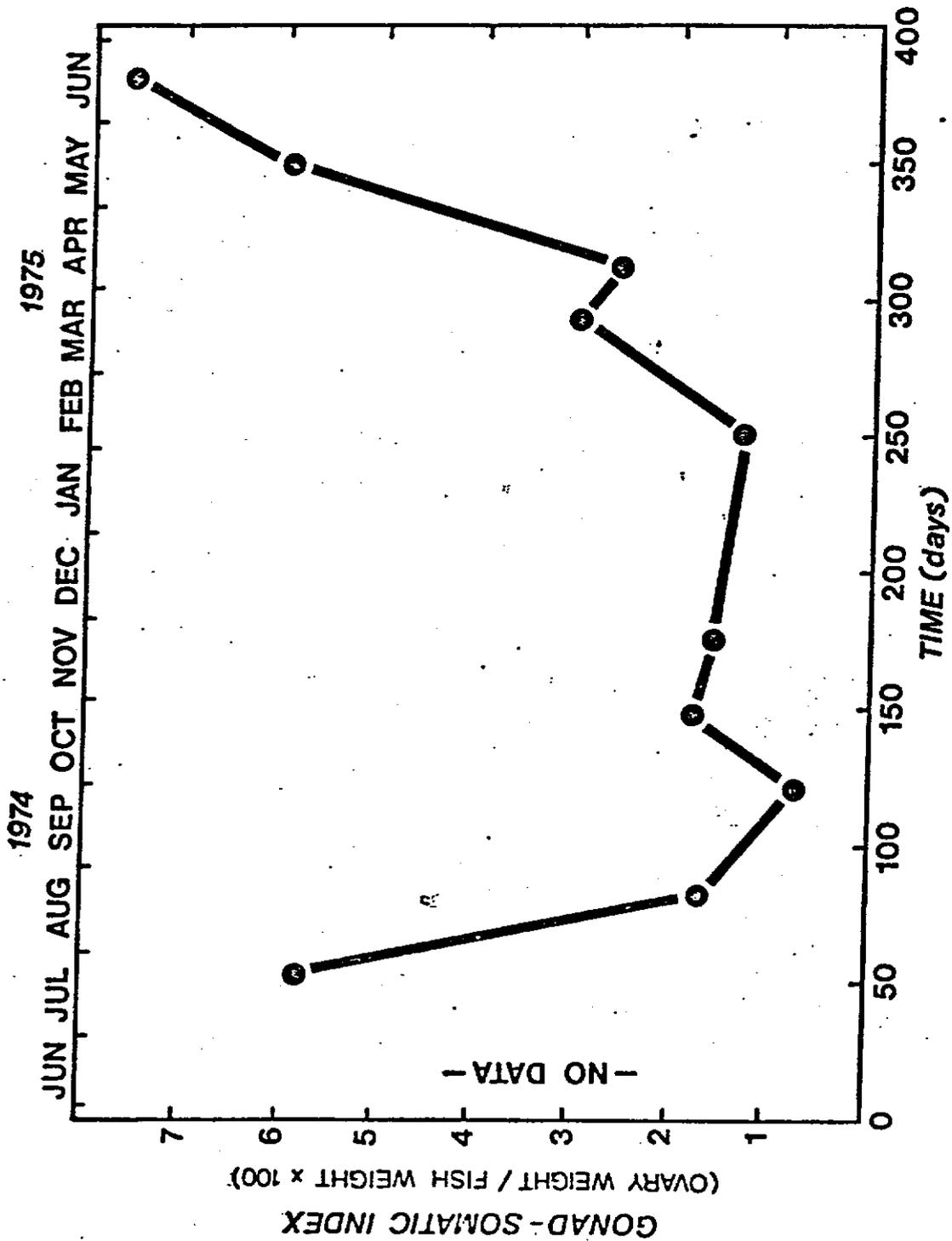


FIGURE 5. Monthly gonad-somatic indices for offshore hake (*Merluccius albidus*) collected in the New York Bight, June 1974 to June 1975.

TABLE 3. Monthly summary of gonad-somatic data for offshore hake (*Merluccius albidus*) collected in the New York Bight, June 1974 to June 1975. A dash (-) indicates no data available.

Survey Month	Number of Observations	Specimen Size Range (mm)	GONAD-SOMATIC INDEX			
			Mean	Variance	Standard Deviation	Range
<u>1974</u>						
June	-	-	-	-	-	-
July	6	317-483	5.70	23.24	4.82	0.36-11.93
August	11	230-393	1.73	13.64	3.69	0.46-12.86
September	6	302-337	0.70	0.08	0.28	0.50- 1.18
October	20	289-540	1.77	4.56	2.14	0.43- 8.80
November	20	269-504	1.64	5.26	2.29	0.20- 8.00
<u>1975</u>						
February	30	249-529	1.51	2.44	1.56	0.20- 6.53
March	10	293-575	3.01	15.40	3.92	0.17-10.94
April	31	268-495	2.61	10.02	3.17	0.25-11.82
May	16	286-433	6.00	38.47	6.20	0.30-18.72
June	6	383-522	7.71	11.39	3.38	3.95-12.15

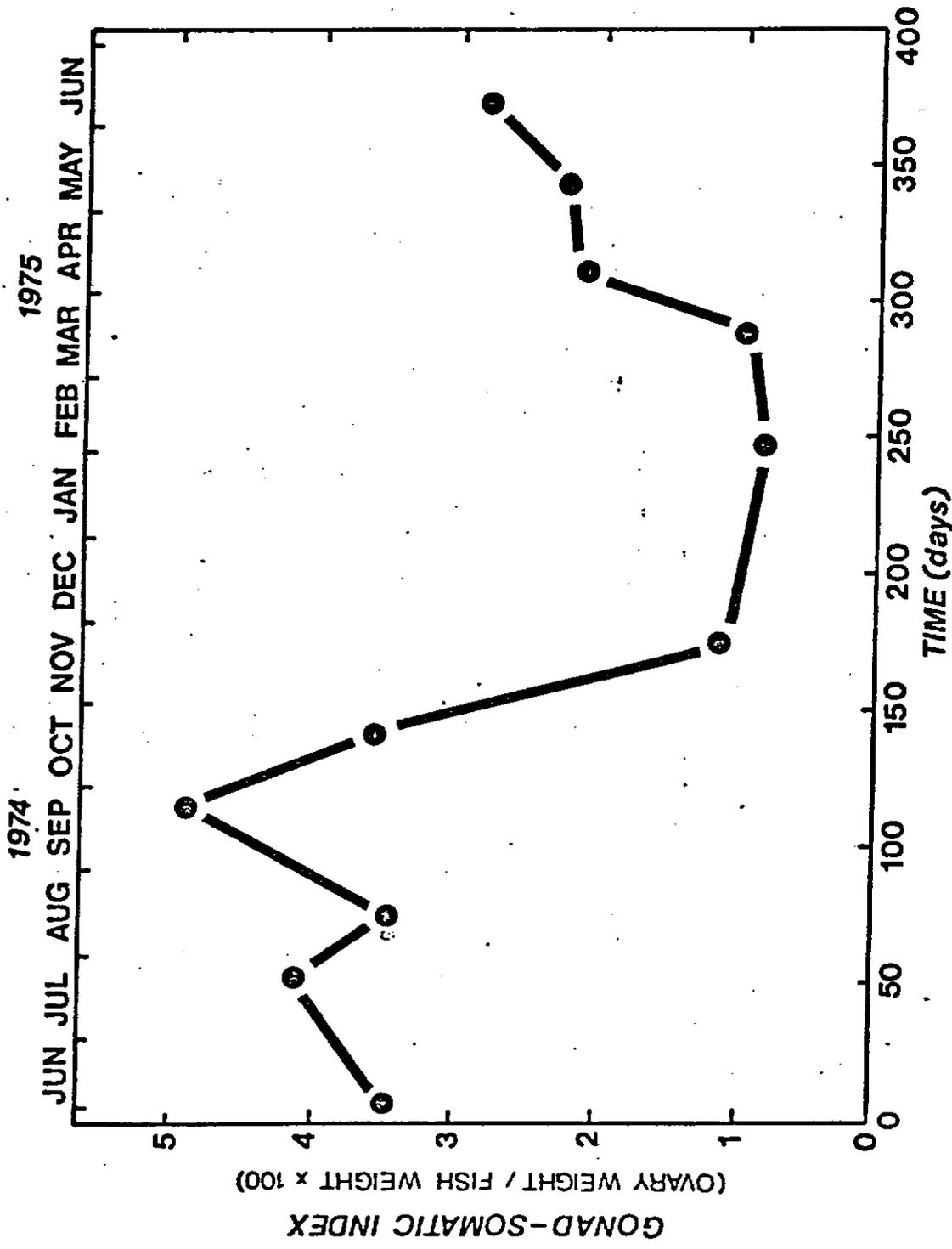


FIGURE 6. Monthly gonad-somatic indices for silver hake (Merluccius bilinearis) collected in the New York Bight, June 1974 to June 1975.

TABLE 4. Monthly summary of gonad-somatic data for silver hake (*Merluccius bilinearis*) collected in the New York Bight, June 1974 to June 1975. A dash (-) indicates no data available.

