

Distributions of Marine Mammals, Birds and  
Turtles near Deepwater Dumpsite 106 (DWD-106)  
and the Philadelphia Dumpsite (PDS)

by

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## INTRODUCTION

The Deepwater Dumpsite 106 (DWD-106) and Philadelphia Dumpsite (PDS) are located off the middle Atlantic states on the eastern United States seaboard (figure 1). DWD-106 lies in deep, slope water and PDS is in outer-shelf water of the Middle Atlantic Bight. An elliptical-shaped envelope (adapted from Smith et al. 1982) is indicated in figure 1, which considers a potential area of impact from materials dumped at these sites because of interactions with warm-core eddies (Bisagni 1976).

From several large-scale efforts in the past decade considerable progress has been made toward a better understanding of the pelagic distribution and abundance of marine mammals, birds and turtles in shelf and slope waters off the northeastern United States. Much of these are presently unpublished either in government reports or manuscripts in review, although some important papers have already been published. Reports from the Cetacean and Turtle Assessment Program (CeTAP) have provided benchmark surveys for cetaceans (Hain et al. 1981; Scott et al. 1981) and turtles (Shoop et al. 1981) for turtles. The Manomet Bird Observatory (MBO) has provided descriptions of mammals, bird and turtle distribution and abundance in shelf and slope waters (Powers in review; Powers and Brown in review, Powers et al. 1982) and the Canadian Wildlife Service for birds in slope and Sargasso waters (Brown 1977). Rowlett (1980) summarized bird and cetacean observations from single-day cruises to the northern Chesapeake Bight.

Using these sources of information we developed generalized maps to illustrate the relative distribution and abundance of selected species of marine mammals, birds, and turtles found in the Middle Atlantic Bight and adjacent slope water. We also provide species accounts to highlight seasonal movements and known areas of concentration.

## METHODS

Hain et al. (1981) plotted sighting distributions of all marine mammal species recorded in 2-month periods and a composite of all periods into an annual distribution map. They also indicated levels of effort associated with each 2-month period. Powers et al. (1982) developed quantitative seasonal plots of relative distribution and abundance for marine mammals by dividing the number of animals of a given species by a measure of observer effort (number 15-min observation periods), where each season was 3-months long and winter started on 1 December. Rowlett (1980) made cumulative plots of sightings for identified and probable cetacean species. Using these data we developed generalized maps of distribution which indicate areas of known occurrence of a cetacean species, areas of non-occurrence that have been reasonably surveyed (i.e. shelf waters), areas where large numbers of a species have been recorded or where they are frequently seen, and areas where we are not certain because data are limited (slope water). The same approach in developing generalized distribution maps from available literature and unpublished data was used for selected species of sea turtles; distribution maps were plotted for those species which are endangered or are regularly known to occur in the area of potential impact (figure 1). Seasonal distribution plots of selected species of sea birds from Powers (in review) are used in the bird section.

## RESULTS AND DISCUSSION

### Cetaceans

Bottlenosed Dolphin (Tursiops truncatus) occurs from Cape Hatteras to at least the Northeast Channel (figure 2). Two forms are recognized. A smaller inshore form is found in coastal waters of the Middle Atlantic Bight (MAB) south of Delaware Bay (Hain et al. 1981). The larger form occurs offshore

along the shelf-edge from 37° to 41°N (Rowlett 1980; Hain et al. 1981; Powers et al. 1982). Their occurrence in outer-shelf waters of MAB is probably year around, but greatest sighting frequencies are from May to October in offshore waters (Hain et al. 1981; Powers et al. 1981). Although this species has been recorded in slope waters, sighting distribution suggests the majority of the offshore form are restricted to the shelf-break area between the 200 - 2000m isobaths (figure 2). Feeding or apparent feeding and calves or juveniles of this species have been recorded in the potentially impacted envelope (figure 1) (Hain et al. 1981).

Spotted Dolphin (Stenella spp.) taxonomy is not clear but S. attenuata/frontalis and S. plagiodon occur in the western North Atlantic (Katona et al. 1977; Hain et al. 1981). Spotted Dolphin occurs in inshore waters of the MAB only south of Chesapeake Bay; otherwise its distribution in the study area is offshore in slope water (Hain et al. 1981; Powers et al. 1982) (figure 3). Spotted Dolphin has been recorded north of 35°N nearly year around (Hain et al. 1981), but the majority of sightings occur from April to October along the shelf-break and south of 38°N (Rowlett 1980; Hain et al. 1981; Powers et al. 1982). Sightings of calves or juveniles have been made in the same areas (Hain et al. 1981).

Striped Dolphin (S. coeruleoalba) occurs from the southern edge of Georges Bank southwards to Cape Hatteras and generally seaward of the 1000m-isobath (Hain et al. 1981) (figure 4). Sightings of this species north of 35°N have been made throughout the year with the majority of observations from March to August (Hain et al. 1981). Sightings are most frequent in slope water within the potential area of impact (figure 1). Sightings of calves or juveniles have been made in the same areas (Hain et al. 1981).

