PRELIMINARY IDENTIFICATION OF SPECIES GROUPS IN THE DEMERSAL FISH FAUNA OF THE NEW YORK BIGHT BASED ON RECURRENT GROUP ANALYSIS

by

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INTRODUCTION

The Sandy Hook Laboratory of the National Marine Fisheries Service conducted a systematic bottom trawl survey between June 1974 and June 1975 of fishes and selected invertebrates occurring in the New York Bight. This study was designed to provide a comprehensive individual species life history as well as a community structure data base necessary for current and anticipated research needs. Herein, results relative to the identification of species groups based on recurrent group analysis of bottom trawl survey data are summarized. The results of this endeavor, 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 species association which may occur in the New York Bight and adjacent areas.

METHODS AND MATERIALS

The New York Bight is defined, for purpose of this paper, as 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 Long Island and New Jersey coastlines are nearly perpendicular. The designated study area was rigidly delineated by two sets of imaginary lines and the 28- and 366-m isobaths to facilitate sampling and data handling (Figure 2). The first set of lines extends seaward from points on Long Island and New York to the 28-m isobath; the second set from the 28-m isobath to the edge of the continental shelf (366 m).

Station locations were selected by a stratified random sampling design (Grosslein, 1969, 1974). 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 km^2 and offshore strata (29-366 m) at a rate of approximately one station per 1,030 km^2.

Research vessels used during this study were 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. LORAN A navigation was the principal method used for station positioning. Radar, land ranges, and visual sightings of buoys were used to position vessels on some of the inshore stations. Fish collections were made with otter trawls towed at approximately 6.5 km/h for 30 min at each station. The trawl used aboard the DELAWARE II was a Yankee No. 36 trawl with a 24.4-m footrope, 18.3-m headrope, and 9.1-m legs. The ALBATROSS IV also used the No. 36 Yankee trawl as well as a No. 41 trawl with a 30.5-m footrope, 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, 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. Table 1 lists dates, vessels, number of stations, and gear type for each collecting interval.

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 supplied to the number and length frequency of the total catch. Additional information relative to sampling design and species abundance

distributions as well as associated hydrographic observations, are given in Wilk et al. (1977).

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.

Recurrent group analysis, i.e. a set of analysis programs for grouping taxa (Fager and Longhurst, 1968), was used in this study to analyze the aforementioned 11 cruises made over 13 months for species groupings. Four computer analysis programs comprised the recurrent group analysis used herein: the first, REGROUP, states that at some specified level (for this study, $\alpha = 0.501$) taxa relate; thus, interrelated species can be placed into groups. The second program, CONNEX, uses the REGROUP and gives significant levels (e.g. 25%, 33%, etc.) of interaction between groups and associates. A third program, AFFIN (Hayes, 1978), shows the affinity indices, i.e. proportioned below any given value (0.50 was used herein, giving the P values shown in Figures 3-13). The fourth, and final program, DOMIN, tests the species dominance within each group. The groups defined in Figures 3-13 are listed in order of rank dominance.

Additional detailed descriptions and applications of recurrent group analysis are given in the following publications: Fager (1957), Sheard (1965), Fager and Longhurst (1968), Venrick (1971), Mearns (1974), Kendall (1975), MacDonald (1975), Renz (1976), Shulenberger (1976, 1977, 1979), Hayes (1978, 1980), Cailliet et al. (1979), Sen Gupta and Hayes (1979), Johnson and Nigrini (1980), and McGowen (1980).

RESULTS AND SUMMARY

Recurrent group analysis results are given in the form of figures for each of the aforementioned 11 collecting intervals (Table 1). Figures 3-13

illustrate species groupings (recurrent groups), associates (single species) of each recurrent group, interaction between recurrent groups and associates, ranking of species in order of dominance within each recurrent group, and the affinities between recurrent groups and associates (percentile).

This preliminary analysis can be summarized as follows: 1) recurrent group analysis provded to be an effective method in recognizing species groups and their associates on a temporal scale; 2) the most widely spread species are clearly identified and generally form the major (first) recurrent group; 3) the analysis clearly identifies deepwater (greater than 183 m) and shelf (less than 183 m) species groupings; 4) the dynamics of the formation and breakdown of species groups is clearly demonstrated on a seasonal basis; and 5) this type of analysis has applications for the detection and understanding of natural and/or man-induced changes in a particular geographical area on a temporal and spatial basis.

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FIGURES

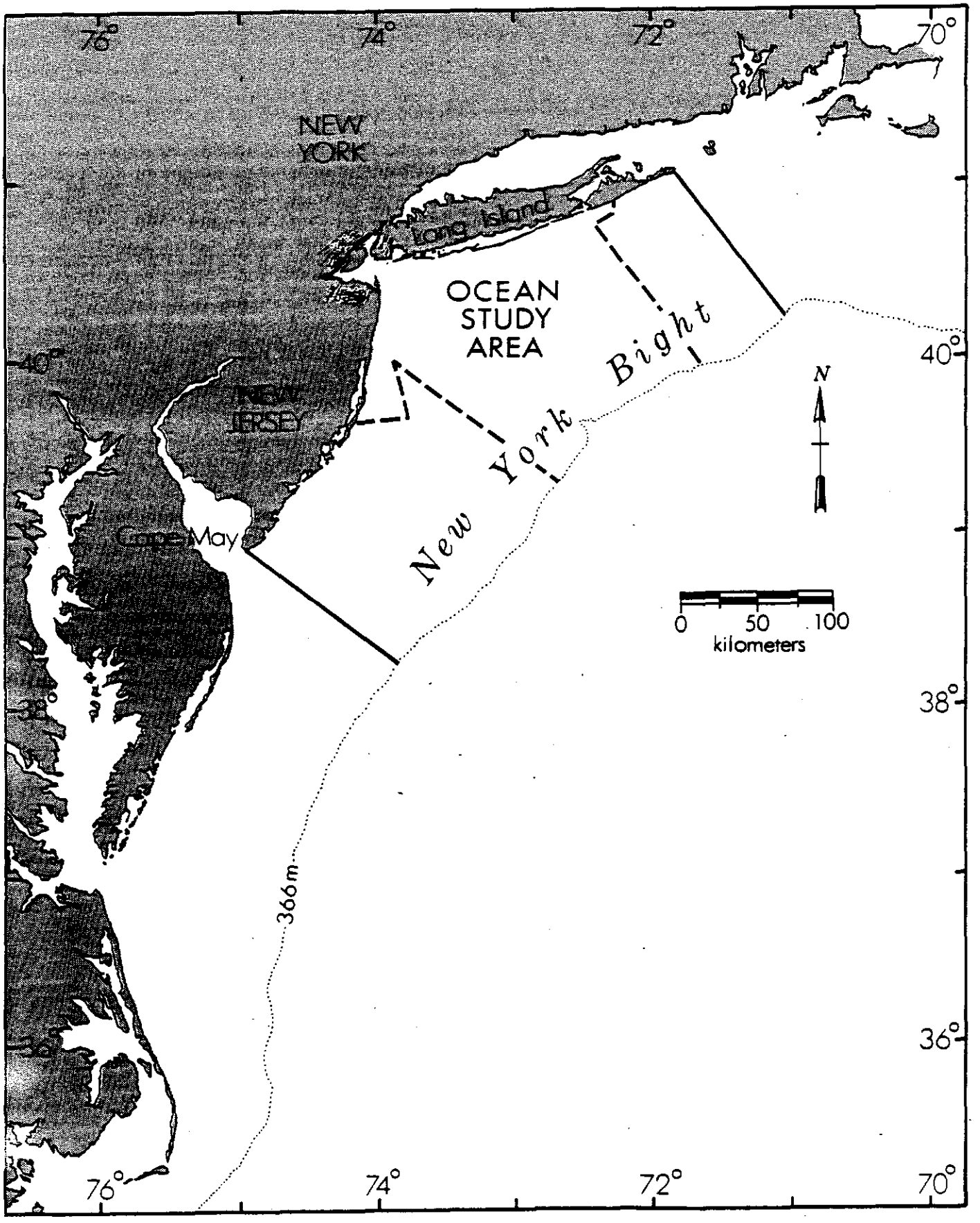

Figure 1.--Middle Atlantic continental shelf with outlines of New York Bight (solid lines) and the study area (dashed lines) within the Bight.