Survey Month	Number of Observations	Specimen Size Range (mm)	GONAD-SOMATIC INDEX			
			Mean	Variance	Standard Deviation	Range
<u>1974</u>						
June	29	202-415	3.37	6.15	2.48	0.47-11.35
July	15	241-420	4.17	11.49	3.39	0.40-11.58
August	12	222-374	3.49	10.30	3.21	1.62- 8.37
September	4	313-341	4.87	14.82	3.85	1.03- 8.72
October	19	214-463	3.54	9.42	3.07	0.44- 9.65
November	65	219-508	1.08	0.74	0.86	0.25- 6.07
<u>1975</u>						
February	298	167-513	0.81	0.21	0.46	0.22- 6.39
March	264	241-565	0.91	0.26	0.51	0.25- 4.43
April	183	253-590	2.10	45.43	6.74	0.32-38.38
May	272	263-562	2.15	3.80	1.95	0.29-13.35
June	98	228-507	2.69	8.88	2.98	0.36-14.37

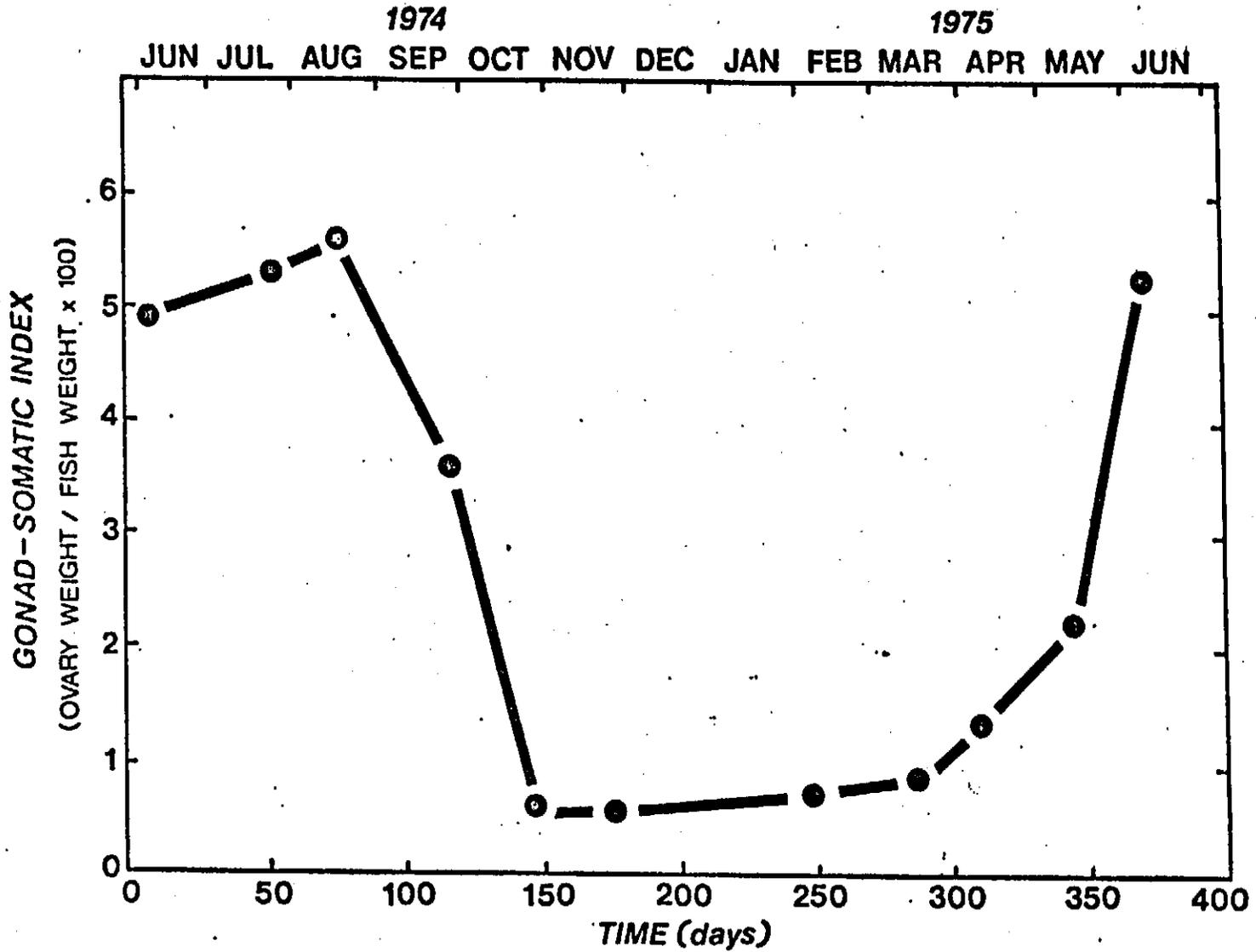


FIGURE 7. Monthly gonad-somatic indices for red hake (*Urophycis chuss*) collected in the New York Bight, June 1974 to June 1975.

TABLE 5. Monthly summary of gonad-somatic data for red hake (*Urophycis chuss*) collected in the New York Bight, June 1974 to June 1975. A dash (-) indicates no data available.

Survey Month	Number of Observations	Specimen Size Range (mm)	GONAD-SOMATIC INDEX			
			Mean	Variance	Standard Deviation	Range
<u>1974</u>						
June	18	270-409	4.94	10.82	3.29	0.50-13.77
July	31	224-453	5.36	13.62	3.69	0.81-14.86
August	46	224-431	5.63	7.29	2.70	1.34-13.70
September	19	243-397	3.58	7.90	2.81	0.23- 8.16
October	9	248-506	0.65	0.08	0.29	0.30- 1.29
November	51	231-521	0.64	0.05	0.22	0.26- 1.37
<u>1975</u>						
February	125	245-533	0.75	0.05	0.23	0.25- 1.59
March	123	188-476	0.91	0.12	0.35	0.15- 2.04
April	102	212-529	1.39	0.76	0.87	0.19- 2.69
May	223	221-621	2.25	2.86	1.69	0.11-15.15
June	79	169-505	5.25	15.29	3.91	0.10-21.31

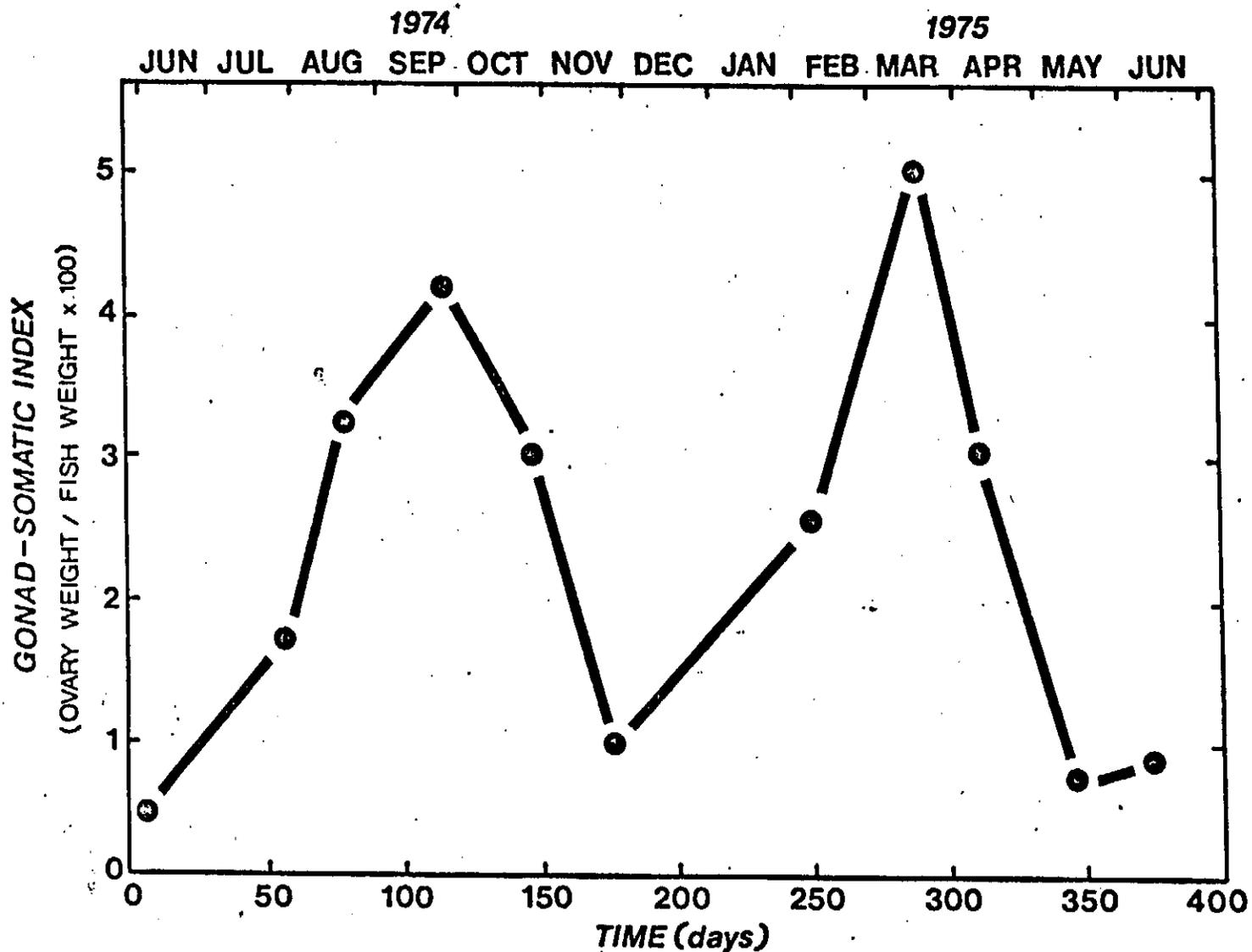


FIGURE 8. Monthly gonad-somatic indices for spotted hake (Urophycis regius) collected in the New York Bight, June 1974 to June 1975.

TABLE 6. Monthly summary of gonad-somatic data for spotted hake (*Urophycis regius*) collected in the New York Bight, June 1974 to June 1975. A dash (-) indicates no data available.