Common or Saddleback Dolphin (Delphinus delphis) occurs in shelf and slope waters from Cape Hatteras northeastward to Georges Bank (Rowlett 1980; Hain et

al. 1981; Powers et al. 1982) and Nova Scotia (Sergeant and Fisher 1957; Leatherwood et al. 1976). Its occurrence on the shelf off the northeastern United States is generally restricted to outer-shelf waters (Hain et al. 1981; Powers et al. 1982) (figure 5). Greatest sighting frequencies in the MAB occur from February to May (Hain et al. 1981) and on Georges Bank from May to June and again from October to December (Hain et al. 1981; Powers et al. 1982). Thus, Common Dolphin appears to be seasonally (winter-spring) common in the area of potential impact (figure 1). Most sightings of feeding or apparent feeding and calves or juveniles have been recorded on Georges Bank (Hain et al. 1981; K. D. Powers, unpubl. data) but their occurrence further south correlates with the period of poorest observer conditions for the year (winter - spring).

White-sided Dolphin (Lagenorhynchus acutus) occurs in shelf waters from the Chesapeake Bight in the MAB (Testaverde and Mead 1980) northeastward to the Gulf of Maine (figure 6). White-sided Dolphin is found in greatest abundance and throughout the year in the southwestern Gulf of Maine (Hain et al. 1981; Powers et al. 1982) and its distribution is most widespread in October and November (Hain et al. 1981). The area of potential impact (figure 1) includes only the marginal, southern limits of the range of this species.

Grampus (Grampus griseus) occur off the northeastern United States from Cape Hatteras to the eastern end of Georges Bank (Hain et al. 1981) (figure 7). Grampus is found with greatest frequency along the outer-shelf of the MAB throughout the year, but most commonly from April to October (Hain et al. 1981; Powers et al. 1982). It is not usually found inshore of 100m-isobath or offshore of 2000m-isobath. The area of potential impact (figure 1) is almost a perfect match to the distribution of Grampus. Calves or juveniles have also been sighted in the area of potential impact (Hain et al. 1981).

Pilot whales (Globicephala spp.) occur in shelf waters from Cape Hatteras to the Gulf of Maine but principally in outer-shelf waters of the MAB and

Georges Bank (Hain et al. 1982; Powers et al. 1982) (figure 8). The Long-finned Pilot Whale (G. melaena) occurs from North Carolina (Leatherwood et al. 1976) to Greenland (Mercer 1975). The Short-finned Pilot Whale (G. macrorhynchus) occurs from North Carolina (Schmidly 1981) to the Gulf of Mexico (Fritts and Reynold 1981). These species are not separable in the field and have been combined for this report, but G. melaena is most likely the predominant species off the northeastern United States. They are most frequently recorded on Georges Bank from May to October (Hain et al. 1981; Powers et al. 1982) and possibly most abundant in the MAB and adjacent slope water from November to May, but observer effort in this area during winter months is relatively poor. The distribution of pilot whales overlaps with the area of potential impact (figure 1) and feeding and calves have been observed within these waters (Hain et al. 1981).

Sperm Whale (Physeter macrocephalus) is an endangered species which is widely distributed throughout the deep waters of the North Atlantic between 30° and 60°N latitude (Brown 1958). Off the northeastern United States Sperm Whales occur along the edge of the continental shelf and seaward into slope waters throughout the year (Hain et al. 1981) (figure 9). Sighting frequencies of Sperm Whales in the area of potential impact (figure 1) are greatest from April to August (Hain et al. 1981; Powers et al. 1982) and feeding and calves or juveniles have been observed in this area. The paucity of sightings in winter months may be related to poor observer effort.

Minke Whale (Balaenoptera acutorostrata) is found in shelf waters from Virginia to Baffin Island (Katona et al. 1977), but sightings south of Nova Scotia are concentrated in the southwestern Gulf of Maine and on Georges Bank (Hain et al. 1981; Powers et al. 1982) (figure 10). They probably occur on the shelf off the New England coast year around, but sighting frequency is greatest from April to October (Hain et al. 1981; Powers et al. 1982). Only the

southern limit of their range overlaps with the area of potential impact (figure 1) and they are most likely to occur in that "envelope" from March to May.

Fin Whale (B. physalus) is an endangered species which is widely distributed throughout shelf waters of the North Atlantic. Fin Whales are found on the shelf off the northeastern United States throughout the year, but the majority of sightings occur off in the southwestern Gulf of Maine from the Great South Channel northwest to Cape Ann, Massachusetts from April to October (Hain et al. 1981; Powers et al. 1982) (figure 11). Rowlett (1980) observed Fin Whales from April to September between Delaware Bay and Baltimore Canyon. Leatherwood et al. (1976) suggested that most Fin Whales in the western North Atlantic move south and offshore during winter months. If this hypothesis is correct, the area of potential impact (figure 1) would overlap with the wintering range of Fin Whales, as well as the summer range of those animals that feed on the MAB.

