FISH AND FISHERIES ASSOCIATED WITH DEEPWATER DUMPSITE 106

by

Stuart J. Wilk, Antonia C. Morris, and Erin E. Feeney

U. S. Department of Commerce

National Oceanic and Atmospheric Administration

National Marine Fisheries Service

Northeast Fisheries Center

Sandy Hook Laboratory

Highlands, New Jersey 07732

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INTRODUCTION

Deepwater Dumpsite 106 (DWD-106) is located approximately 106 nm (196 km) from Ambrose Lightship; 90 nm (167 km) due east of Cape Henelopen, Delaware; and 32 nm (56 km) due south of the Hudson Submarine Canyon system. The area in question is more specifically defined as being bounded by 38°40'N, 39°00'N, 72°00'W, and 72°30'W (Figure 1). In terms of bathymetry, DWD-106 can generally be described as being located over the lower continental slope and upper continental rise, and is characterized by depths between 1,500 m in the northwest portion of the area to approximately 2,750 m in the southwest corner. At present this area is used for the disposal of chemical wastes from the highly industrialized New York-New Jersey metropolitan area. Additional detailed information describing the bathymetry, bottom morphology, water properties, circulation, and weather conditions of DWD-106 and adjacent areas can be found in U. S. Department of Commerce (1977a).

It is our intent herein to describe the fish and fisheries of an area that could be potentially influenced by dumping at DWD-106 assuming a drift period of 100 days and an initial eddy diameter of 150 km. Figure 1 illustrates the approximately 116,000 km^2 area that could be permanently or temporarily influenced based on the aforementioned drift period and eddy size. The "potential area of influence" will be abbreviated as PAI throughout the remainder of this paper for the sake of brevity.

After an extensive search for existing data or information sources applicable to defining and describing the fish and fisheries resources of this large expanse of ocean, eight rather diverse, but loosely related, data sources were identified as being germane. These sources can be separated into two distinct categories, those that are either synoptic and/or of long duration, and those that are either limited temporally and/or spatially, but nevertheless descriptive of the total area. Included in the former grouping are: 1) governmental records of U.S. commercial catch and value, 2) observed Japanese longline catch and effort, and 3) National Marine Fisheries Service (NMFS) autumn and spring research vessel surveys. Those data sources which fall into the latter grouping include: 1) bio-economic data which describe the New Jersey offshore recreational fishery, 2) tilefish fishery catch and effort information, 3) descriptive information pertinent to fishing grounds utilized by New Jersey commercial and recreational user groups, 4) governmental records of foreign landings and values for the year 1979, and 5) a review of existing literature pertinent to deep-sea fishes associated with DWD-106. These sources, although somewhat diverse in scope and nature, when combined, analyzed, and synthesized should provide the reader with a comprehensive overview of the fish and fisheries associated with DWD-106 and its PAI. It should also be noted, that whenever possible and applicable, dollar and cents estimates of values are given to point out the magnitude of potential economic impact should the resources, in general, and harvesters (i.e. recreational and commercial users) specifically, be adversely affected by dumping at DWD-106.

METHODS AND MATERIALS

The following sections give detailed descriptions of the aforementioned eight data sources with particular reference to collection methodology as well as techniques employed to present, interpret, synthesize, and analyze these data sources in a manner relative to the objectives of this endeavor.

U.S. Commercial Landings and Values

This data set includes 13 consecutive years (1968-1980) of landings and ex-vessel value (i.e. amount paid to fishermen) information for commercially important finfishes and invertebrates. These data are collected at a state level, on a regular and timely basis, by either NMFS Fishery Reporting Specialists or State agents under contract to NMFS. Subsequently, these data are first assigned to statistical reporting areas (i.e. capture locations) based on direct vessel interviews; and second, incorporated into a regional data management system to simplify data handling and retrieval. As a matter of reference, Figure 2 illustrates the statistical reporting areas within the scope of this paper as well as the location of DWD-106 and its associated PAI.

To facilitate the use of these data as a descriptive tool, they were appropriately factored on the basis of the percent the PAI ellipse occupied a given statistical reporting area. In addition, based on first-hand working knowledge of particular fisheries, species were eliminated owing to the fact that they would not occur in the PAI, and therefore should not be included in factored tabulations for specific statistical reporting areas (e.g. surf, soft, and hard clams and menhaden). All relative data were then tabulated on a state-year, year-statistical reporting area, and year-dominant species basis to provide catch and value trends for the PAI. At this point it should be noted: 1)eonly the years 1972-1980 were used in the year-dominated species tabulatione owing to the completeness of those data; and, 2) where given, dollar values have not been adjusted for inflation.

Japanese Longline Fishery - Observed Data

Four years (1978-1981) of longline catch and effort information from Fishery Reporting Zone No. 16, as recorded by U.S. Fisheries Observers stationed aboard Japanese longline vessels, comprise this data set. The particular "Reporting Zone" in question can generally be described as extending from just south of the mouth of Chesapeake Bay to approximately the 40°00'N latitude line off New Jersey, with its offshore boundary being the U.S. 200-mile fisheries conservation zone (FCZ). Figure 3 illustrates the extent and location of Reporting Zone No. 16 as well as DWD-106 and its PAI, which have been superimposed for purposes of this paper.

This data set was selected since it provides the most timely, quantitative, and unbiased series of information relative to tunas, billfishes, sharks, and assorted oceanic finfishes which seasonally frequent this area of the western North Atlantic. An extensive review of additional data along these lines, including research survey cruises, U.S. commercial landings, and foreign catch information, have already been collected, tabulated, analyzed, and presented in previous reports concerning DWD-106 (U.S. Department of Commerce 1977b). In addition, Thompson's (1982) statistical comparison of observed versus reported Japanese longline landings and associated effort adds credence to our choice of data sets pertinent to this particular fishery.

All data were tabulated by year and species and catch-per-unit-effort (CPUE), based on 10,000 hooks fished, calculated for individual species, species groups (i.e. tunas, billfishes, sharks and rays, and other finfish), and all species combined on both a yearly and grand total basis. As a matter of information and reference, these tabulations are based on over two and one-half million hooks fished over the four years represented herein.

NMFS Research Survey Cruises

NMFS, and its predecessor agencies, have conducted routine spring and autumn research vessel surveys over the continental shelf from Nantucket Shoals to Cape Hatteras since 1965. The finfish and invertebrate data collected during these synoptic bottom trawl surveys provide one of the most comprehensive records of seasonal and geographic trends in distribution and abundance, within the scope of this paper, on a species specific as well as community structure bases.

Surveys are based on a stratified random sampling design, thereby providing for; first, a statistically valid sample for population studies; and second, sampling in all trawlable areas down to 365 m and not just in those areas of known resource concentrations. Grosslein (1969, 1974) and more recently Azarovitz (1981) give detailed information and insight pertinent to the rationale, methodology, and history of this survey series.

For the purposes of this paper, cumulative plots, with the location of DWD-106 and its PAI superimposed, were computer generated for spring and autumn trawl survey catches of 24 and six selected species of finfish and invertebrates respectively. These plots illustrate the density distribution of each species and their relationship in time and space to DWD-106 and its PAI. It should be noted here, only positive catches are shown in the individual species plots. The spring survey plots include nine surveys (1968-1974, 1976, and 1978) and the autumn plots include 12 surveys (1965-1975, and 1977). As points of reference, Figures 4 and 5 illustrate the cumulative station plots for spring and autumn, respectively as well as the location of DWD-106 and its PAI.

Survey of New Jersey's Offshore Recreational Fishery

Beginning in 1981, and continuing to the present, personnel from the New Jersey Department of Environmental Protection, Division of Fish, Game, and Wildlife, have collected information relative to the somewhat specialized offshore canyon fishery which takes place from May to October off the coast of

New Jersey. The purpose of this program is primarily to estimate, and secondarily to better understand, participation, catch, effort, and value of this burgeoning offshore big-game recreational fishery. Figure 6 illustrates the extent of the survey area, which generally can be defined as the area found between the 30 (55 m) and 100 (183 m) fathom isobaths and the associated submarine canyon systems located therein.

Fisheries data were collected in the following manner; first, a list of canyon fishing boats was compiled by canvassing marinas, bait and tackle dealers, and identified canyon fishermen; second, each week a random telephone survey of canyon anglers was conducted to ascertain their catch (species and number) and effort (trips made) during the previous week; and finally, total catch was estimated by expanding the data collected from over 550 offshore trips. In addition, data concerning the economic value of the fishery were obtained by the direct mailing of questionnaires to known participants in the fishery. Figley and Long (1982) give detailed information relative to the history and background of the fishery as well as descriptions of the areas surveyed (i.e. various submarine canyons), and explanations of the collection and analysis methodology employed during this continuing project. Herein, with the objectives of this paper in mind, 1981 participation, catch, effort, and economic data are summarized and discussed.

Tilefish Fishery Catch and Effort

This data set consists of nine years (1973-1981) of tilefish (*Lopholatilus chamaeleonticeps*) catch information and fishing effort projections based on preliminary interpretations and calculations of information gleened from voluntary fishermen logbooks and governmental records of total catch. These data were willingly provided to the authors by C. Grimes, K. Able, and S.

Turner of Rutgers University, New Brunswick, New Jersey. It should be noted that the above mentioned have focused their research efforts to a large degree on this particular species and its fishery for the last four to six years. Additional information relative to the biology and ecology as well as the fishery for tilefish can be found in Freeman and Turner (1977), Grimes et al. (1980a, b), Able et al. (1981), and Turner et al. (1981).

All data were extracted from logbook records on a yearly basis to ascertain the total number of vessels fishing, trips made per month, amount (units) of gear fished, and catch per unit of gear (kg). The unit of gear employed in this fishery is defined as a "tub" which equals one-half mile of longline gear. Total vessel years, i.e. that percent of a year a vessel was involved in the fishery, was determined from direct interviews and/or first-hand knowledge of the fishery. Total units of gear were then calculated by multiplying vessel years x trips per month x 12 months x units of gear fished per month. All information was then tabulated along with governmental records of landings to provide the appropriate information for comparison of catch, effort, and participation trends over time.

Survey of New Jersey's Ocean Fishing Grounds

This non-quantitative, but highly descriptive and informative source delineates and describes geographically, in the form of charts and text, the ocean fishing grounds utilized by New Jersey recreational and commercial fishermen (Long and Figley 1981). Definition, location, and seasonality of individual fishing grounds are based on a direct interview survey of over 340 currently active recreational and commercial fishermen. This survey was designed and conducted by the New Jersey Department of Environmental Protection's, Division of Fish, Game, and Wildlife personnel. This collection of information, although limited spatially, provides an additional dimension to this paper; however, it must be closely scrutinized and logically extended and expanded with the seasonality and geographic range of each species kept in perspective.

Herein, using those data given in Long and Figley (1981), only those recreational and commercial fisheries which fall into the geographic scope of this paper are considered (i.e. DWD-106's PAI). Each fishery, or fishery complex, is graphically represented in the form of a chart which delineates recreational and commercial fishing grounds on a seasonal basis. At this point in time, we would be remiss if we did not thank those members of the New Jersey Division of Fish, Game and Wildlife who provided the authors with draft materials as well as a full-size set of "fishing grounds" charts.

Foreign Landings and Values (1979)

This somewhat limited, but nevertheless relative, data set consists of 1979 non-U.S. landings and value information for selected finfish and invertebrate species or species groups. These data, as mandated by the Magnuson Fishery Conservation and Management Act of 1976 (MFCMA), are collected by either U.S. Foreign Fisheries Observers stationed aboard foreign vessels during fishing operations, by international reporting agreements, or by a combination of both methods. Under the auspices of MFCMA, fisheries are designated for particular species or species groups in predetermined amounts during particular fishing seasons in designated areas (i.e. "fishing windows"). Herein we have tabulated the results of the 1979 foreign fishing season relative to six major fisheries for those "fishing windows" which fall within the perview of this paper. As a point of reference, Figure 7 illustrates the "fishing windows" in question (1-4) as well as the location of DWD-106 and its PAI.

Deep-Sea Fish Fauna

This section is based on a review of current pertinent literature which identifies and enumerates and/or discusses the biology and ecology of the pelagic and benthic deep-sea fish fauna generally found within the predescribed boundaries of this paper (i.e. DWD-106's PAI). With regard to terminology, "deep-sea fishes" are defined for purposes of this report as those fish which for the most part inhabit deep shelf slope and abyssal oceanic waters usually in excess of 600 m, and further have little or no direct commercial value at the present time (e.g. Myctophids (lanternfish)). It should be noted, this section is included, although it provides no new information, for the explicit purpose of rounding out this report by providing as complete a picture as possible relative to all finfish species associated wiah DWD-106 and its PAI.

RESULTS AND DISCUSSION

A simplified, but highly informative, tabular-graphic format or a somewhat criptic narrative, or both, whichever is more applicable to the particular subject area will be employed to present our results. The results of our tabulations and graphic interpretations, owing to the diversity of information, will be presented under the same eight headings identified in the Methods and Materials section for purposes of continuity.

U.S. Commercial Landings and Values

Results of our factored tabulations, i.e. the percent of the PAI ellipse occupied by the various statistical reporting areas (Figure 2), are given in the form of three tables: Table 1 gives the commercial landings and values by state and year, as well as, on a total landings and values basis for each year (1968-1980). This tabulation demonstrates the almost continuous increases in landings and values that have occurred within the limitations of these data. In addition, the dynamic nature, i.e. ebb and flow, of landings and values is obvious on both an inter- as well as intra-state basis. Table 2 summarizes catch and values by year and statistical reporting area, and identifies the percent each statistical area is occupied by the PAI ellipse. This information provides a basis for comparing the catch and value of each statistical reporting area from year to year and within years as well as providing those data necessary to compare the importance of a particular reporting area to another. Table 3 gives landings and value by year (1972-1980) on a selected species basis; thus providing information for the purpose of demonstrating which resources are the most sought after in terms of weight and/or value over time. It should be obvious from these data, that American lobster (*Homarus americanus*), and sea scallop (*Placopecten magellanicus*) represent the big "cash crops" historically in the invertebrate category, along with ocean quahog (*Arctica islandica*) in more recent years (1979-1980). Under the finfish category, summer flounder (*Paralichthys dentatus*), tilefish (*Lopholatilus chamaeleonticeps*), scup (*Stenotomus chrysops*), and swordfish (*Xiphias gladius*) dominate, both historically as well as at present, in both catch and value.

Japanese Longline Fishery--Observed Data

Table 4 gives observed Japanese longline catch-per-unit-of-effort (CPUE) from Fishery Reporting Zone No. 16 by species and species group (i.e. tunas, billfishes, sharks, rays, and other finfish) for the years 1978-1981. The PAI ellipse is almost entirely within this particular fishing zone (Figure 3); therefore, the species composition and calculated catch rates can be termed as somewhat representative of the area considered within the context of this paper. Thus, it is interesting to note, that the big-eye tuna (Thunnus obesus), yellowfin tuna (Thunnus albacares), albacore (Thunnus alalunga), swordfish (Xiphias gladius), blue shark (Prionace glanca), and lancetfish (Alepisaurus ferox) make up, on an average, greater than 86% of the CPUE from this reporting zone. Also of interest, the first three species mentioned above are generally considered to be the target species of the Japanese longline fishery within the Mid-Atlantic area.

At present, this fishery is dominated primarily by the Japanese distant water longline fleet, with little if any U.S. participation, except in the area of swordfish fishing. However, if and when this situation begins to reverse, these valuable oceanic fishery resources will obviously become more important to domestic fishermen at which time any adverse man-induced change in abundance and/or distribution could have economic ramifications throughout the fishery. The data presented, regarding the present fishery, indicate the potential for U.S. participation, and therefore, the potential of any man-induced change must also be taken into account (i.e. DWD-106's PAI).

NMFS Research Survey Cruises

This seasonal research vessel bottom trawl survey data set, for purposes of this paper, was distilled to a series of spring (1968-1974, 1976, and 1978) and autumn (1965-1975, and 1977) computer-generated cumulative plots. Twenty-four species of finfish and six species of invertebrates were specifically selected to illustrate seasonal and geographic trends in distribution and abundance relative to DWD-106 and its PAI.

Selected finfish species are illustrated in Figures 8-31 and include the following: spiny dogfish (Squalus acanthias), little skate (Raja erinacea), blueback herring (Alosa aestivalis), alewife (Alosa pseudoharengus), goosefish (Lophius americanus), offshore hake (Merlussius albidus), silver hake (Merluccius bilinearis), red hake (Urophycis chuss), spotted hake (Urophycis regalis), white hake (Urophycis tenuis), ocean pout (Macrozoarces americanus), black sea bass (Centropristis striata), scup (Stenotomus chrosops), Atlantic mackerel (Scomber scombrus), butterfish (Peprilus triacanthus), northern searobin (Prionotus carolinus), longhorned sculpin (Myoxocephalus octodecemspinosus), Gulf Stream flounder (Citharichthys arctifrons), summer flounder (Paralichthys dentatus), fourspot flounder (Paralichthys oblongus), windowpane (Scophthalmus aquosus), witch flounder (Glyptocephalus cynoglossus), yellowtail flounder (Limanda ferruginea), and winter flounder (Pseudopleuronectes americanus).

Plots of invertebrate species are given in Figures 32-37 and include: Jonah crab (Cancer borealis), rock crab (Cancer irroratus), American lobster (Homarus americanus), and long-finned squid (Loligo pealei).

Any number of conclusions can be drawn from this series of plots regarding the relationship between individual species and the PAI associcated with DWD-106, some of the most obvious include: 1) several species such as offshore hake (Figure 13), white hake (Figure 17), Gulf Stream flounder (Figure 25), American lobster (figure 34), and sea scallops (Figure 35), tend to remain in the PAI throughout the year based on their narrow range of ecological requirements (i.e. temperature and/or depth) or sessil nature; 2) other species tend to migrate inshore and offshore seasonally and therefore are more or less abundant in the PAI at any one particular point in time and space. Included in this category are the following species: spiny dogfish (Figure 8), little skate (Figure 9), blueback herring (Figure 10), alewife (Figure 11), silver hake (Figure 14), red hake (Figure 15), spotted hake (Figure 16), black sea bass (Figure 19), scup (figure 20), butterfish (Figure 22), northern searobin (Figure 23), summer flounder (Figure 26), fourspot flounder (Figure 27), and long-finned squid (Figure 37); 3) those species which either winter or summer in or near the PAI, and then, for all practical purposes, migrate either north or south entirely out of the area. An example of this type of relationship would be the Atlantic mackerel (Figure 21) which winters in the Mid-Atlantic and with the advent of spring moves inshore to spawn and then north and east to summer; and 4) those species which are found in relatively small numbers in the PAI, although they might be very abundant in adjacent areas. Examples of this species category include: ocean pout (Figure 18), longhorned sculpin (figure 24), windowpane flounder (Figure 28), yellowtail flounder (Figure 30), and winter flounder (Figure 31).

Survey of New Jersey's Offshore Recreational Fishery

Although this survey only deals with the big-game fishery off New Jersey (Figure 6); with a little imagination one can project and expand these results, at least as far as Cape Hatteras to the south and Rhode Island to the north and east. Results of the 1981 survey include: Participation - New Jersey's canyon fleet consisted of approximately 800 boats including 714 private-, 82 charter-, and four party-boats; Effort - 5,473 trips were made during the 1981 season, with private-boats accounting for 89% of the activity; Catch - total catch for all species was approximately 40,000 fish, with yellowfin tuna (*Thunnus albacares*) (18,200); albacore (*Thunnus alalunga*) (14,600); bigeye tuna (*Thunnus obesus*) (1,400); and white marlin (*Tetrapturus albidus*) (2,600) accounting for 92% of the total. The estimated weight of the aforementioned four species was just slightly less a than two million pounds (907 mt); and Value - 800 boats made up the canyon fleet with an average size of 36 feet and value of slightly greater than $90 thousand. Therefore, value of the entire fleet was estimated at $73 million. In addition, boat owners participating in this fishery spent approximately $11.1 million during 1981 for the following: boats and boating equipment, $4.6 million; boat maintenance, $2.2 million; mooring and storage, $0.7 million; insurance, $0.6 million; fishing equipment, $0.7 million; fuel, $1.8 million; and bait, ice and food, $0.6 million.

The above stated facts and figures should leave the reader with little, if any, doubt as to: first, the magnitude and importance of this offshore recreational fishery; and second, the impact any adverse change in distribution and/or abundance of tunas and billfishes would have on the fishery.

Tilefish Fishery Catch and Effort

Table 5 gives tilefish (*Lopholatilus chamaeleonticeps*) catch and effort data for the years 1973 to 1981 based on information extracted from fishermen logbooks and governmental records of landings. Information given in this tabulation include: number of vessels actively fishing, the part of the year they fish, number of trips made per month, quantity of gear fished per trip, quantity of gear fished per year, and average catch per unit of gear. In addition, catch in weight (mt) is given, on a yearly basis, for both the longline and total fishery.

It should be apparent from these data, that since 1978, this fishery has undergone dramatic changes as illustrated by an all but doubling of fishing effort (total "tubs"), a 50% decline in catch-per-unit-effort (CPUE), and a relatively constant harvest (longline landings). The combined simultaneous occurrence of increased effort, decreased CPUE, and stable yield over time are usually indicative of stock decline; therefore, it would be safe to assume that the tilefish stock is probably under some type of stress (i.e. fishing pressure) at this point in time. It is then logical to ask the following question: What would be the impact on this already tenuous situation if it was complicated and compounded by environmental stress (i.e. DWD-106's PAI)?

Survey of New Jersey's Ocean Fishing Grounds

This source of information was reduced to 15 charts (Figures 38-52) which graphically delineate selected recreational and commercial ocean fishing grounds for 22 species based on a one-year survey of actively involved fishermen. In addition, each chart gives the seasonality of each fishery, or fishery complex as well as the location of DWD-106 and its PAI. The charts in question illustrate the ocean fishing grounds for the following: Atlantic mackerel (Figure 38); tilefish (Figure 39); summer flounder (Figure 40); scup (Figure 41); black sea bass (Figure 42); butterfish (Figure 43); silver and red hake (Figure 44); Atlantic cod and pollock (figure 45); yellowfin tuna, albacore, and bigeye tuna (Figure 46); white and blue marlin (Figure 47); swordfish (Figure 48); ocean quahog (Figure 49); American lobster and red crab (Figure 50); sea scallop (Figure 51); and short- and long-finned squid (Figure 52).

If one logically extends and expands as well as takes into account the data presented in previous sections of this paper (e.g. commercial landings and value, recreational landings and value (big-game), and the distribution and abundance of important species), the information illustrated in the above mentioned 15 charts becomes quite relevant in terms of potential adverse impacts caused by ocean dumping at DWD-106.

Foreign Landings and Values (1979)

Results of our tabulations, although limited in scope (i.e. 1979 only), are given in the form of a tabular inset which is found in Figure 7. Combined data for "fishing windows" 1 through 4 have been summarized in the aforementioned table and include: 1) total catch in metric tons (mt), 2) dollar value per metric ton ($/mt), and 3) total dollar value of the catch (value $) for silver hake (*Merluccius bilinearis*), red hake (*Urophycis chuss*), Atlantic mackerel (*Scomber scombrus*), butterfish (*Peprilus triacanthus*), dogfish spp., and squid spp. This tabulation demonstrates both the amount and value of these species within the geographic limitation of the "fishing windows" associated with DWD-106 and its PAI. As a point of interest these six species and/or species groups totaled approximately 21,000 mt (46.5 million pounds) worth greater than 8.7 million dollars at an average of almost 350 dollars per mt. It should be obvious from these data that first squids and second silve hake dominated the catch while butterfish commanded the highest price in the market place.

These somewhat dated data illustrate the amount and value of these resources, this information coupled with recent (1980-81) joint U.S.-foreign ventures, indicate the growing importance of these fisheries to U.S. commercial fishing interests. Therefore, any poential man-induced changes must be weighed heavily against growth potential and possible socio-economic ramifications which could be lost or accrued by this relatively new concept in the U.S. commercial fishing industry.

Deep-Sea Fish Fauna

The results of our literature search are presented in the form of discussions relative to first pelagic, and second demersal deep-sea fishes which are directly or indirectly associated with DWD-106 and its PAI.

The primary sources of information describing pelagic deep-sea fish in the vicinity of DWD-106 are Krueger et al (1975 and 1977). For the sake of brevity, these two research endeavours can be briefly summarized as follows: 1)a the pelagic fish fauna is comprised mainly of mesopelagic species whicha generally drift with prevailing oceanic currents; 2) 110 mesopelagic species were collected at DWD-106 during baseline studies, with 108 of these species being collected in the upper 800 m; 3) Cyclothone and Myctophids (lanternfish) make up 90% of the day catch below 400 m, with lanternfish accounting for 95% of the catch in the upper 200 m at night; 4) at DWD-106 species composition of these mesopleagic species depends on the movement of water masses in and out of the area, i.e. slope water, warm-core eddies, and even Sargasso Sea waters; 5) Cyclothone microdon and C. braveri were the first and third most abundant species; and 6) of the fifty species of lanternfish collected only Ceratoscopelus maderensis, Hygophum hygomi, Lobianchia dofleini, and Benthosema glaciale were seasonally abundant. For additional details and discussions, Krueger et al. (1975 and 1977) should be carefully reviewed.

In terms of demersal deep-sea fishes, Musick et al. (1975), based on trawl collections, describe four groupings of demersal deep-sea fishes in the depth limits of DWD-106; these are as follows: 1) "Middle slope" group (1,200-1,800 m)awhich is dominated by Antimora rostrata (blue hake), Synaphobranchus kaupi,a Coryphaenoides carapinus, Alepocephalus agassizzi, and Diarolene intronigra; 2) "lower slope" group (1,700-2,100 m) which is dominated by A. rostrata, C. carapinus, Halsauropsis macrochir, and S. kaupi; 3) "upper rise" group (2,100-2,900) m) which is dominated by C. armatus and A. rostrata; and 4) "lower rise" group (>2,900 m) dominated by C. armatus. Additional detailed information relative to these demersal forms and their relationship to DWD-106 can be found in Meade et al. (1964), Haedrich et al. (1975), Musick (1976), Cohen and Pawson

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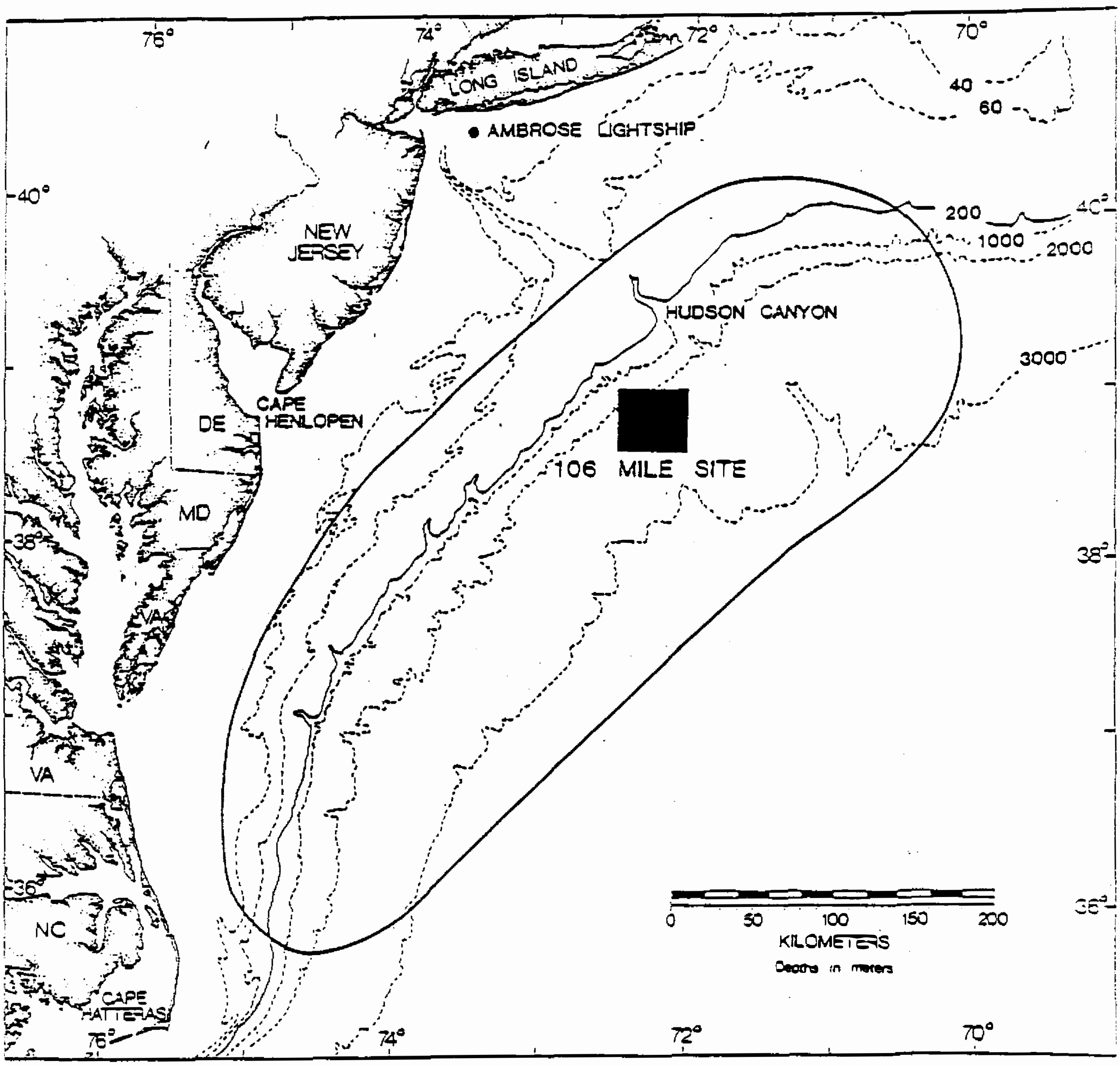


Figure 1.--Location of Deepwater Dumpsite 106 (DWD-106) and its potential area of influence (PAI) assuming a drift period of 100 days and an initial eddy diameter of 105 km.