Survey Month	Number of Observations	Specimen Size Range (mm)	GONAD-SOMATIC INDEX			
			Mean	Variance	Standard Deviation	Range
<u>1974</u>						
June	1	252	0.60	-	-	0.60
July	14	191-338	1.64	1.19	1.09	0.44- 4.04
August	29	178-346	3.20	6.35	2.52	0.41-10.12
September	44	183-360	4.20	16.32	4.04	0.37-22.09
October	77	206-333	2.99	6.05	2.46	0.32-13.75
November	78	204-340	0.97	0.41	0.64	0.26- 3.60
<u>1975</u>						
February	4	318-355	2.57	12.60	3.55	0.57- 7.87
March	3	283-333	5.01	14.98	3.87	0.76- 8.34
April	7	291-386	3.09	8.70	2.95	0.33- 8.03
May	12	299-368	0.69	0.02	0.15	0.48- 0.99
June	13	288-367	0.85	0.40	0.20	0.73- 1.26

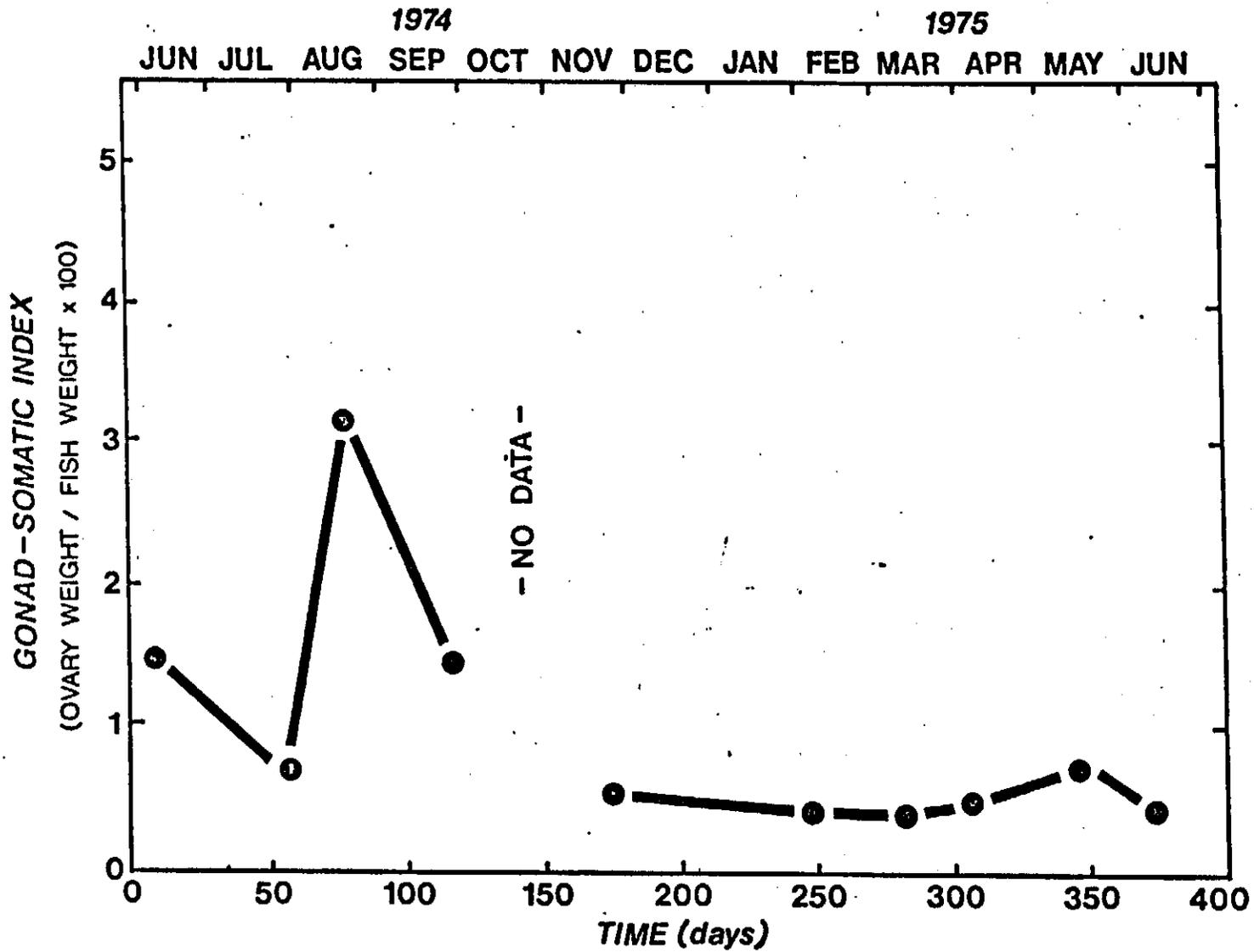


FIGURE 9. Monthly gonad-somatic indices for ocean pout (Macrozoarces americanus), collected in the New York Bight, June 1974 to June 1975.

TABLE 7. Monthly summary of gonad-somatic data for ocean pout (*Macrozoarces americanus*) collected in the New York Bight, June 1974 to June 1975. A dash (-) indicates no data available.

Survey Month	Number of Observations	Specimen Size Range (mm)	GONAD-SOMATIC INDEX			
			Mean	Variance	Standard Deviation	Range
<u>1974</u>						
June	1	458	1.58	-	-	1.58
July	4	299-373	0.57	0.06	0.25	0.29- 0.89
August	2	380-409	3.13	14.05	3.75	0.48- 5.78
September	2	349-440	1.45	1.04	1.02	0.73- 2.17
October	-	-	-	-	-	-
November	3	341-455	0.50	0.001	0.04	0.46- 0.53
<u>1975</u>						
February	76	310-631	0.47	0.02	0.13	0.29- 0.98
March	24	284-586	0.46	0.02	0.12	0.12- 0.68
April	57	269-663	0.51	0.06	0.24	0.05- 1.58
May	64	360-659	0.79	0.44	0.66	0.07- 3.43
June	14	242-558	0.45	0.05	0.22	0.05- 1.04

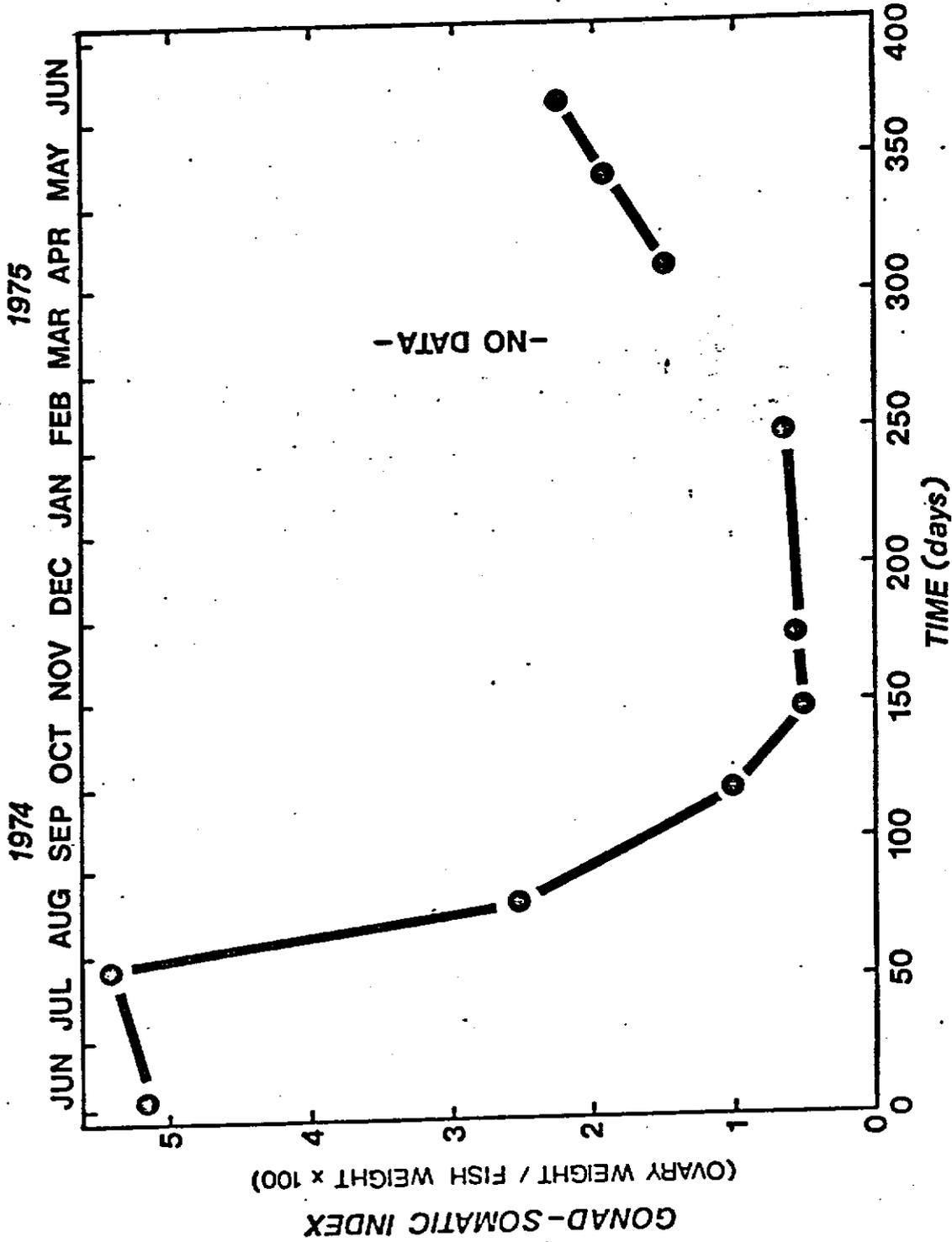


FIGURE 10: Monthly gonad-somatic indices for black sea bass (*Centropristis striata*) collected in the New York Bight, June 1974 to June 1975.

TABLE 8. Monthly summary of gonad-somatic data for black sea bass (Centropristis striata) collected in the New York Bight, June 1974 to June 1975. A dash (-) indicates no data available.

Survey Month	Number of Observations	Specimen Size Range (mm)	GONAD-SOMATIC INDEX			
			Mean	Variance	Standard Deviation	Range
<u>1974</u>						
June	1	264	5.20	-	-	5.20
July	16	208-401	5.60	1.44	1.20	3.42- 8.07
August	25	219-368	2.48	1.10	1.05	0.71- 4.61
September	20	189-353	1.07	0.66	0.81	0.16- 2.71
October	15	224-305	0.53	0.02	0.13	0.26- 0.78
November	8	246-452	0.55	0.04	0.20	0.28- 0.89
<u>1975</u>						
February	2	316-349	0.65	0.14	0.38	0.38- 0.92
March	-	-	-	-	-	-
April	1	243	1.22	-	-	1.22
May	25	221-389	1.91	1.12	1.06	0.68- 4.87
June	52	173-365	2.23	3.53	1.88	0.33- 8.05