Humpback Whale (Megaptera novaeangliae) is an endangered species which in the western North Atlantic breeds in the Caribbean and migrates north to summer feeding grounds from Cape Cod, Massachusetts to Iceland (Katona et al. 1980). Sightings of Humpbacks are concentrated in the southwestern Gulf of Maine from the Great South Channel northwest to Cape Ann, Massachusetts from April to October (Hain et al. 1981; Powers et al. 1982) (figure 12). Their seasonal migration to southerly breeding areas probably passes through the area of potential impact (figure 1). South of Cape Hatteras humpbacks have been sighted in coastal waters to Miami, Florida (Schmidly 1981), but there is a dearth of sightings on the shelf north of Cape Hatteras until the Great South Channel is reached (Hain et al. 1981, Powers et al. 1982). This suggests an offshore route seaward of the shelf-break, which passes through the area of potential impact (figure 1).

Right Whale (Eubalaena glacialis) is an endangered species which is known to occur throughout the temperate seas of the North Atlantic (Watson 1981). In that part of the western North Atlantic off the northeastern United States, Scott et al. (1981) estimated only 29 (+ 44) individuals. More recently Kraus and Prescott (1981) have identified at least 59 individual Right Whales in the Bay of Fundy. Right Whales are seen with some regularity throughout the year north of 40°30'N with most sightings in the southwestern Gulf of Maine from April to June (Hain et al. 1981) and in the Bay of Fundy from August through September (Kraus and Prescott 1982) (figure 13). During late summer and fall most Right Whales migrate south from the Gulf of Maine (Winn et al. 1981). Reeves et al. (1978) assumed Right Whales migrated offshore in fall and near shore in spring; however, Winn et al. (1981) hypothesized that the majority of Right Whales migrated offshore in both spring and fall. Thus, Right Whales would only occur in the area of potential impact (figure 1) from February to April and September to November.

Beaked whales are rare in the western North Atlantic although they have been sighted in the potential area of impact (figure 1). Hain et al. (1981) listed 3 sightings of Cuvier's Beaked Whale (Ziphius cavirostris) and 1 sightings of a possible Dense Beaked Whale (Mesoplodon densirostris).

#### Sea Turtles

Although five species of sea turtles occur off the northeastern United States, three species are considered rare and will not be discussed. They are Atlantic Ridley (Lepidochelys kempfi), Hawksbill (Eretmochelys imbricata) and Green Turtle (Chelonia mydas) (Shoop et al. 1981).

Loggerhead Turtle (Caretta caretta) is a threatened species and is the most numerous sea turtle in shelf water off the northeastern United States (Shoop et al. 1981). In winter and early spring their range is shelf and slope

waters south of 37°N (Shoop et al. 1981), but from May to November they are found throughout the MAB and reach the southern edge of Georges Bank from July to August (Shoop et al. 1981; Powers et al. 1982) (figure 14). They are also present in slope waters at this time but sightings are substantially less frequent compared to the MAB (Shoop et al. 1981). The range of Loggerheads overlaps the area of potential of impact (figure 1) from May to November and principally in the western edge of the "envelope" around PDS.

Leatherback Turtle (Dermochelys coriacea) is seasonally common in shelf waters off the northeastern United States, but is less abundant than the loggerhead (Shoop et al. 1981). Leatherbacks initially appear in the Gulf of Maine in May and June, possibly from offshore waters, and move southward on the shelf reaching the MAB by July (Shoop et al. 1981) (figure 15). The distribution maps given by Shoop et al. (1981) indicate little overlap in range with the potential area of impact (figure 1). However, their migration route in spring is not known and they may pass through the "envelope" in early spring.

#### Sea Birds

Northern Fulmars (Fulmarus glacialis) are found throughout boreal, subarctic and arctic waters of the North Atlantic. In the western North Atlantic fulmars occur south to at least Cape Hatteras in late winter and early spring (December to April) (figures 16 and 17), although the majority of fulmars south of the Grand Banks off Newfoundland are found on the northern flank of Georges Bank (Powers in review). The area of potential impact (figure 1) includes only the marginal southern limits of the pelagic range of fulmars.

Shearwaters are seasonally abundant in the western North Atlantic and five species regularly occur: (Cory's Shearwater (Calonectris diomedea), Greater Shearwater (Puffinus gravis), Sooty Shearwater (P. griseus), Manx Shearwater

(P. puffinus) and Audubon's Shearwater (P. lherminieri). Cory's are found throughout cool subtropical waters of the North Atlantic in summer and fall (Palmer 1962; Brown 1977), but in greatest abundance on the shelf off the northeastern United States from Long Island to the Great South Channel (figures 18 and 19). Greaters are found principally in boreal and subarctic waters of the western North Atlantic from May to November (figures 20 to 22) (Brown et al. 1975; Powers in review). The majority of the population resides from Georges Bank north to the Grand Bank, although seasonal migrations through the area of impact may occur. The distribution of Sooties (figures 23 and 24) is comparable to that of Greaters, except that they have a clock-wise migration through the North Atlantic and the majority of the population is in the east by August (Phillips 1963). A small population of Manx occurs in shelf waters of the western North Atlantic from April to November, although their migration routes from wintering areas off Brazil (Spencer 1972) must pass through the area of potential impact (figure 1). Audubon's are found principally in slope waters from June to October (figures 25 and 26) and their distribution coincides with the area of impact (figure 1).