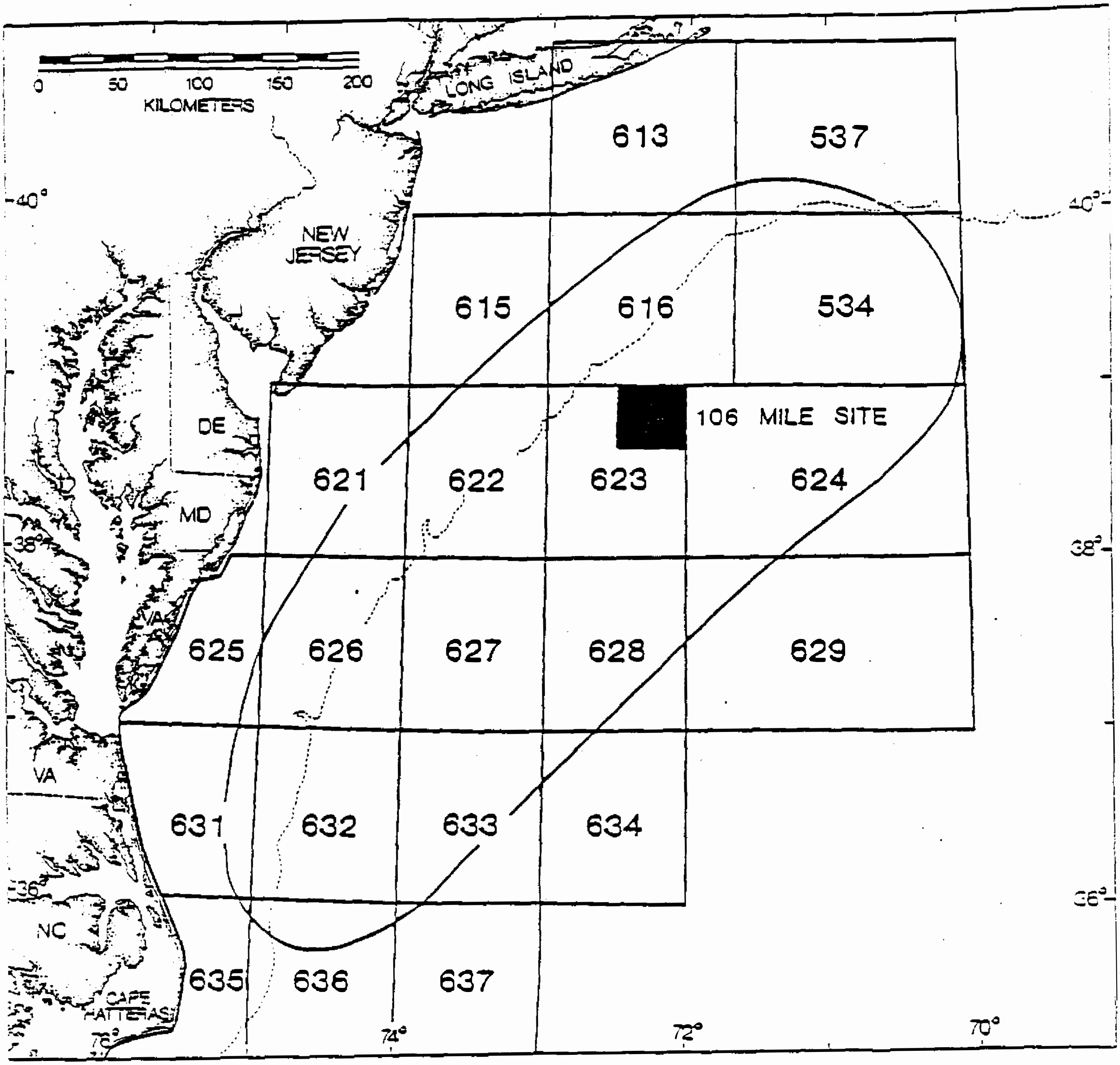


Figure 2.--Location of NMFS statistical reporting areas as well as Deepwater Dumpsite 106 (DWD-106) and its potential area of influence (PAI).

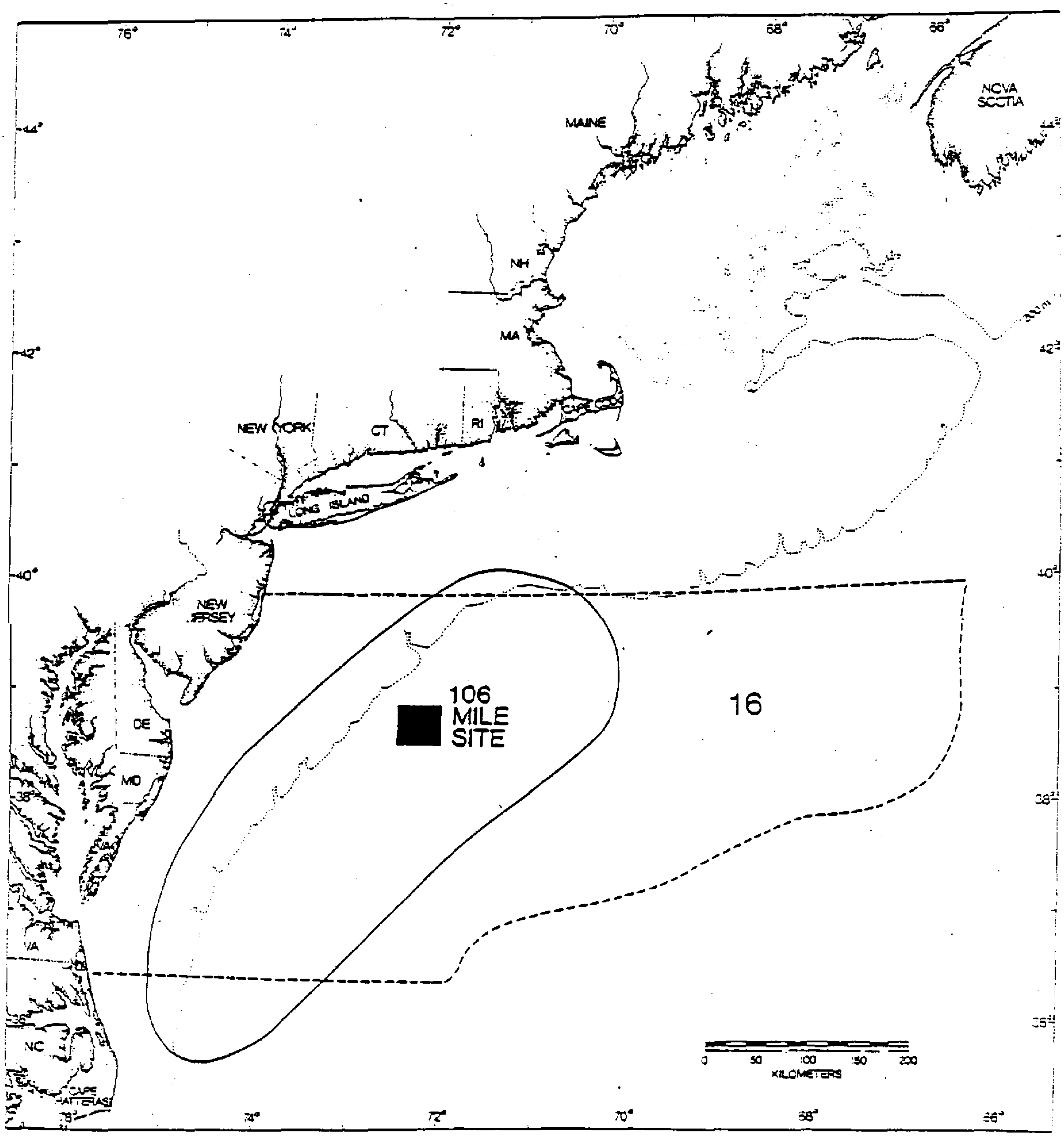


Figure 3.--Location of Fishery Reporting Zone No.16 as well as Deepwater Dumpsite 106 (DWD-106) and its potential area of influence (PAI).

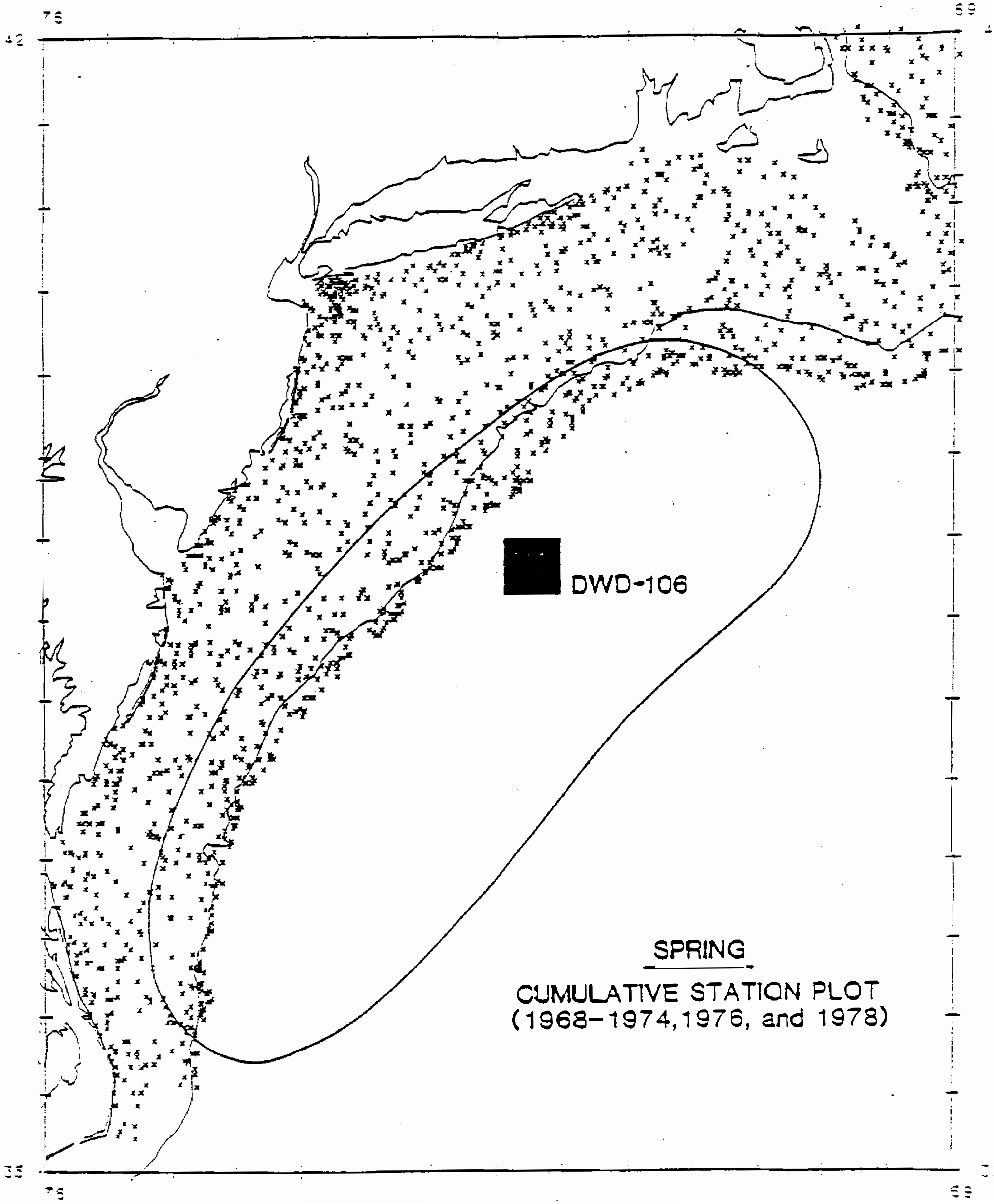


Figure 4.--Cumulative station plots of trawl sets for nine standardized NMFS spring bottom trawl surveys (1968-1974, 1976 and 1978) including location of Deepwater Dumpsite 106 (DWD-106) and its potential area of influence (PAI).

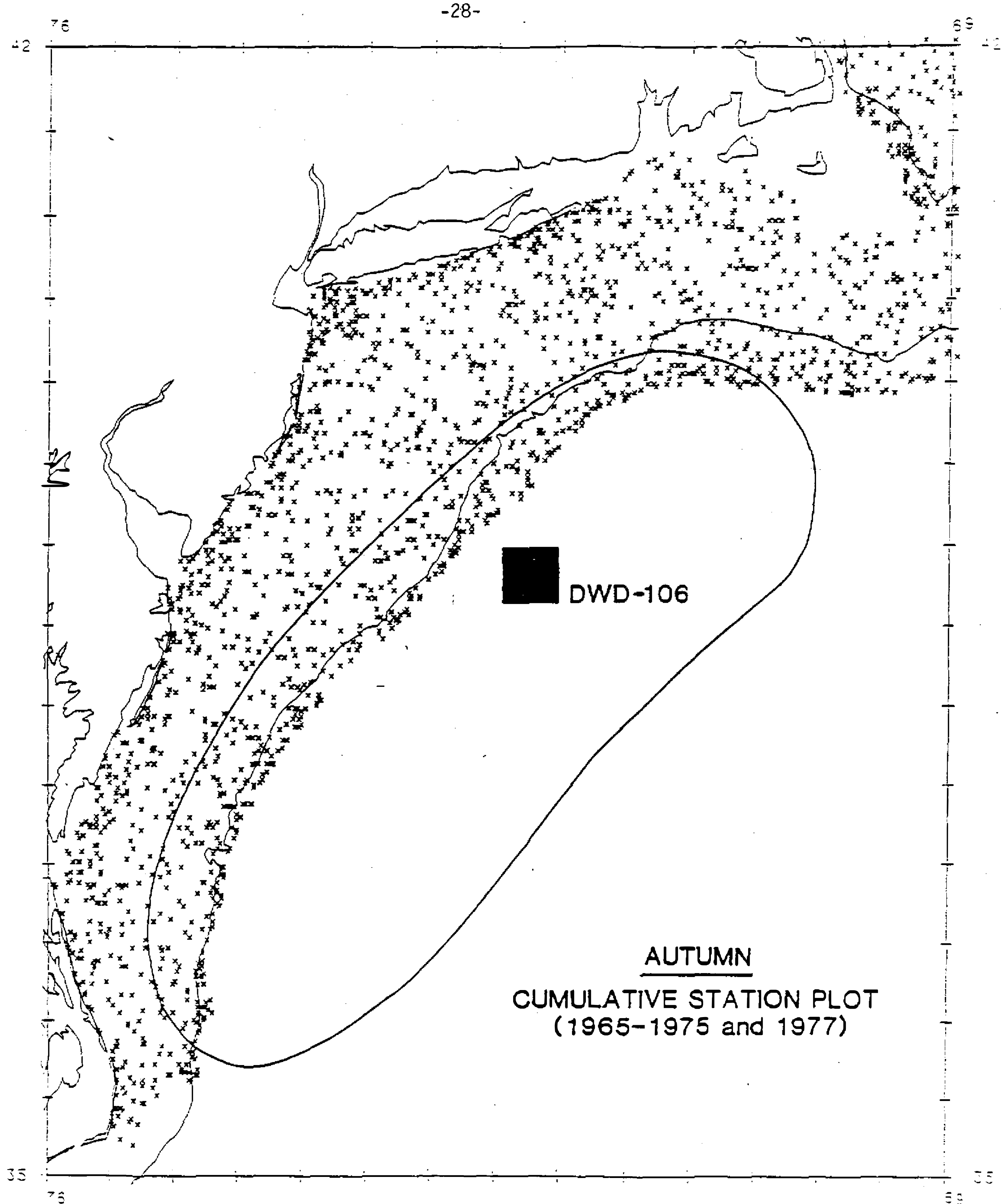


Figure 5.--Cumulative station plots of trawl sets for 12 standardized NMFS autumn bottom trawl surveys (1965-1975 and 1977) including location of Deepwater Dumpsite 106 (DWD-106) and its potential area of influence (PAI).

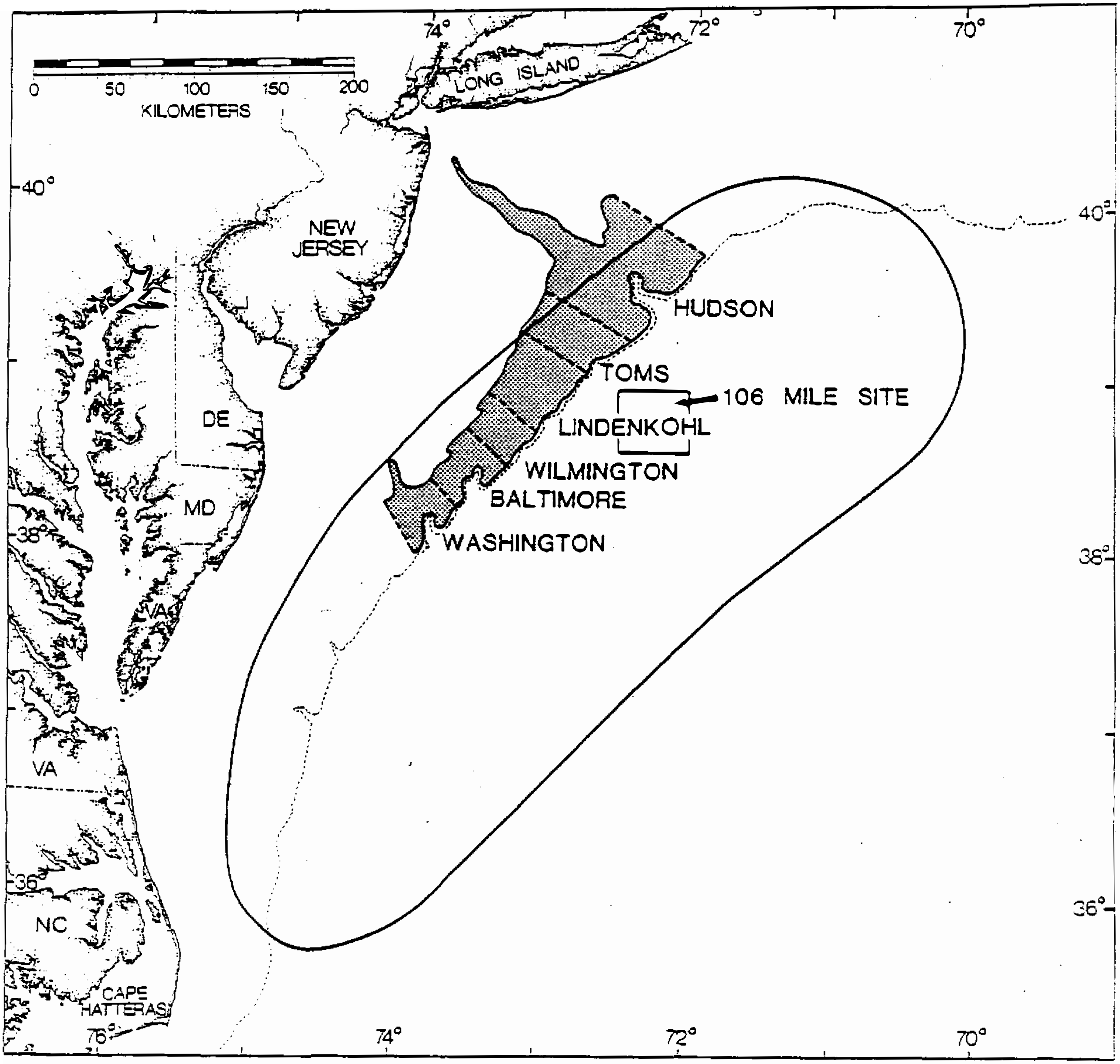
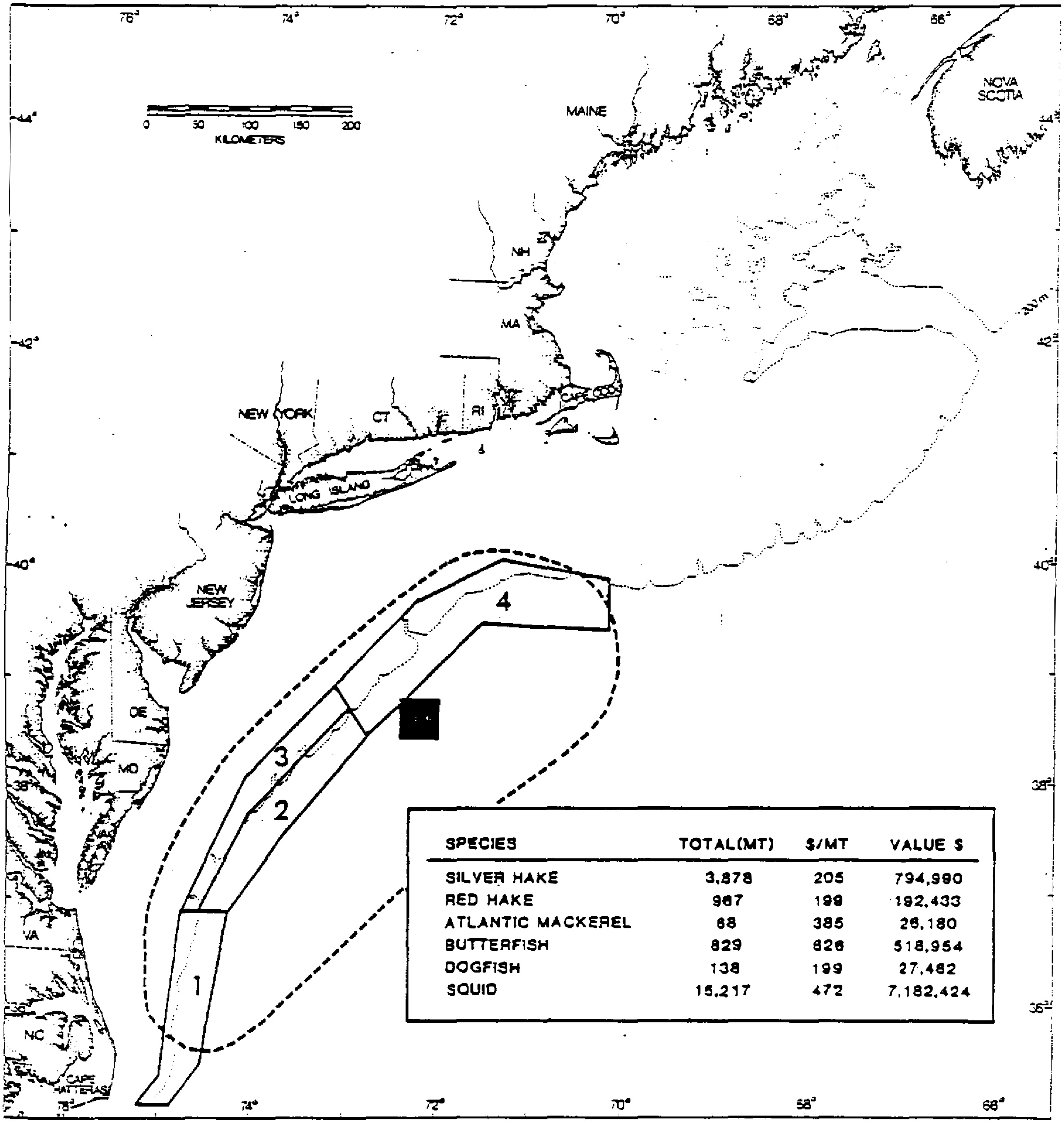


Figure 6.--New Jersey's offshore sportfishing grounds (shaded area) including locations of submarine canyons and Deepwater Dumpsite 106 (DWD-106) and its potential area of influence (PAI).



SPECIES	TOTAL(MT)	$/MT	VALUE $
SILVER HAKE	3,878	205	794,990
RED HAKE	967	199	192,433
ATLANTIC MACKEREL	68	385	26,180
BUTTERFISH	829	626	518,954
DOGFISH	138	199	27,462
SQUID	15,217	472	7,182,424

Figure 7.--Foreign "fishing windows" (1-4) overlayed with location of Deepwater Dumpsite 106 (DWD-106) and its potential area of influence (PAI). Also included are 1979 foreign landings and values for selected finfish and invertebrate species.

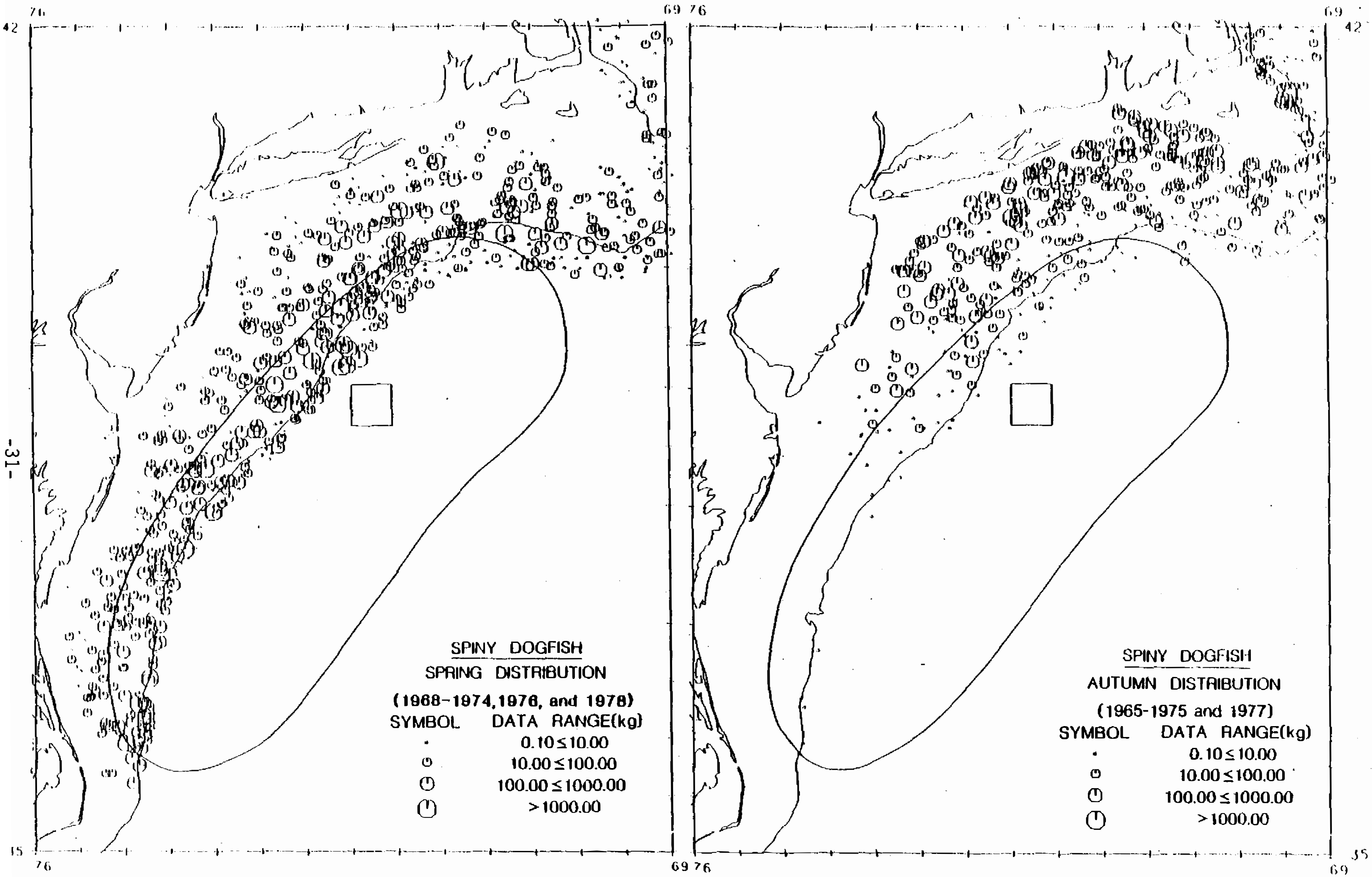


Figure 8.--Spring and autumn cumulative plots for spiny dogfish from NMFS-NEFC standardized bottom trawl survey cruises. Also illustrated is the location of Deepwater Dumpsite 106 (DWD-106) with its potential area of influence (PAI).

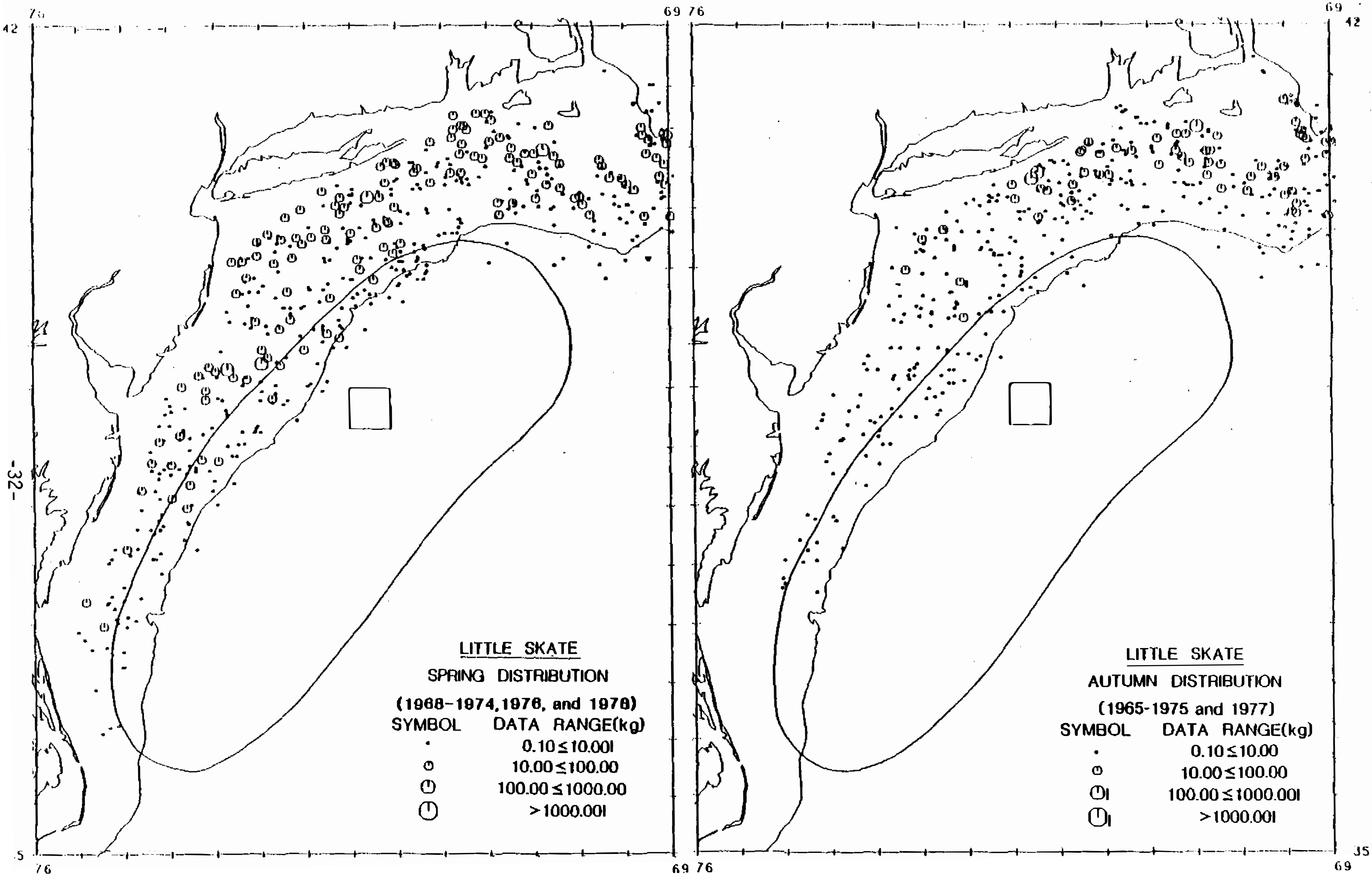


Figure 9.--Spring and autumn cumulative plots for little skate from NMFS-NEFC standardized bottom trawl survey cruises. Also illustrated is the location of Deepwater Dumpsite 106 (DWD-106) with its potential area of influence (PAI).