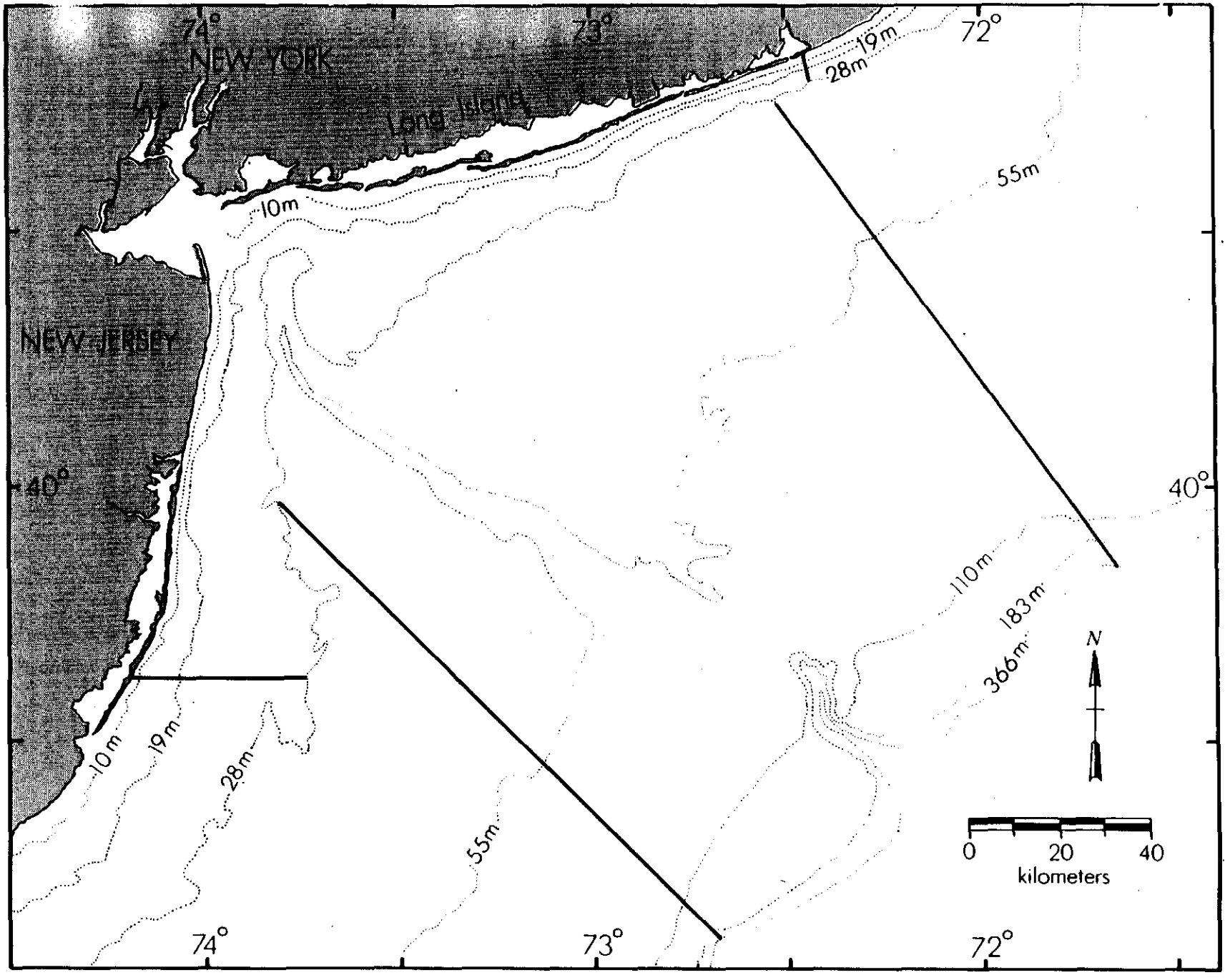

Figure 2.--Study area divided into depth strata where finfishes were sampled during a bottom trawl survey, June 1974 to June 1975.