Storm-petrels seasonally occur in the western North Atlantic. Wilson's Storm-Petrel (Oceanites oceanicus) is a southern hemisphere breeder which spends the austral winter off the northeastern United States from April to November (Palmer 1962) (figures 27 to 29). It's found in greatest abundance along the edge of the continental shelf in the MAB from April to May and Georges Bank and in the southwestern Gulf of Maine from June to August (Powers in review). Rowlett (1980) observed c. 200 Wilson's on 13 August 1974 feeding over a slick created by the dumping of sulfuric acid-iron waste at the Dupont Acid Waste Dumpsite off Delaware at 38°33'N, 74°16'W. Although the slick was visible for days, the petrels were seen feeding on parts of the slick for less than 3h after the dumping. The attraction of Wilson's to oily slicks (Palmer

1962) and their relative abundance in the area of potential impact (figure 1) is of concern. Leach's Storm-Petrel (Oceanodroma leucorhoa) breeds from Cape Cod north to Newfoundland and its pelagic distribution is mainly centered around their breeding colonies (Brown et al. 1975). Off the northeastern United States they are most common in the Gulf of Maine and slope water south of Georges Bank in summer months (figure 30), but densities of Leach's in these waters are relatively small ( $< 3$  birds/km<sup>2</sup>) compared to shelf waters off Nova Scotia and Newfoundland.

Gannet (Morus bassana) occurs in shelf waters off the northeastern United States from October to May (Powers in review) (figures 31 and 32). They are most abundant in the MAB in winter and will aggregate around fishing vessels. Gannets are found in greatest densities in March and April along the edge of the shelf which overlaps the area of potential impact (figure 1).

Phalaropes are seasonal migrants off the northeastern United States. Red Phalarope (Phalaropus fulicarius) is the most abundant species in spring (local densities  $> 1000$  birds/km<sup>2</sup>) (figures 33 and 34); neither Red nor Northern phalarope (Lobipes lobatus) are abundant in fall (Powers in review). The spring migration of phalaropes coincides in space (outer shelf) and time (April - May) with an offshore peak in zooplankton biomass (Powers and Backus 1981). The western edge of the area of potential impact (figure 1) coincides with the migration corridor of both phalaropes in spring at least and offshore dumping would be of concern to their survivability since they sit and peck at small (1-3 mm) zooplankters at the surface.

Great Black-backed and Herring gulls (Larus marinus and L. argentatus) occur year around offshore the northeastern United States, although they are found in greatest abundance from October to April (Powers in press) (figures 35 to 40). In summer months these species are aggregated around coastal breeding colonies from the Carolinas (Portnoy et al. 1981) north to the Canadian arctic

(Powers et al. 1981). Their pelagic distribution is profoundly influenced by fishing activities and they routinely follow ships of all types. Their range extends into the area of potential impact (figure 1).

Black-legged Kittiwake (Rissa tridactyla) is a visitor to shelf waters south of Nova Scotia from September to March. The southern limit of their pelagic range extends south to at least Cape Hatteras (Powers in review), but the majority of kittiwakes in this area are found on Georges Bank and the southwestern Gulf of Maine (figure 41). They occur in the area of potential impact (figure 1) but this is a marginal southern limit of their range.

Alcids are generally most vulnerable to oil spills and five species have pelagic ranges in the western North Atlantic (Brown et al. 1975). Georges Bank is the southern range limit of any significant densities of Razorbill (Alca torda, murre (Uria spp.), Dovekie (Plautus alle) and Common Puffin (Fratercula arctica) (Powers in review). Since the area of potential impact is marginal range, no species maps are given.

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- Figure 38. Relative distribution and abundance of Herring Gull (Larus argentatus) in fall (September to November) off the northeastern United States.
- Figure 39. Relative distribution and abundance of Herring Gull (Larus argentatus) in winter (December to February) off the northeastern United States.
- Figure 40. Relative distribution and abundance of Herring Gull (Larus argentatus) in spring (March to May) off the northeastern United States.
- Figure 41. Relative distribution and abundance of Black-legged Kittiwake (Rissa tridactyla) in winter (December to February) off the northeastern United States.