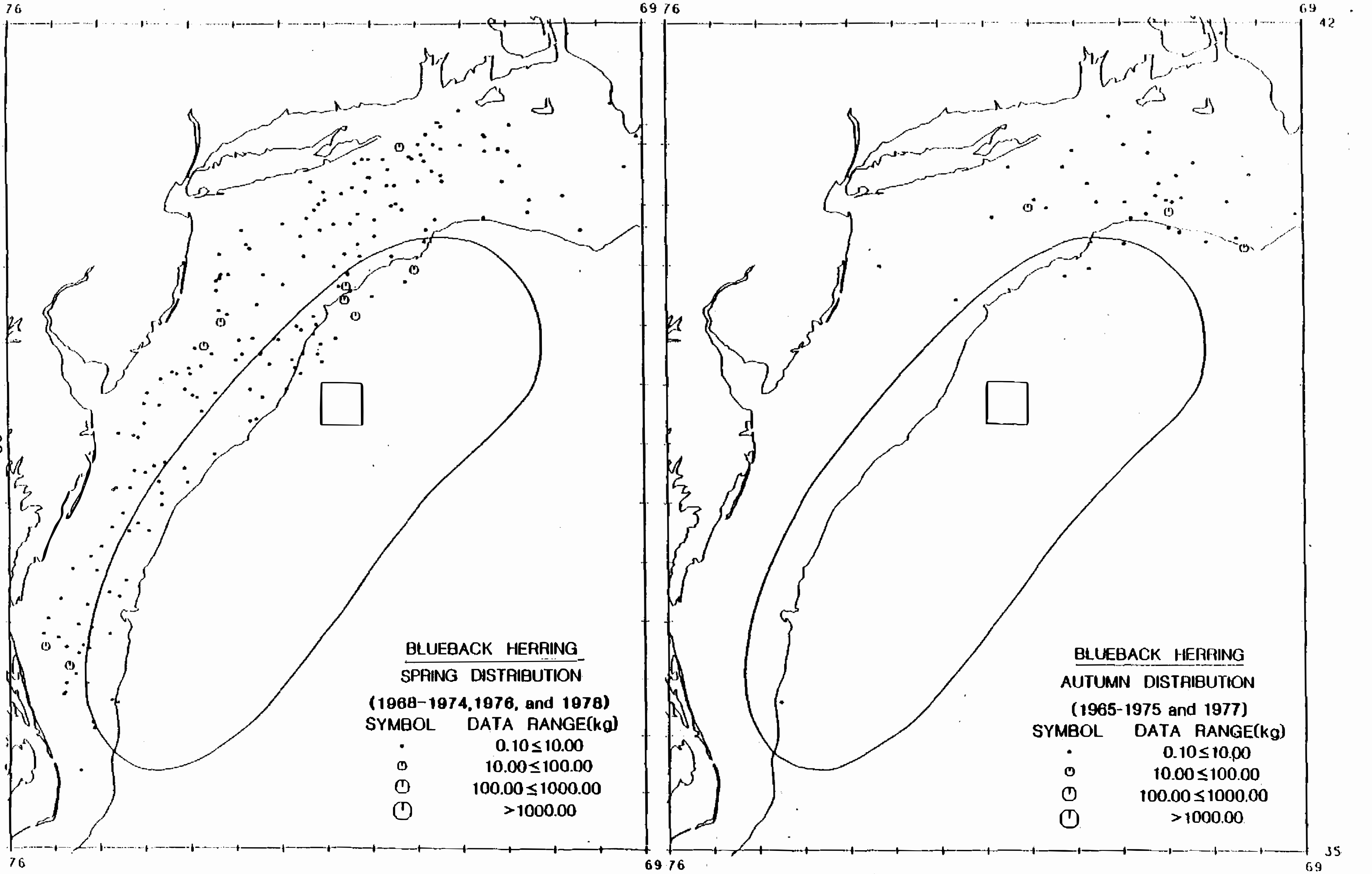


Figure 10.--Spring and autumn cumulative plots for blueback herring from NMFS-NEFC standardized bottom trawl survey cruises. Also illustrated is the location of Deepwater Dumpsite 106 (DWD-106) with its potential area of influence (PAI).

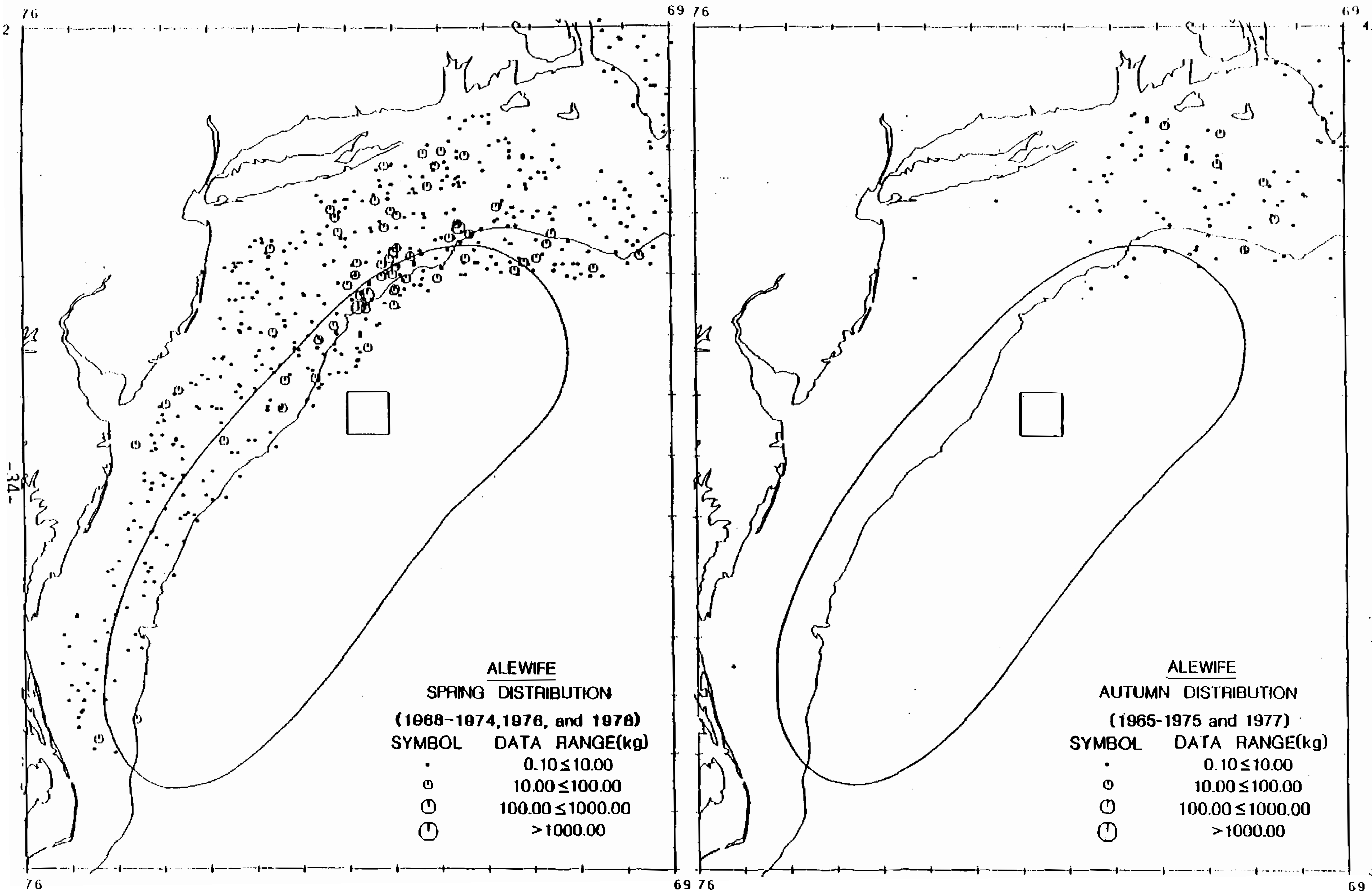


Figure 11.--Spring and autumn cumulative plots for alewife from NMFS-NEFC standardized bottom trawl survey cruises. Also illustrated is the location of Deepwater Dumpsite 106 (DWD-106) with its potential area of influence (PAI).

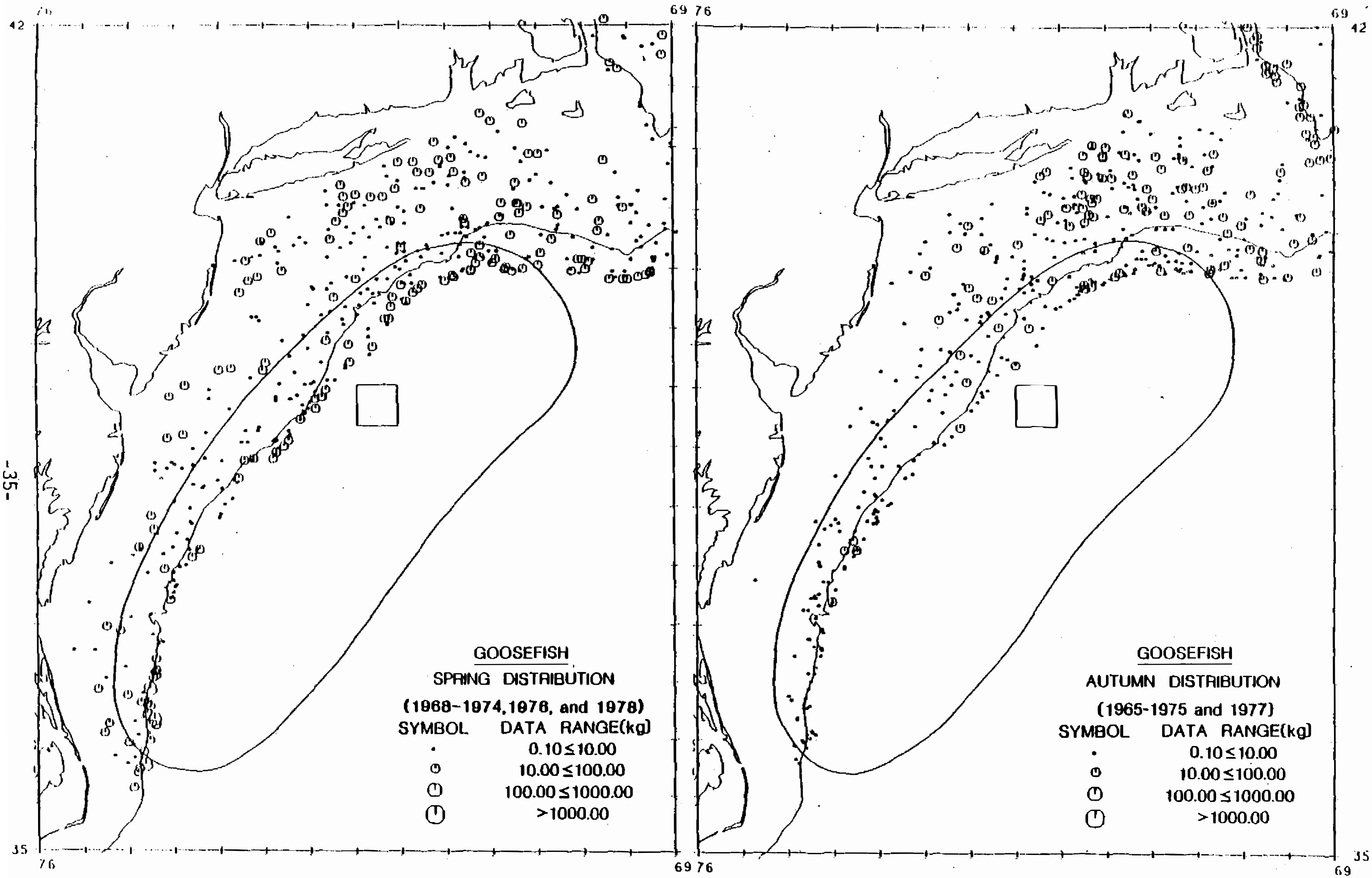


Figure 12.--Spring and autumn cumulative plots for goosefish from NMFS-NEFC standardized bottom trawl survey cruises. Also illustrated is the location of Deepwater Dumpsite 106 (DWD-106) with its potential area of influence (PAI).

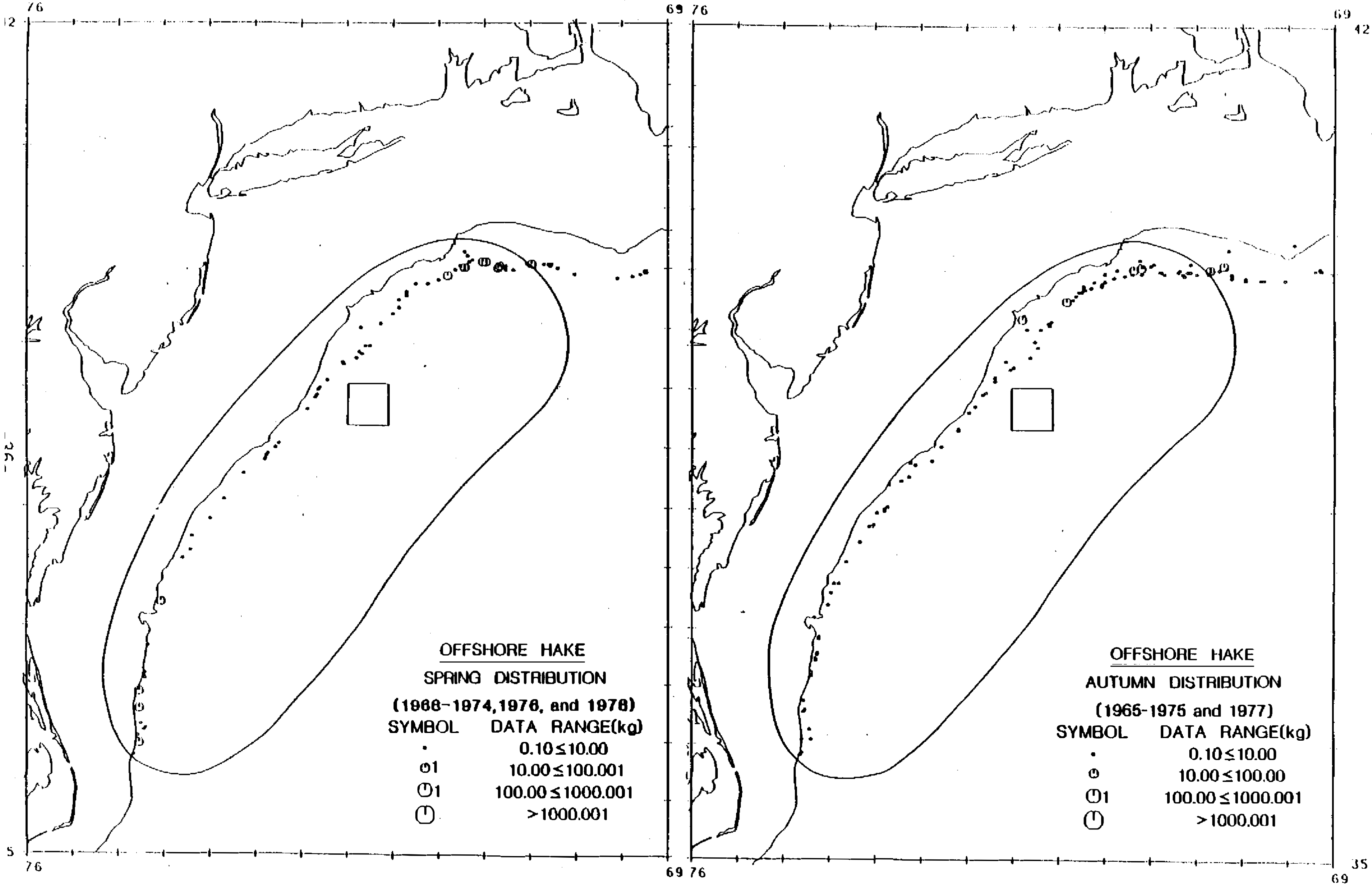


Figure 13.--Spring and autumn cumulative plots for offshore hake from NMFS-NEFC standardized bottom trawl survey cruises. Also illustrated is the location of Deepwater Dumpsite 106 (DWD-106) with its potential area of influence (PAI).

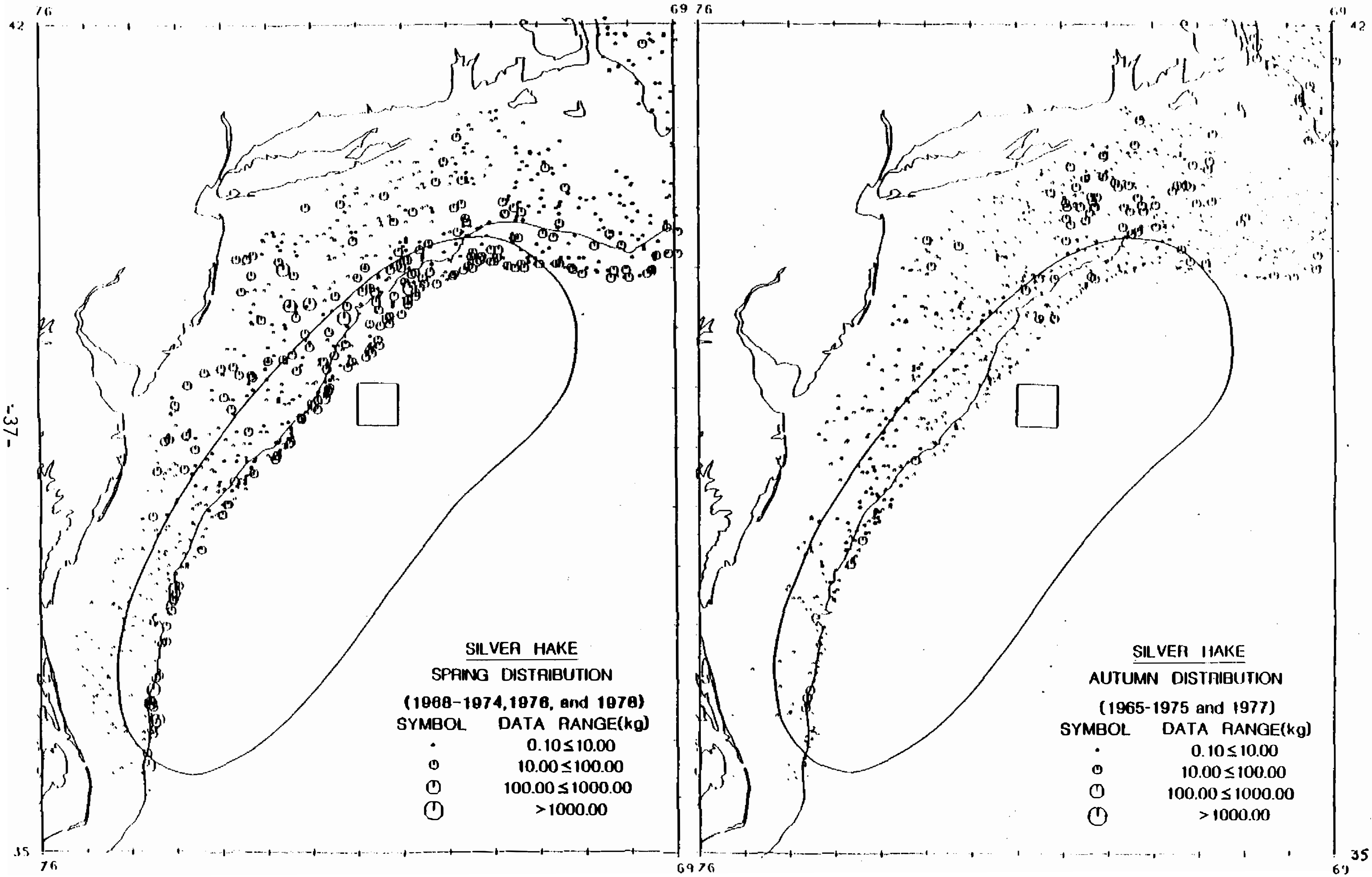


Figure 14.--Spring and autumn cumulative plots for silver hake from NMFS-NEFC standardized bottom trawl survey cruises. Also illustrated is the location of Deepwater Dumpsite 106 (DWD-106) with its potential area of influence (PAI).

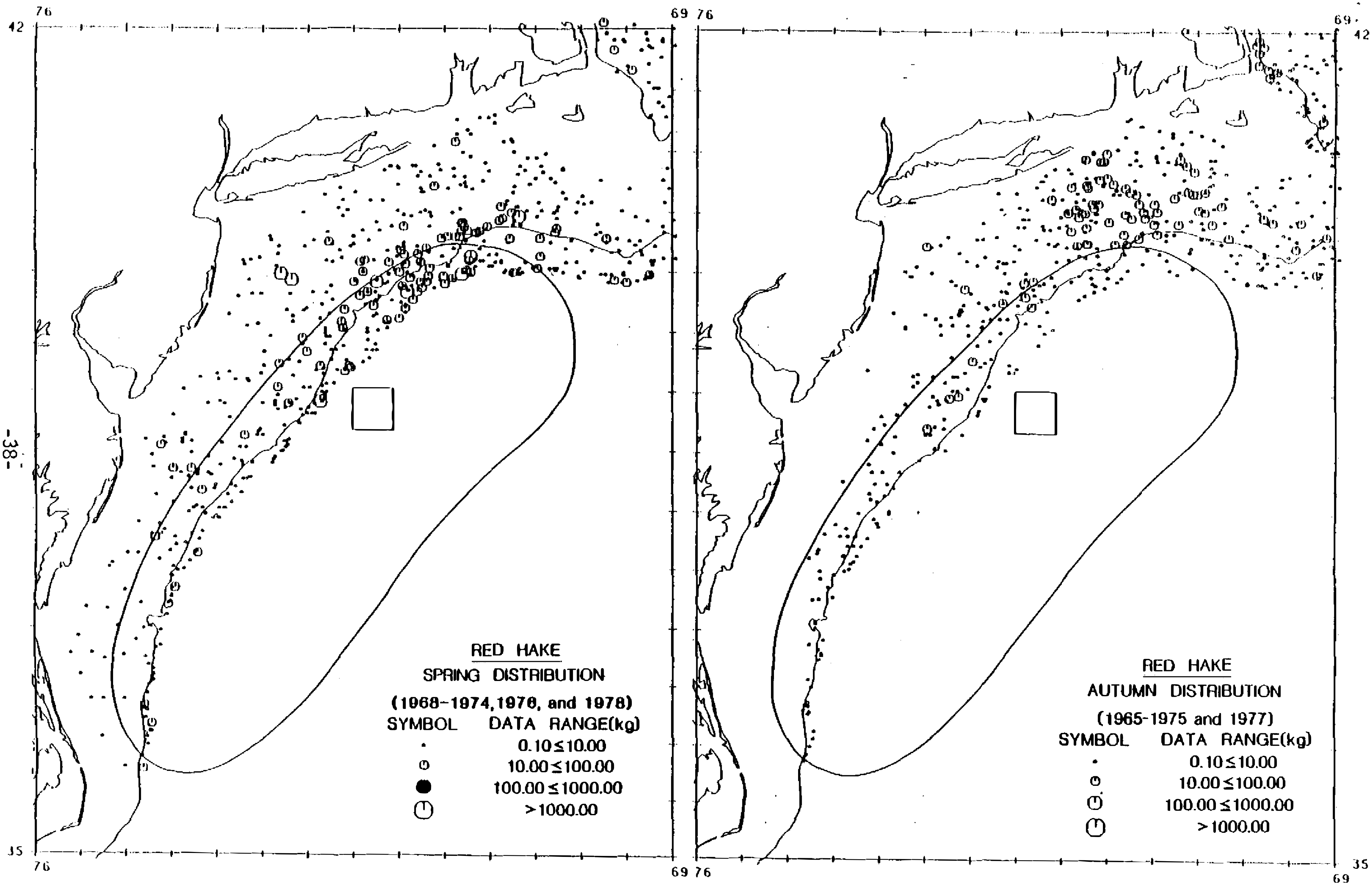


Figure 15.--Spring and autumn cumulative plots for red hake from NMFS-NEFC standardized bottom trawl survey cruises. Also illustrated is the location of Deepwater Dumpsite 106 (DWD-106) with its potential area of influence (PAI).

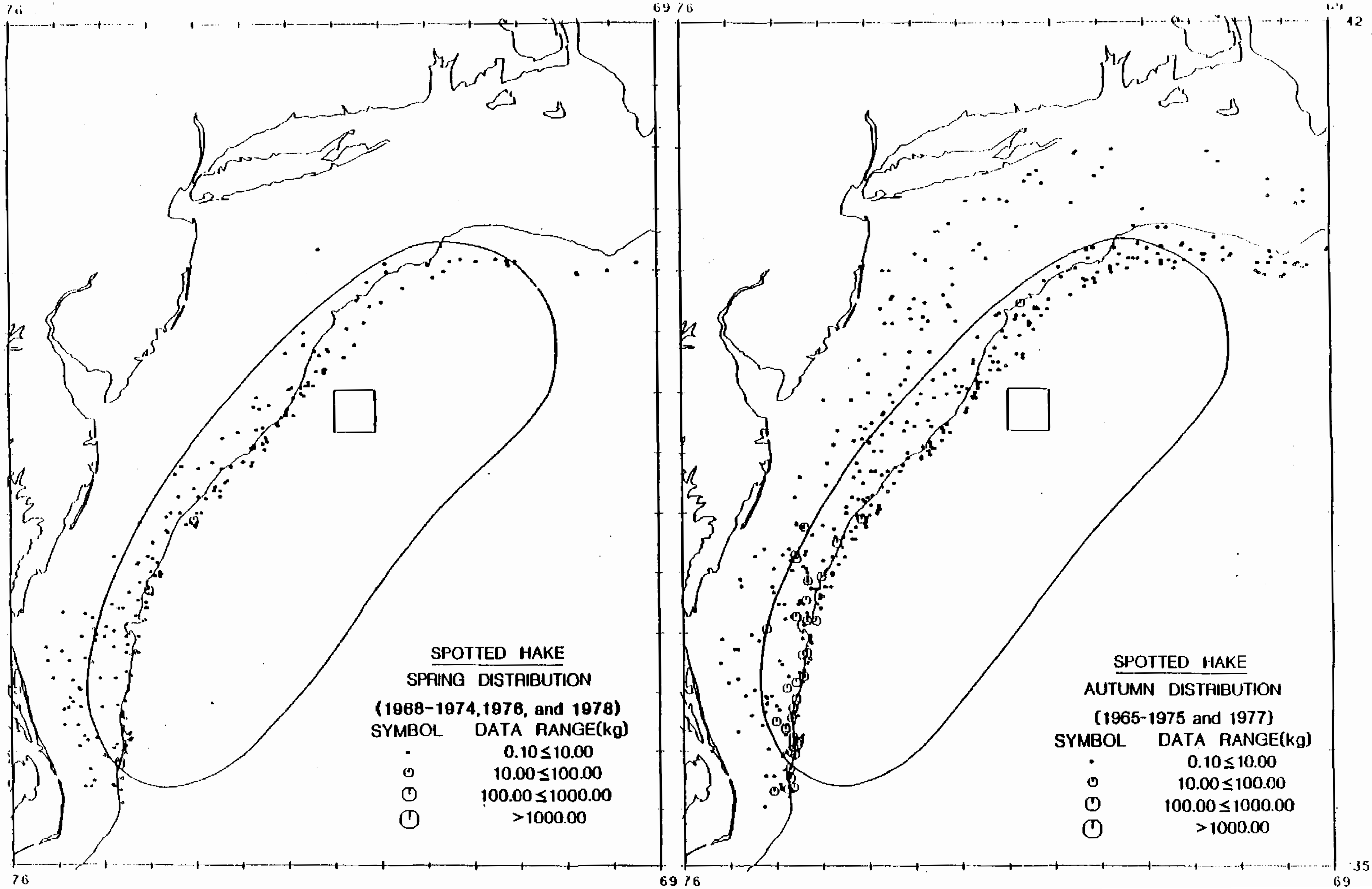


Figure 16.--Spring and autumn cumulative plots for spotted hake from NMFS-NEFC standardized bottom trawl survey cruises. Also illustrated is the location of Deepwater Dumpsite 106 (DWD-106) with its potential area of influence (PAI).

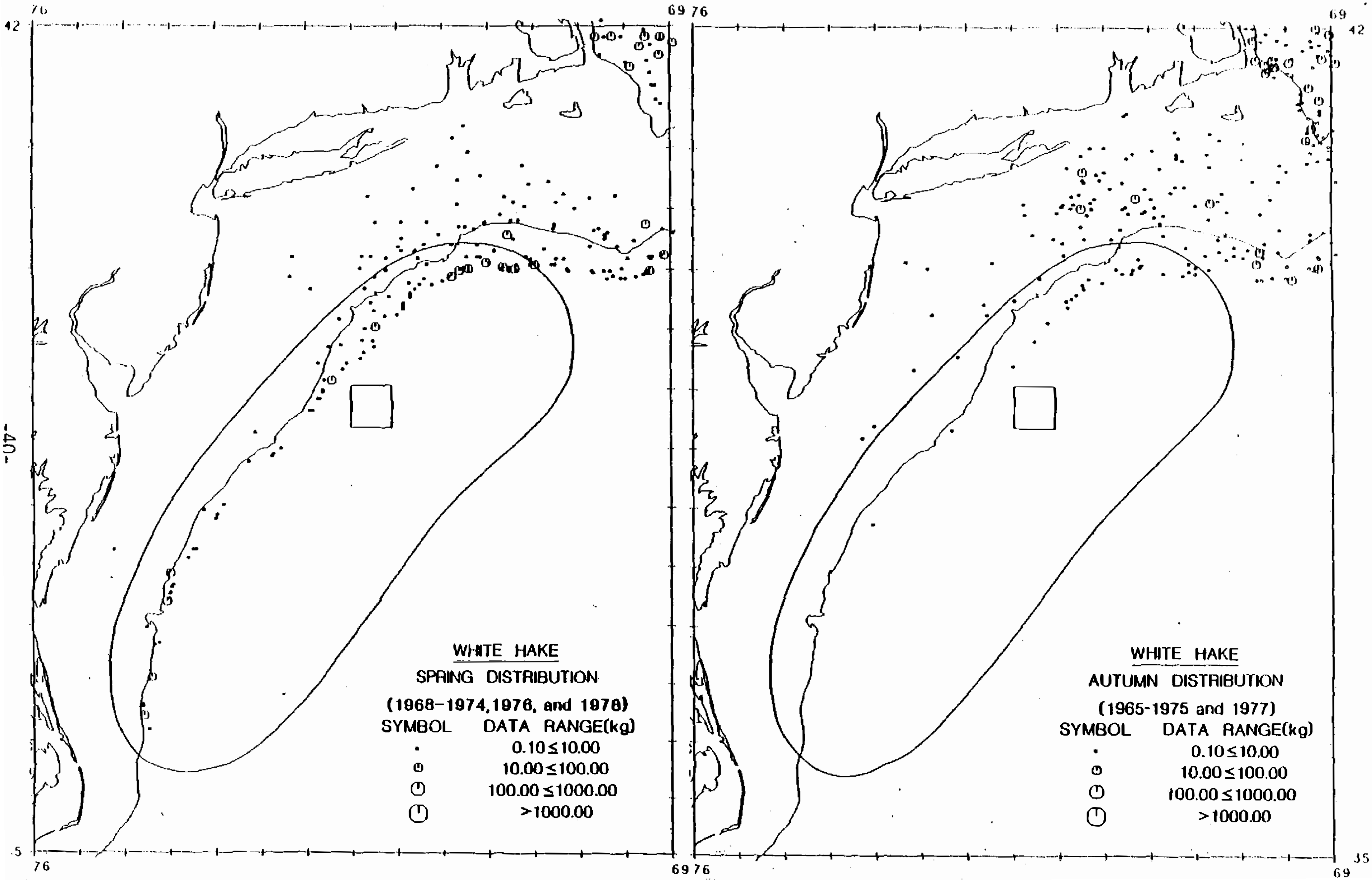


Figure 17.--Spring and autumn cumulative plots for white hake from NMFS-NEFC standardized bottom trawl survey cruises. Also illustrated is the location of Deepwater Dumpsite 106 (DWD-106) with its potential area of influence (PAI).