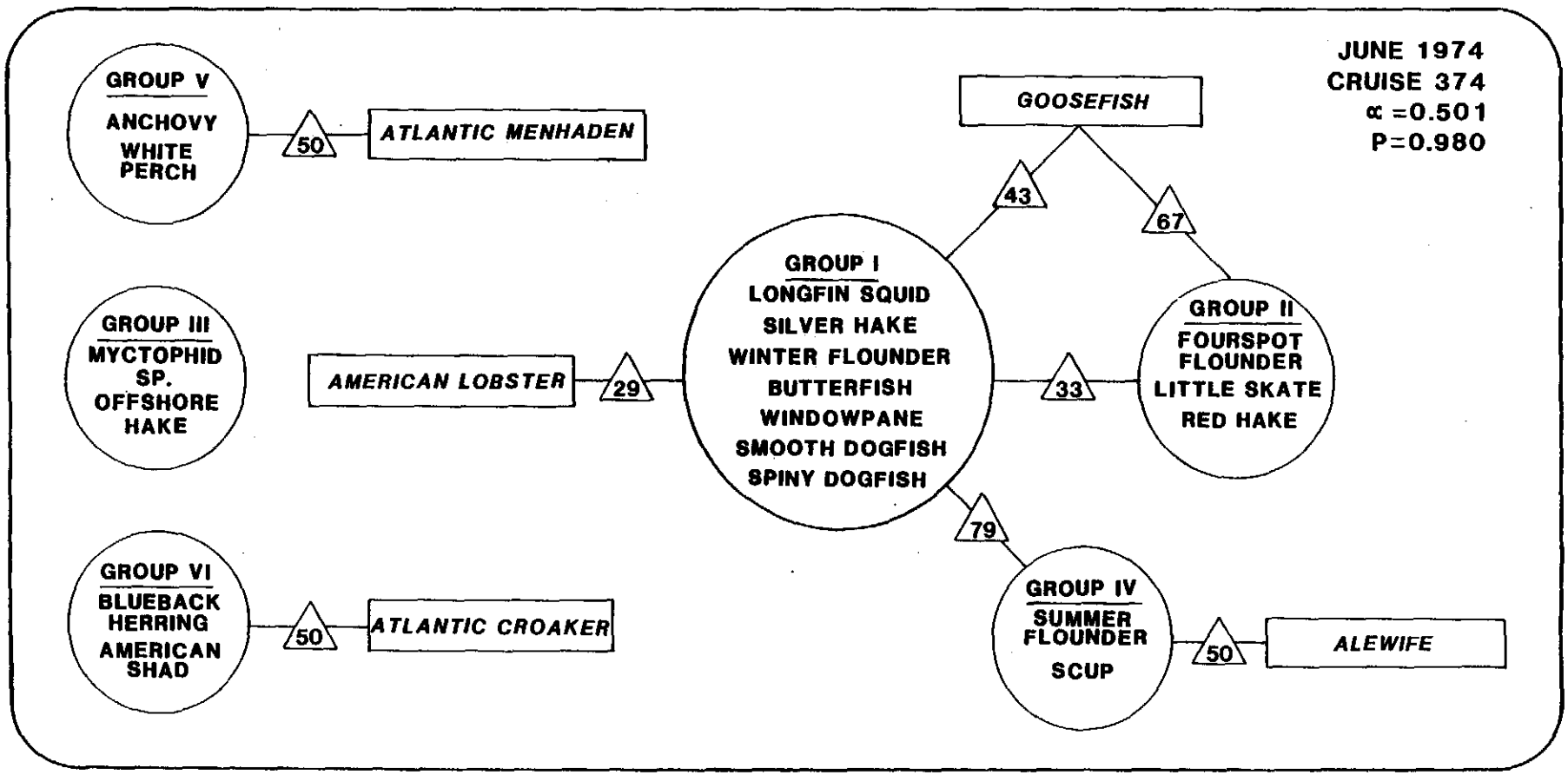

Figure 3.--Recurrent groups (circles) and associates (rectangles) identified from the New York Bight during June 1974. Affinities between groups and associates are given in triangles. Solid lines connecting groups and associates indicate affinities >0.25 and dotted lines affinities <0.25.

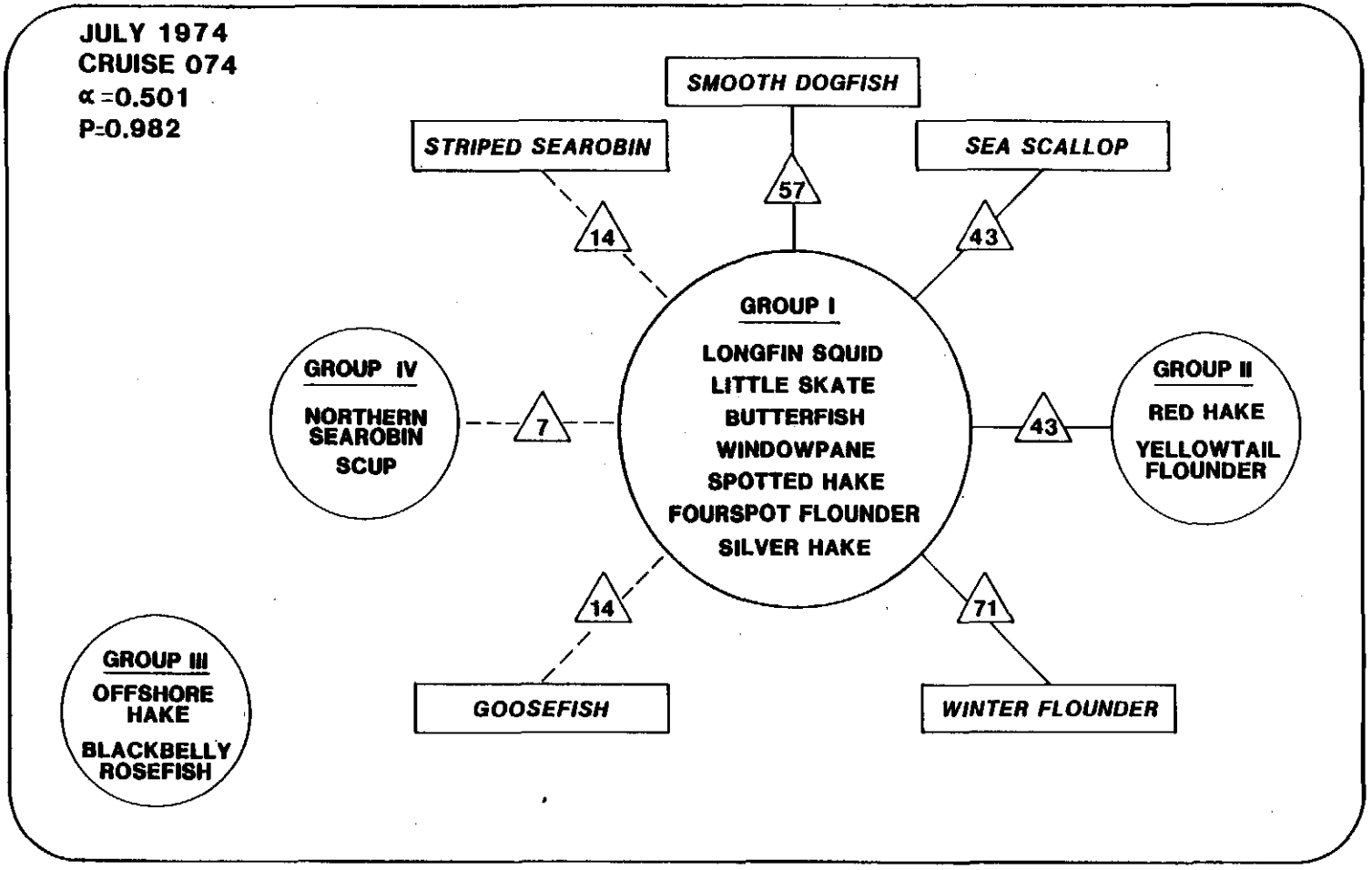

Figure 4.--Recurrent groups (circles) and associates (rectangles) identified from the New York Bight during July 1974. Affinities between groups and associates are given in triangles. Solid lines connecting groups and associates indicate affinities >0.25 and dotted lines affinities <0.25.