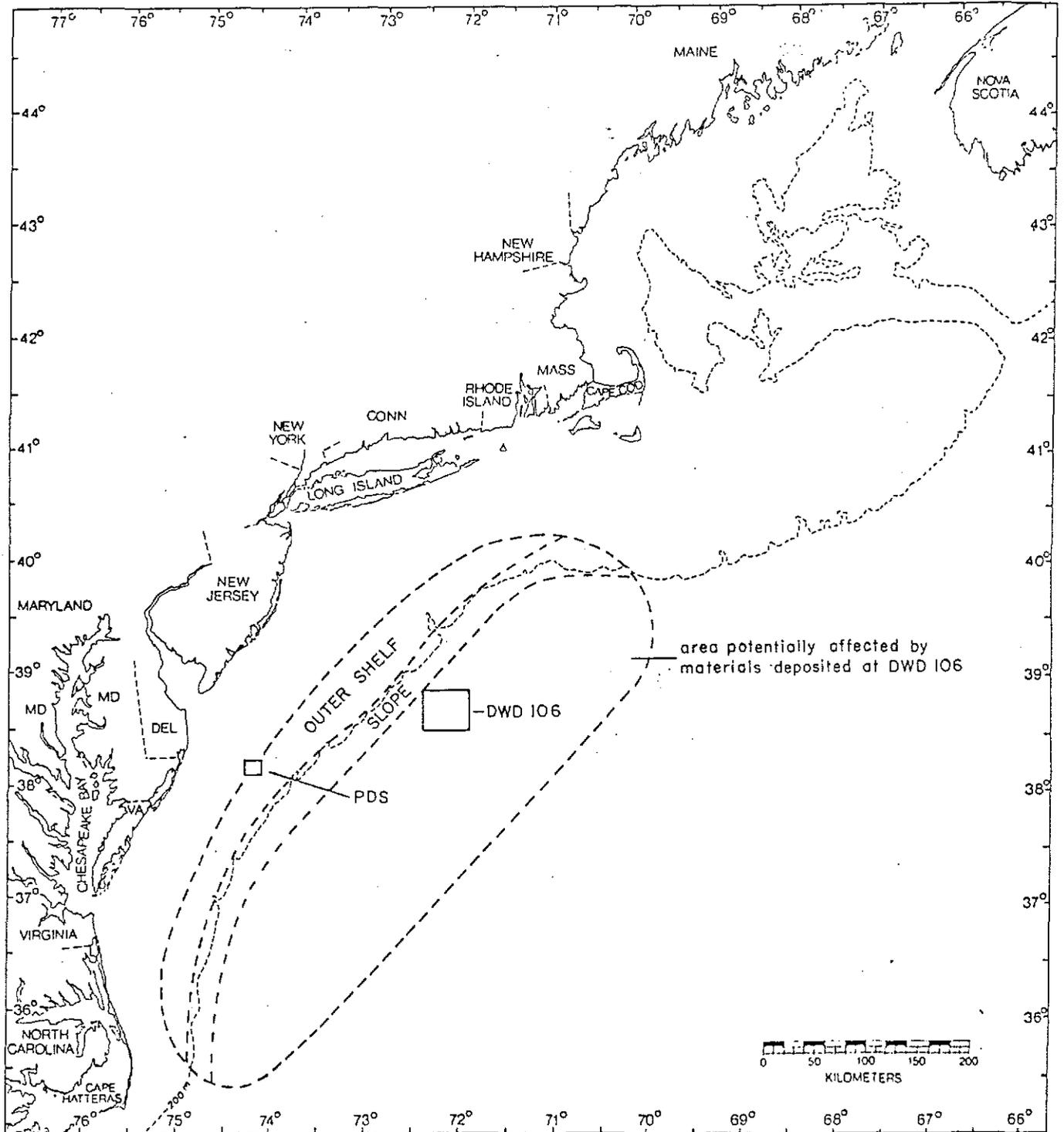


Figure 1. Location of study area, Philadelphia Dumpsite (PDS), Deepwater Dumpsite 106 (DWD-106) and limits of warm-core eddy interaction envelope (adapted from Smith et al. 1982)