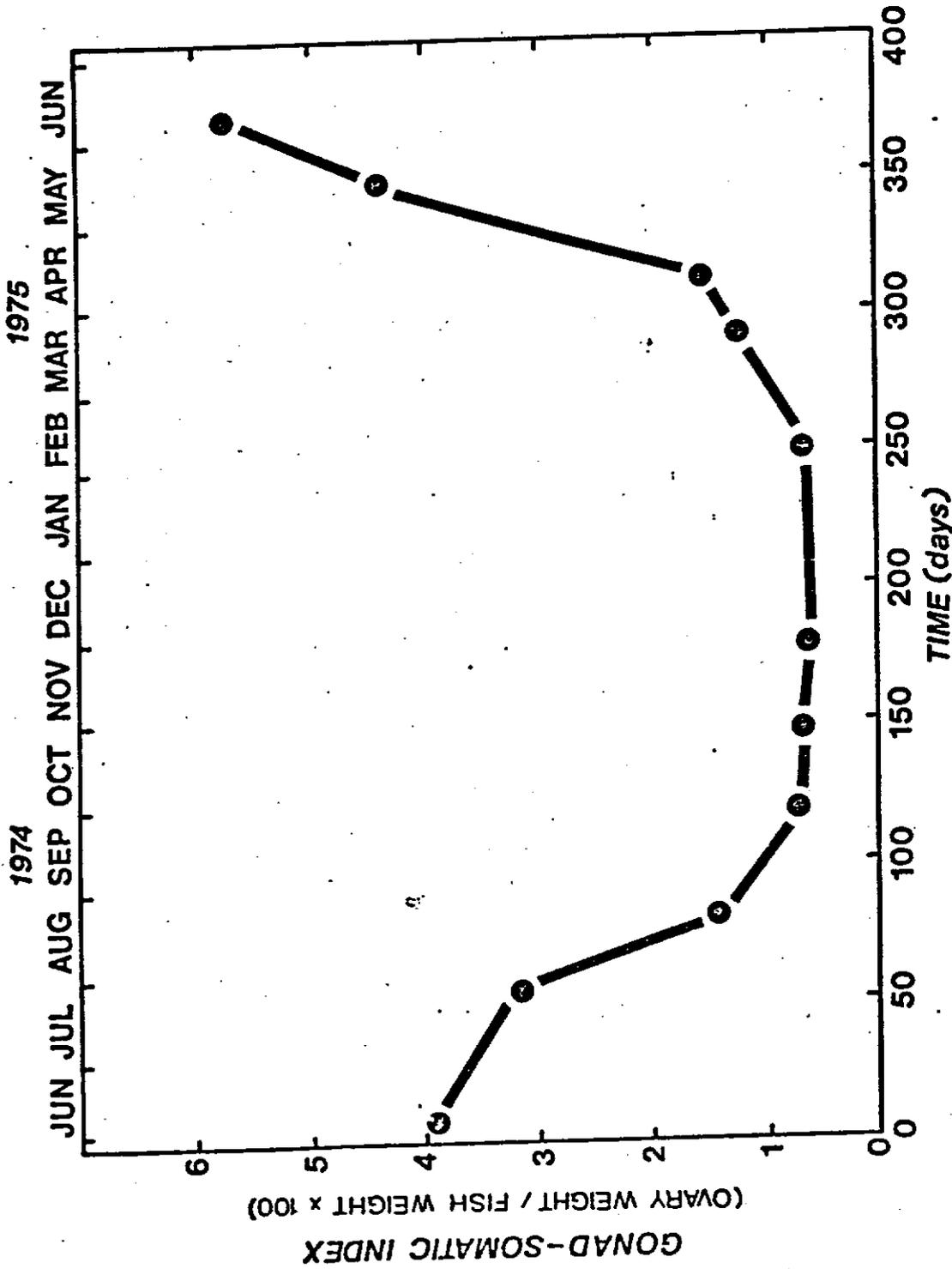


FIGURE 11. Monthly gonad-somatic indices for butterfish (*Peprillus triacanthus*) collected in the New York Bight, June 1974 to June 1975.

TABLE 9. Monthly summary of gonad-somatic data for butterfish (*Peprilus triacanthus*) collected in the New York Bight, June 1974 to June 1975. A dash (-) indicates no data available.

Survey Month	Number of Observations	Specimen Size Range (mm)	GONAD-SOMATIC INDEX			
			Mean	Variance	Standard Deviation	Range
1974						
June	90	119-215	4.07	8.07	2.84	0.53-12.71
July	24	141-196	3.20	2.62	1.62	0.65- 5.93
August	26	139-205	1.43	2.28	1.51	0.33- 6.32
September	16	142-199	0.76	0.01	0.11	0.63- 0.96
October	30	147-216	0.76	0.02	0.14	0.40- 1.10
November	21	155-220	0.76	0.07	0.27	0.14- 1.12
1975						
February	1	190	0.83	-	-	0.83
March	22	126-242	1.29	0.10	0.31	0.79- 1.82
April	20	126-213	1.64	0.55	0.74	0.73- 3.20
May	79	127-230	4.42	5.71	2.39	0.70-10.40
June	99	122-215	5.74	9.61	3.10	0.42-12.38

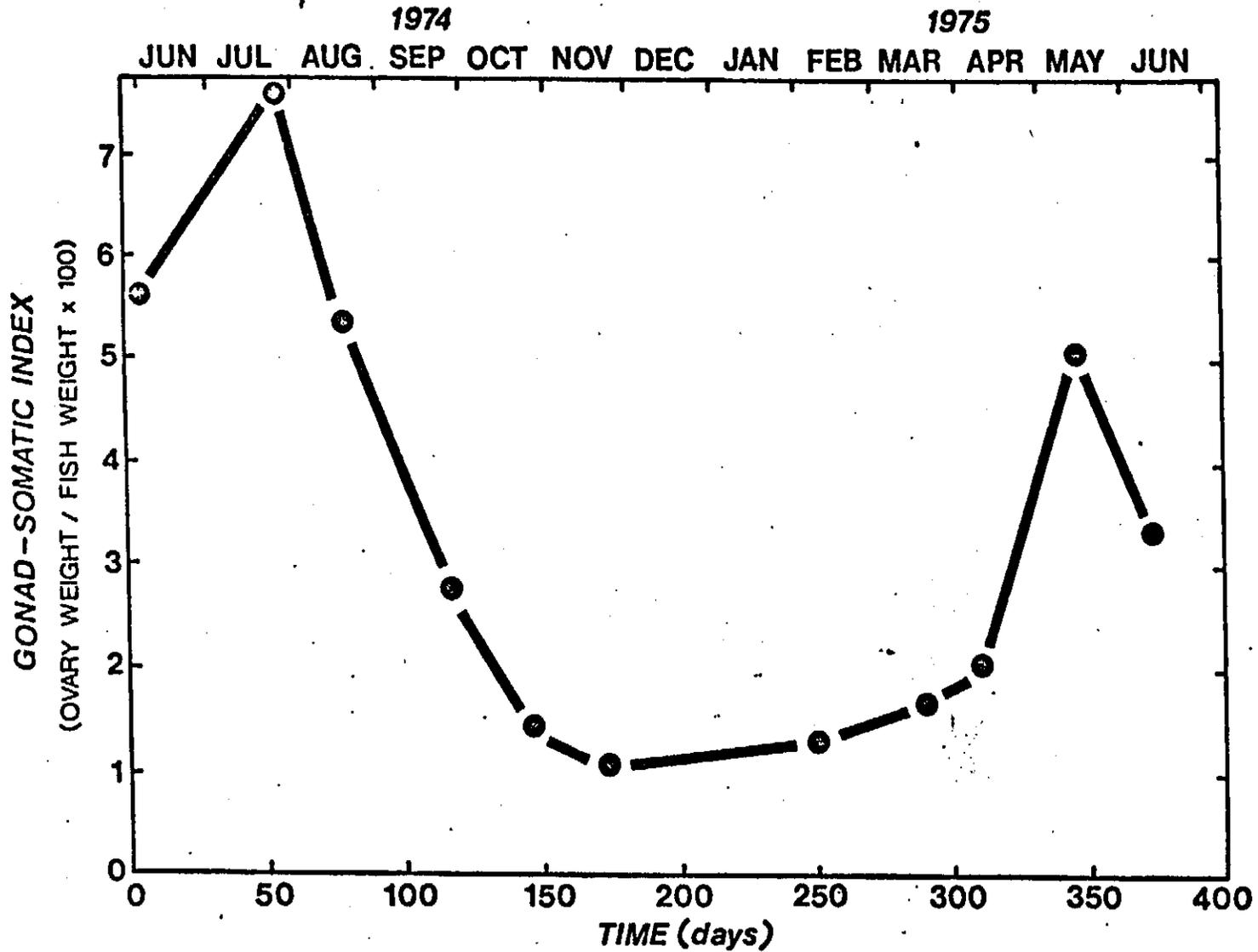


FIGURE 12. Monthly gonad-somatic indices for northern searobin (Prionotus carolinus) collected in the New York Bight, June 1974 to June 1975.

TABLE 10. Monthly summary of gonad-somatic data for northern searobin (*Prionotus carolinus*) collected in the New York Bight, June 1974 to June 1975. A dash (-) indicates no data available.

Survey Month	Number of Observations	Specimen Size Range (mm)	GONAD-SOMATIC INDEX			
			Mean	Variance	Standard Deviation	Range
<u>1974</u>						
June	14	228-275	5.63	5.52	2.35	2.57- 9.94
July	21	204-270	7.63	2.53	1.59	3.86- 9.92
August	19	182-318	5.43	13.69	3.70	0.32-10.23
September	48	143-297	2.76	4.75	2.18	0.33- 7.04
October	16	214-341	1.41	0.25	0.50	0.46- 2.27
November	15	221-330	1.06	0.26	0.51	0.55- 2.25
<u>1975</u>						
February	11	241-318	1.27	0.12	0.35	0.59- 1.83
March	5	259-340	1.74	0.32	0.57	0.74- 2.10
April	11	242-300	2.05	0.40	0.63	1.34- 3.54
May	12	238-308	5.18	8.41	2.90	1.40- 9.87
June	39	192-280	3.31	5.71	2.39	0.73-12.40