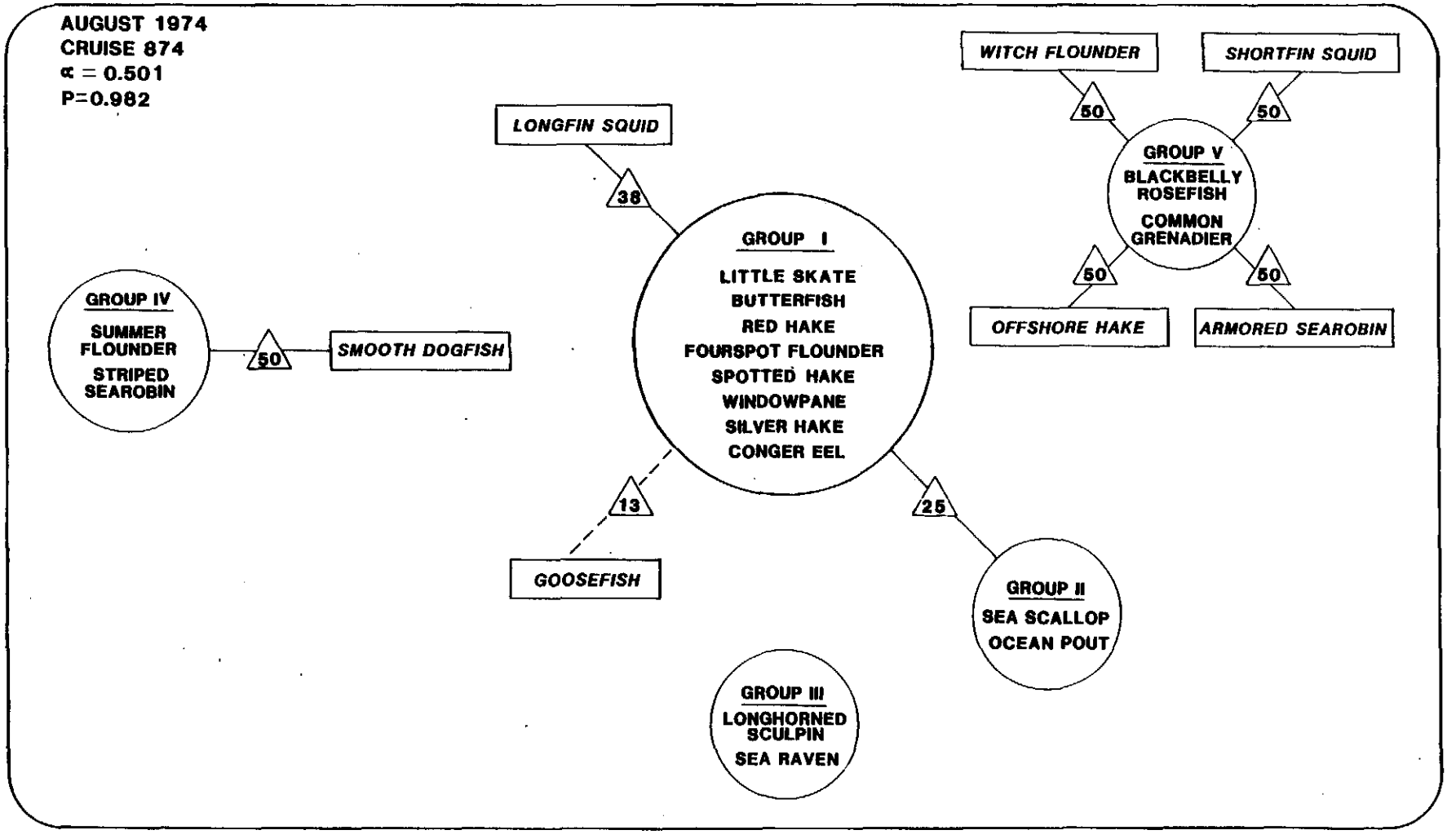

Figure 5.--Recurrent groups (circles) and associates (rectangles) identified from the New York Bight during August 1974. Affinities between groups and associates are given in triangles. Solid lines connecting groups and associates indicate affinities >0.25 and dotted lines affinities <0.25.

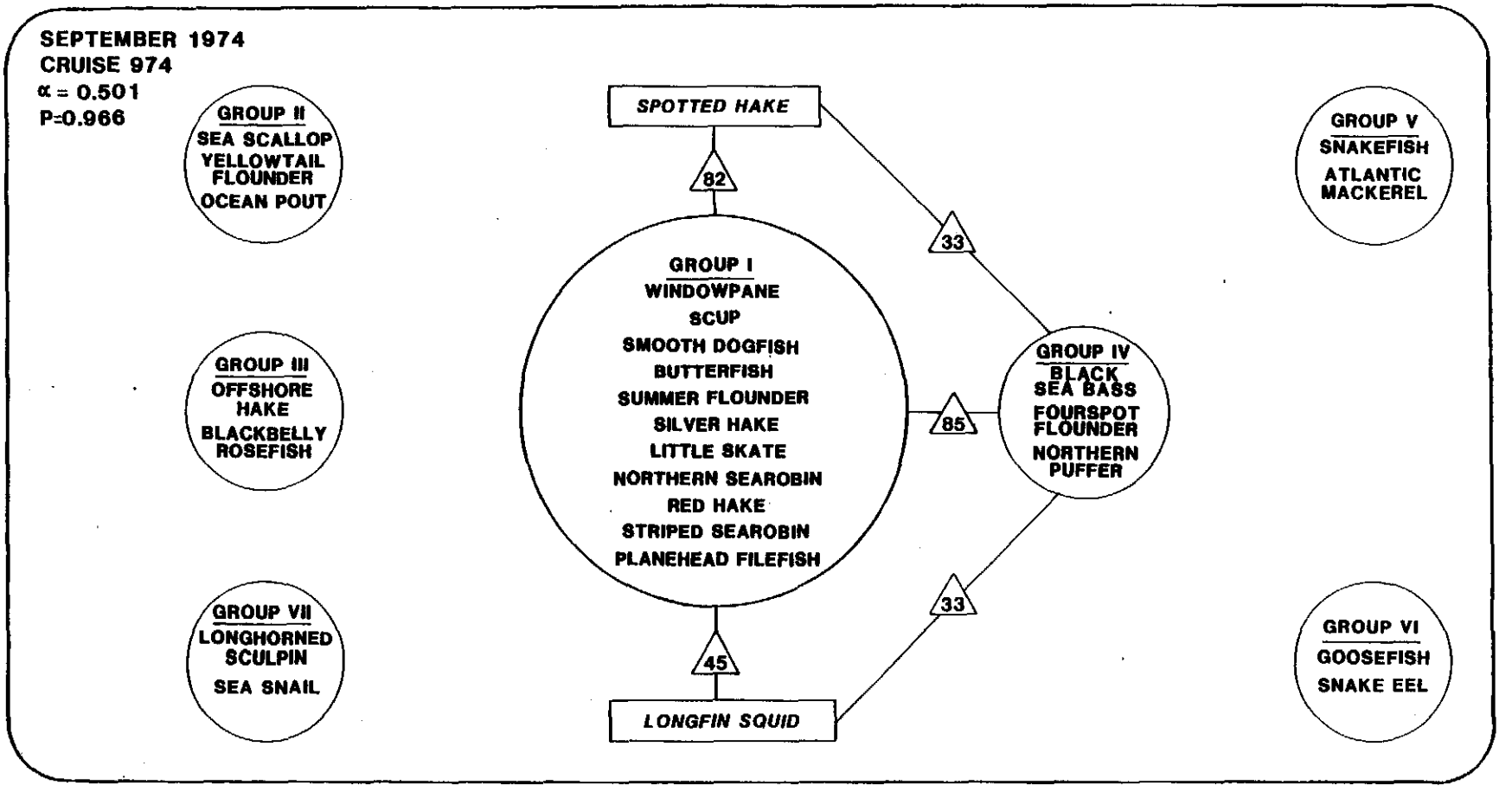

Figure 6.--Recurrent groups (circles) and associates (rectangles) identified from the New York Bight during September 1974. Affinities between groups and associates are given in triangles. Solid lines connecting groups and associates indicate affinities >0.25 and dotted lines affinities <0.25.