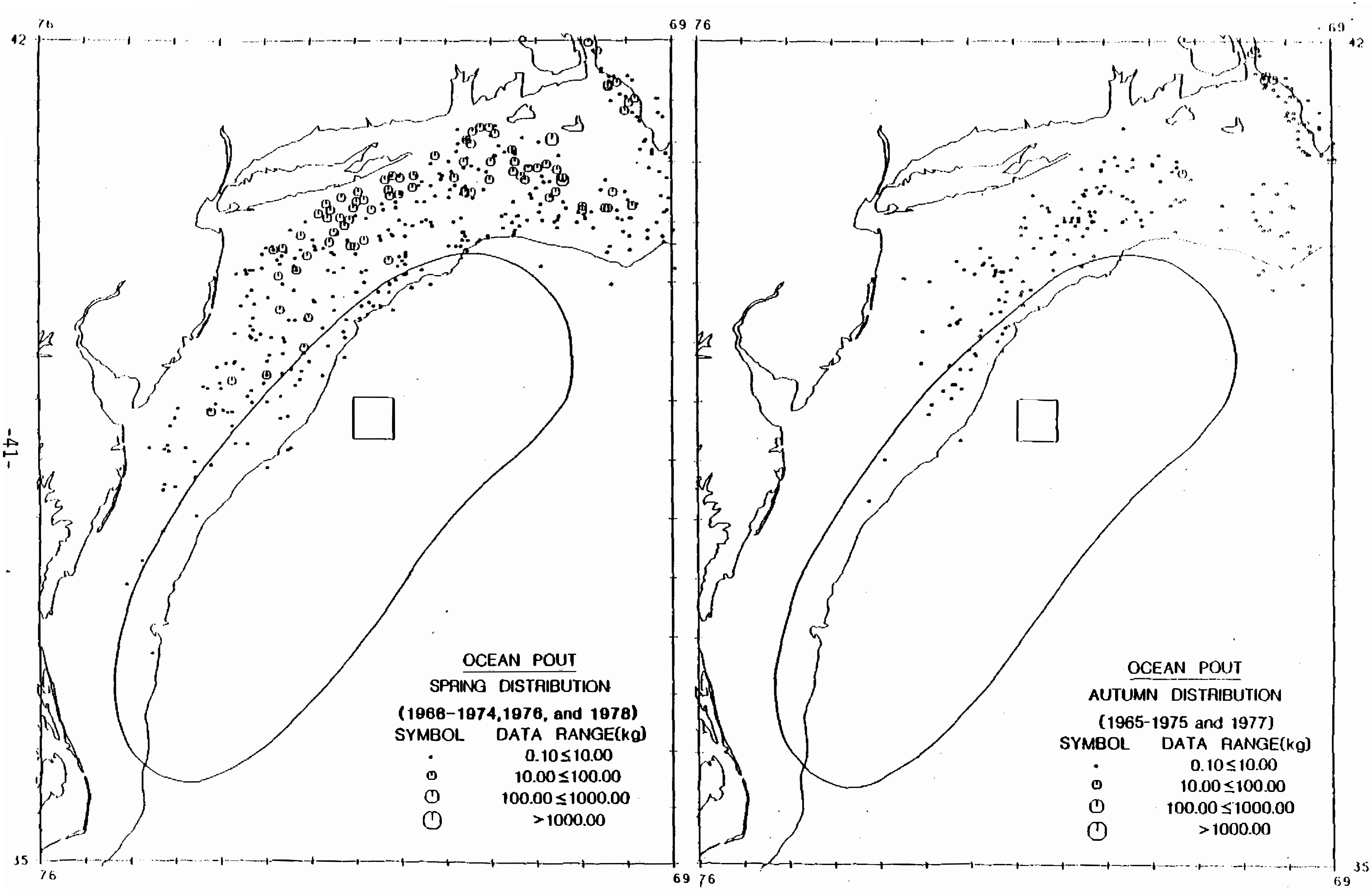


Figure 18.--Spring and autumn cumulative plots for ocean pout from NMFS-NEFC standardized bottom trawl survey cruises. Also illustrated is the location of Deepwater Dumpsite 106 (DWD-106) with its potential area of influence (PAI).

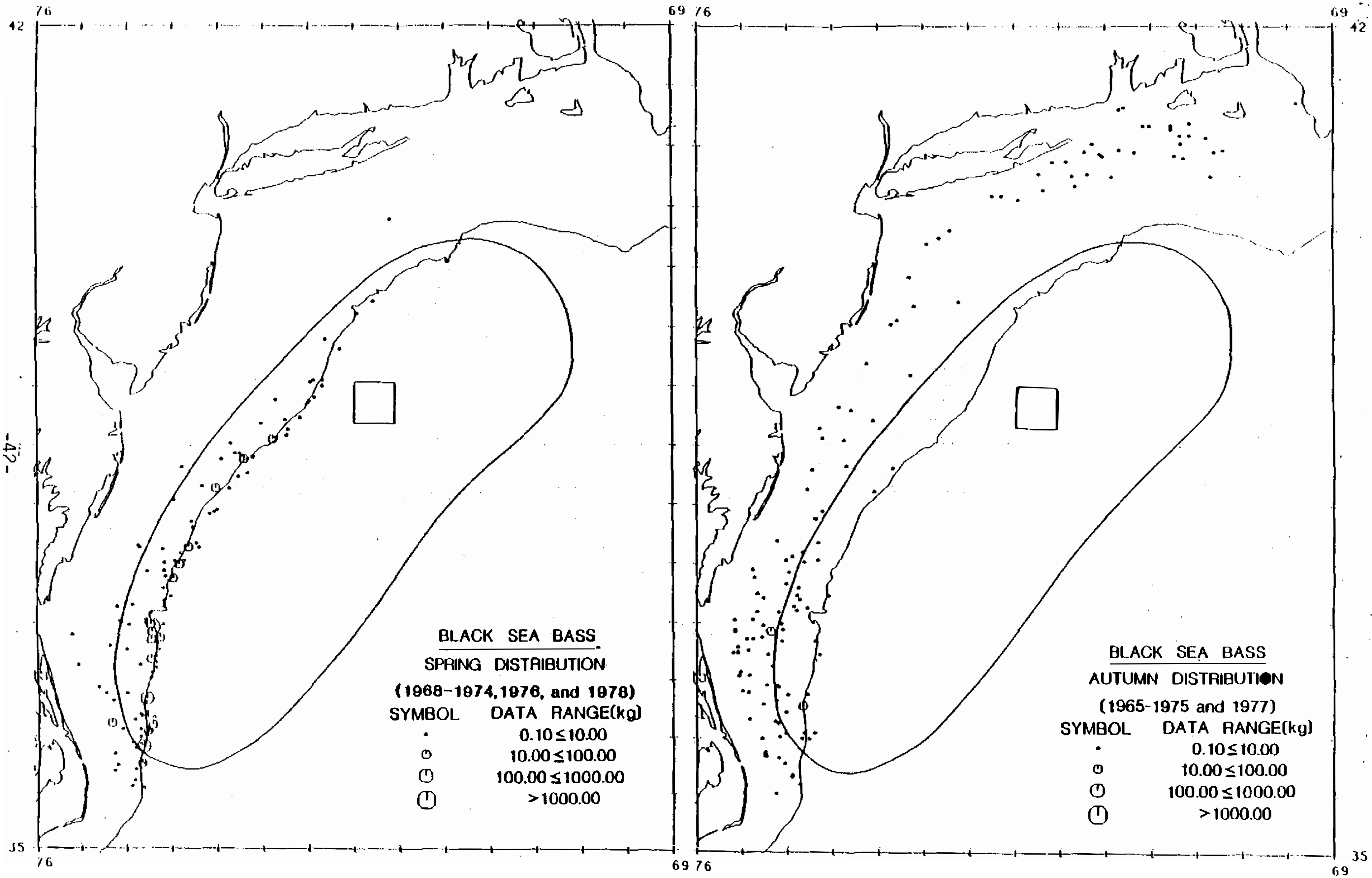


Figure 19.--Spring and autumn cumulative plots of black sea bass from NMFS-NEFC standardized bottom trawl survey cruises. Also illustrated is the location of Deepwater Dumpsite 106 (DWD-106) with its potential area of influence (PAI).

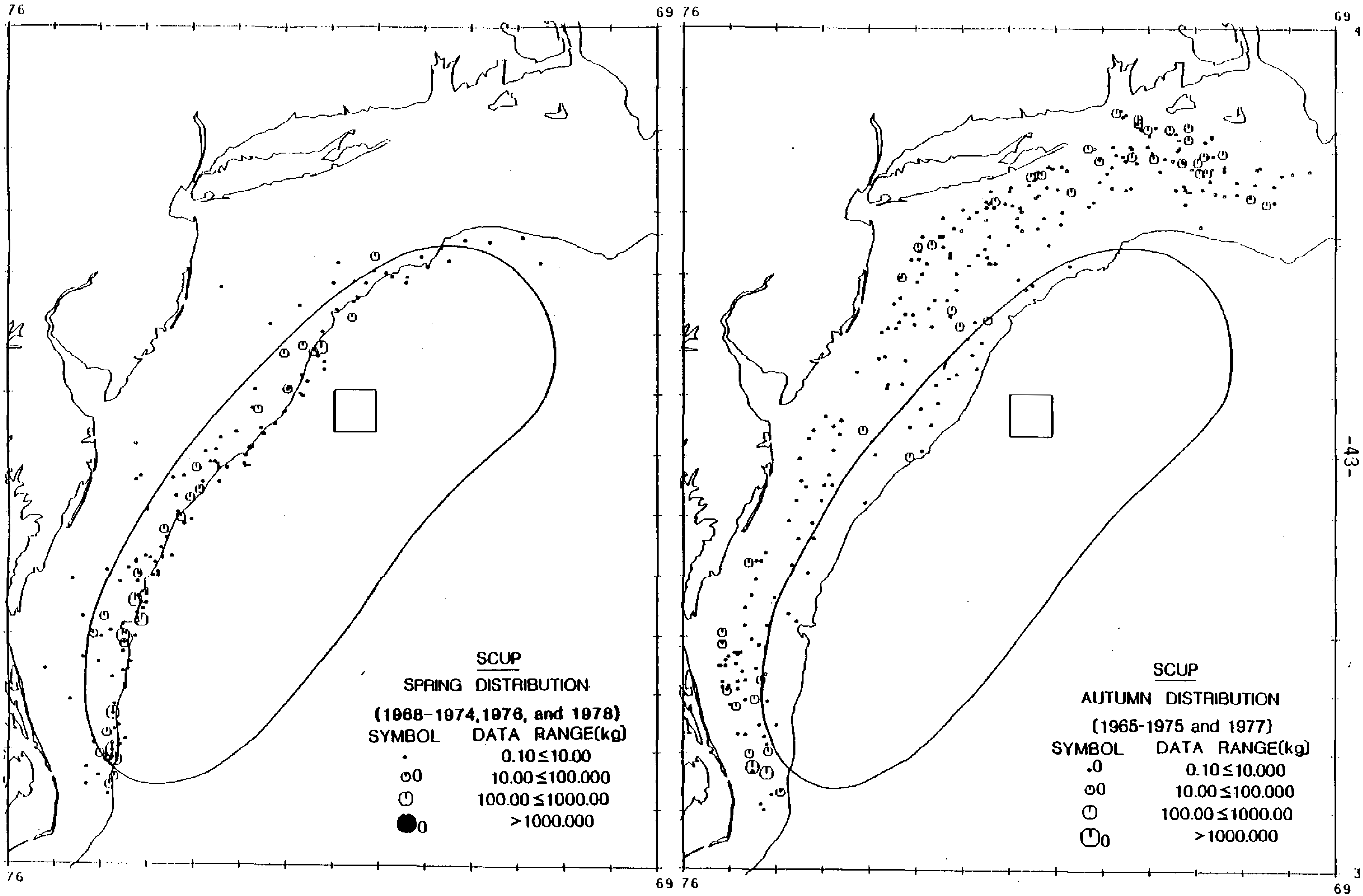


Figure 20.--Spring and autumn cumulative plots for scup from NMFS-NEFC standardized bottom trawl survey cruises. Also illustrated is the location of Deepwater Dumpsite 106 (DWD-106) with its potential area of influence (PAI).

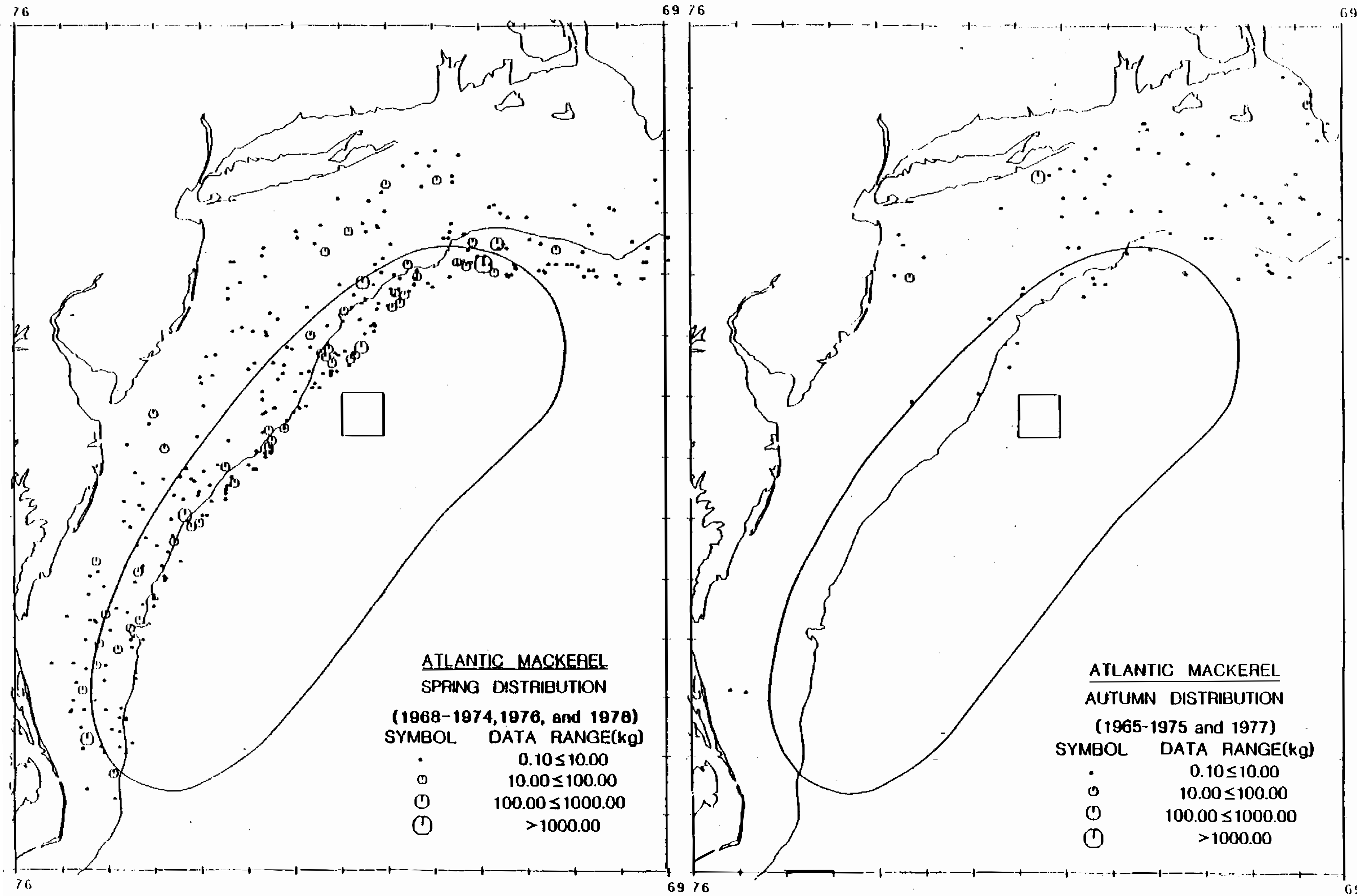


Figure 21.--Spring and autumn cumulative plots for Atlantic mackerel from NMFS-NEFC standardized bottom trawl survey cruises. Also illustrated is the location of Deepwater Dumpsite 106 (DWD-106) with its potential area of influence (PAI).

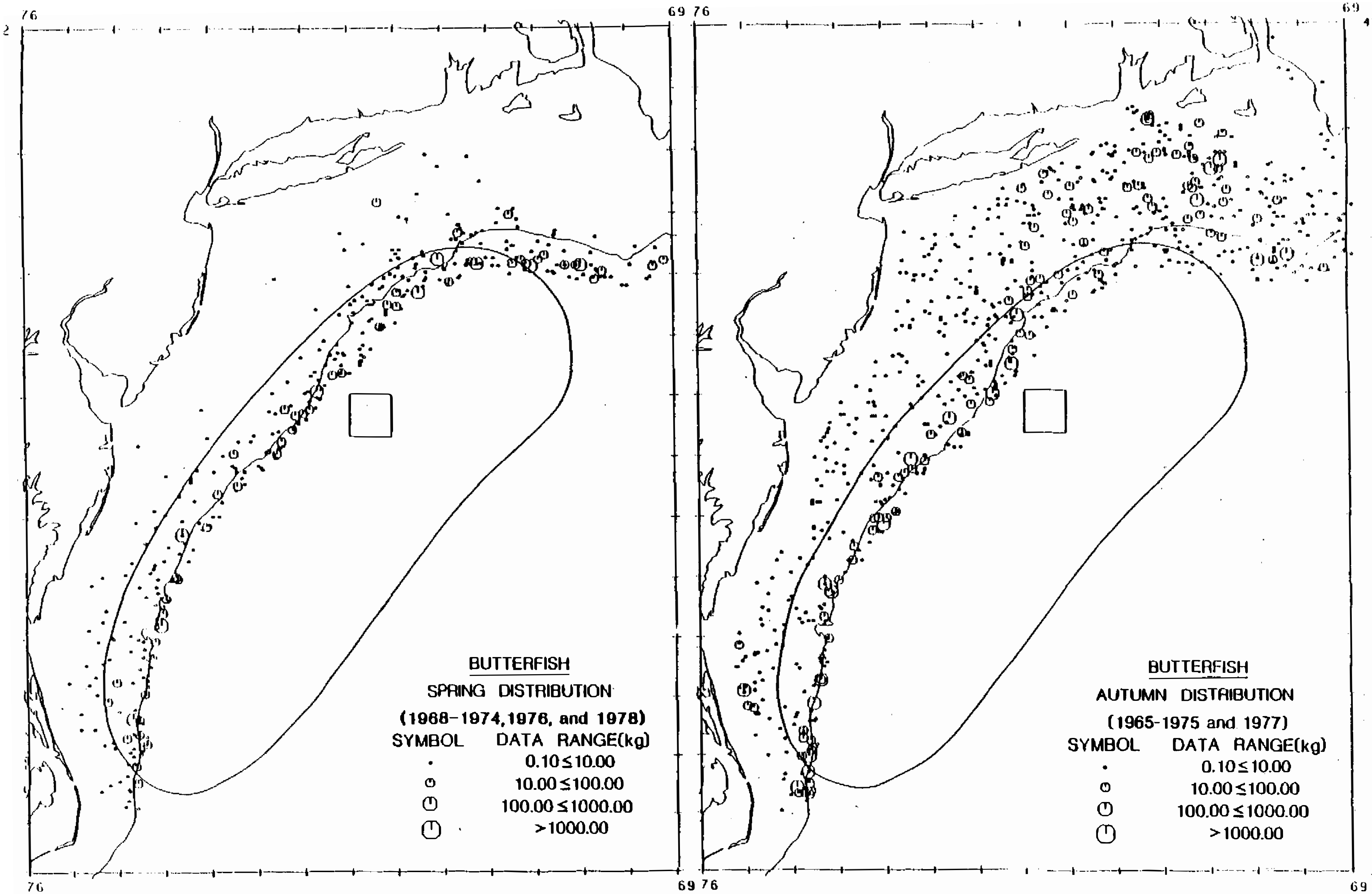


Figure 22.--Spring and autumn cumulative plots for butterfish from NMFS-NEFC standardized bottom trawl survey cruises. Also illustrated is the location of Deepwater Dumpsite 106 (DWD-106) with its potential area of influence (PAI).

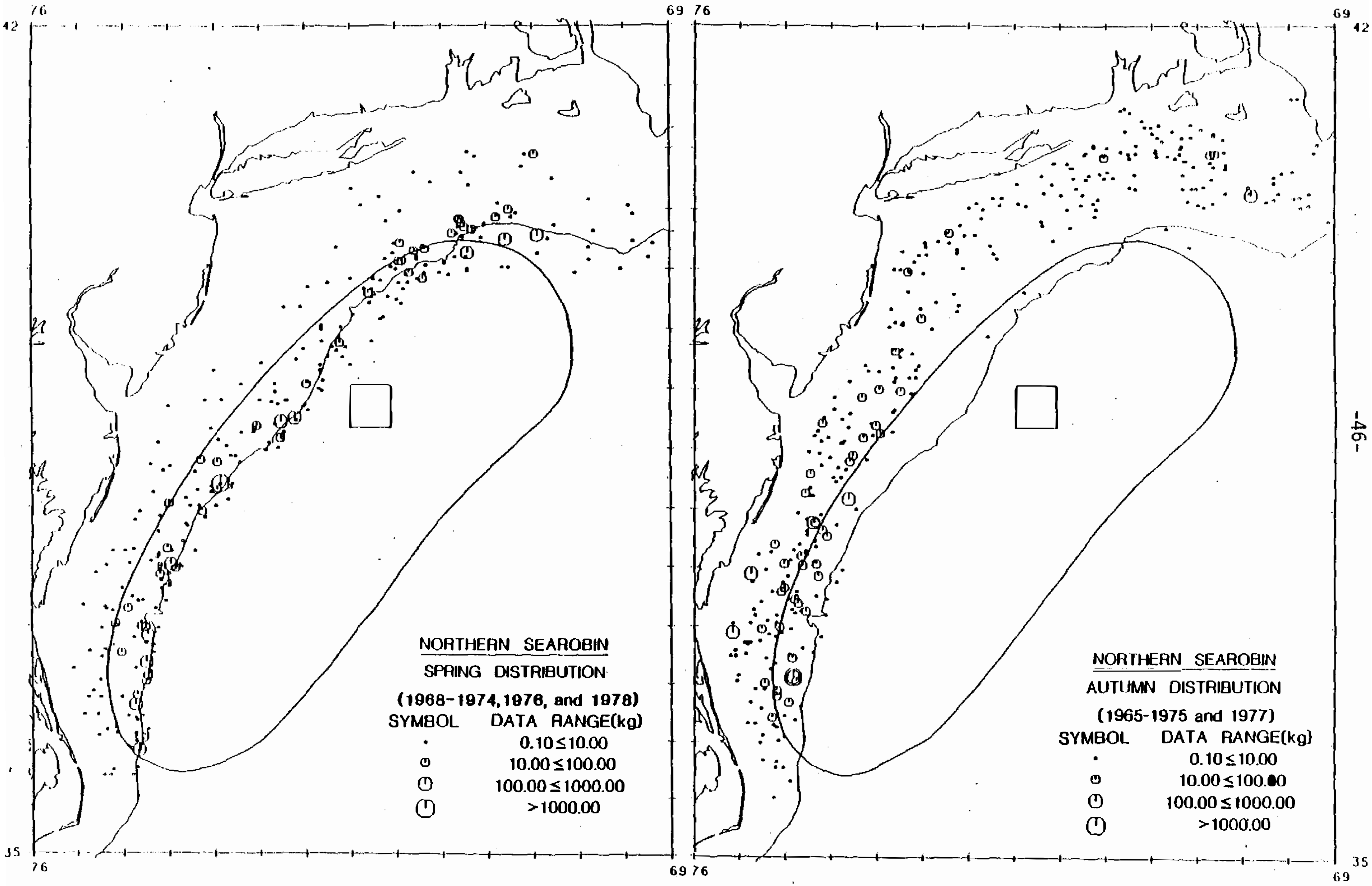


Figure 23.--Spring and autumn cumulative plots for northern searobin from NMFS-NEFC standardized bottom trawl survey cruises. Also illustrated is the location of Deepwater Dumpsite 106 (DWD-106) with its potential area of influence (PAI).

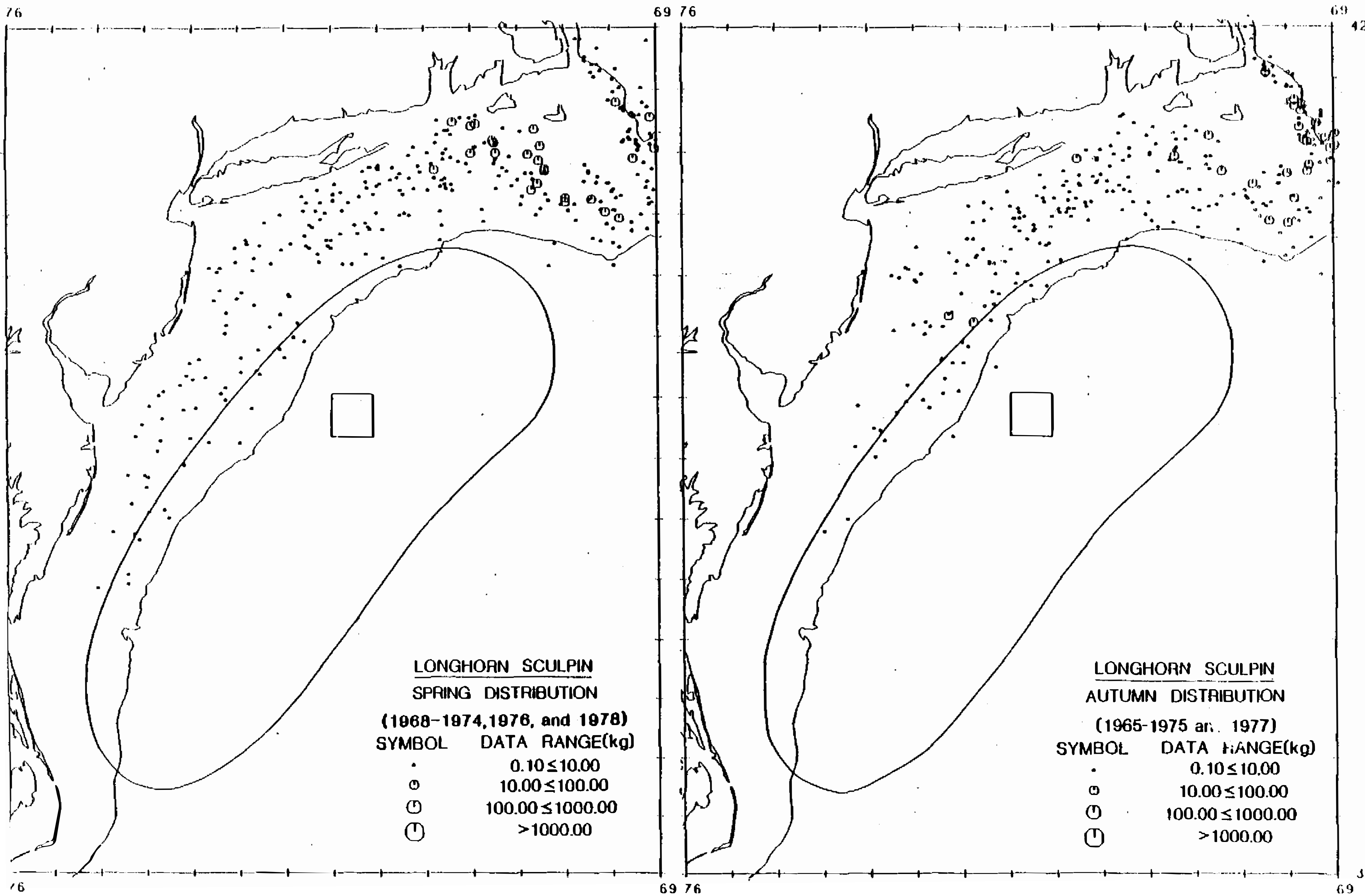


Figure 24.--Spring and autumn cumulative plots for longhorn sculpin from NMFS-NEFC standardized bottom trawl survey cruises. Also illustrated is the location of Deepwater Dumpsite 106 (DWD-106) with its potential area of influence (PAI).

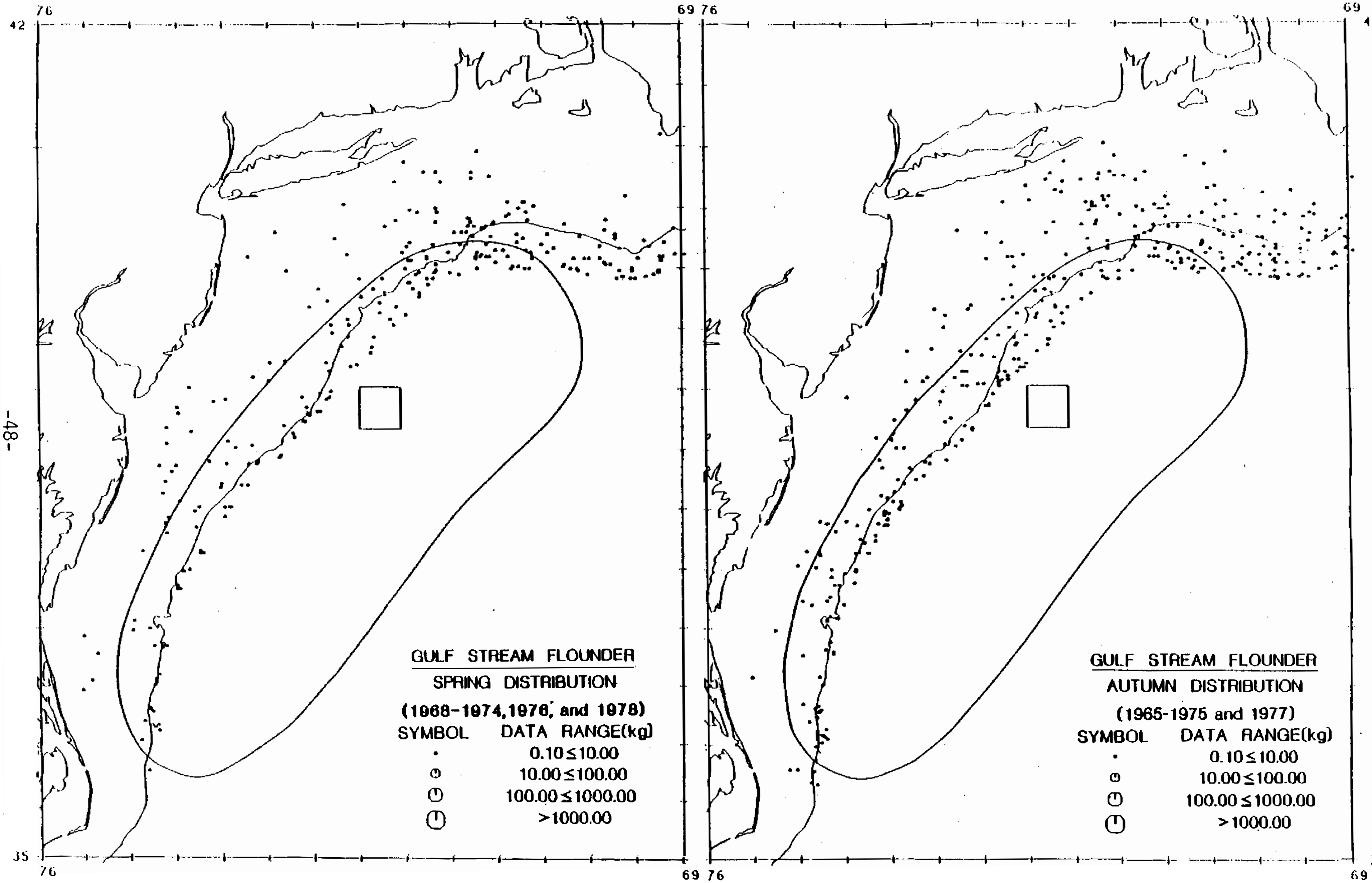


Figure 25.--Spring and autumn cumulative plots for Gulf Stream flounder from NMFS-NEFC standardized bottom trawl survey cruises. Also illustrated is the location of Deepwater Dumpsite 106 (DWD-106) with

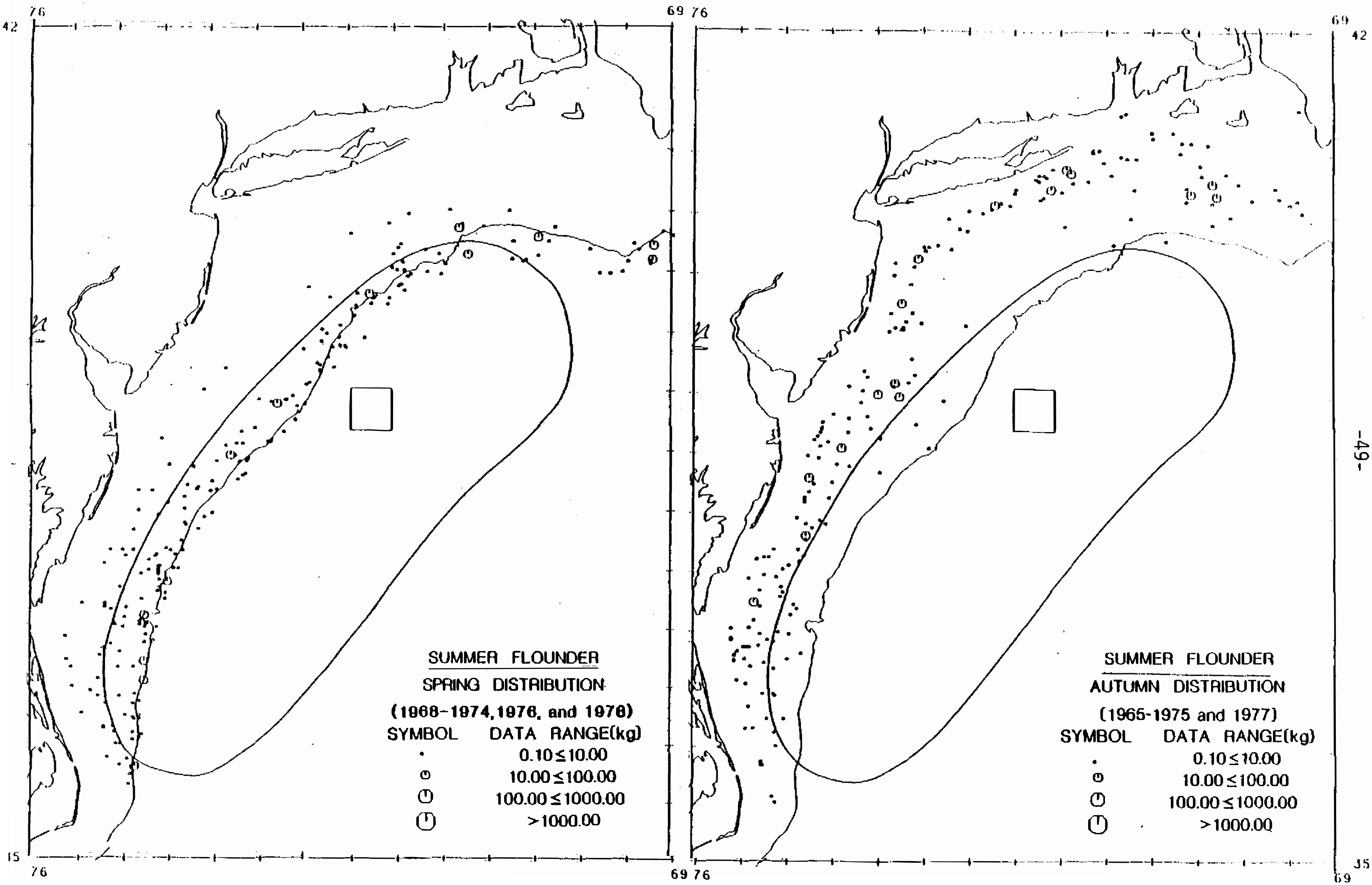


Figure 26.--Spring and autumn cumulative plots for summer flounder from NMFS-NEFC standardized bottom trawl survey cruises. Also illustrated is the location of Deepwater Dumpsite 106 (DWD-106) with its potential area of influence (PAI).