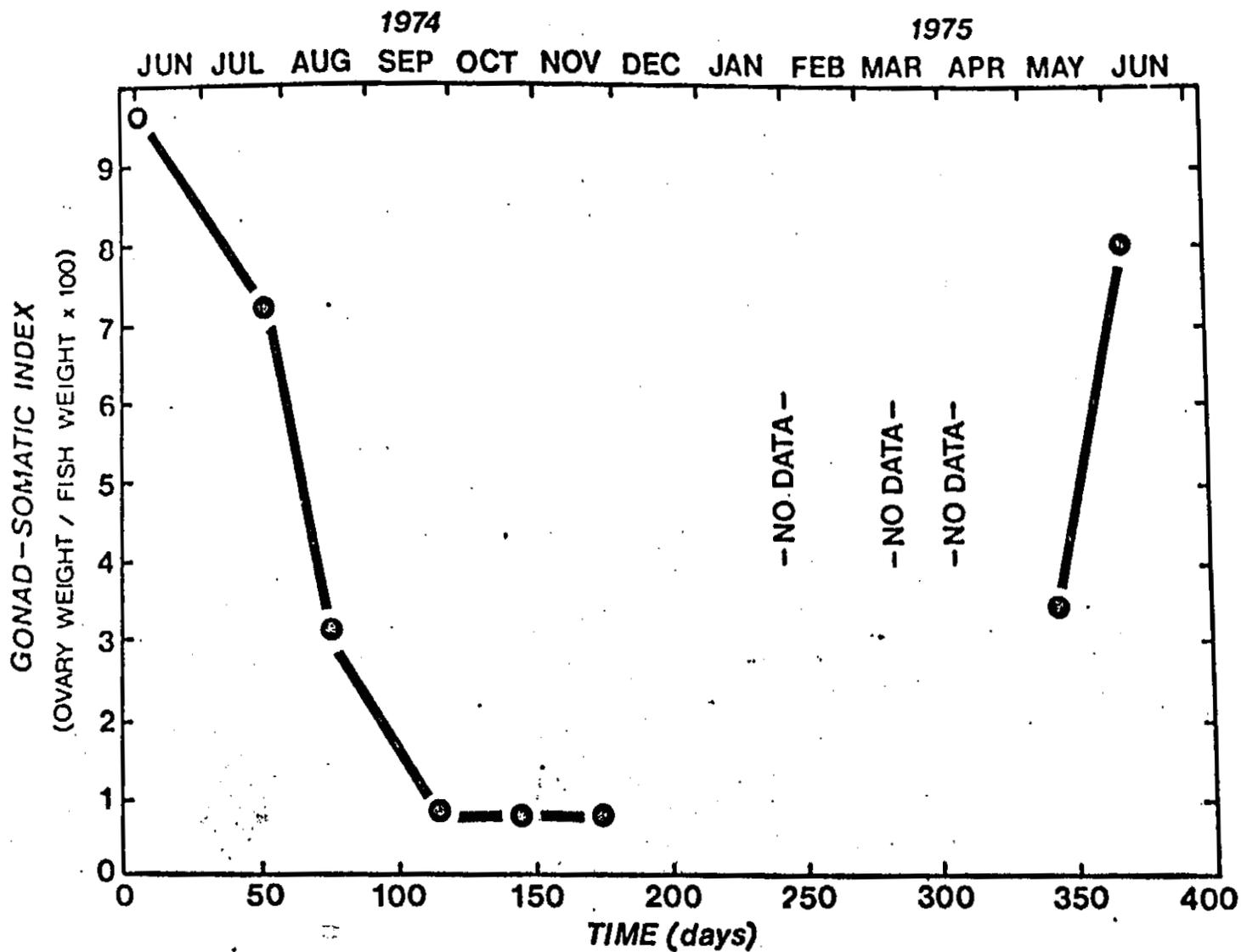


FIGURE 13. Monthly gonad-somatic indices for striped searobin (*Prionotus evolans*) collected in the New York Bight, June 1974 to June 1975.

TABLE 11. Monthly summary of gonad-somatic data for striped searobin (*Prionotus evolans*) collected in the New York Bight, June 1974 to June 1975. A dash (-) indicates no data available.

Survey Month	Number of Observations	Specimen Size Range (mm)	GONAD-SOMATIC INDEX			
			Mean	Variance	Standard Deviation	Range
<u>1974</u>						
June	2	348-373	9.87	12.96	3.60	9.61-10.12
July	16	225-364	7.35	35.28	5.94	0.23-21.32
August	11	204-346	3.19	16.24	4.03	0.50-13.35
September	19	238-414	0.82	0.04	0.29	0.33- 1.35
October	36	214-403	0.83	0.10	0.31	0.18- 1.36
November	30	294-372	0.85	0.15	0.39	0.12- 1.68
<u>1975</u>						
February	-	-	-	-	-	-
March	-	-	-	-	-	-
April	-	-	-	-	-	-
May	2	338-348	3.49	1.19	1.09	2.72- 4.26
June	10	289-353	8.16	10.76	3.28	3.57-13.07

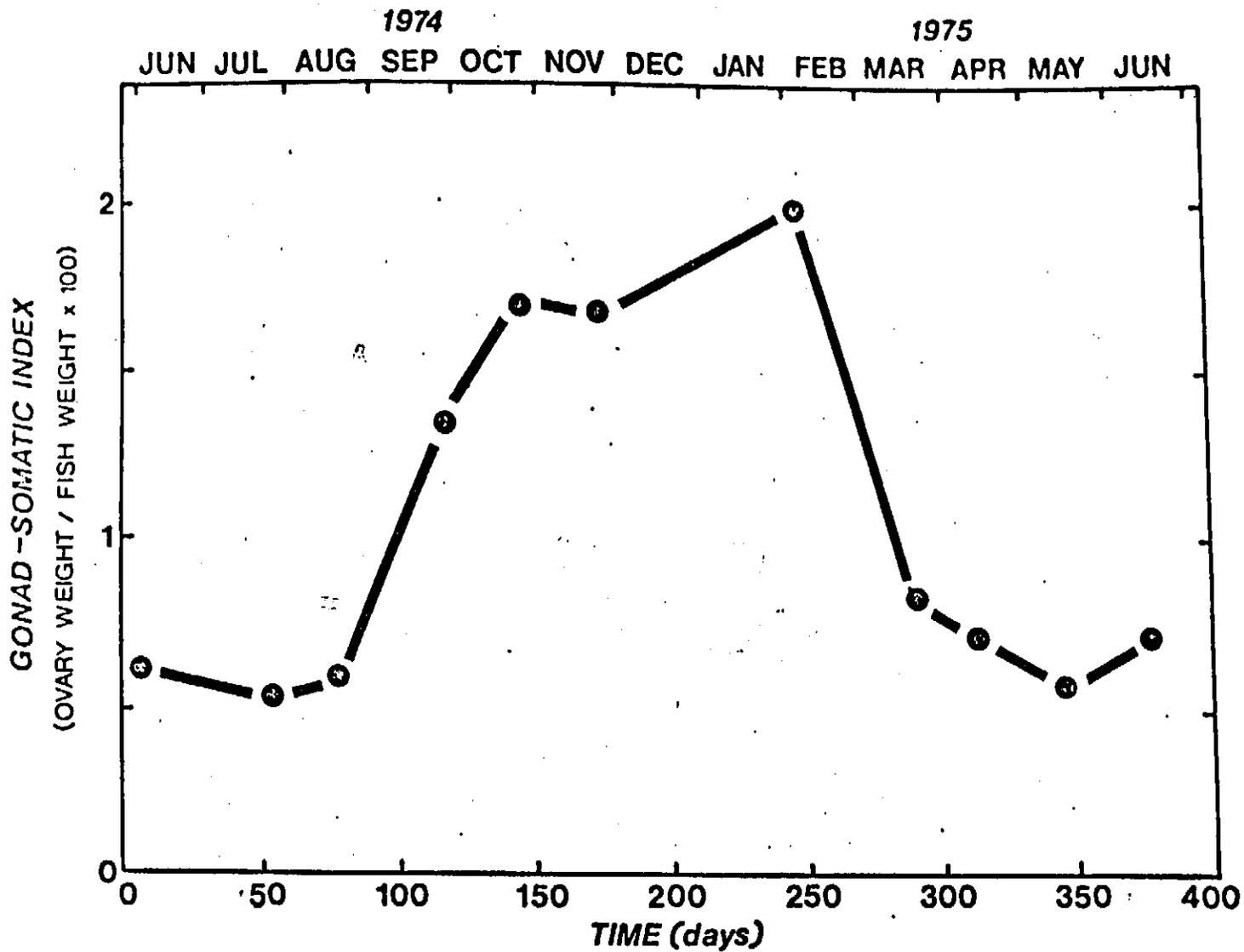


FIGURE 14. Monthly gonad-somatic indices for summer flounder (Paralichthys dentatus) collected in the New York Bight, June 1974 to June 1975.

TABLE 12. Monthly summary of gonad-somatic data for summer flounder (*Paralichthys dentatus*) collected in the New York Bight, June 1974 to June 1975. A dash (-) indicates no data available.

Survey Month	Number of Observations	Specimen Size Range (mm)	GONAD-SOMATIC INDEX			
			Mean	Variance	Standard Deviation	Range
<u>1974</u>						
June	62	309-692	0.63	0.11	0.33	0.31- 2.26
July	69	257-650	0.55	0.04	0.19	0.27- 1.27
August	44	353-537	0.57	0.03	0.17	0.29- 1.01
September	97	265-540	1.29	1.80	1.34	0.23- 5.59
October	81	283-660	1.77	4.16	2.04	0.13-11.53
November	40	301-716	1.68	1.46	1.21	0.18- 6.35
<u>1975</u>						
February	17	346-540	1.98	15.13	3.89	0.24-13.17
March	14	406-630	0.84	0.10	0.32	0.51- 1.78
April	12	382-547	0.81	0.15	0.38	0.46- 1.91
May	63	255-594	0.52	0.07	0.27	0.15- 1.22
June	116	276-651	0.70	0.28	0.53	0.17- 4.94