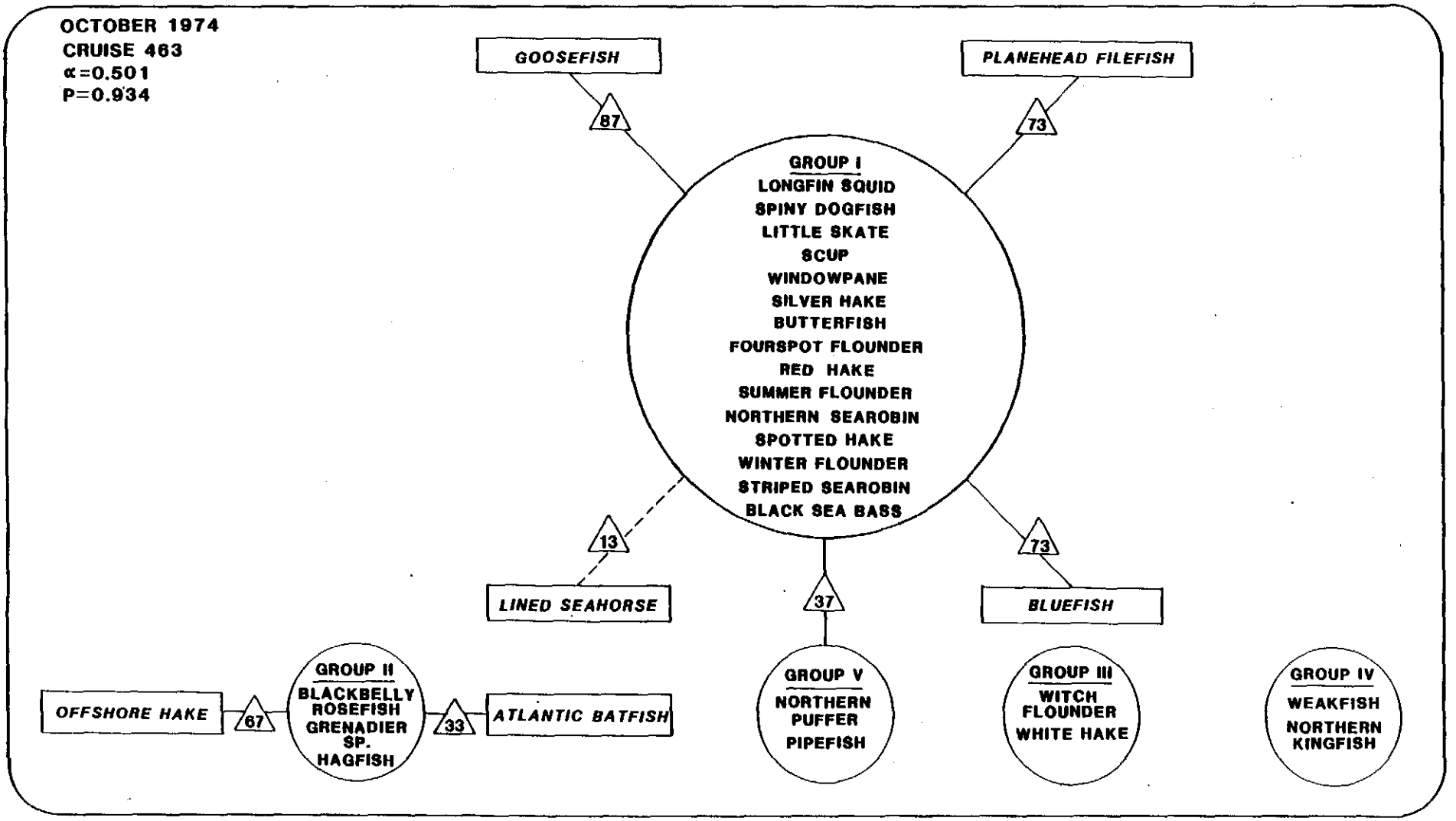

Figure 7.--Recurrent groups (circles) and associates (rectangles) identified from the New York Bight during October 1974. Affinities between groups and associates are given in triangles. Solid lines connecting groups and associates indicate affinities >0.25 and dotted lines affinities <0.25.

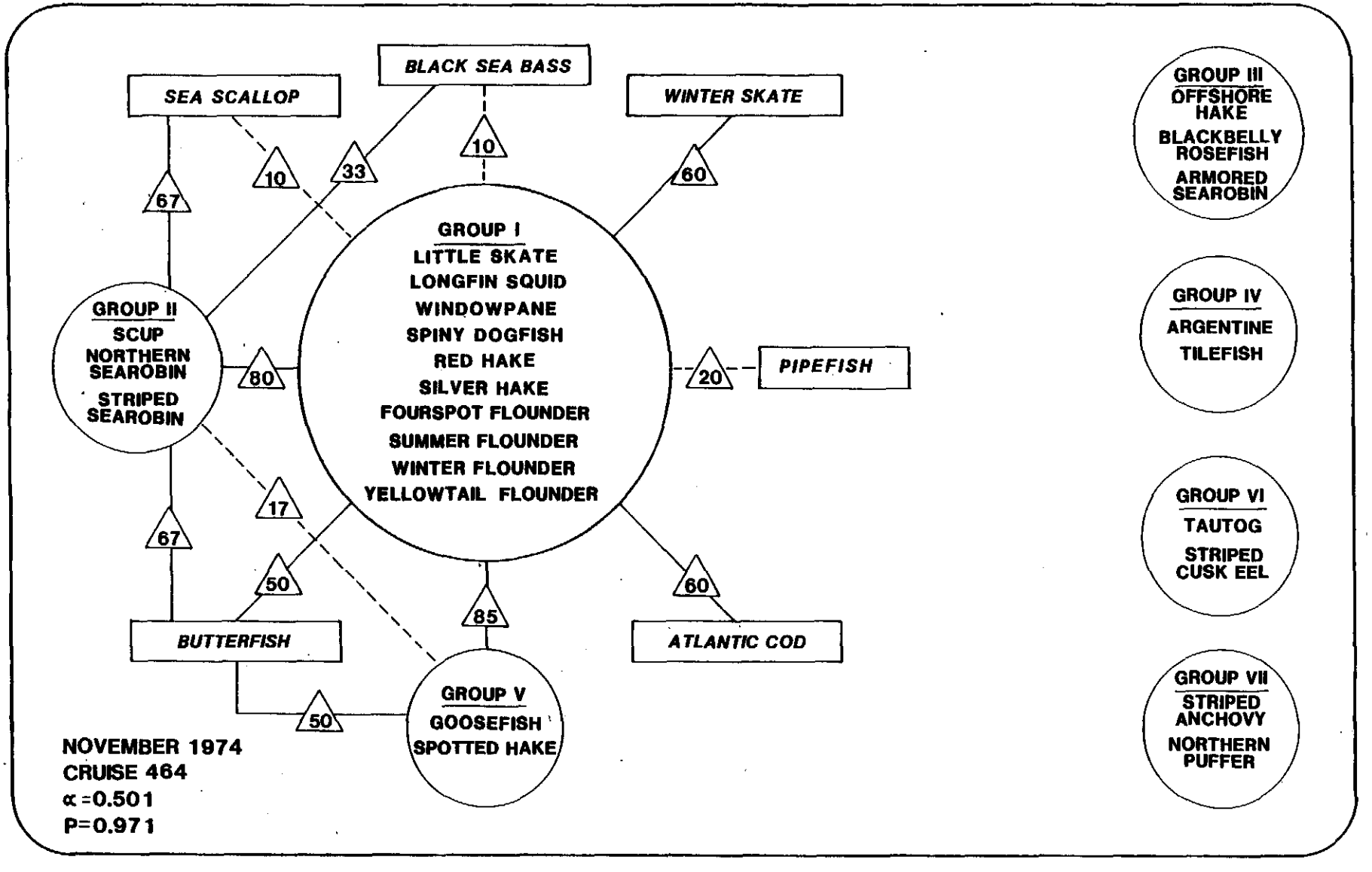

Figure 8.--Recurrent groups (circles) and associates (rectangles) identified from the New York Bight during November 1974. Affinities between groups and associates are given in triangles. Solid lines connecting groups and associates indicate affinities >0.25 and dotted lines affinities <0.25.