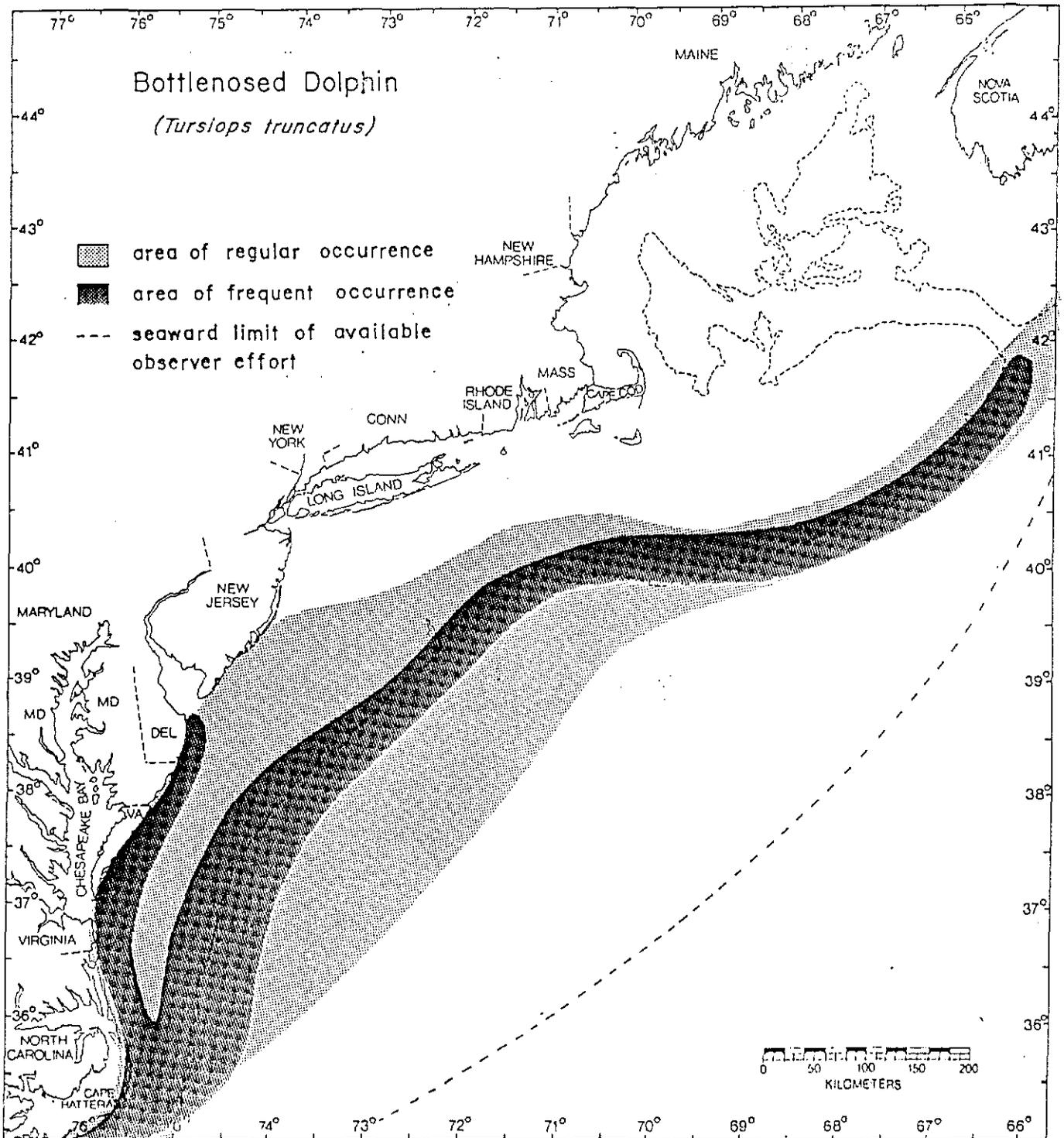


Figure 2. Annual distribution of Bottlenosed Dolphin (*Tursiops truncatus*) off the northeastern United States.