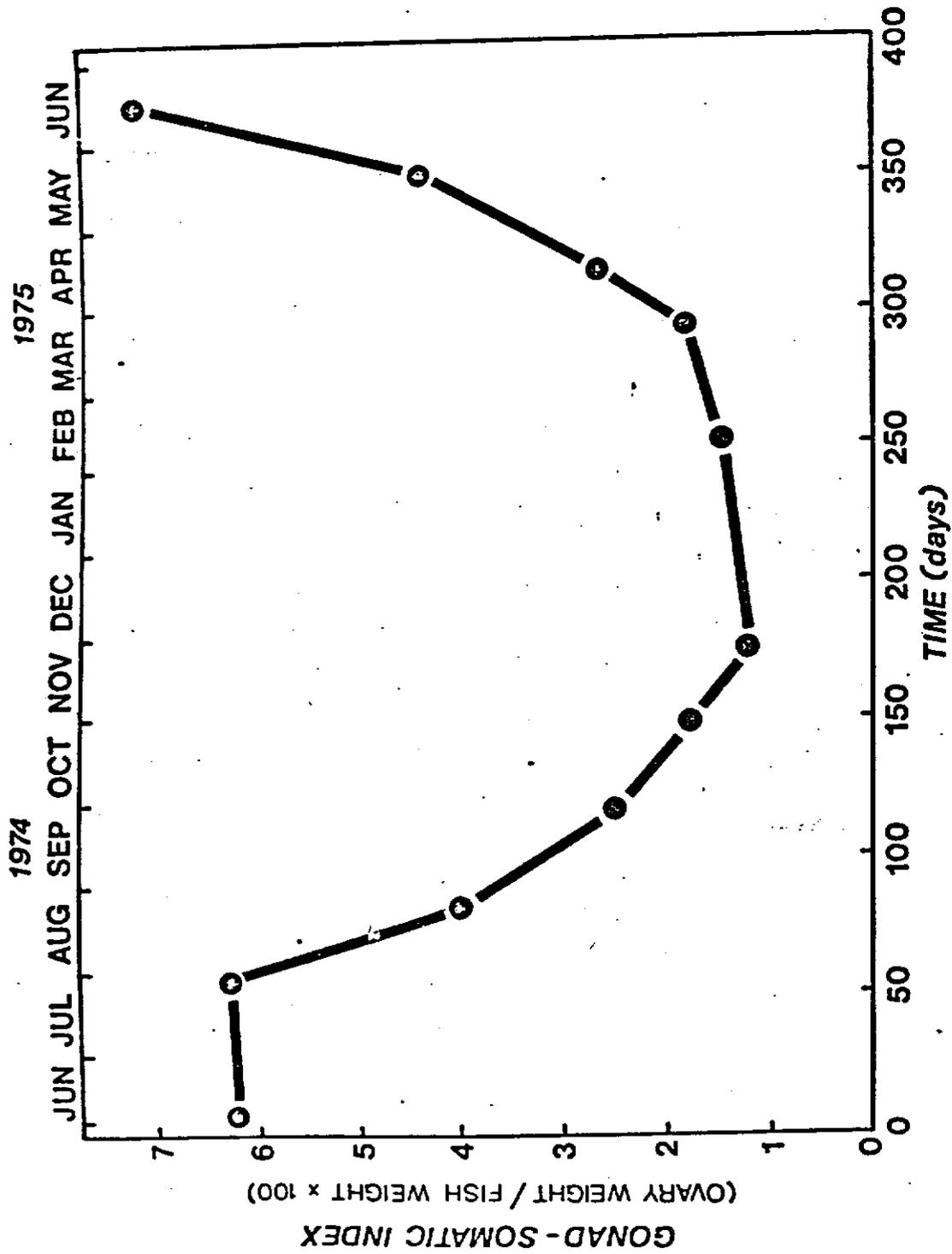


FIGURE 15. Monthly gonad-somatic indices for fourspot flounder (Paralichthys oblongus) collected in the New York Bight, June 1974 to June 1975.

TABLE 13. Monthly summary of gonad-somatic data for fourspot flounder (*Paralichthys oblongus*) collected in the New York Bight, June 1974 to June 1975. A dash (-) indicates no data available.

Survey Month	Number of Observations	Specimen Size Range (mm)	GONAD-SOMATIC INDEX			
			Mean	Variance	Standard Deviation	Range
<u>1974</u>						
June	6	244-330	6.19	2.34	1.53	4.63- 8.87
July	28	153-318	6.22	2.92	1.71	3.45-10.07
August	31	224-347	4.05	2.31	1.52	1.53- 7.54
September	25	233-356	2.45	1.28	1.13	1.35- 6.23
October	36	240-374	1.75	0.42	0.65	1.15- 4.90
November	82	194-386	1.32	0.21	0.46	0.37- 2.11
<u>1975</u>						
February	64	214-403	1.52	0.29	0.54	0.48- 2.73
March	33	202-405	1.92	0.62	0.79	0.69- 3.27
April	41	251-395	2.85	1.39	1.18	0.59- 5.72
May	81	242-419	4.59	4.45	2.11	0.53-12.38
June	34	208-359	7.34	13.32	3.65	0.40-13.98

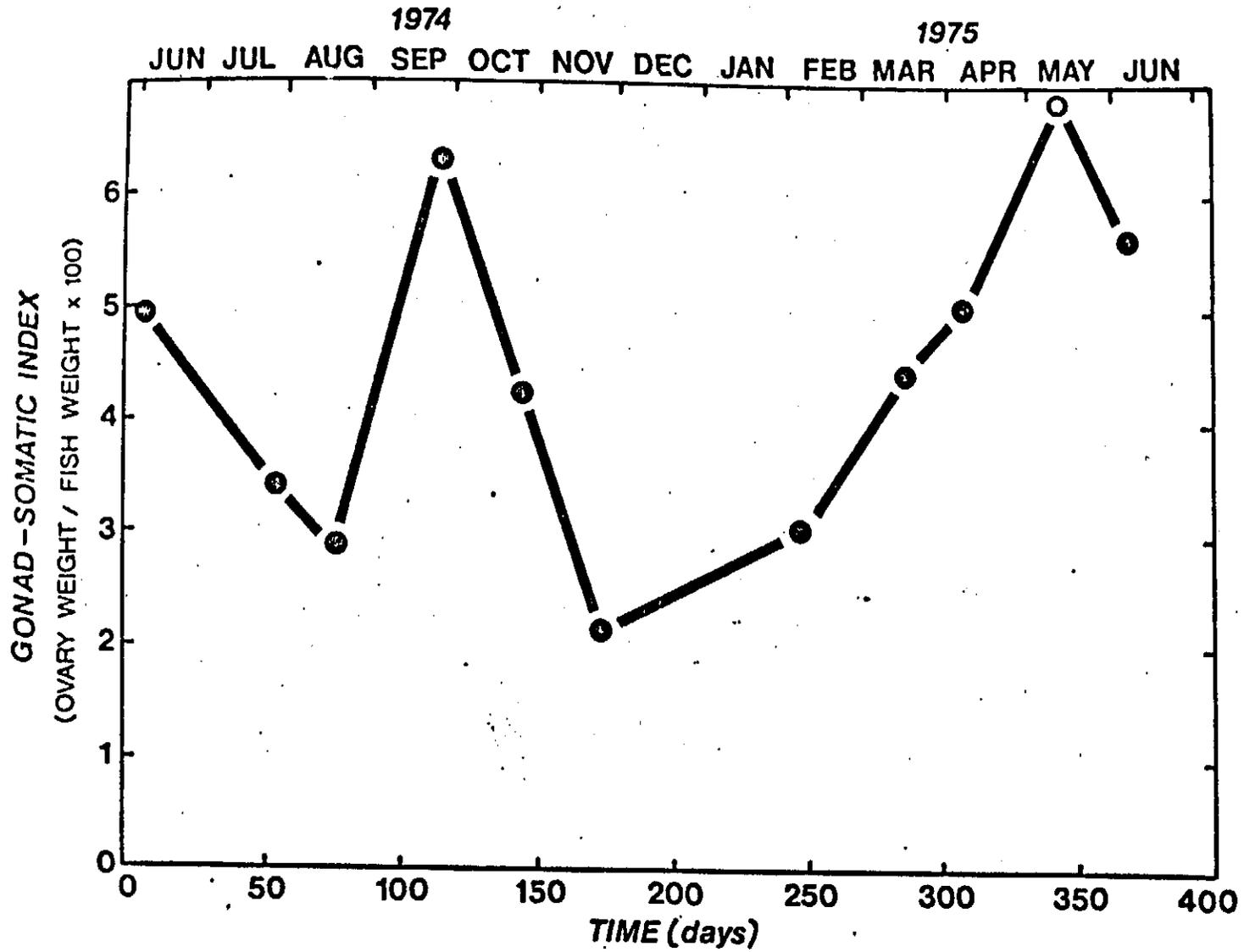


FIGURE 16. Monthly gonad-somatic indices for windowpane (Scophthalmus aquosus) collected in the New York Bight, June 1974 to June 1975.

TABLE 14. Monthly summary of gonad-somatic data for windowpane (*Scophthalmus aquosus*) collected in the New York Bight, June 1974 to June 1975. A dash (-) indicates no data available.

Survey Month	Number of Observations	Specimen Size Range (mm)	GONAD-SOMATIC INDEX			
			Mean	Variance	Standard Deviation	Range
1974						
June	63	227-330	4.98	8.76	2.96	0.90-12.73
July	106	213-332	3.43	3.96	1.99	0.55-10.14
August	133	218-323	2.87	1.93	1.39	0.53- 6.96
September	151	176-356	6.37	8.76	2.96	0.69-16.63
October	162	164-340	4.32	5.90	2.43	0.63-13.36
November	246	178-341	2.16	1.28	1.13	0.20- 5.72
1975						
February	230	186-352	3.08	2.82	1.68	0.52-10.92
March	127	180-343	4.54	6.66	2.58	0.59-11.52
April	172	195-369	5.08	10.76	3.28	0.52-18.57
May	175	149-366	7.00	20.79	4.56	0.24-16.13
June	151	179-341	5.74	7.84	2.80	0.39-12.90