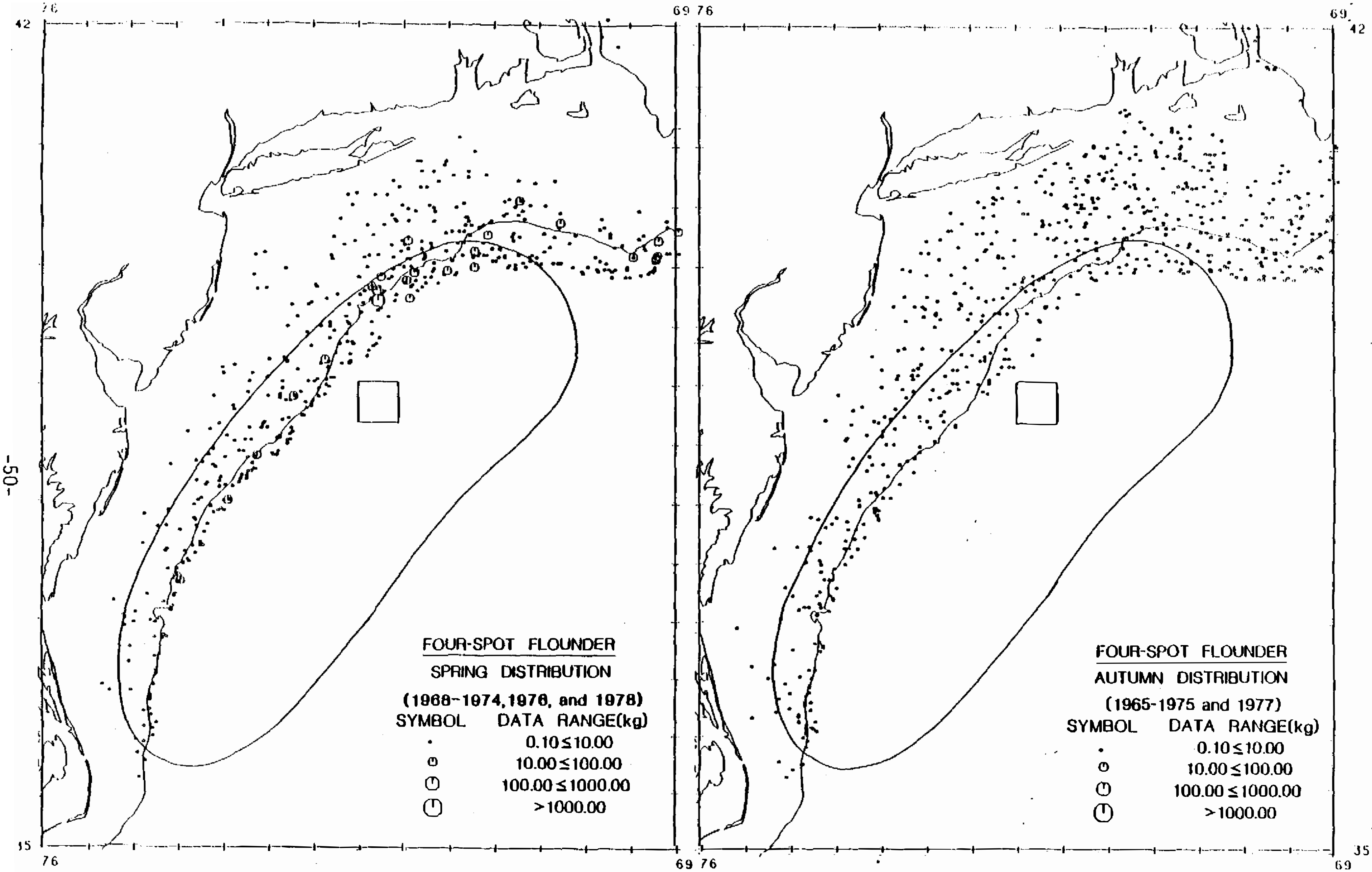


Figure 27.--Spring and autumn cumulative plots for four-spot flounder from NMFS-NEFC standardized bottom trawl survey cruises. Also illustrated is the location of Deepwater Dumpsite 106 (DWD-106) with its potential area of influence (PAI).

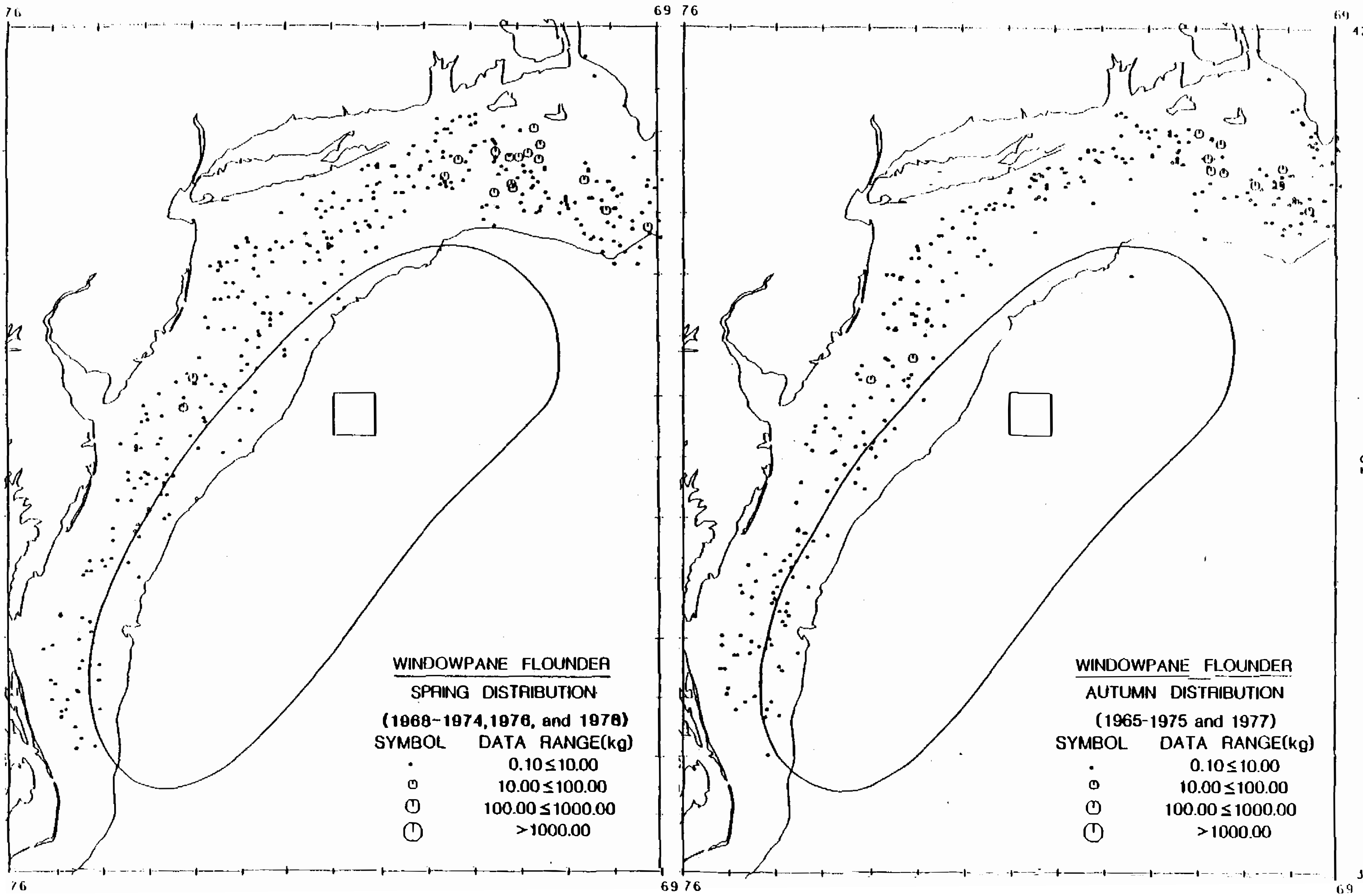
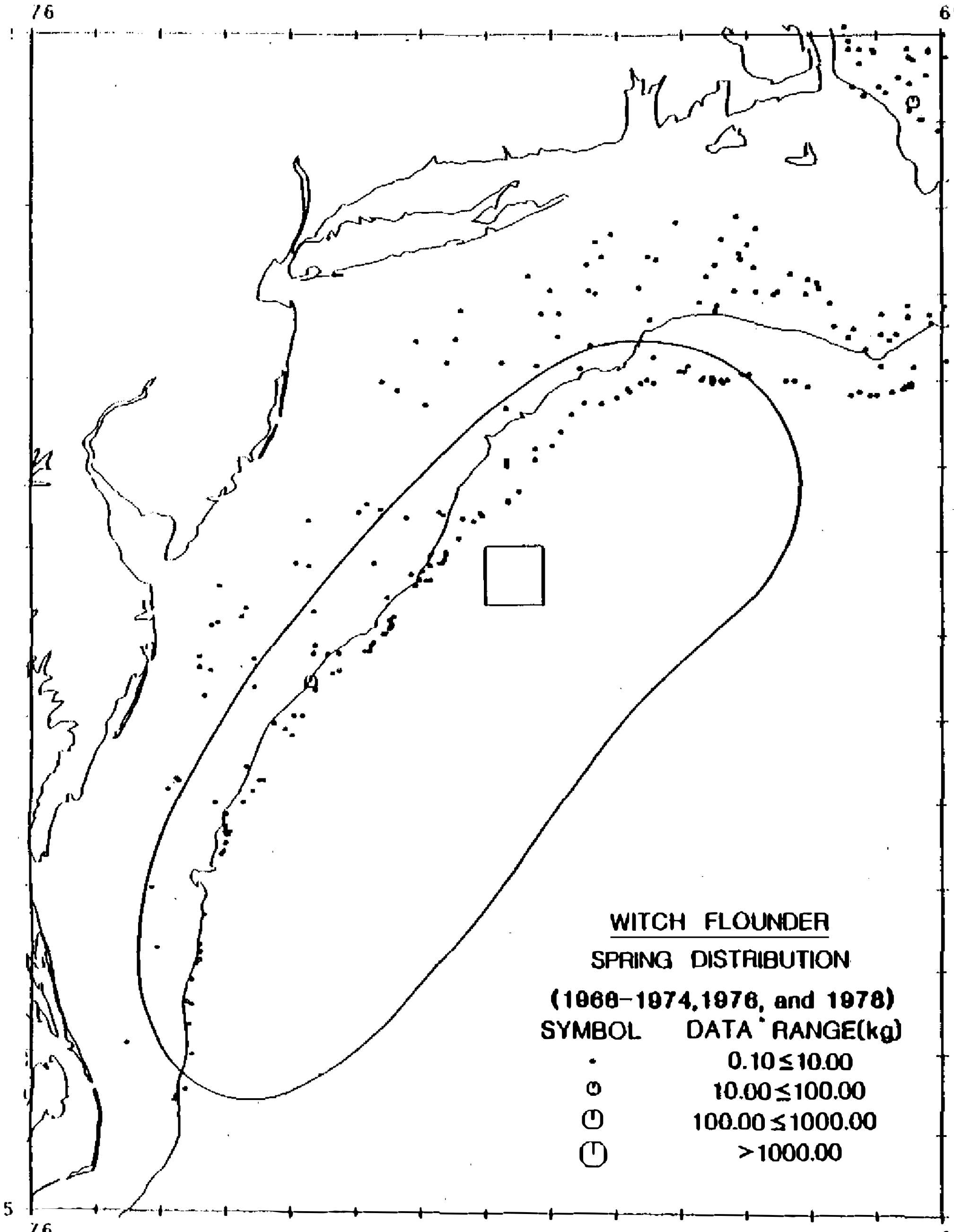


Figure 28.--Spring and autumn cumulative plots for windowpane flounder from NMFS-NEFC standardized bottom trawl survey cruises. Also illustrated is the location of Deepwater Dumpsite 106 (DWD-106) with its potential area of influence (PAI).



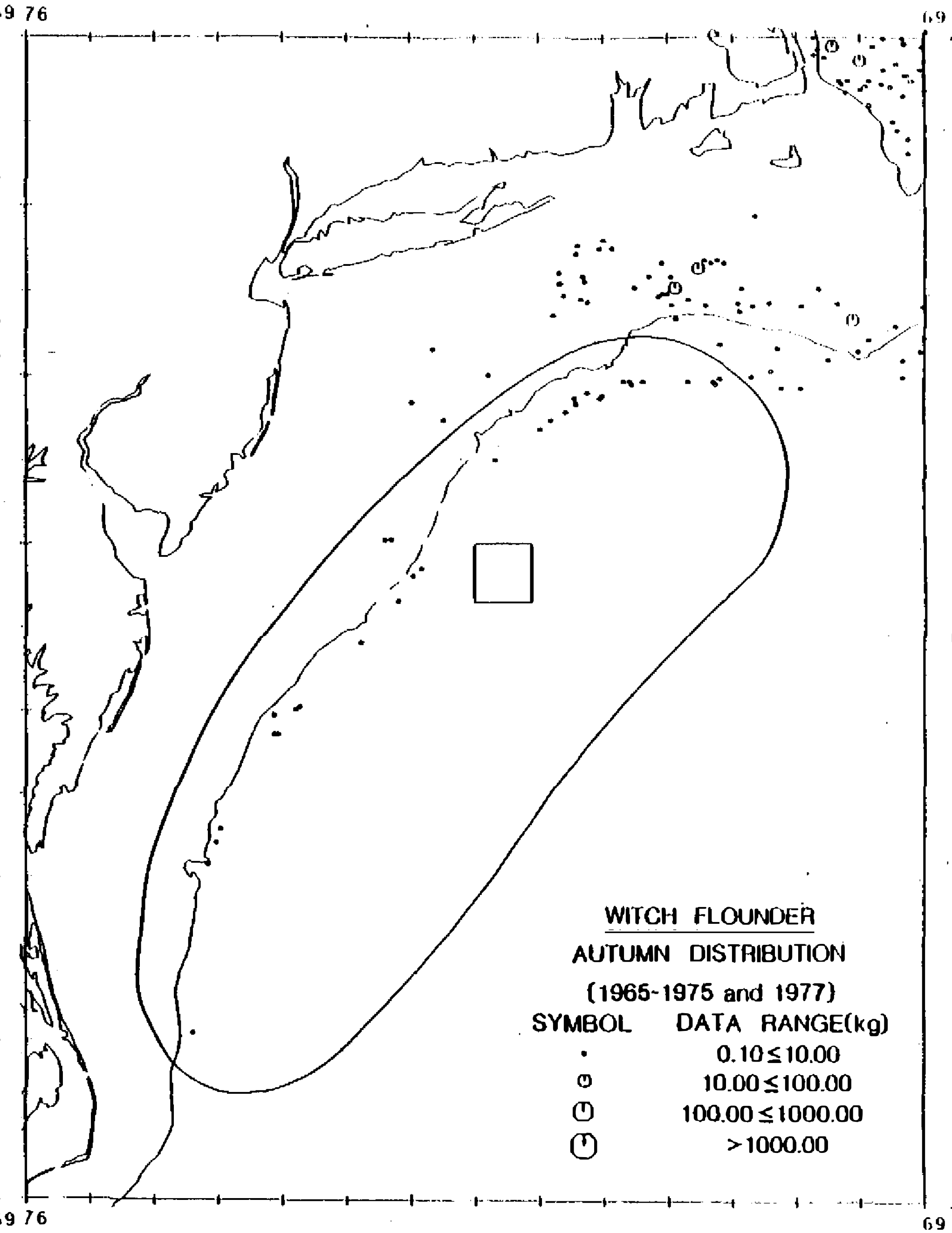


Figure 29.--Spring and autumn cumulative plots for witch flounder from NMFS-NEFC standardized bottom trawl survey cruises. Also illustrated is the location of Deepwater Dumpsite 106 (DWD-106) with its potential area of influence (PAI).

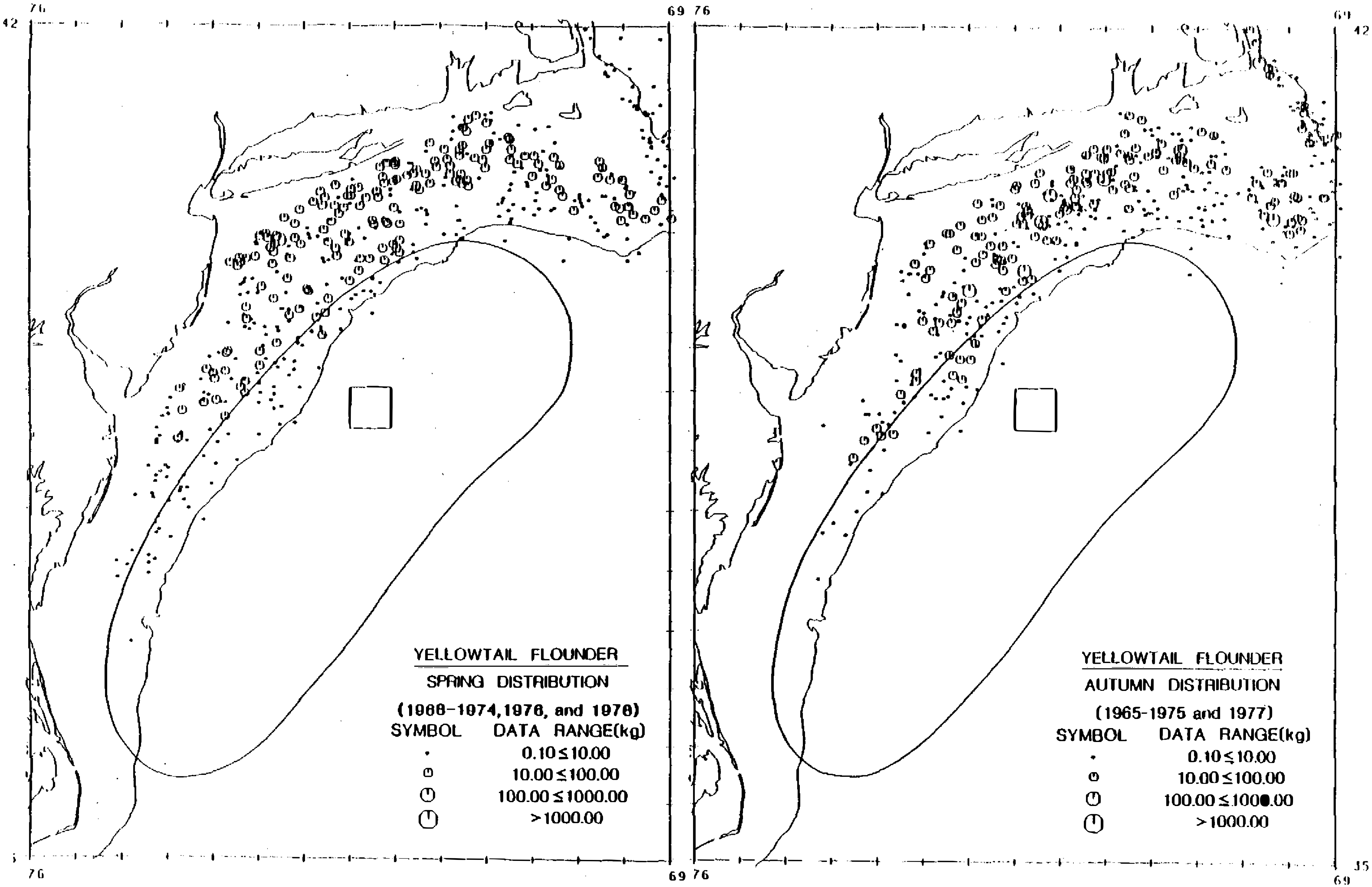


Figure 30.--Spring and autumn cumulative plots for yellowtail flounder from NMFS-NEFC standardized bottom trawl survey cruises. Also illustrated is the location of Deepwater Dumpsite 106 (DWD-106) with its potential area of influence (PAI).

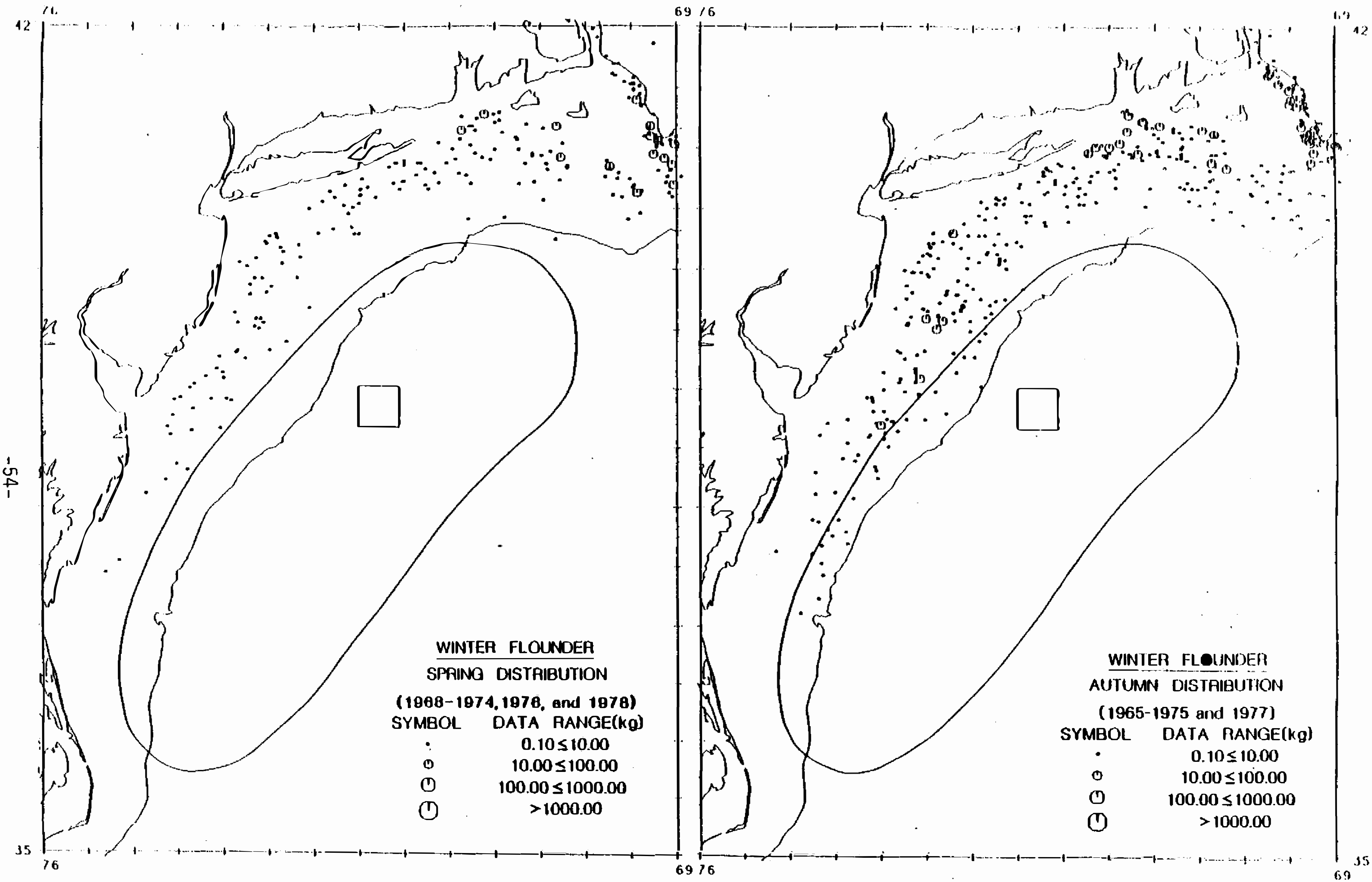


Figure 31.--Spring and autumn cumulative plots of winter flounder from NMFS-NEFC standardized bottom trawl survey cruises. Also illustrated is the location of Deepwater Dumpsite 106 (DWD-106) with its potential area of influence (PAI).

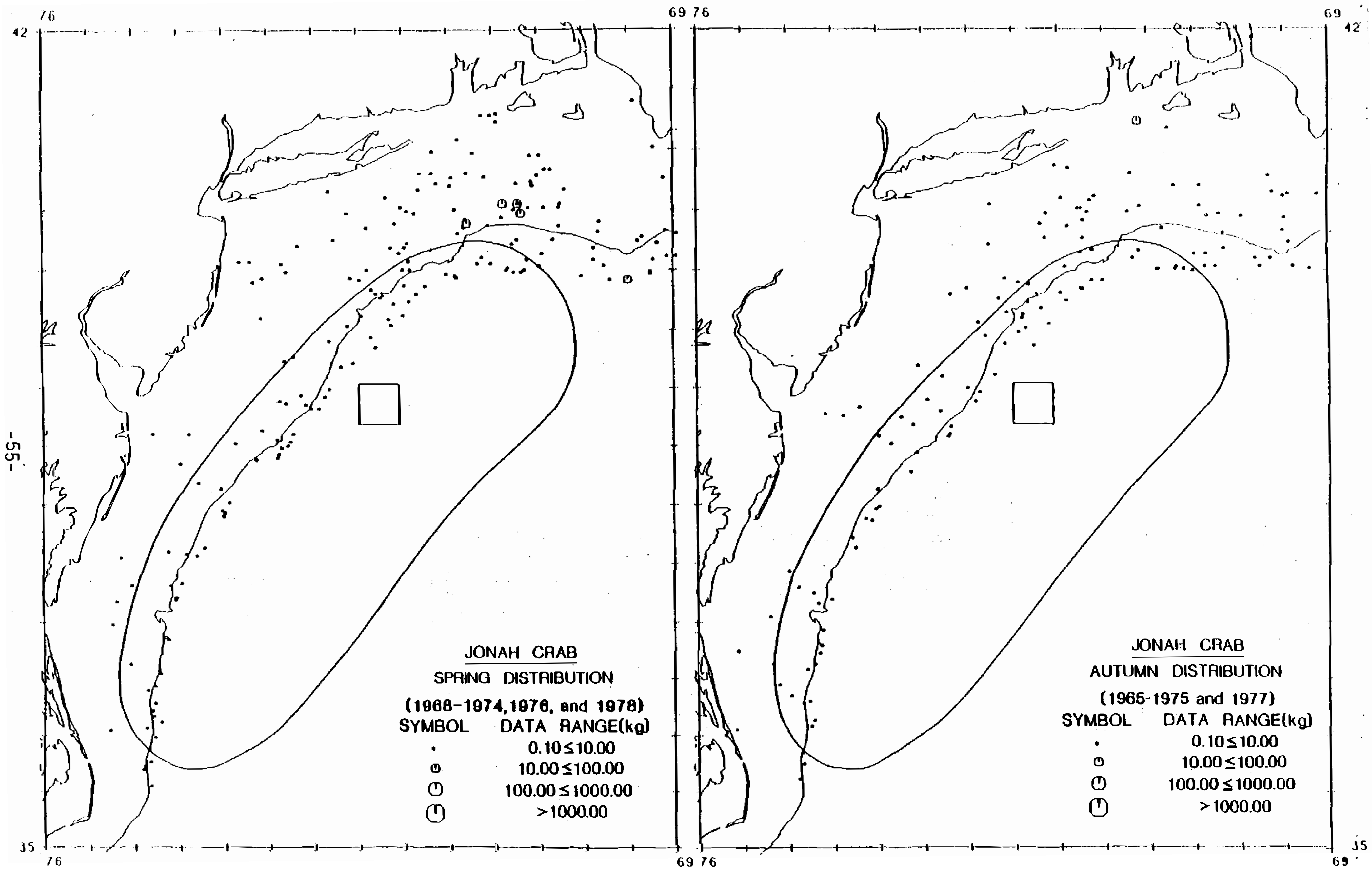


Figure 32.--Spring and autumn cumulative plots for Jonah crab from NMFS-NEFC standardized bottom trawl survey cruises. Also illustrated is the location of Deepwater Dumpsite 106 (DWD-106) with its potential area of influence (PAI).