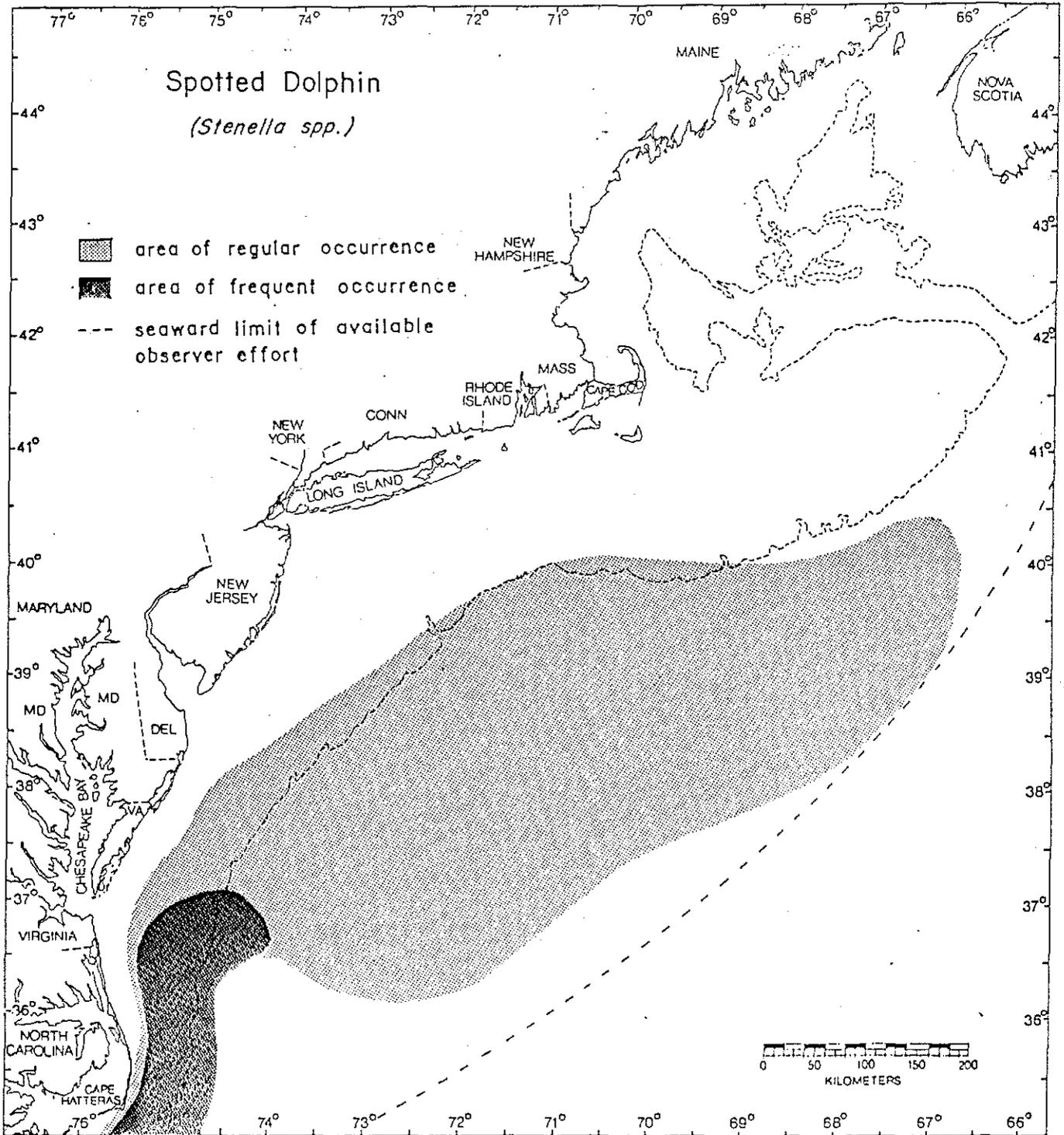


Figure 3. Annual distribution of spotted dolphins (*Stenella attenuata/frontatis* and *S. plagiodon*) off the northeastern United States.