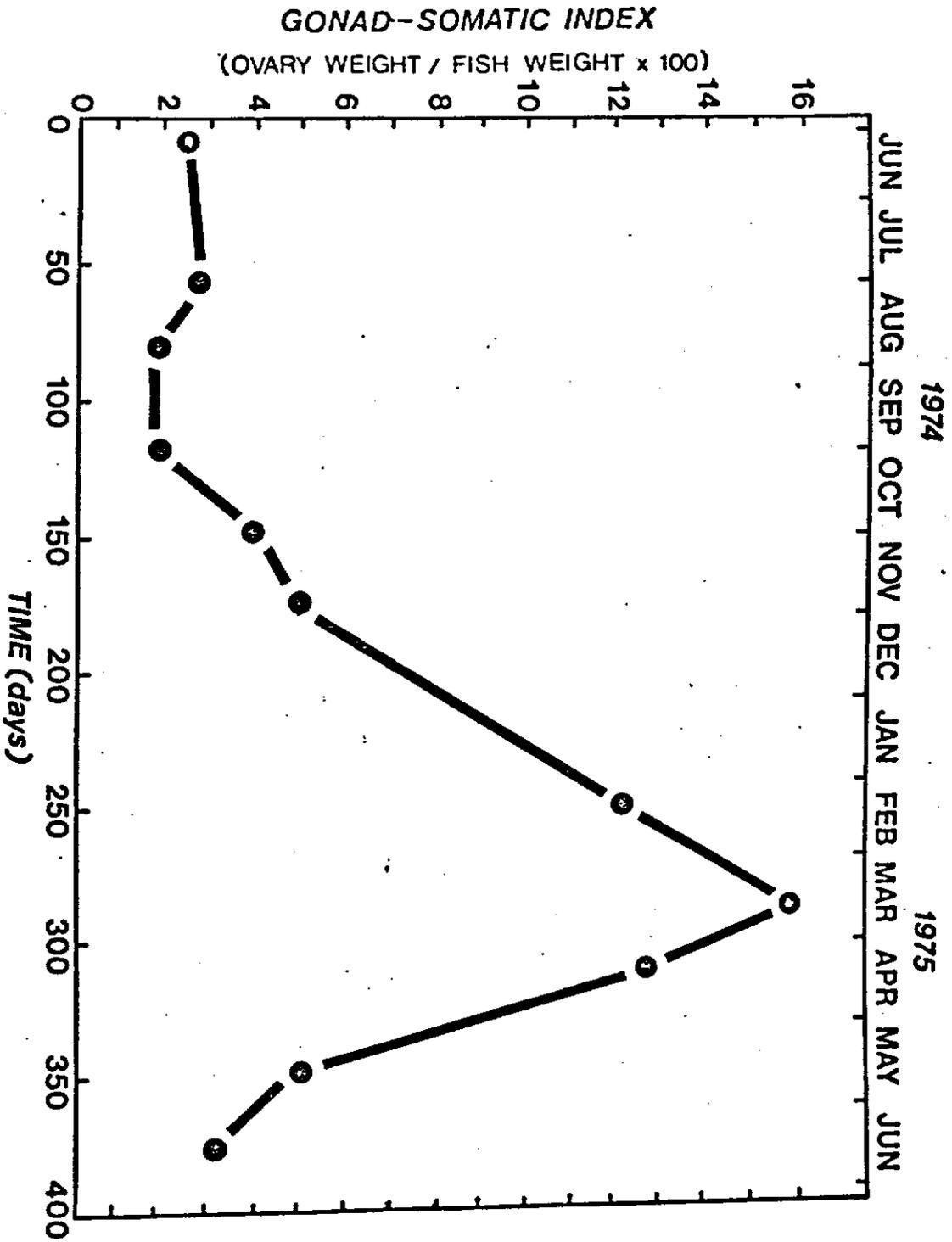


FIGURE 17. Monthly gonad-somatic indices for yellowtail flounder (*Limanda ferruginea*) collected in the New York Bight, June 1974 to June 1975.

TABLE 15. Monthly summary of gonad-somatic data for yellowtail flounder (*Limanda ferruginea*) collected in the New York Bight, June 1974 to June 1975.
A dash (-) indicates no data available.

Survey Month	Number of Observations	Specimen Size Range (mm)	GONAD-SOMATIC INDEX			
			Mean	Variance	Standard Deviation	Range
<u>1974</u>						
June	10	268-368	2.61	0.94	0.97	0.58- 3.98
July	2	335-345	2.81	0.31	0.56	2.41- 3.21
August	4	136-384	1.90	0.74	0.86	0.96- 2.96
September	20	173-381	1.81	1.96	1.40	0.34- 3.94
October	12	291-382	4.05	1.77	1.33	1.38- 6.80
November	36	224-380	5.00	2.99	1.73	0.44- 8.21
<u>1975</u>						
February	220	204-422	12.00	22.47	4.74	0.39-23.85
March	48	269-401	15.81	45.56	6.75	2.25-27.09
April	120	254-420	12.87	82.63	9.09	0.47-30.23
May	113	189-409	5.13	35.28	5.94	0.26-27.04
June	47	274-393	3.28	1.44	1.20	0.39- 5.57

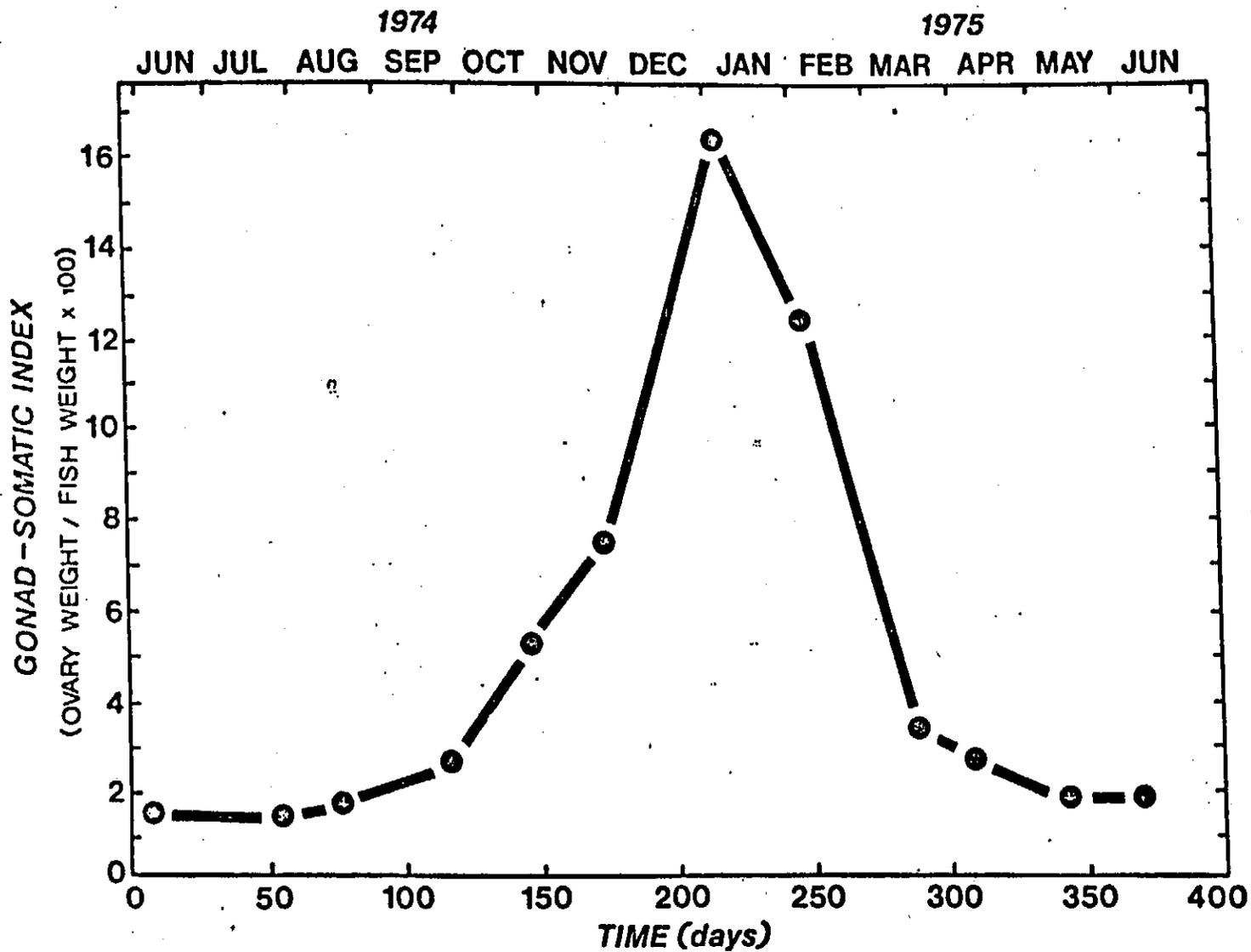


FIGURE 18. Monthly gonad-somatic indices for winter flounder (Pseudopleuronectes americanus) collected in the New York Bight, June 1974 to June 1975.

TABLE 16. Monthly summary of gonad-somatic data for winter flounder (*Pseudopleuronectes americanus*) collected in the New York Bight, June 1974 to June 1975. A dash (-) indicates no data available.

Survey Month	Number of Observations	Specimen Size Range (mm)	GONAD-SOMATIC INDEX			
			Mean	Variance	Standard Deviation	Range
<u>1974</u>						
June	120	175-375	1.47	0.48	0.69	0.42- 3.70
July	58	177-362	1.45	0.41	0.64	0.38- 3.06
August	16	196-344	1.61	0.46	0.68	0.26- 2.98
September	19	173-346	2.57	2.82	1.68	0.96- 6.16
October	107	174-397	5.11	7.02	2.65	0.45-12.48
November	174	99-393	7.35	14.44	3.80	0.41-17.21
<u>1975</u>						
January	5	218-316	16.25	15.78	3.97	12.29-21.40
February	128	192-416	12.52	87.24	9.34	0.18-28.77
March	35	211-399	3.20	16.24	4.03	0.09-21.27
April	89	132-370	2.71	15.76	3.97	0.48-20.84
May	158	163-361	1.80	0.92	0.96	0.36- 4.41
June	164	137-399	1.83	23.72	4.87	0.25- 3.91

Summary of published literature relative to reproductive cycles as well as results of the 1974 to 1975 Middle Atlantic Bight study.

Species	Author(s)	Study Area(s)	Spawning Times
<u>pseudoharengus</u>	Clayton et al. (1978)	Parker River, Massachusetts	Mid-April through June
	Gusey (1976)	Parker River, Massachusetts	Mid-April through June
	Hildebrand and Schroeder (1928)	Chesapeake Bay	Spring
	Kissil (1974)	Bride Lake, Connecticut	March through June
	Leim and Scott (1966)	Atlantic coast of Canada	May
	Norden (1967)	Milwaukee Harbor	July and August
	Ode11 (1934)	Seneca Lake, New York	Late May, early June, through mid-August
	Pritchard (1929)	Lake Ontario	July and August
	Present study	Middle Atlantic Bight	February through May; peak spawning in April
OFFSHORE HAKE <u>Merluccius albidus</u>	Rohr and Gutherz (1977)	New England	April through July
	Colton et al. (1978)	Middle Atlantic Bight	June through September
	Present study	Middle Atlantic Bight	April through August; peak spawning in June
SILVER HAKE <u>Merluccius bilinearis</u>	Bigelow (1917)	Gulf of Maine, Nova Scotia	June through September; peak spawning in July and August

TABLE 17 (continued)