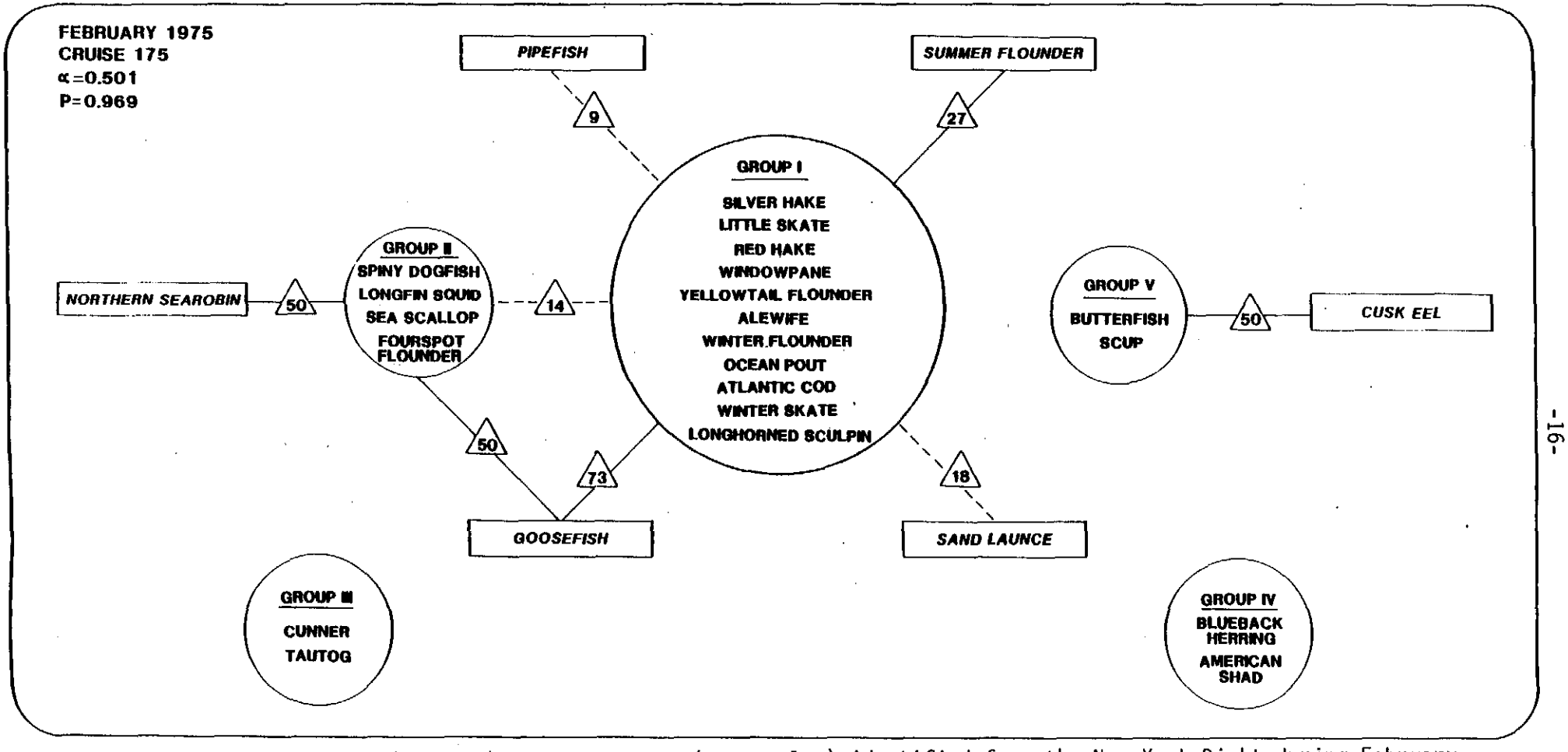

Figure 9.--Recurrent groups (circles) and associates (rectangles) identified from the New York Bight during February 1975. Affinities between groups and associates are given in triangles. Solid lines connecting groups and associates indicate affinities >0.25 and dotted lines affinities <0.25.