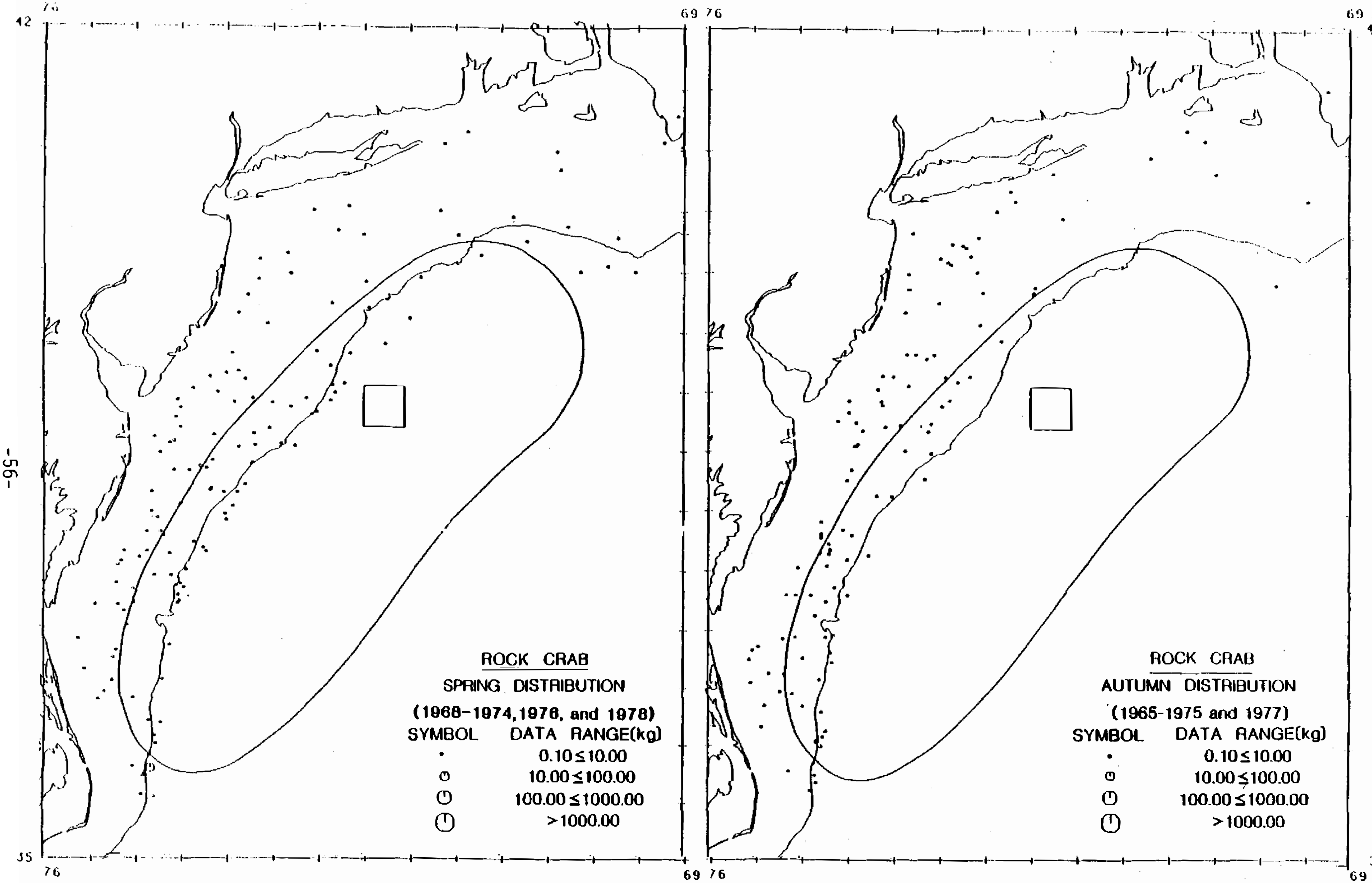


Figure 33.--Spring and autumn cumulative plots for rock crab from NMFS-NEFC standardized bottom trawl survey cruises. Also illustrated is the location of Deepwater Dumpsite 106 (DWD-106) with its potential area of influence (PAI).

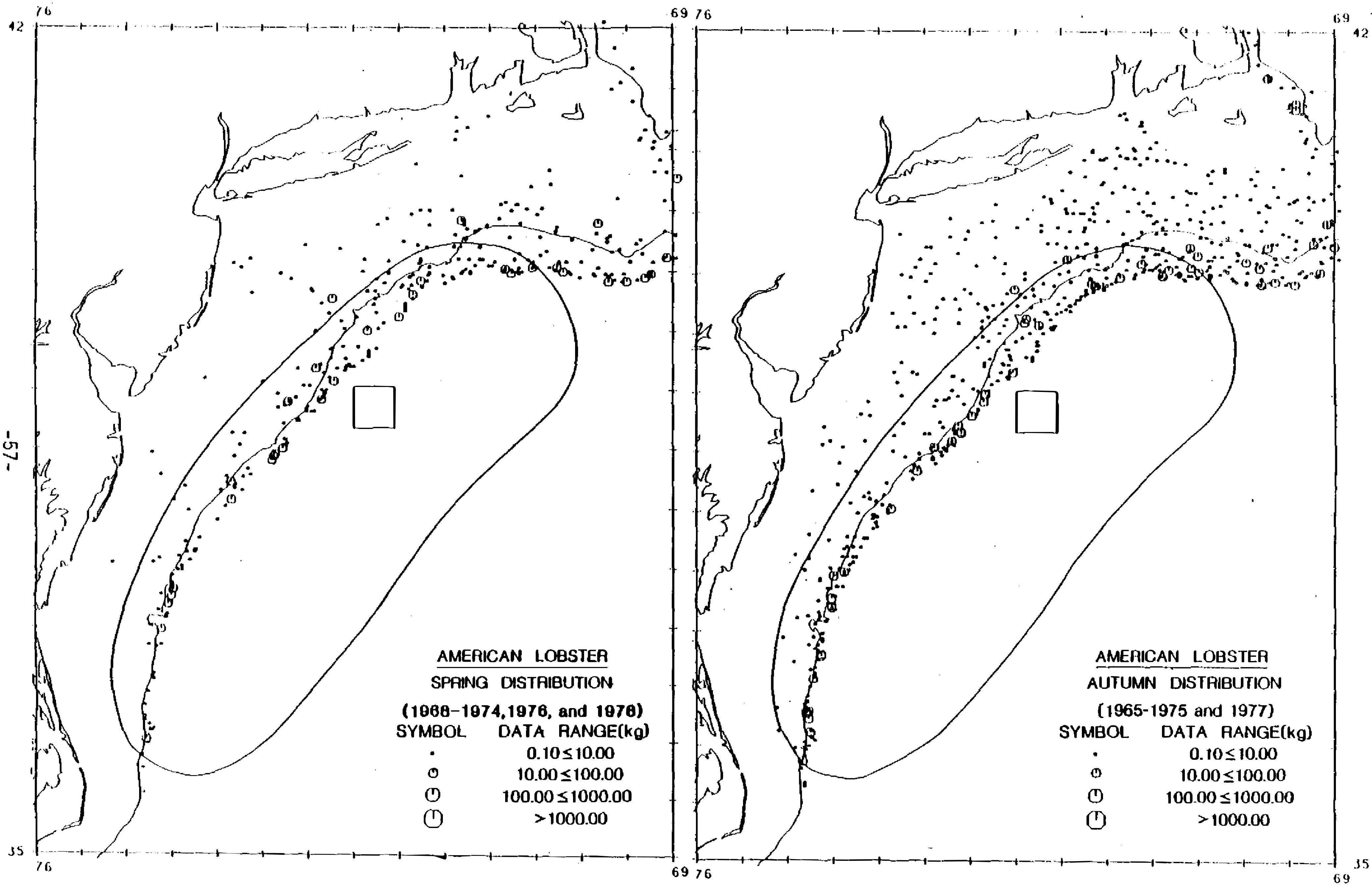


Figure 34.--Spring and autumn cumulative plots for American lobster from NMFS-NEFC standardized bottom trawl survey cruises. Also illustrated is the location of Deepwater Dumpsite 106 (DWD-106) with its potential area of influence (PAI).

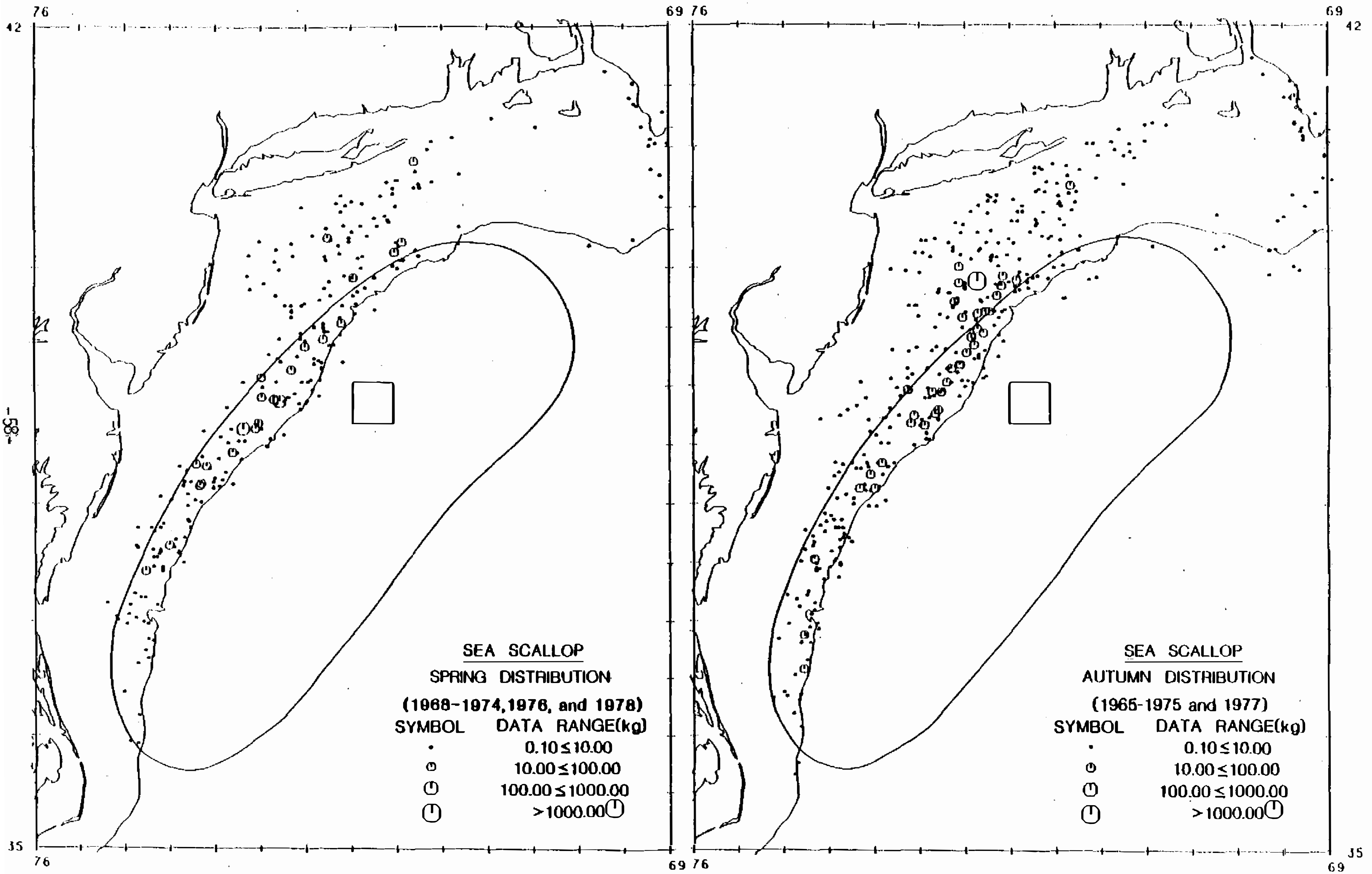


Figure 35.--Spring and autumn cumulative plots for sea scallop from NMFS-NEFC standardized bottom trawl survey cruises. Also illustrated is the location of Deepwater Dumpsite 106 (DWD-106) with its potential area of influence (PAI).

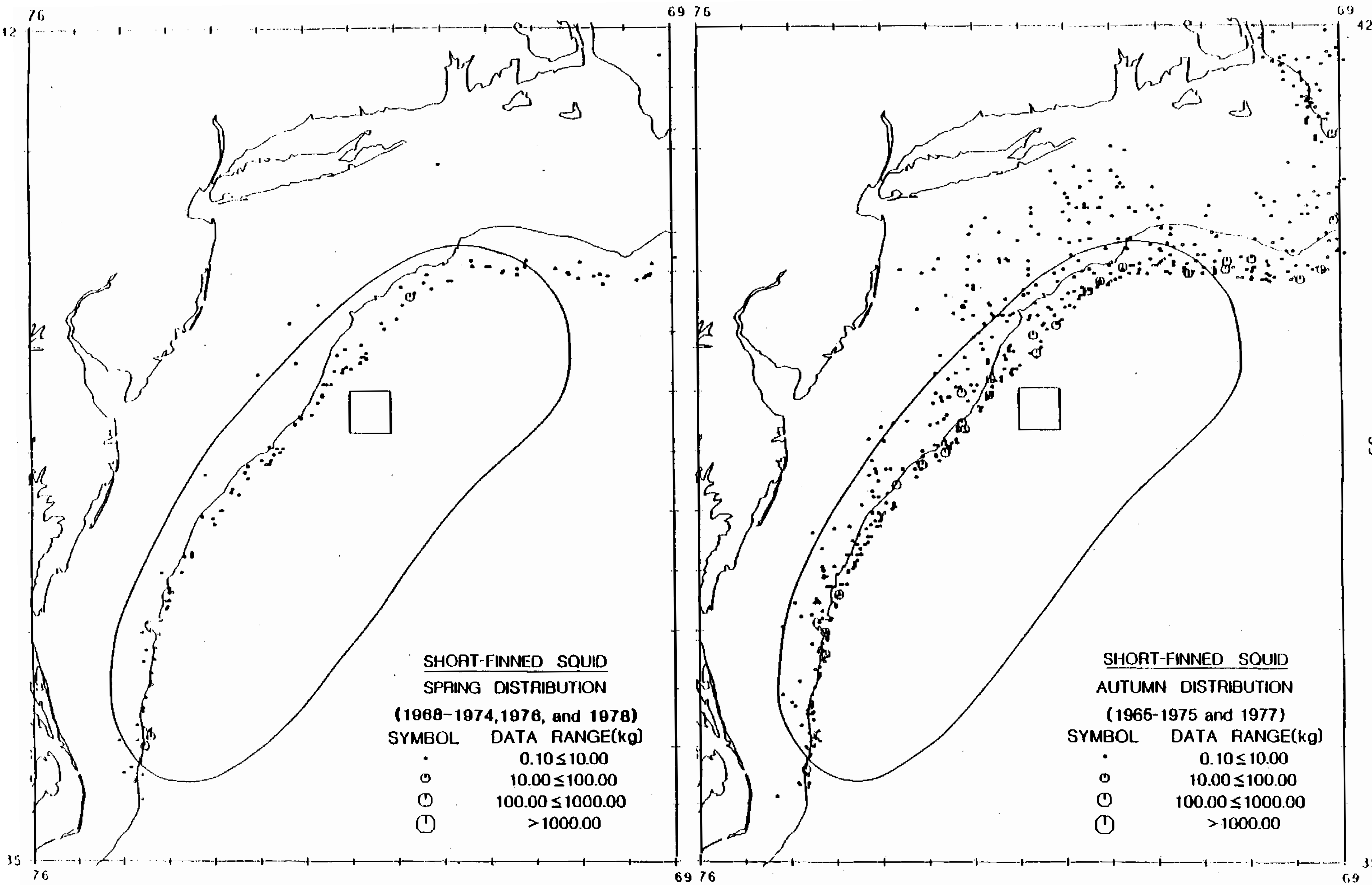


Figure 36.--Spring and autumn cumulative plots for short-finned squid from NMFS-NEFC standardized bottom trawl survey cruises. Also illustrated is the location of Deepwater Dumpsite 106 (DWD-106) with its potential area of influence (PAI).

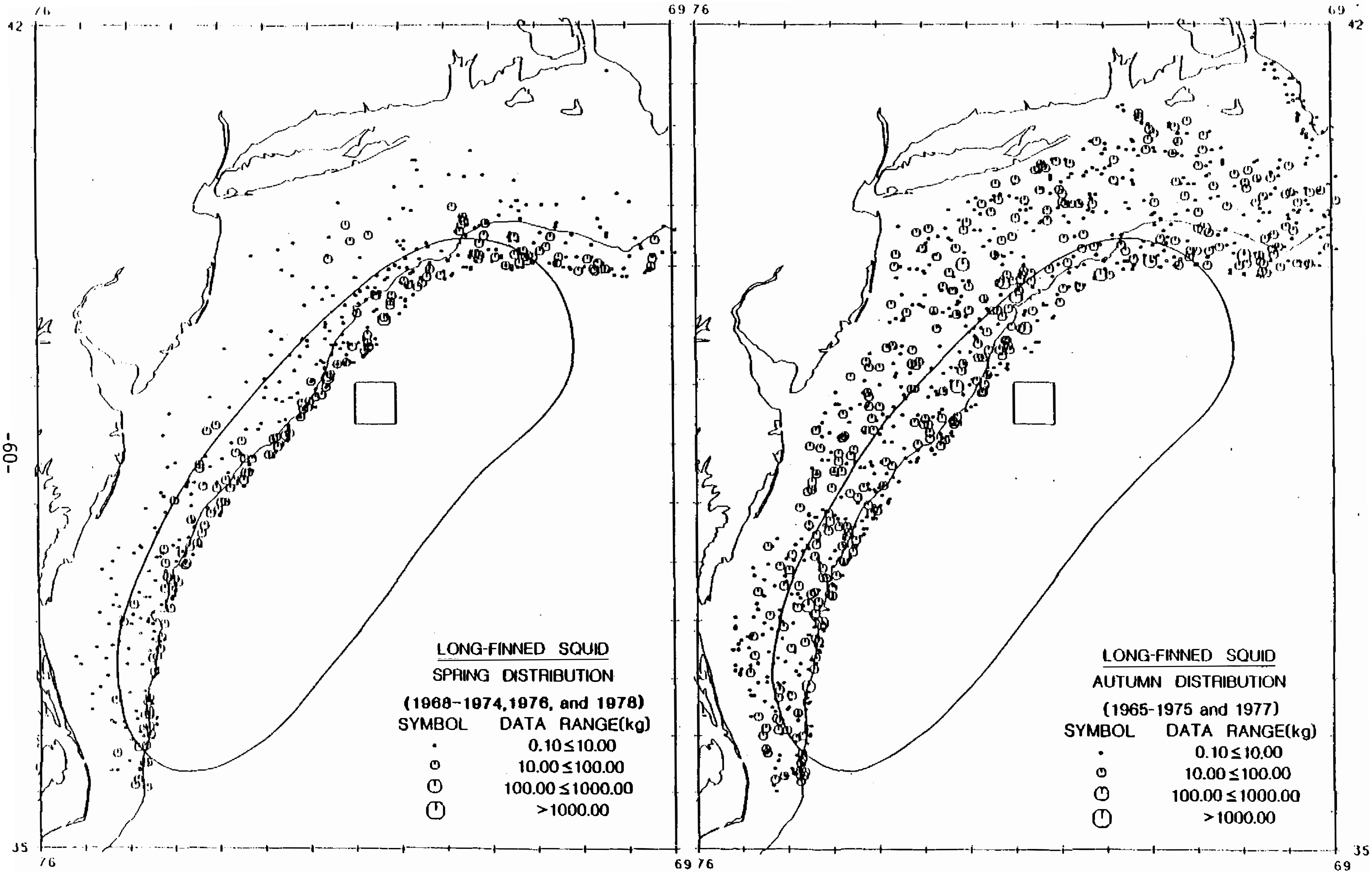


Figure 37.--Spring and autumn cumulative plots for long-finned squid from NMFS-NEFC standardized bottom trawl survey cruises. Also illustrated is the location of Deepwater Dumpsite 106 (DWD-106) with its potential area of influence (PAI).

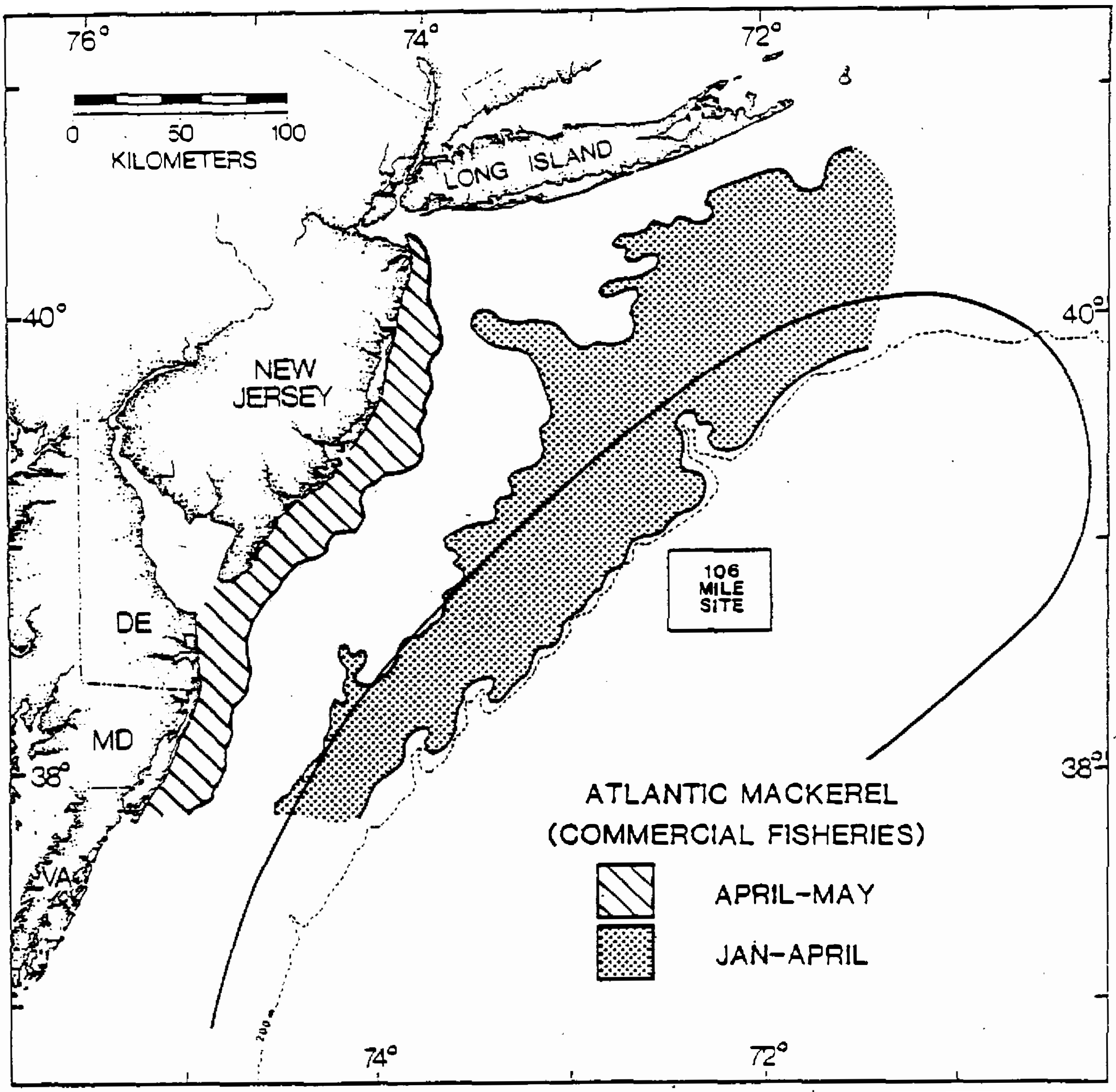


Figure 38.--New Jersey's commercial fishing grounds for Atlantic mackerel (Long and Figley 1981) including location of Deepwater Dumpsite 106 (DWD-106) and its potential area of influence (PAI).

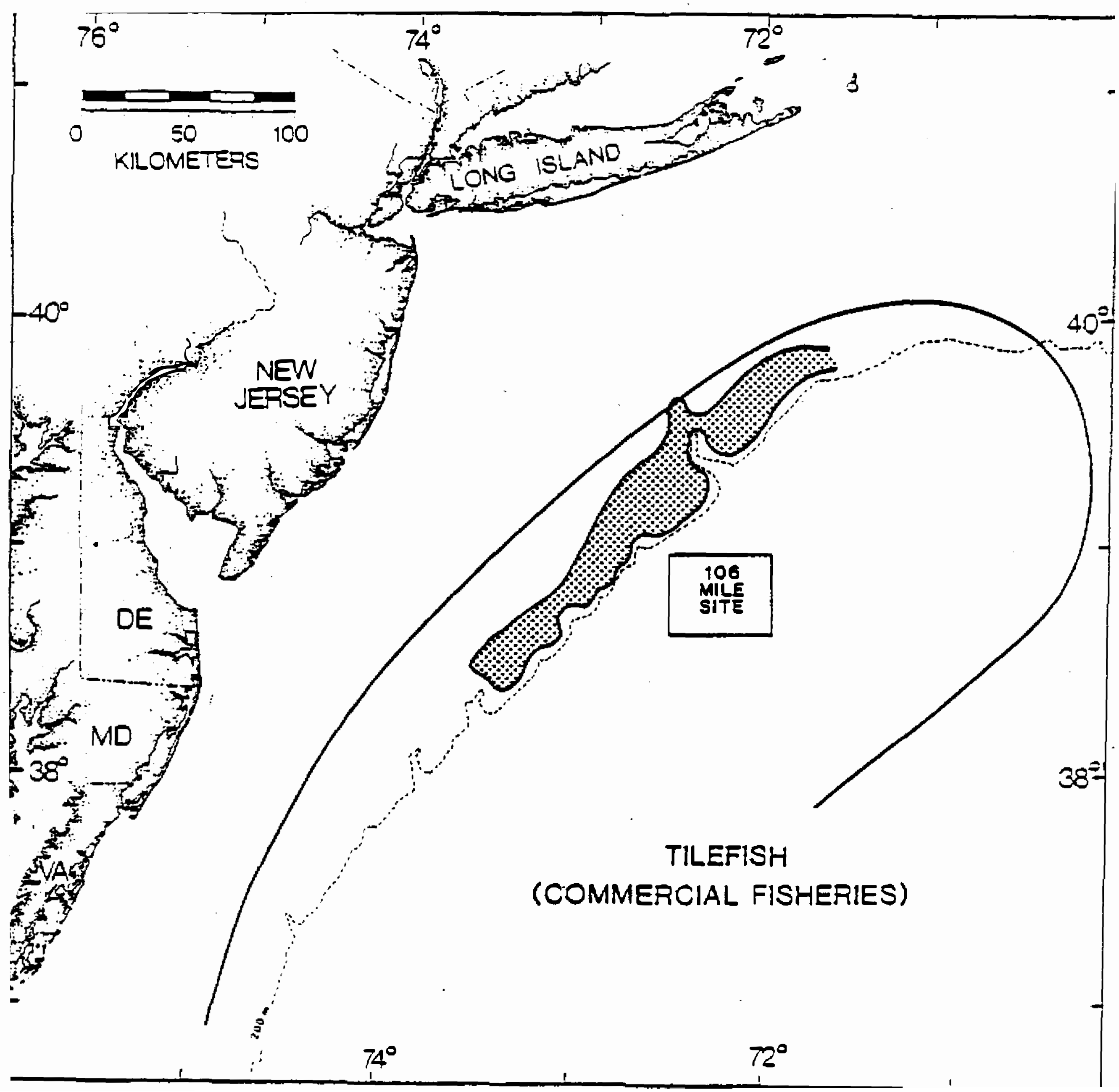


Figure 39.--New Jersey's commecial fishing grounds for tilefish (Long and Figley 1981) including location of Deepwater Dumpsite 106 and its potential area of influence (PAI).

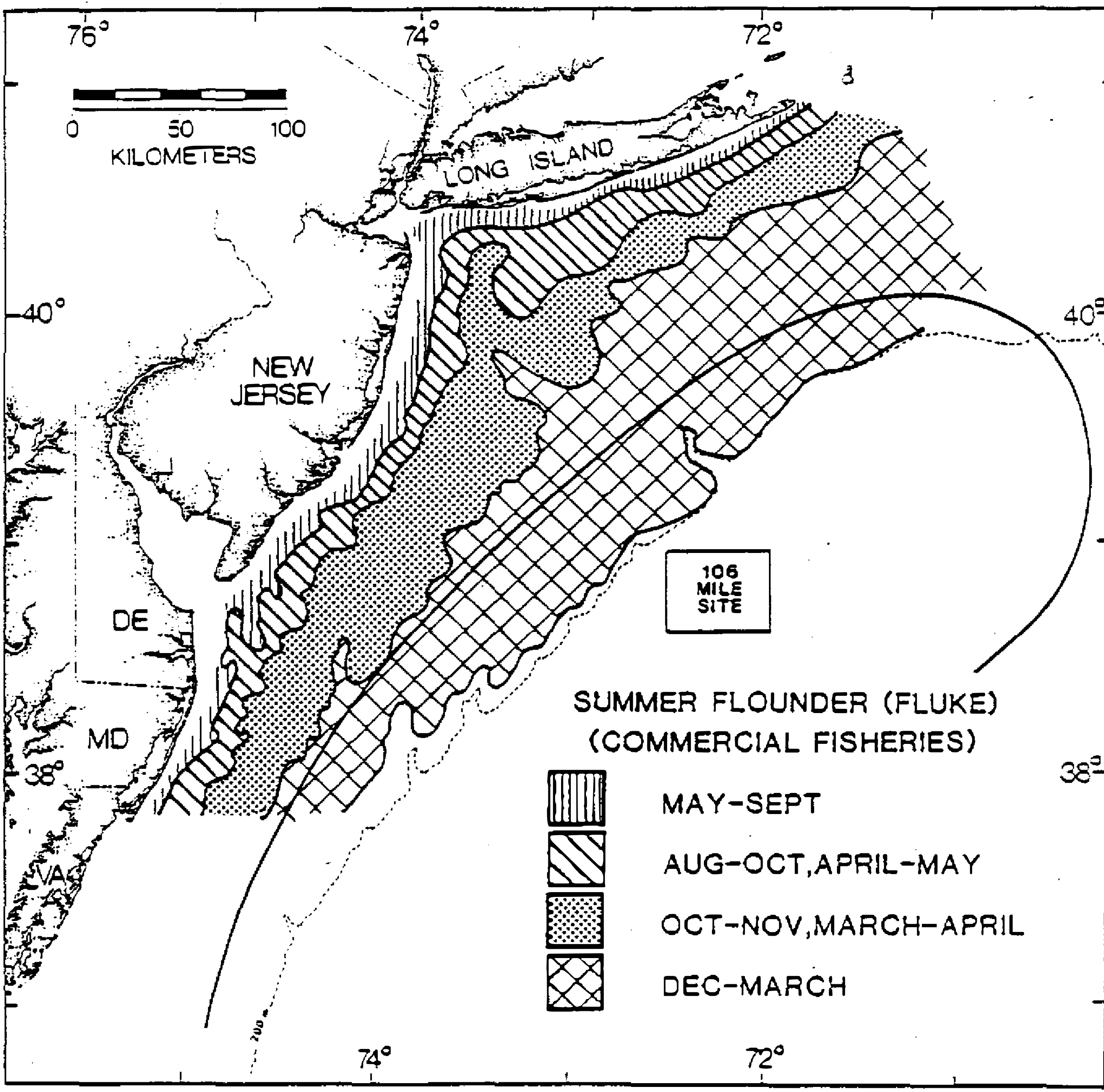


Figure 40.--New Jersey's commercial fishing grounds for summer flounder (Long and Figley 1981) including location of Deepwater Dumpsite 106 (DWD-106) and its potential area of influence (PAI).