Species	Author(s)	Study Area(s)	Spawning Times
SILVER HAKE (cont.)	Bigelow and Schroeder (1953)	1) Gulf of Maine: outer part of Nova Scotia to Sable Island	1) June through August
		2) Long Island	2) May, June and July
	Bigelow and Welsh (1925)	Gulf of Maine	June through October
	Clayton et al. (1978)	New England to Mid-Atlantic coast	Late spring and summer
	Colton et al. (1978)	1) Northeast Georges Bank and central Gulf of Maine	1) June through October; peak spawning in July and August
		2) Southern Georges Bank	2) May through October; peak spawning in May and June
		3) Nantucket Shoals - Virginia	3) June through December; peak spawning in June
	Colton and Temple (1961)	Georges Bank	May through July
	Fahay (1974)	Middle Atlantic shelf	May through November; peak spawning in June
	Herman (1963)	Narragansett Bay	June through September
Hildebrand and Schroeder (1928)	New England Coast	June through October; peak spawning in July and August	
Leim and Scott (1966)	Middle Ground and Sable Island Bank, off Nova Scotia to off Cape May at the mouth of the Delaware Bay	June through September	

(continued)

	Author(s)	Study Area(s)	Spawning Times
1967 (cont.)	Sarnits and Sauskan (1967)	West bar of Sable Island	June through August
1967 (cont.)	Present study	Middle Atlantic Bight	June through October; peak spawning in September
1967 (cont.)	Bigelow and Schroeder (1953)	Ipswich Bay	July
1967 (cont.)	Colton and Temple (1961)	Georges Bank	June through September
1967 (cont.)	Colton et al. (1978)	1) South Georges Bank, Nantucket Shoals	1) May through September; peak spawning in June and July
1967 (cont.)		2) Middle Atlantic Bight	2) May through October; peak spawning in June and July
1967 (cont.)	Gusey (1976)	Gulf of Saint Lawrence to North Carolina	June through September
1967 (cont.)	Hildebrand and Schroeder (1928)	1) Massachusetts Bay region	1) Early summer
1967 (cont.)		2) Southeastern Nova Scotia	2) June
1967 (cont.)	Leim and Scott (1966)	1) Southern Gulf of Saint Lawrence	1) Mid-summer
1967 (cont.)		2) Southeastern Nova Scotia	2) Early autumn
1967 (cont.)		3) Bay of Fundy	3) Winter or spring
1967 (cont.)	Musick (1969)	Northern part of Middle Atlantic Bight	May through September
1967 (cont.)	Perlmutter (1939)	Long Island waters	May through September
1967 (cont.)	Present study	Middle Atlantic Bight	June through September; peak spawning in August

TABLE 17 (continued)

Species	Author(s)	Study Area(s)	Spawning Times
SPOTTED HAKE <u>Urophycis regius</u>	Barans (1969)	Chesapeake Bight	October
	Barans and Barans (1972)	Mid-Atlantic Bight	Late September through November
	Bigelow and Schroeder (1953)	Coast of Carolinas	December
	Colton et al. (1978)	New York Bight-Cape Hatteras	January through May and August through December; peak spawning in October
	Present study	Middle Atlantic Bight	February through April; peak spawning in March. Also August through October; peak spawning in September
OCEAN POUT <u>Macrozoarces americanus</u>	Bigelow and Schroeder (1953)	Gulf of Maine	September and October
	Clayton et al. (1978)	1) Bay of Fundy	1) Mid-September through November
		2) New York-New Jersey	2) Late October through December
	Leim and Scott (1966)	Atlantic coast of Canada	Autumn
	Present study	Middle Atlantic Bight	August

TABLE 17 (continued)

Species	Author(s)	Study Area(s)	Spawning Times
BLACK SEA BASS <u>Centropristis</u> <u>striata</u>	Bean (1903)	Woods Hole area	June
	Bigelow and Schroeder (1953)	1) North Carolina coast	1) May
		2) Off New Jersey, Long Island, southern New England	2) Mid-May through June
	Hildebrand and Schroeder (1928)	1) North Carolina coast	1) May
		2) Chesapeake mouth	2) Late May
		3) New Jersey, Long Island, southern New England coasts	3) Mid-May through June
	Kendall (1977)	1) Chesapeake Bay	1) Late May
2) Southern New England		2) Early summer	
Perlmutter (1939)	Long Island waters	Mid-May through June	
Present study	Middle Atlantic Bight	June through August	
BUTTERFISH <u>Peprilus triacanthus</u>	Bigelow and Schroeder (1953)	Gulf of Maine	June through August; peak spawning in July
	Colton et al. (1978)	1) Southwest Georges Bank, Nantucket Shoals	1) May through August; peak spawning in June and July
2) Middle Atlantic Bight		2) May through October; peak spawning in July and August	

(continued)

Species	Author(s)	Study Area(s)	Spawning Times
NORTHERN SEAROBIN (cont.)	Croker (1965)	Sandy Hook Bay	July
	Herman (1963)	Narragansett Bay	May through August
	Hildebrand and Schroeder (1928)	Chesapeake Bay	June and July
	Kawhara (1978)	Gulf of Maine, Georges Bank, southern New England, Middle Atlantic Bight	April or May through August
	Leim and Scott (1966)	1) Gulf of Maine 2) Saint Mary's Bay	1) June through August 2) July
	Murawski et al. (1978)	1) Chesapeake Bay 2) Gulf of Maine	1) May through June 2) June through August; peak spawning in July
	Pearson (1941)	Chesapeake Bay	June and July
	Present study	Middle Atlantic Bight	May through August; peak spawning in June
NORTHERN SEAROBIN <u>Prionotus carolinus</u>	Bigelow and Schroeder (1953)	1) Woods Hole area 2) Off England coast	1) June through September; peak spawning in July and August 2) April and May
	Clayton et al. (1978)	Woods Hole, Massachusetts	June through September
	Colton et al. (1978)	Block Island to Cape Hatteras	May through November

TABLE 17 (continued)

Species	Author(s)	Study Area(s)	Spawning Times
NORTHERN SEAROBIN (cont.)	Herman (1963)	Narragansett Bay	June through August
	Hildebrand and Schroeder (1928)	1) Beaufort, North Carolina 2) Woods Hole, Massachusetts	1) Spring 2) June through August
	Leim and Scott (1966)	Off New England	June through August
	Nichols and Breder (1926)	New York	June through August
	Roberts (1978)	1) Chesapeake Bight 2) Woods Hole, Massachusetts	1) July through September 2) June through August
	Present study	Middle Atlantic Bight	April through August; peak spawning in July
STRIPED SEAROBIN <u>Prionotus evolans</u>	Herman (1963)	Narragansett Bay	June through August
	Perlmutter (1939)	Long Island	May through July
	Present study	Middle Atlantic Bight	May through August; peak spawning in June
SUMMER FLOUNDER <u>Paralichthys dentatus</u>	Bigelow and Schroeder (1953)	Eastern coast	Late autumn, winter, early spring
	Colton et al. (1978)	1) Nantucket Shoals - south 2) Middle Atlantic Bight	1) January through April and October through December 2) January through April and September through December; peak spawning in October

Species	Author(s)	Study Area(s)	Spawning Times
SUMMER FLOUNDER (cont.)	Gusey (1976)	Cape Cod, Massachusetts to Cape Lookout, North Carolina	September through November
	Leim and Scott (1966)	Cape Cod area	Early spring
	Smith (1973)	1) Northern part of Mid-Atlantic Bight 2) Chesapeake Bay 3) South of Chesapeake Bay	1) Early September through February 2) Peak spawning in October 3) Peak spawning in November
	Smith et al. (1975)	1) North of Chesapeake Bay 2) South of Chesapeake Bay	1) September through December 2) November through February
	Present study	Middle Atlantic Bight	October through February
FOURSPOT FLOUNDER <u>Paralichthys</u> <u>oblongus</u>	Bigelow and Schroeder (1953)	Gulf of Maine, including Georges Bank	May through mid-July
	Colton et al. (1978)	1) Nantucket Shoals-south 2) Middle Atlantic Bight	1) May through July 2) May through October; peak spawning in July
	Herman (1963)	Narragansett Bay	May
	Leonard (1971)	36°00' to 38°00' north latitude to 80 miles offshore, and Norfolk Canyon	June through August
	Present study	Middle Atlantic Bight	May through August; peak spawning in June

TABLE 17. (continued)

Species	Author(s)	Study Area(s)	Spawning Times
WINDOWPANE <u>Scophthalmus aquosus</u>	Bigelow and Schroeder (1953)	1) Gloucester 2) Woods Hole, Massachusetts 3) Long Island Sound	1) Late June 2) May and June 3) May through August
	Colton et al. (1978)	1) Georges Bank, Nantucket Shoals-south 2) Middle Atlantic Bight	1) May through August 2) April through December; peak spawning in October
	Croker (1965)	Sandy Hook Bay	May and June
	Hildebrand and Schroeder (1928)	Gulf of Maine	Late spring and summer
	Leim and Scott (1966)	Gulf of Saint Lawrence	Late spring, early summer
	Perlmutter (1939)	Long Island waters	May through August
	Smith et al. (1975)	South of Chesapeake Bay	April through June
	Present study	Middle Atlantic Bight	Bimodal with peaks in May and September
YELLOWTAIL FLOUNDER <u>Limanda ferruginea</u>	Bigelow and Schroeder (1953)	Isles of Shoals-Boone	Mid-March through August
	Colton and Temple (1961)	Georges Bank	May through July
	Colton et al. (1978)	1) Browns Bank 2) Middle Atlantic Bight	1) May through July; peak spawning in June 2) April through August; peak spawning in May and June

TABLE 17 (continued)

Species	Author(s)	Study Area(s)	Spawning Times
YELLOWTAIL FLOUNDER (cont.)	Gusey (1976)	General	Spring
	Hildebrand and Schroeder (1928)	New England coast	Summer
	Leim and Scott (1966)	1) Middle ground	1) June and early July
		2) Cape Cod	2) Mid-April through July
	Smith et al. (1975)	North Carolina to eastern tip of Long Island	March through June
	Present study	Middle Atlantic Bight	February through April; peak spawning in March
WINTER FLOUNDER <u>Pseudopleuronectes</u> <u>americanus</u>	Bigelow and Schroeder (1953)	1) New England	1) January through May; peak spawning in February and March
		2) Gulf of Maine-Boothbay, Maine	2) March through May; peak spawning in March and April
	Colton et al. (1978)	Georges Bank	March through June
	Croker (1965)	Sandy Hook Bay	April through June
	Leim and Scott (1966)	1) South of Cape Cod	1) Late winter and spring; peak spawning in February and March
		2) Canadian waters	2) April and May

TABLE 17 (continued)

Species	Author(s)	Study Area(s)	Spawning Times
WINTER FLOUNDER (cont.)	Perlmutter (1939)	Long Island waters	Mid-December through May; peak spawning in January, February, and March
	Present study	Middle Atlantic Bight	November through March; peak spawning in January

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