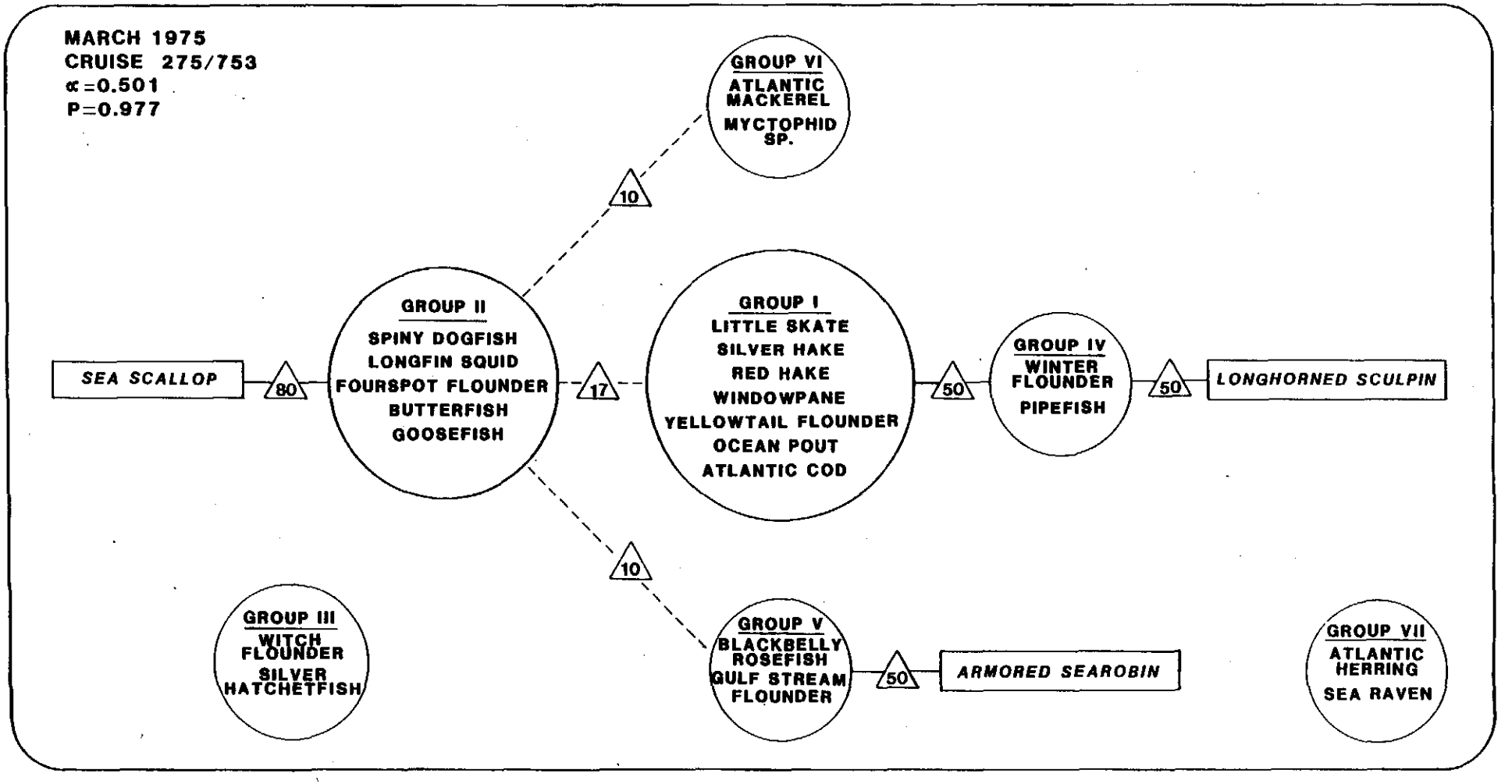

Figure 10.--Recurrent groups (circles) and associates (rectangles) identified from the New York Bight during March 1975. Affinities between groups and associates are given in triangles. Solid lines connecting groups and associates indicate affinities >0.25 and dotted lines affinities <0.25.

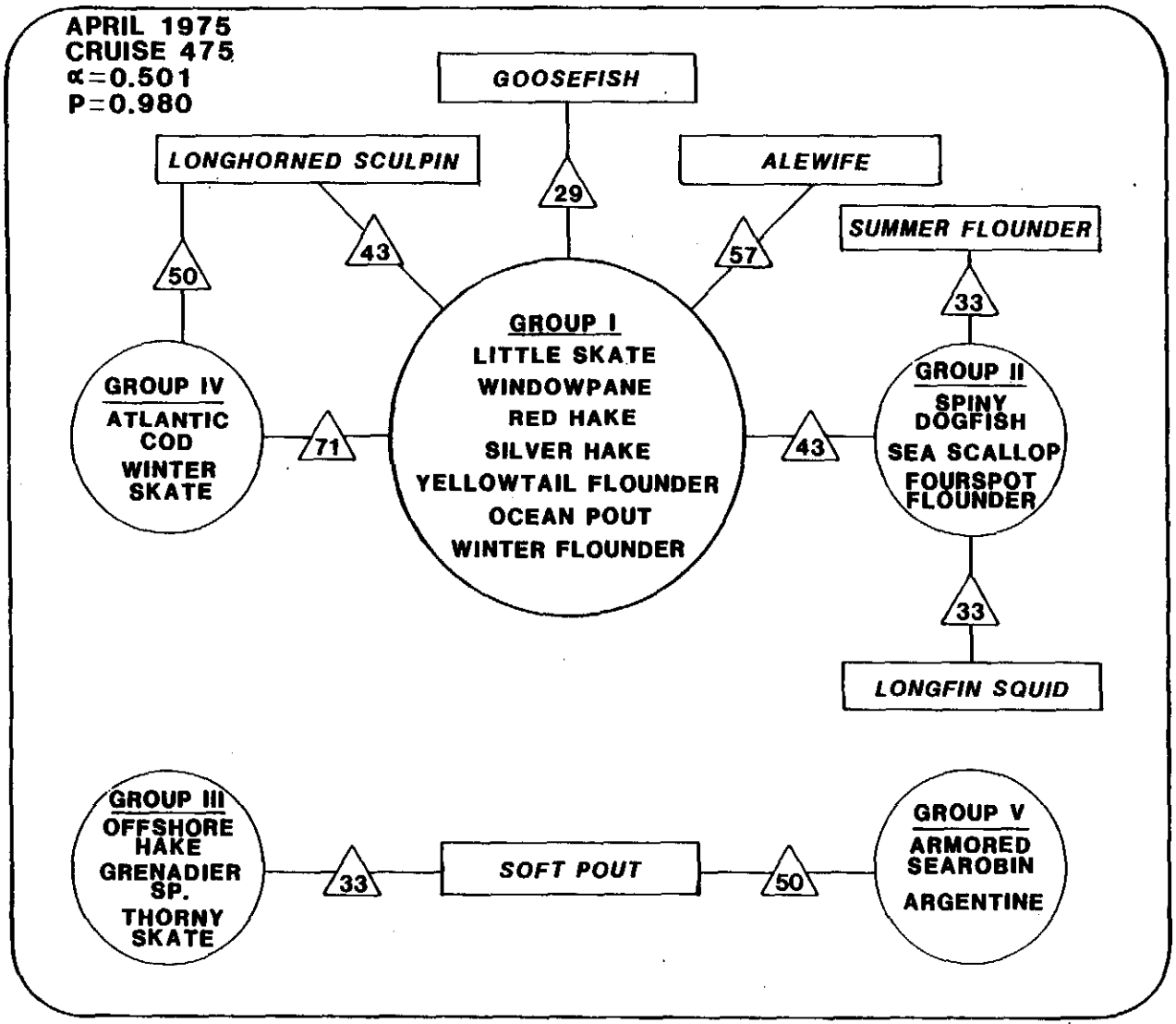

Figure 11.--Recurrent groups (circles) and associates (rectangles) identified from the New York Bight April 1975. Affinities between groups and associates are given in triangles. Solid lines connecting groups and associates indicate affinities >0.25 and dotted lines affinities <0.25.