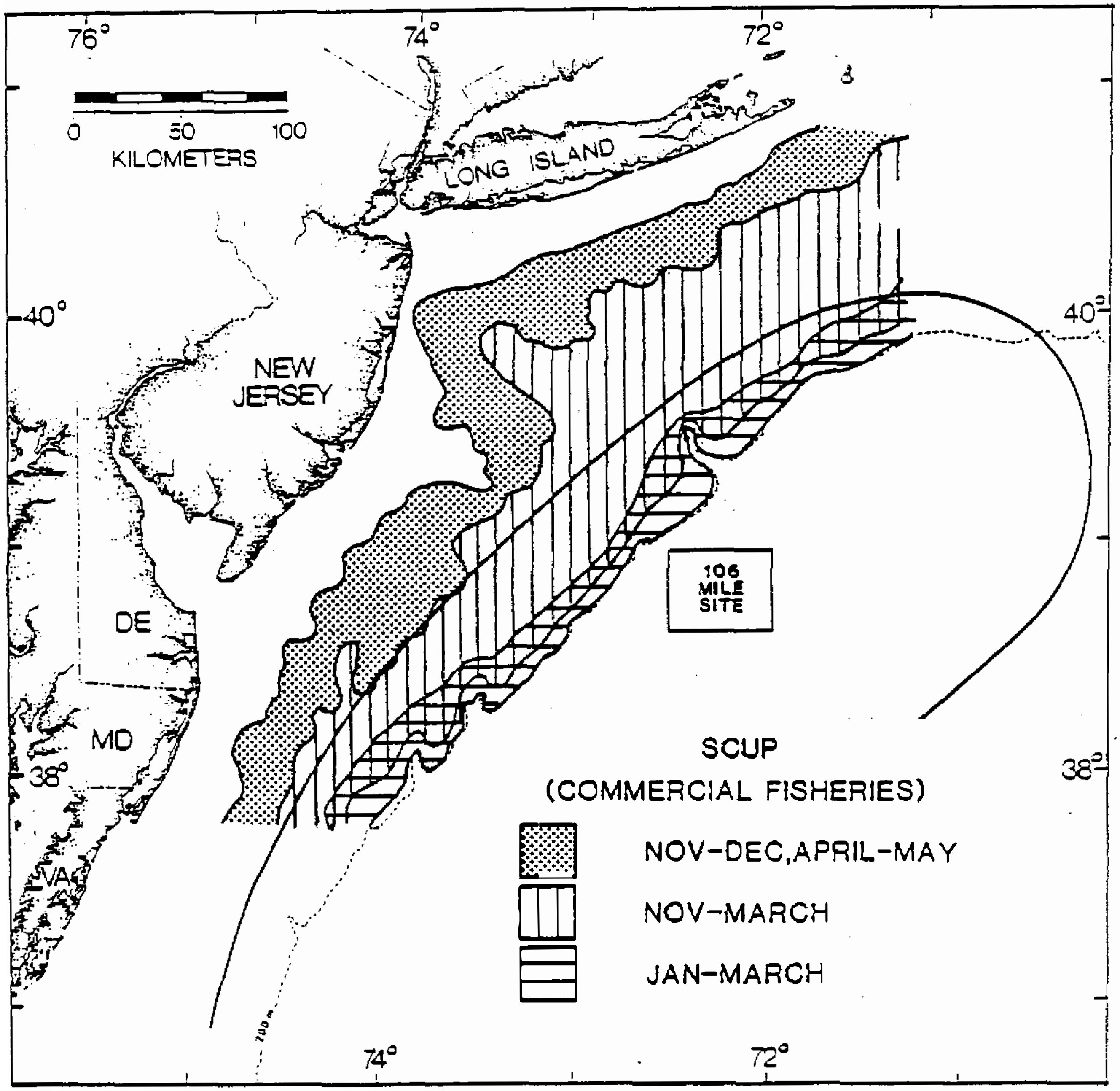


Figure 41.--New Jersey's commercial fishing grounds for scup (Long and Figley 1981) including location of Deepwater Dumpsite 106 (DWD-106) and its potential area of influence (PAI).

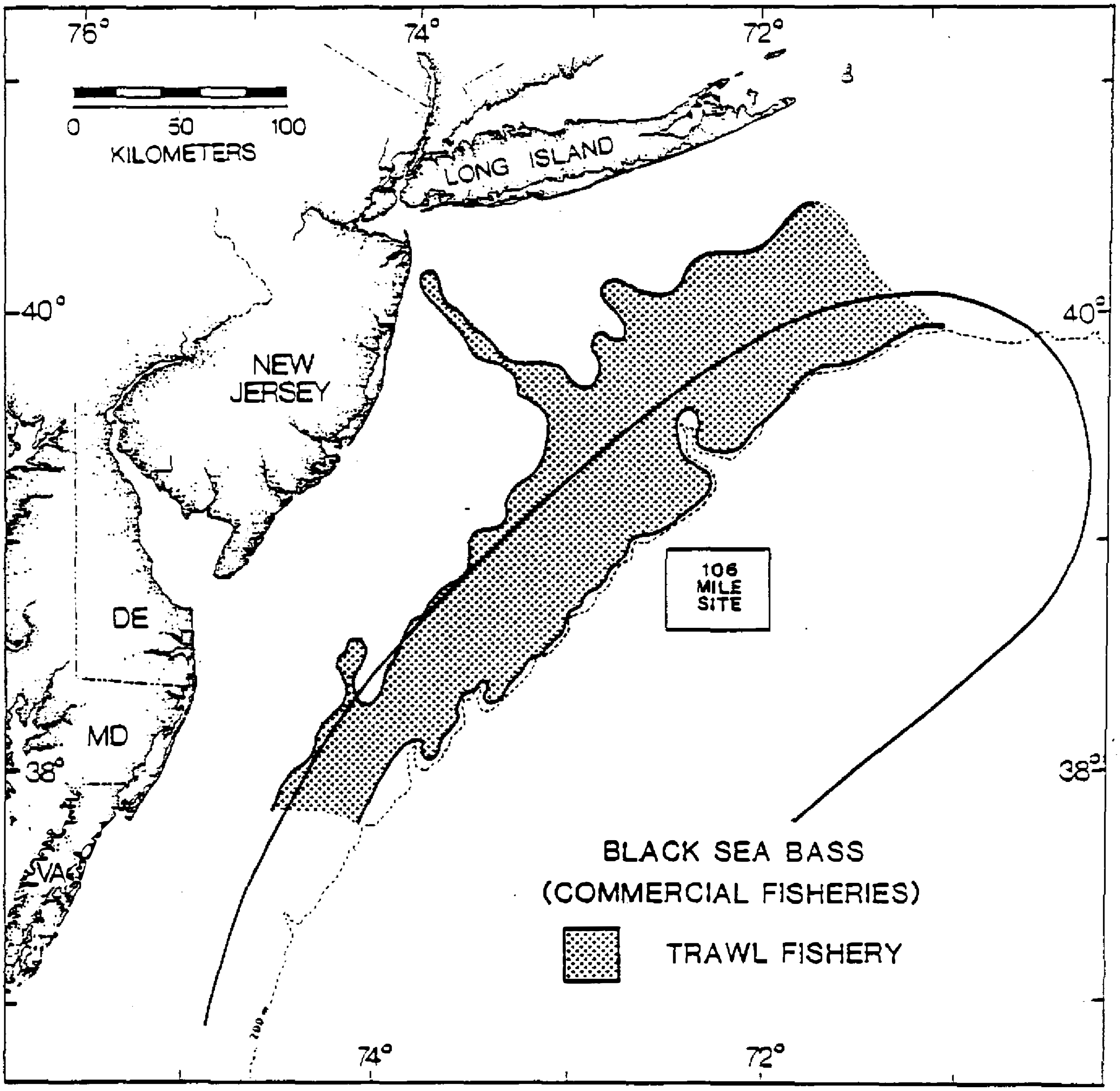


Figure 42.--New Jersey's commercial fishing grounds for black sea bass (Long and Figley 1981) including location of Deepwater Dumpsite 106 (DWD-106) and its potential area of influence (PAI).

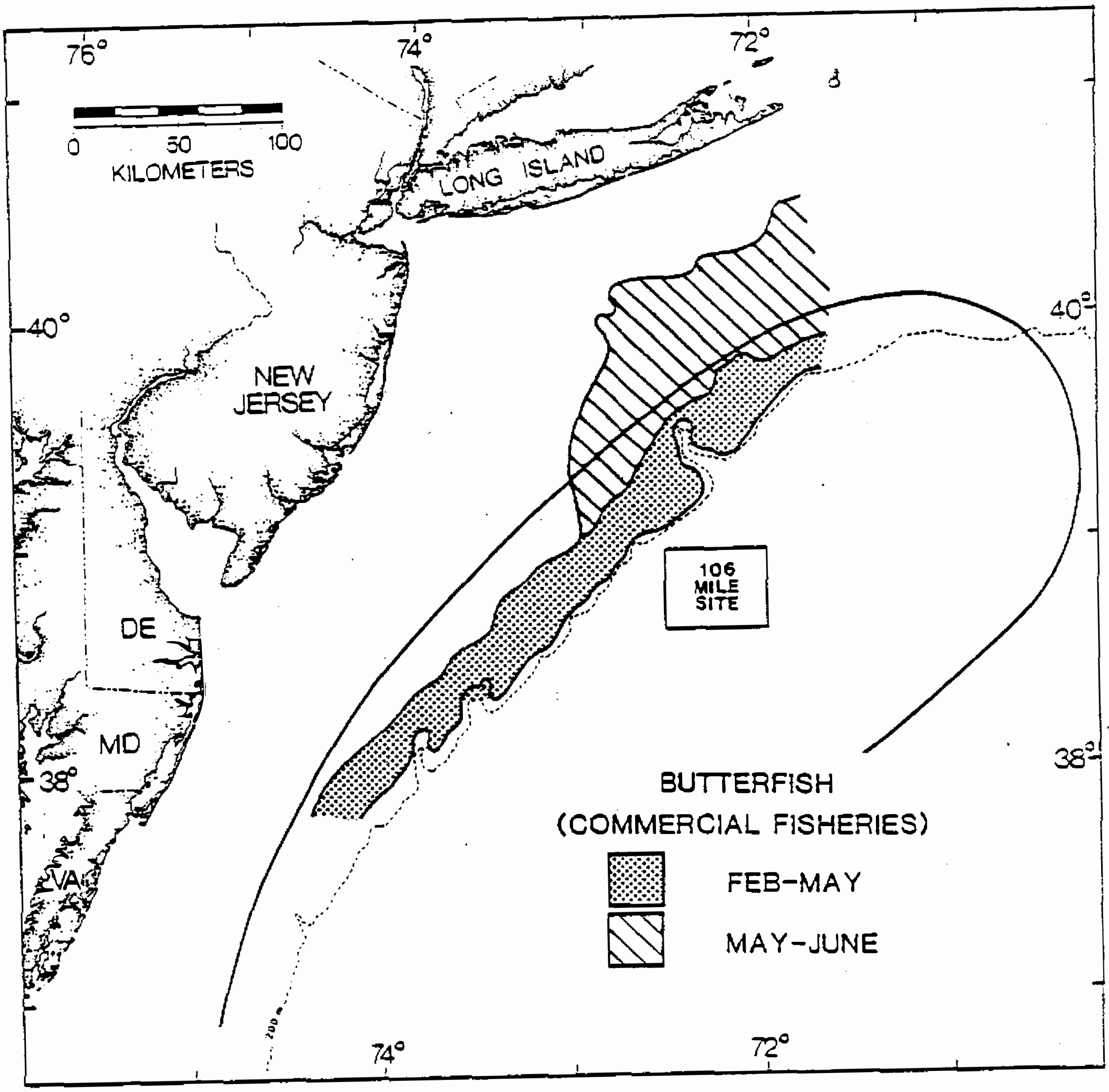


Figure 43.--New Jersey's commercial fishing grounds for butterfish (Long and Figley 1981) including location of Deepwater Dumpsite 106 (DWD-106) and its potential area of influence (PAI).

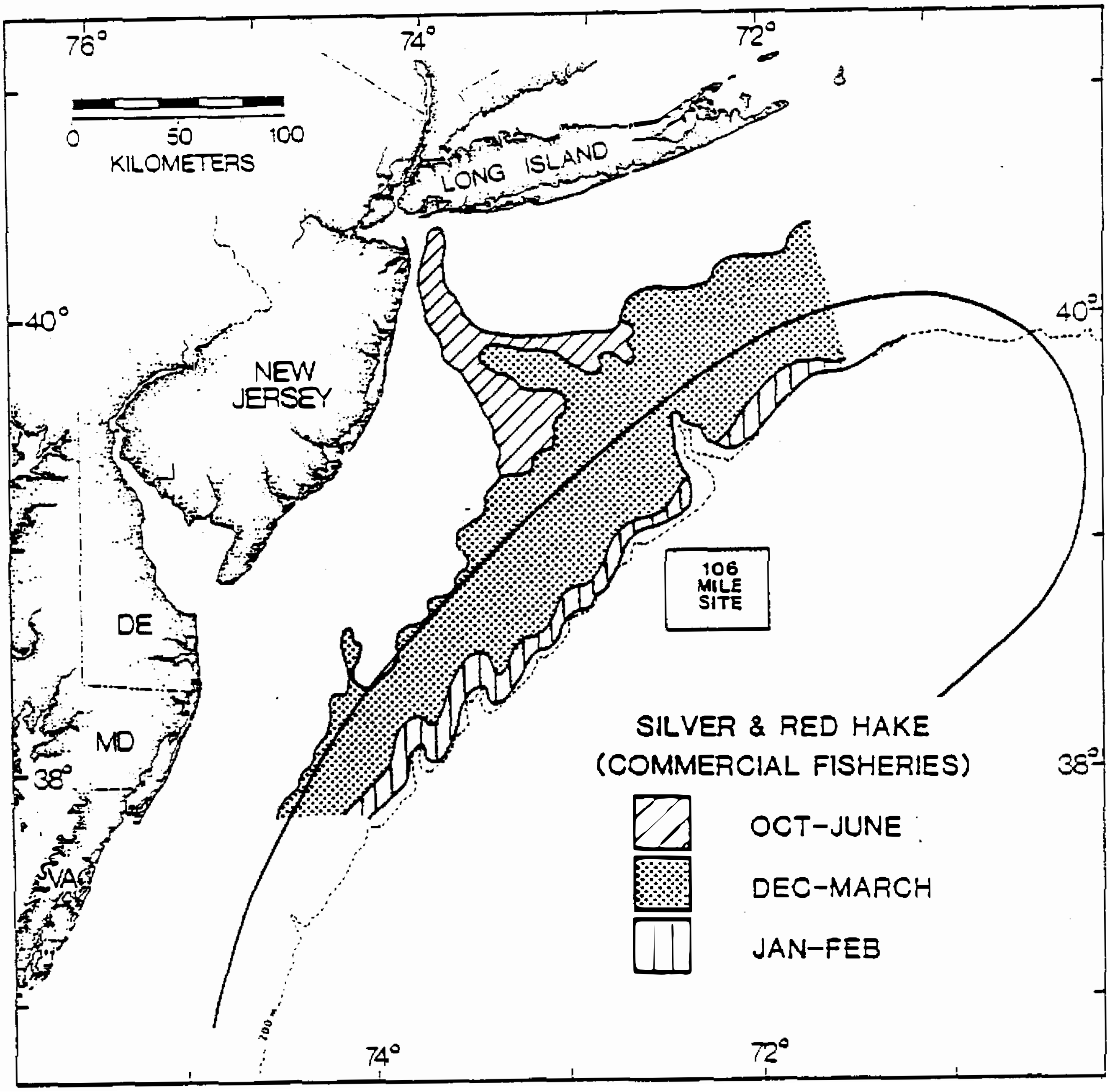


Figure 44.--New Jersey's commercial fishing grounds for silver and red hake (Long and Figley 1981) including location of Deepwater Dumpsite 106 (DWD-106) and its potential area of influence (PAI).

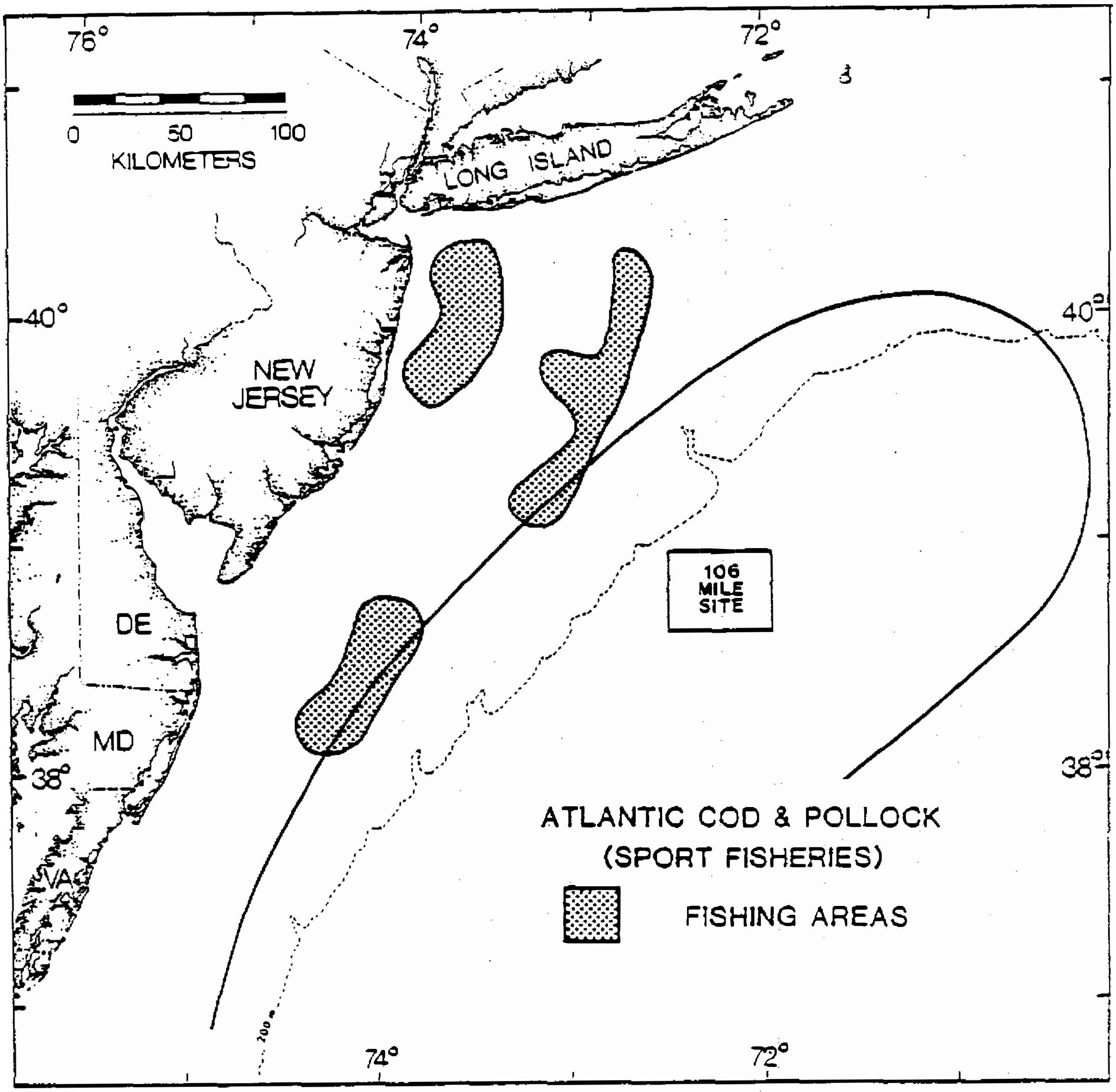


Figure 45.--New Jersey's recreational fishing grounds for Atlantic cod and pollock (Long and Figley 1981) including location of Deepwater Dumpsite 106 (DWD-106) and its potential area of influence (PAI).

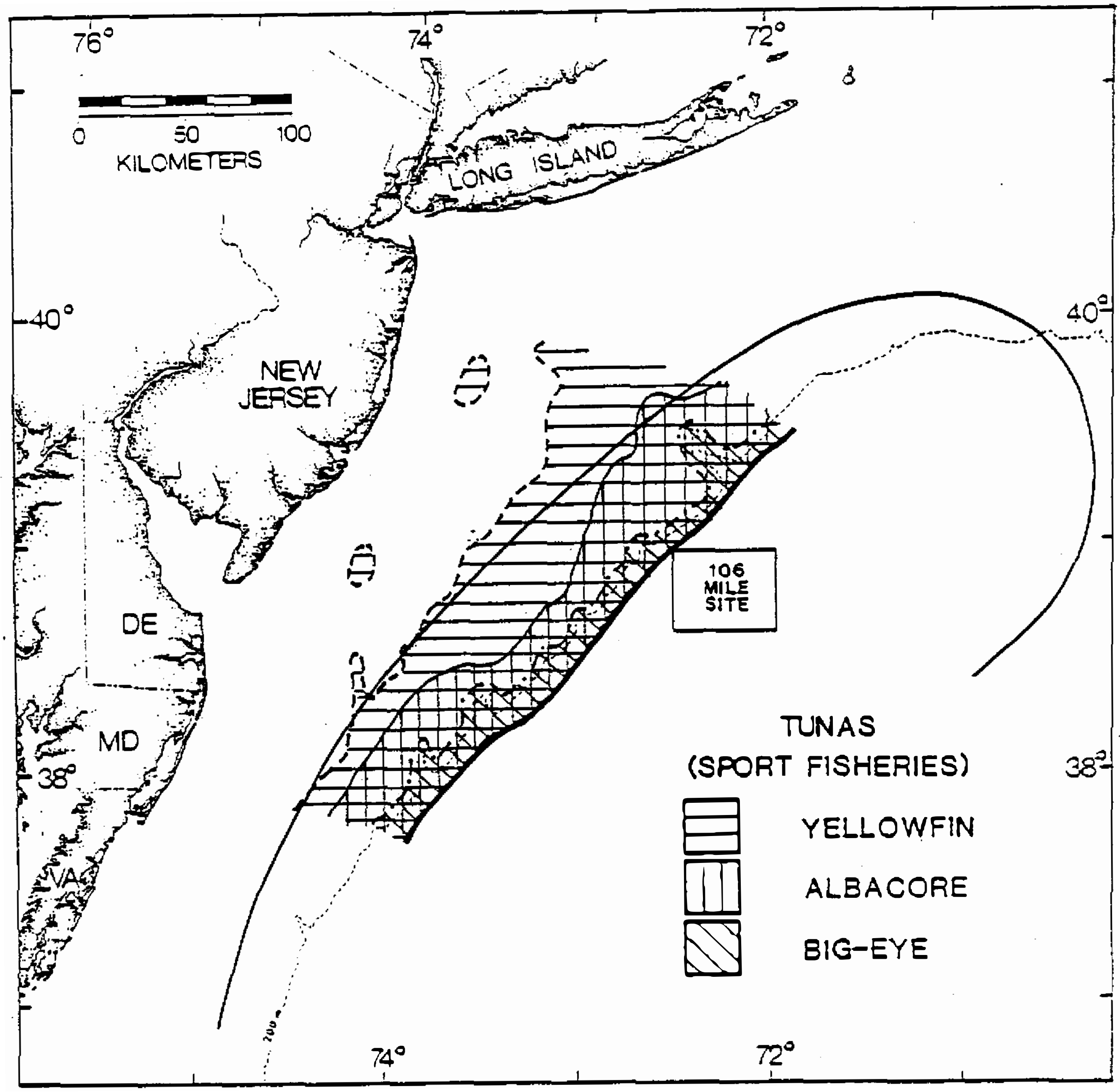


Figure 46.--New Jersey's recreational fishing grounds for tunas (Long and Figley 1981) including location of Deepwater Dumpsite 106 (DWD-106) and its potential area of influence (PAI).

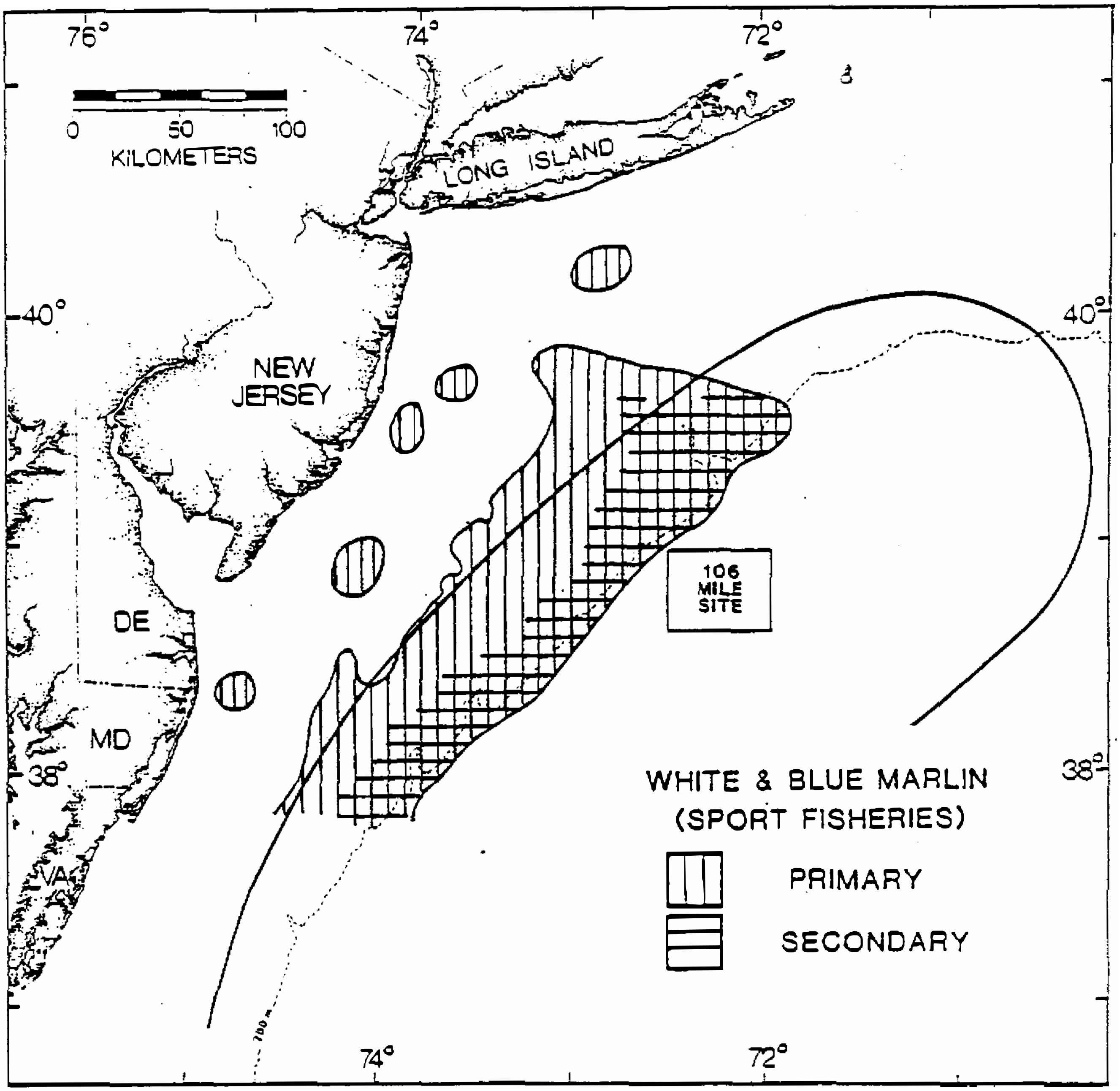


Figure 47.--New Jersey's recreational fishing grounds for white and blue marlin (Long and Figley 1981) including location of Deepwater Dumpsite 106 (DWD-106) and its potential area of influence (PAI).

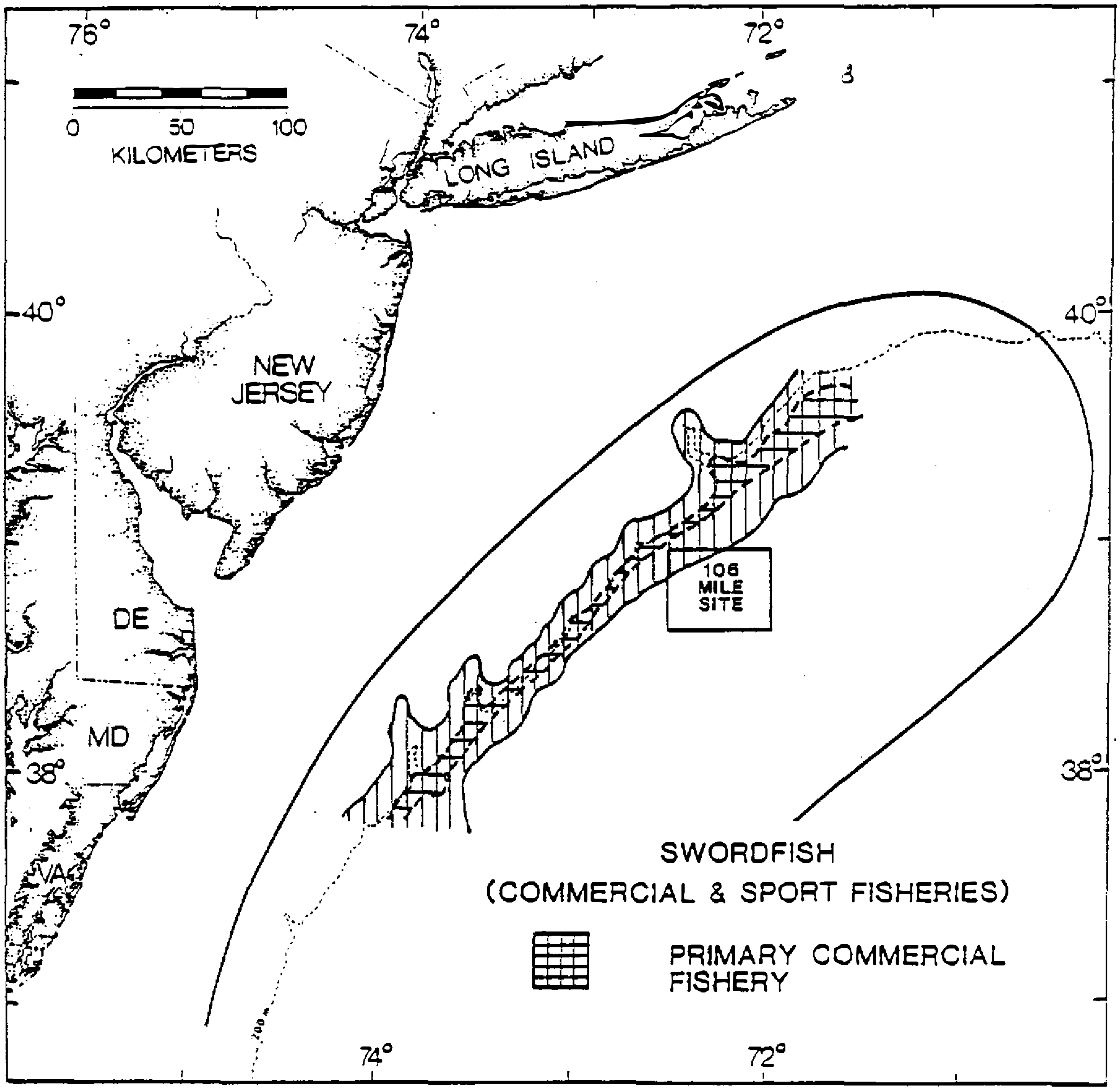


Figure 48.--New Jersey's commercial and recreational fishing grounds for swordfish (Long and Figley 1981) including location of Deepwater Dumpsite 106 (DWD-106) and its potential area of influence (PAI).

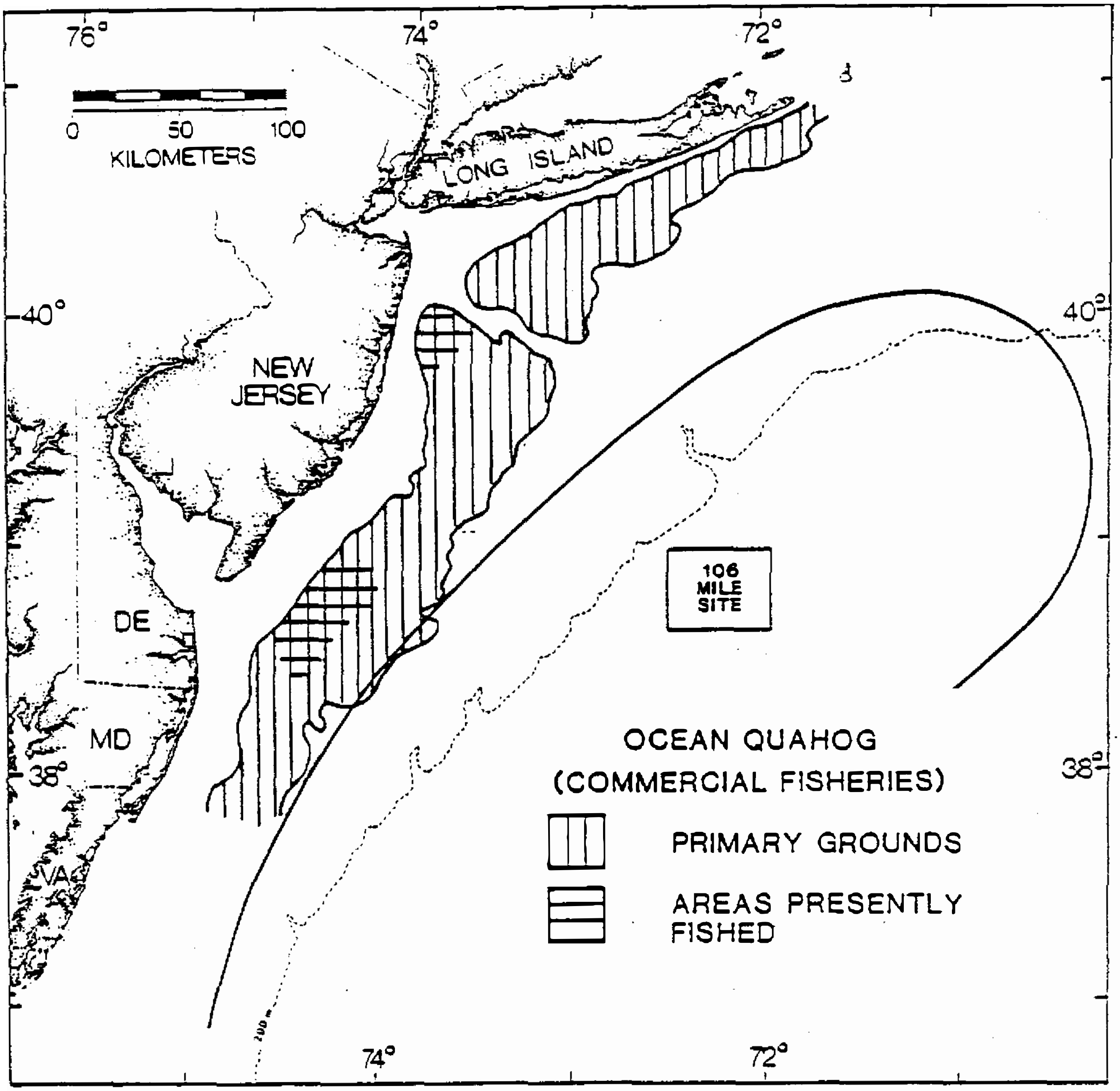


Figure 49.--New Jersey's commercial fishing grounds for ocean quahog (Long and Figley 1981) including location of Deepwater Dumpsite 106 (DWD-106) and its potential area of influence (PAI).

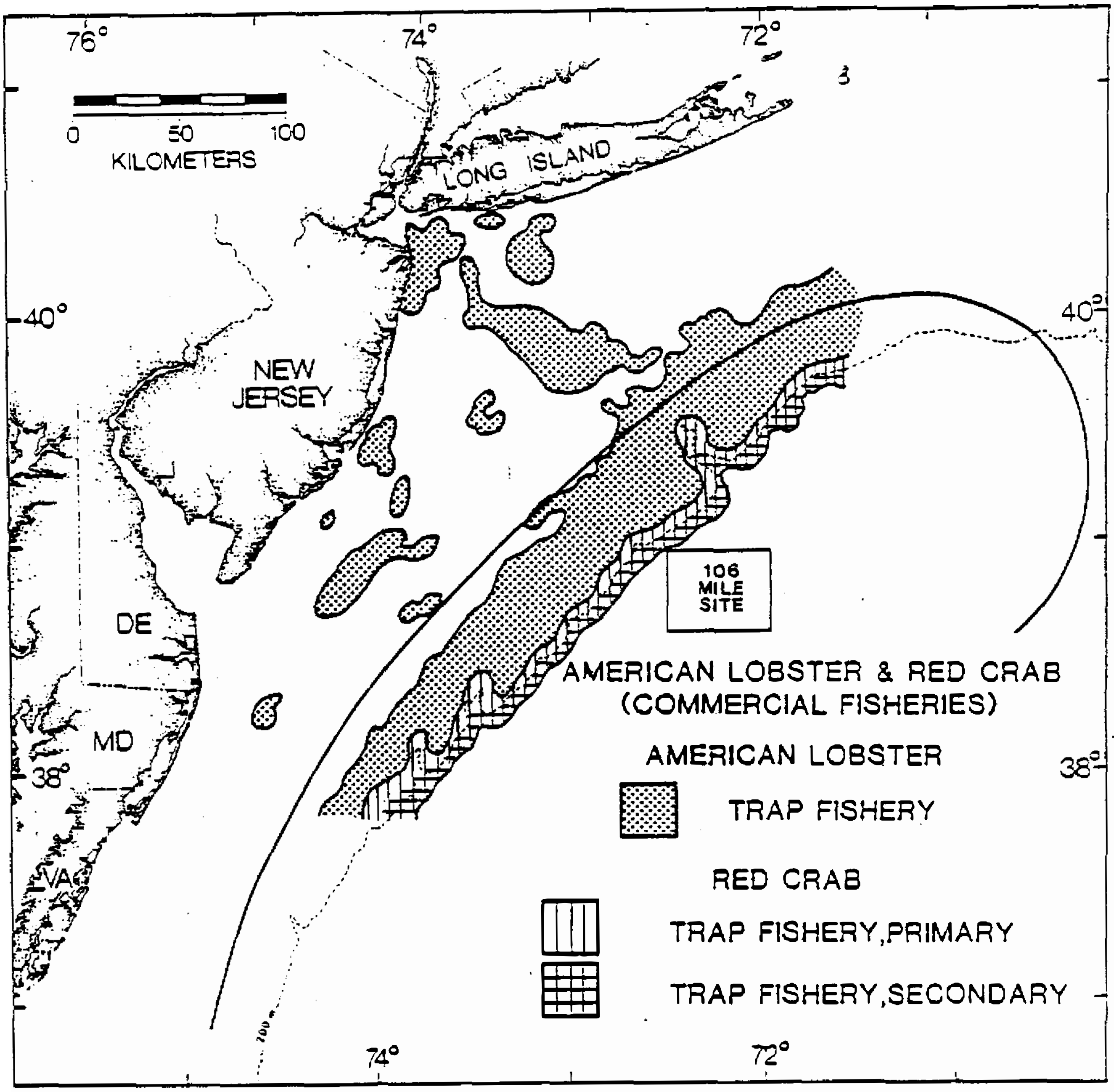


Figure 50.--New Jersey's commercial fishing grounds for American lobster and red crab (Long and Figley 1981) including location of Deepwater Dumpsite 106 (DWD-106) and its potential area of influence (PAI).

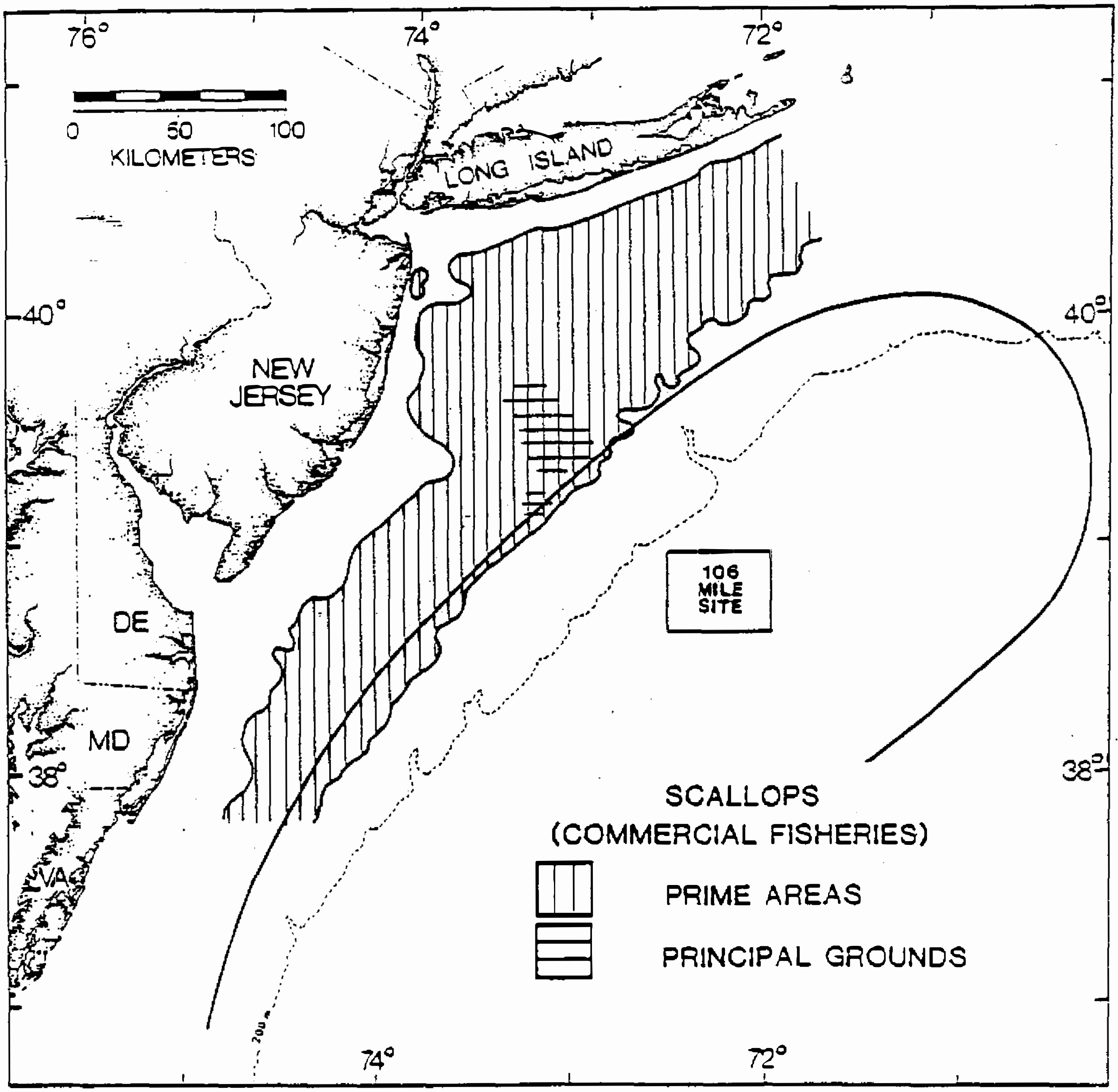


Figure 51.--New Jersey's commercial fishing grounds for scallops (Long and Figley 1981) including location of Deepwater Dumpsite 106 (DWD-106) and its potential area of influence (PAI).

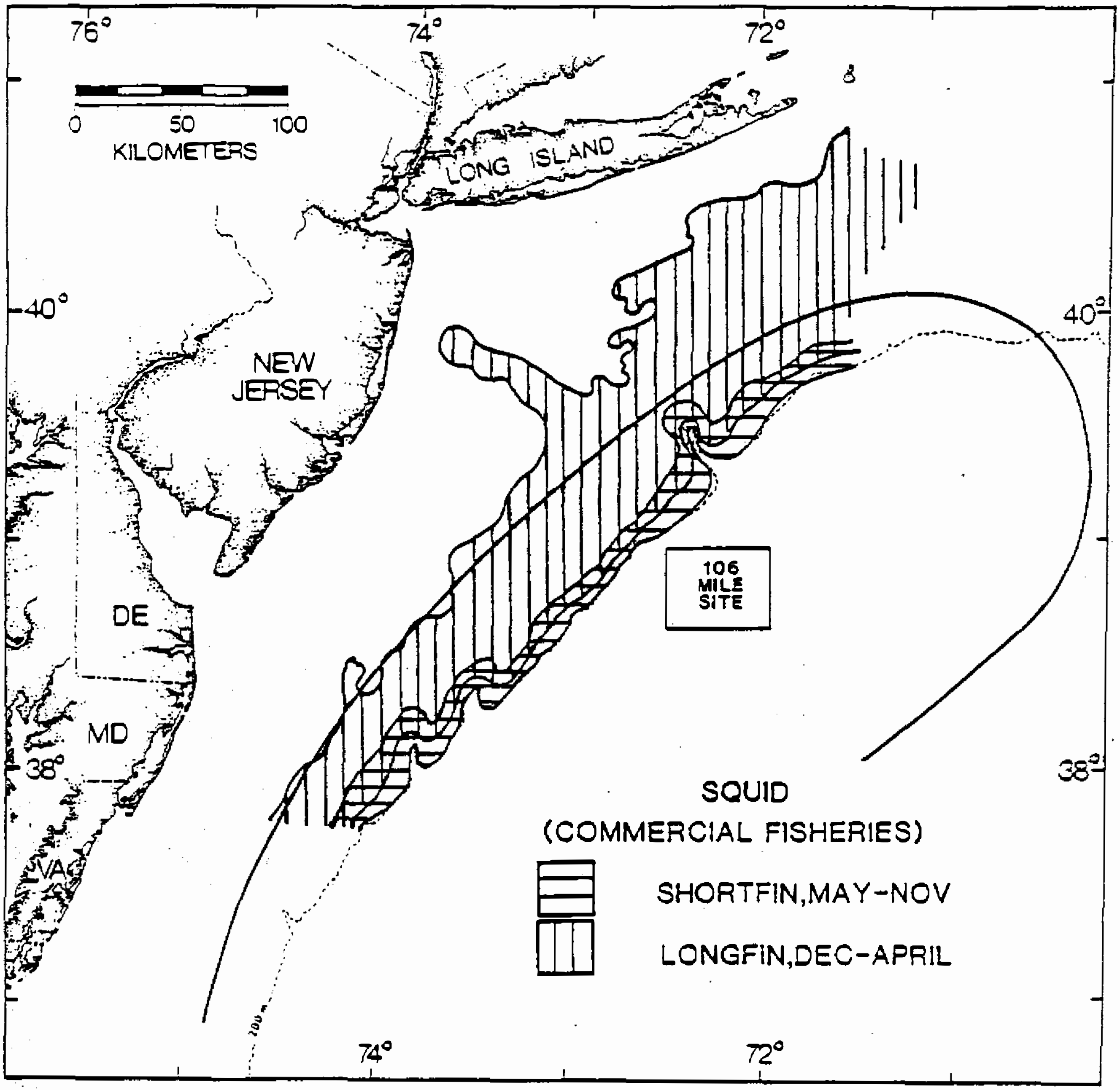


Figure 52.--New Jersey's commercial fishing grounds for squid species (Long and Figley 1981) including location of Deepwater Dumpsite 106 (DWD-106) and its potential area of influence (PAI).

Table 1.--Commercial landings and values by state and year for the potential area influenced (PAI) by Deepwater Dumpsite 106 (DWD-106), 1968-1980. Landings are expressed in weight (mt) and value in thousands of dollars. A dash (-) indicates no data reported.

Year	Massachusetts		Rhode Island		New York		New Jersey		Delaware		Maryland		Virginia		Total	
	Weight	Value	Weight	Value	Weight	Value	Weight	Value	Weight	Value	Weight	Value	Weight	Value	Weight	Value
1968	3,451	2,971	-	-	-	-	-	-	-	-	-	-	-	-	3,451	2,971
1969	2,435	1,451	-	-	-	-	-	-	-	-	-	-	-	-	2,435	1,451
1970	1,589	746	-	-	-	-	-	-	-	-	-	-	-	-	1,589	746
1971	585	404	-	-	-	-	-	-	-	-	-	-	-	-	585	404
1972	920	1,858	1,161	668	118	412	-	-	4	3	117	66	-	-	2,319	3,007
1973	1,325	1,628	2,559	1,128	191	690	4,761	1,498	17	10	167	93	630	949	9,650	5,996
1974	932	2,642	135	78	173	707	2,439	1,778	21	15	209	111	1,366	1,885	5,275	7,216
1975	1,051	3,196	1,565	944	33	82	4,569	2,503	35	27	349	159	1,606	2,377	9,208	9,288
1976	1,909	5,856	1,828	2,070	508	1,015	3,364	5,626	64	38	383	227	1,792	3,982	9,848	18,814
1977	1,416	3,357	2,412	2,242	546	793	7,558	6,417	30	22	653	500	2,042	4,187	14,657	17,518
1978	1,547	5,832	1,924	2,062	500	1,083	7,613	9,744	26	31	1,171	793	3,562	19,636	16,343	39,181
1979	940	1,641	1,921	1,448	833	1,589	6,047	9,503	19	29	2,627	1,872	4,320	10,763	16,707	26,845
1980	1,108	1,443	1,623	1,627	641	1,372	5,640	8,195	22	43	3,698	2,482	3,737	12,394	16,469	27,556

Table 2.--Commercial landings and values by year and statistical reporting area for the potential area influenced (PAI) by Deepwater Dumpsite 106 (DWD-106), 1968-1980; including percent of each area occupied by the PAI. Landings are expressed in weight (mt) and value in thousands of dollars. A dash (-) indicates no data reported and an asterisk (*) less than 0.5 mt and/or 500 dollars.

Statistical Reporting Area	Percent of Area in PAI	1968		1969		1970		1971		1972		1973		1974		1975		1976		1977		1978		1979		1980	
		Weight	Value	Weight	Value	Weight	Value	Weight	Value	Weight	Value	Weight	Value	Weight	Value	Weight	Value	Weight	Value	Weight	Value	Weight	Value	Weight	Value	Weight	Value
534	71	-	-	-	-	-	-	-	-	-	-	-	-	1	*	-	-	79	45			2	4	-		86	81
537	14	2,301	190	1,551	213	1,394	176	495	95	1,403	678	1,978	678	355	1,056	1,619	954	993	887	1,401	1,035	2,125	1,639	2,264	1,663	2,636	1,800
615	20	92	213	29	64	9	24	3	9	63	195	1,837	430	393	492	676	907	564	1,383	657	1,007	381	8,215	440	2,496	467	2,390
616	84	833	2,007	626	661	150	439	86	300	477	1,001	889	1,464	1,126	2,275	1,169	2,891	3,115	9,416	3,245	5,692	3,296	7,591	2,272	8,561	2,401	4,918
621	20	48	121	13	31	*	1	-	-	131	118	2,818	689	1,544	666	2,818	1,054	2,456	1,375	3,395	1,311	3,679	3,521	3,766	3,065	1,656	2,795
622	70	131	316	193	427	34	100	-	-	*	*	673	537	402	1,014	1,642	2,206	1,053	2,314	1,812	2,990	1,669	4,241	1,472	1,450	1,724	7,053
623	100	41	110	5	12	-	-	-	-	-	-	-	-	-	-	-	-	32	97	-	-	28	122	1	2	5	18
624	87	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-			
626	71	5	14	17	43	2	6	-	-	237	988	700	1,288	752	908	718	858	1,433	3,116	3,194	4,595	4,335	11,140	5,370	7,377	4,679	7,194
627	100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	2	7	2	20	10	11	322				
628	75	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
629	13	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
632	100	-	-	-	-	-	-	-	-	6	27	750	906	693	779	564	418	115	177	926	786	816	2,383	1,095	2,004	810	1,190
633	13	-	-	-	-	-	-	-	-	-	-	-	-	2	6	-	-	1	1	-	-	*	1	-	-		
636	24	-	-	-	-	-	-	-	-	-	-	6	2	6	20	-	-	*	*	5	15	2	1	68	227	6	21
TOTAL		3,451	2,971	2,434	1,451	1,589	746	584	404	2,319	3,007	9,652	5,995	5,274	7,216	9,207	9,290	9,848	18,813	14,657	17,521	16,344	39,100	16,706	26,847	16,470	27,558

Table 3.--Commercial landings and value by year and dominant species for the potential area influenced (PAI) by Deepwater Dumpsite 106 (DWD-106), 1972-1980. Landings are expressed in weight (mt) and value in thousands of dollars. A dash (-) indicates no data reported and an asterisk (*) less than 0.5 mt and/or 500 dollars.

GROUP/Species1	1972 Weight	1972 Value	1973 Weight	1973 Value	1974 Weight	1974 Value	1975 Weight	1975 Value	1976 Weight	1976 Value	1977 Weight	1977 Value	1978 Weight	1978 Value	1979 Weight	1979 Value	1980 Weight	1980 Value
FINFISH																		
Dogfish	1	*	2	*	2	*	1	*	4	1	2	1	4	2	102	20	142	29
Conger eel	*	*	2	1	-	-	4	2	3	1	7	2	8	4	3	1	11	6
Atlantic herring	1	*	122	7	28	2	433	28	7	1	4	*	15	2	4	1	4	*
Goosefish	*	*	1	*	*	*	3	1	4	2	48	26	125	61	255	1731	279	237
Atlantic cod	78	26	112	46	91	36	68	45	30	23	76	34	190	105	46	34	61	52
Silver hake	184	37	205	207	147	18	272	60	192	34	578	149	180	57	480	198	475	186
Red hake	12	1	43	5	22	2	37	5	44	5	37	9	53	9	104	32	78	18
White hake	13	2	21	6	18	8	15	5	12	6	5	2	4	2	-	-	3	1
Black sea bass	26	17	498	234	331	208	685	365	416	270	11,088	530	419	349	514	564	391	554
Tilefish	1	*	9	5	287	191	53	36	527	517	867	884	934	1,118	746	992	844	1,515
Bluefish	5	1	27	5	52	10	66	18	75	17	93	22	87	22	102	26	74	16
Scup	47	27	764	343	727	222	1,456	707	830	377	1,691	738	2,225	938	11,571	1,040	4,527	1,0071
Weakfish	25	5	213	28	216	47	756	75	461	79	330	83	319	109	517	156	496	173
Atlantic croaker	*	*	7	3	20	6	141	24	158	34	1,331	47	120	56	28	29	2	2
Atlantic mackerel	141	12	148	44	68	17	174	36	103	25	167	33	255	54	222	91	232	46
Skipjack tuna	-	-	-	-	-	-	11	*	-	-	15	8	-	-	97	75	51	60
Bluefin tuna	28	9	*	*	971	58	*	*	2111	147	185	126	86	79	2	4	3	10
Swordfish	7	20	24	68	31	94	295	287	321	114	24	100	172	504	100	351	253	1,062
Butterfish	27	7	140	62	99	34	270	136	1271	86	185	89	501	1,027	354	293	601	408
Summer flounder	47	46	615	491	662	478	1,195	954	2,724	2,895	1,670	2,006	1,711	2,427	2,822	3,601	2,184	2,570
Windowpane	1	*1	1	*	28	15	36	15	15	8	18	9	40	19	28	15	16	5
Witch flounder	6	3	12	6	11	6	5	3	7	4	6	4	10	7	12	8	8	5
Yellowtail flounder	524	117	459	200	183	113	135	106	58	63	153	16	121	152	310	315	201	203
Winter flounder	83	34	131	64	2	1	70	41	34	27	559	587	149	130	162	117	173	116
INVERTEBRATES																		
Ocean quahogs	-	-	-	-	-	-	-	-	217	140	665	438	2,305	453	4,364	2,728	4,570	3,025
Jonah crab	-	-	-	-	18	10	17	10	46	30	19	13	19	6	26	11	26	16
Red crab	*	*	6	1	8	2	44	26	150	92	468	332	200	165	443	334	897	798
Rock crab	2	1	45	7	120	14	24	6	25	4	4	1	22	4	22	7	2	*
American lobster	330	868	471	1,666	499	1,900	643	2,700	446	1,635	1,332	1,897	317	1,258	2,472	1,797	319	1,771
Scallops	365	1,630	453	1,579	766	2,456	978	3,947	2,613	9,736	2,584	8,783	4,100	23,204	2,083	14,420	1,576	13,421
Conch	10	4	25	16	18	11	19	10	1	*	13	10	21	23	16	11	5	4
Squid spp.	47	114	179	84	213	83	205	85	284	119	156	137	129	137	260	221	239	159
MISCELLANEOUS																		
Bait and pet food	469	8	902	32	47	2	299	6	189	5	401	13	35	*	6791	21	139	5

Table 4.--Observed Japanese longline catch per unit of effort (CPUE) by species and species group expressed in numbers per 10,000 hooks from Fishing Zone 16, 1978-1981. A dash (-) indicates no data and an asterisk (*) less than 0.01 CPUE.

GROUP/Species	CPUE (no./10,000 hooks) 1978	1979	1980	1981	1978-1981
TUNAS					
Bluefin	0.27	0.84	2.43	2.73	2.24
Bigeye	91.39	52.20	84.23e	66.79	71.96e
Yellowfin	28.66	50.04	34.16e	15.43	24.25e
Skipjack	0.15	1.18	0.10	0.07	0.19
Albacore	38.94	96.75e	57.16	35.05	46.21
Blackfin	0.73	-	0.02	0.26	0.23
Little	0.04	-	0.09	0.02	0.04
Atlantic bonito	-	-	0.14	0.01	0.04
Uncl. tuna	-	0.13	0.10	0.38	0.25
TOTAL	160.18	201.14	178.43	120.74	145.41
BILLFISHES					
Blue marlin	0.89	0.51	0.28	0.28e	0.36
White marlin	1.47	8.74	2.60	3.07e	3.33
Sailfish	0.08	0.08	-	0.01e	0.02
Spearfish	0.12	0.17	0.19	0.13e	0.14
Swordfish	17.11	9.84	10.60	8.42e	9.93
Uncl. billfish	0.19	-	0.02	0.07e	0.07
TOTAL	19.86	19.34	13.69	11.98	13.85
SHARKS AND RAYS					
Silky	0.08	-	-	0.02	0.02
Blacktip	-	0.04	-	0.01	0.01
Whitetip	0.27	0.04	0.09	0.03	0.07
Dusky	0.27	2.96	0.05	0.20	0.43
Blue	77.76e	132.05	85.59	57.10	72.67
Tiger	2.59e	0.04	0.10	0.01	0.29
Hammerhead	0.15e	0.30	0.41	0.38	0.36
Porbeagle	0.04e	-	0.10	0.13	0.11
Brown	0.12e	-	0.02	-	0.02
White	-	1.39	0.38	0.12	0.29
Uncl. dogfish	0.04	-	-	-	*
Bignose	0.04	0.08	0.03e	-	0.02
Lemon	0.04	-	0.03e	-	0.01
Shortfin mako	0.12	-	1.89e	2.03	1.62
Longfin mako	0.15	-	0.15e	0.17	0.15
Uncl. mako	2.47	6.55	1.60e	0.37	1.44
Bigeye thresher	0.39	-	0.15e	0.78e	0.05
Uncl. thresher	0.50	0.89	0.43e	0.43e	0.48
Atlantic sharpnose	-	-	-	-	*

Table 4.--(continued)

GROUP/Species	CPUE (no./10,000 hooks) 1978	1979	1980	1981	1978-1981
SHARKS AND RAYS (cont.)					
Bull	-	-	-	-	0.01
Seven gill	-	-	-	-	0.02
Uncl. sharks	4.48	7.52	1.531	4.61	4.17
Uncl. stingrays	29.67	36.91	25.56	4.84	15.03
Manta ray	-	0.13	-	0.11	0.08
TOTAL	119.18	188.90	118.11	71.361	97.371
OTHER FINFISH					
Uncl. dolphin	0.19	0.25	0.28	0.11	0.17
Wahoo	0.12	0.46	0.26	0.05	0.14
King mackerel	0.501	0.21	0.29	0.03	0.16
Lancetfish	27.93	61.06	74.21	65.70	63.45
Oilfish	11.24	8.87	8.43	0.68	4.27
Ocean sunfish	1.24	1.35	1.51	4.25	3.06
Multicolored opah	4.09	1.86	1.761	0.541	1.30
Barracuda	0.04	-	-	0.021	0.02
Uncl. eel	0.08	-	0.02	0.011	0.02
Amberjack	-	0.25	-	-	0.02
Bigscale pomfret	0.66	3.25	0.69	0.29	0.69
Frigate mackerel	-	-	-	0.01	*
Jack crevale	0.04	-	-	-	*
Escolar	-	0.04	-	0.01	0.01
Uncl. puffer	-	-	0.07	-	0.02
Remora	-	-	-	0.03	0.02
Uncl. finfish	1.62	3.04	4.751	1.47	2.38
TOTAL	47.75	80.64	92.27	73.20	75.75
GRAND TOTAL	346.97	490.02	402.59	277.281	332.38

Table 5.--Tilefish (Lopholatilus chamaeleonticeps) catch and effort information based on fishermen logbooks and government records of landings (Source: C.aGrimes, K. Able, and S. Turner; Rutgers University, New Brunswick, New Jersey). A dash (-) indicates data not available and/or complete.

Year	Vessels Fishing	Vessel Years[1]	Trips Per Month[2]	Tubs[3] Fished Per Trip[2]	Calculated Total Tubs Fisheda (rounded to 10's)	Catch Per Tub[2] (kg)	Landings Longline (mt)	Landings Totala (mt)
1973	8	3.6	3.20	13.5a	1,870	127	370	393
1974	7	3.2	3.30	15.2	1,930	156	399	585
1975	9	3.4	3.40	38.7	5,370	114	430	711
1976	13	5.6	2.75	40.3	7,450	112	739	1,076
1977	17	8.1	2.60	49.2	12,430	136	1,607	2,075
1978	21	13.7	3.00	64.8	31,960	105	2,870	3,413
1979	31	17.3	2.75	72.5	41,390	101	3,222	3,840
1980	29	22.9	1.90	90.7	47,360	88	3,481	3,486
1981	29	26.0	2.00	100.6	62,770	58	3,190[4]	3,190[4]
1982	26	-	-	-	-	43[4]	-	-

[1]Determined from direct interviews and/or first-hand knowledge of fishery.a

[2]Based on fishermen logbook information.a

[3]A "tub" equals one-half mile of longline gear.

[4]Based on preliminary data.a