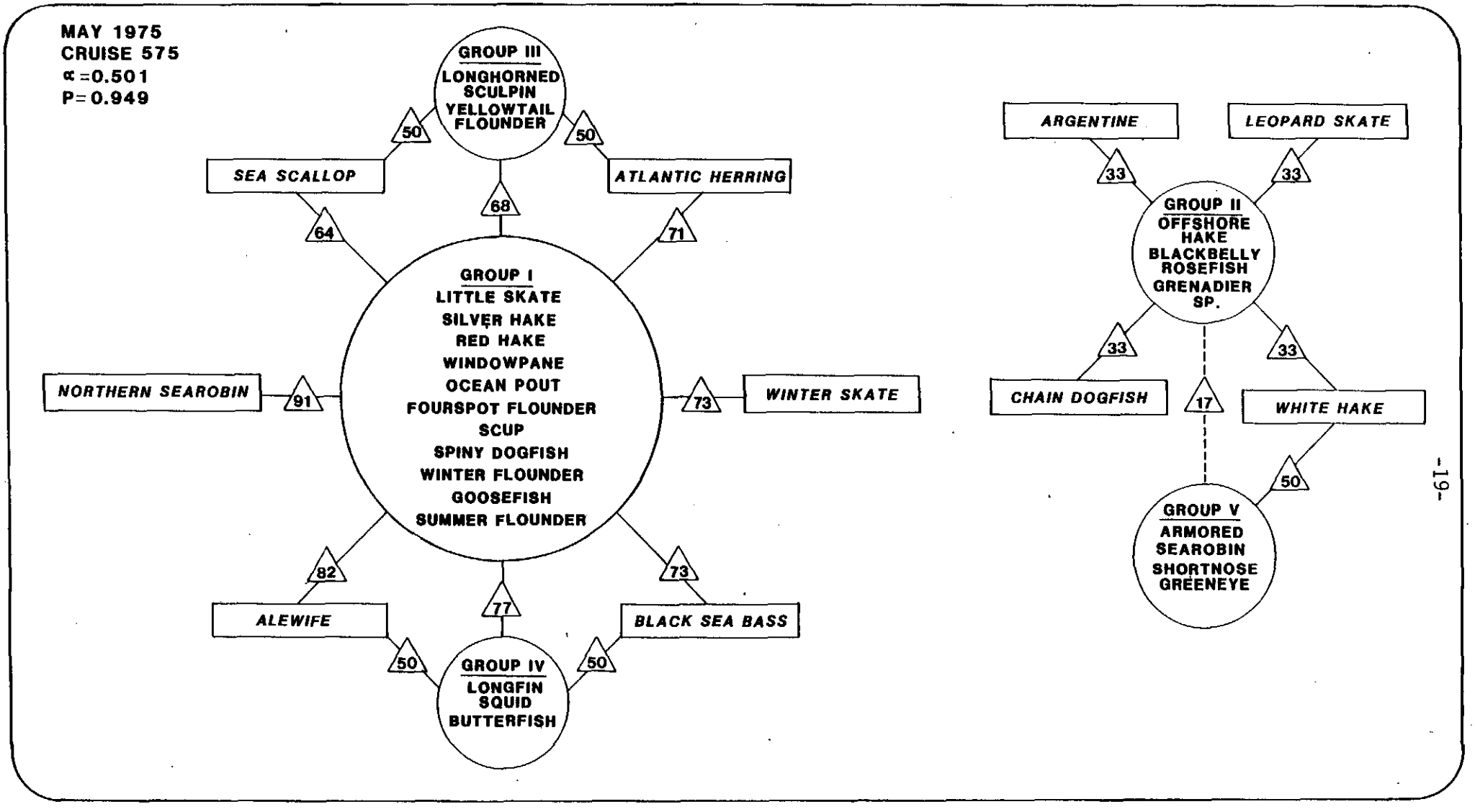

Figure 12.--Recurrent groups (circles) and associates (rectangles) identified from the New York Bight during May 1975. Affinities between groups and associates are given in triangles. Solid lines connecting groups and associates indicate affinities >0.25 and dotted lines affinities <0.25.

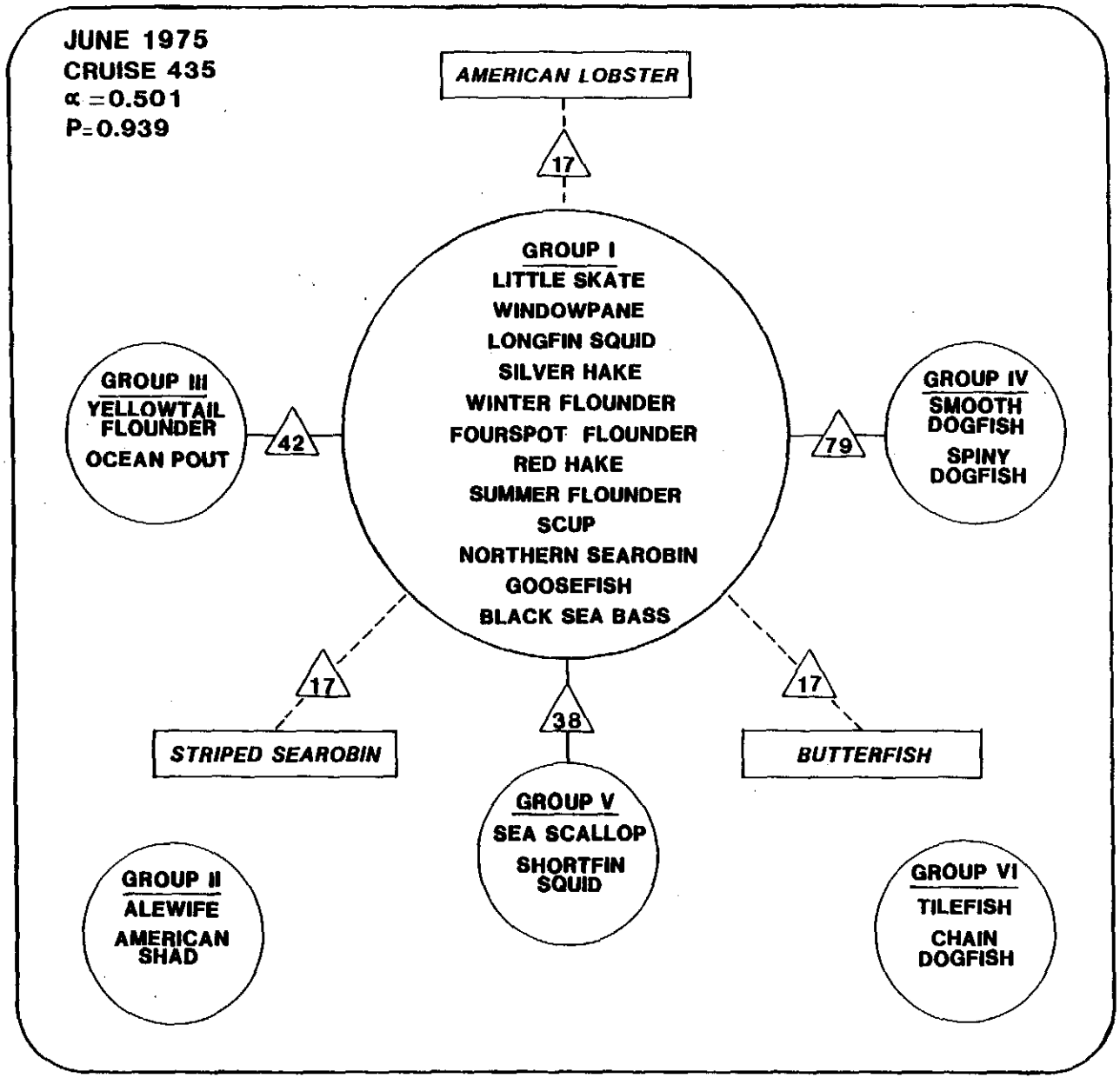

Figure 13.--Recurrent groups (circles) and associates (rectangles) identified from the New York Bight during June 1975. Affinities between groups and associates are given in triangles. Solid lines connecting groups and associates indicate affinities >0.25 and dotted lines affinities <0.25.

TABLE

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

Survey Dates	Cruise Code	Vessel	No. of Stations Sampled	Gear Type
1974				
Jun 3-7	374	DELAWARE II	43	#36 trawl
Jul 24-29	074	DELAWARE II	41	#36 trawl
Aug 16-21	874	DELAWARE II	45	#36 trawl
Sep 23-28	974	DELAWARE II	40	#36 trawl
Oct 22-28	463	DELAWARE II	40	#36 trawl
Nov 18-25	464	DELAWARE II	37	#36 trawl
1975				
Jan 31; Feb 1-6	175	DELAWARE II	51	#36 trawl
Mar 6-8, 10	275/753	ALBATROSS IV	19	#41 trawl
Mar 20-24		ATLANTIC TWIN	27	3/4 Yankee trawl
Apr 1-3, 5-10	475	ALBATROSS IV	48	#36 trawl
May 5-12	575	DELAWARE II	60	#36 trawl
Jun 2-9	435	DELAWARE II	64	#36 trawl
TOTAL			515	