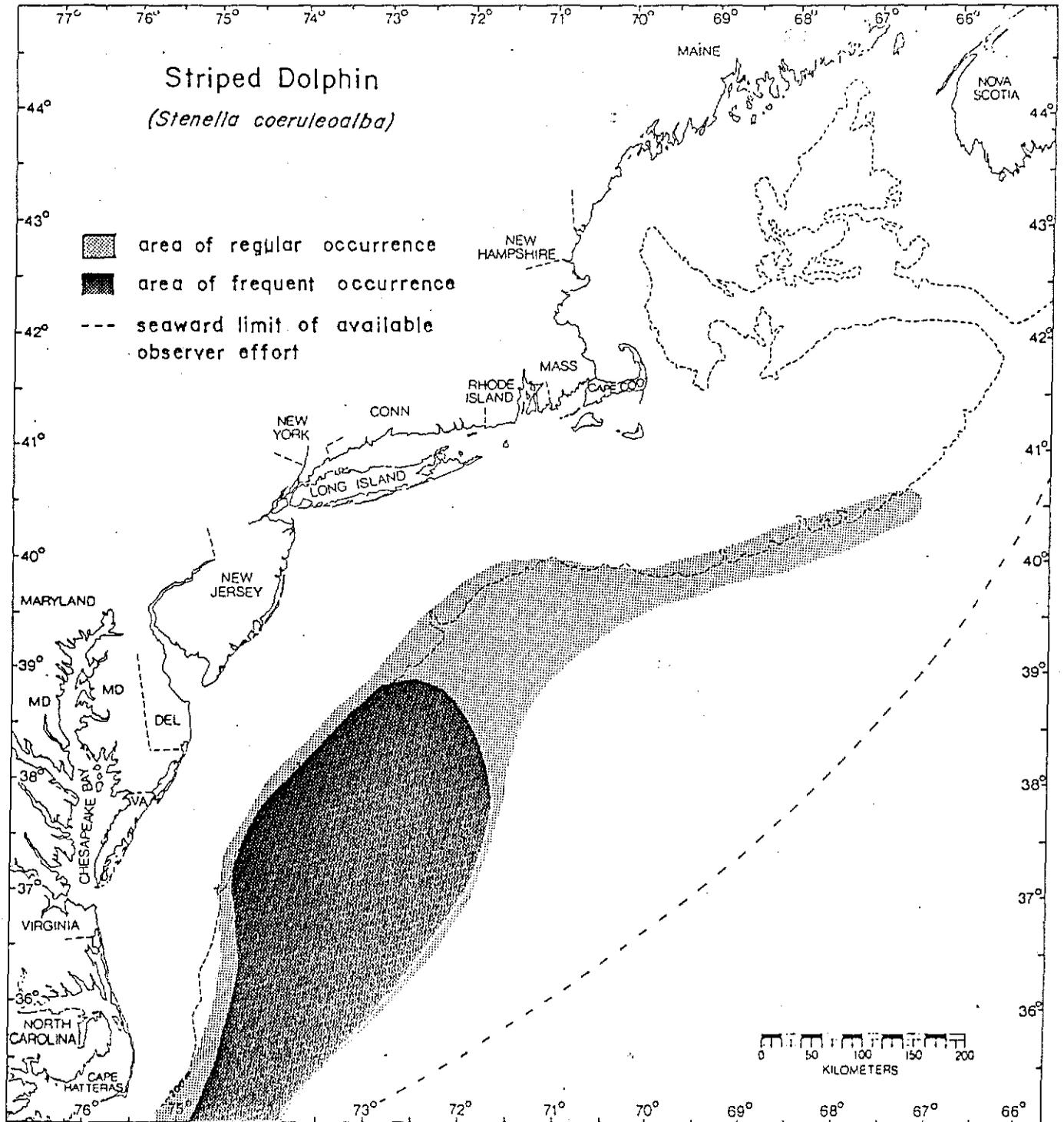


Figure 4. Annual distribution of Striped Dolphin (*Stenella coeruleoalba*) off the northeastern United States.

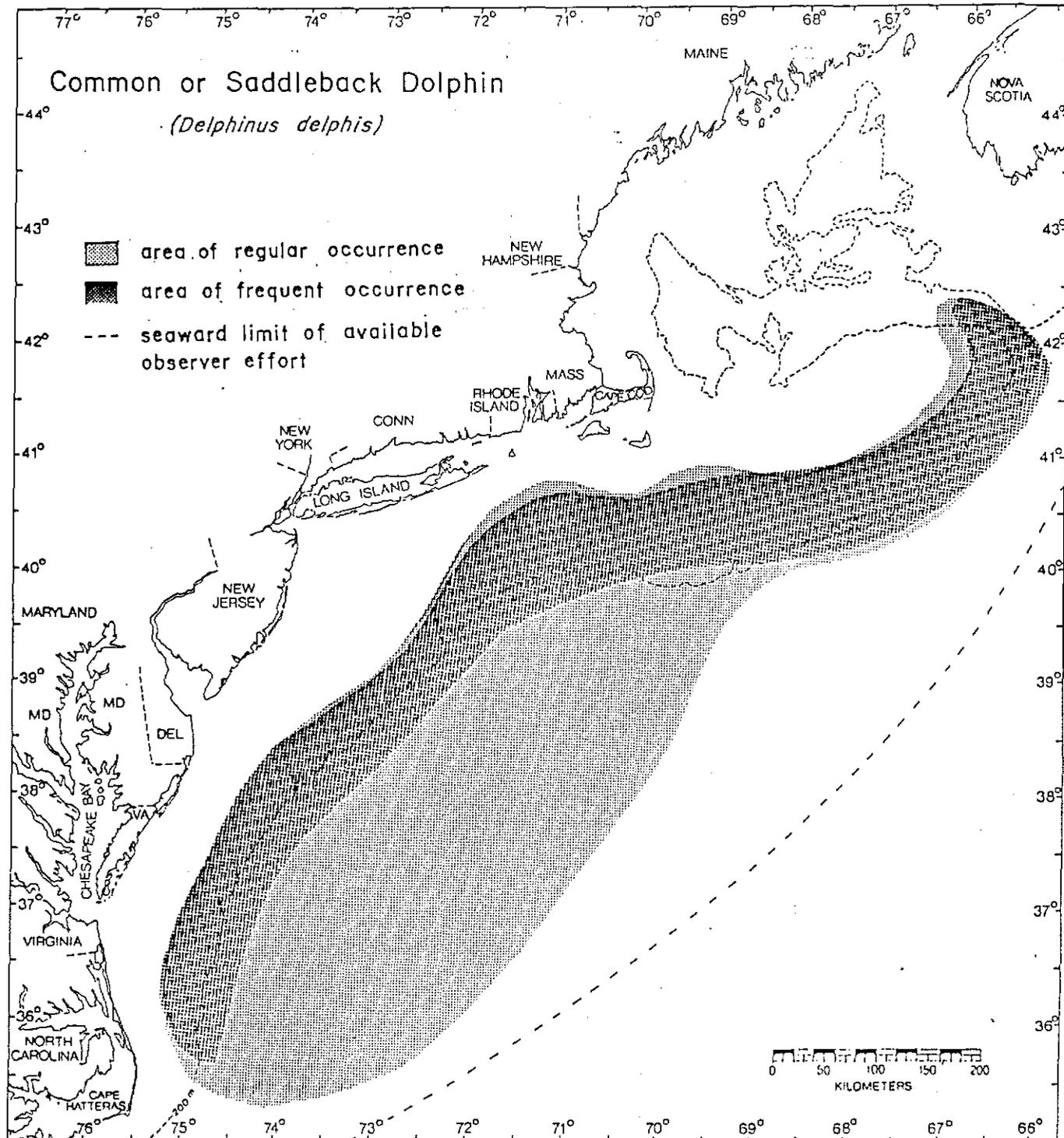


Figure 5. Annual distribution of Common or Saddleback Dolphin (*Delphinus delphis*) off the northeastern United States.

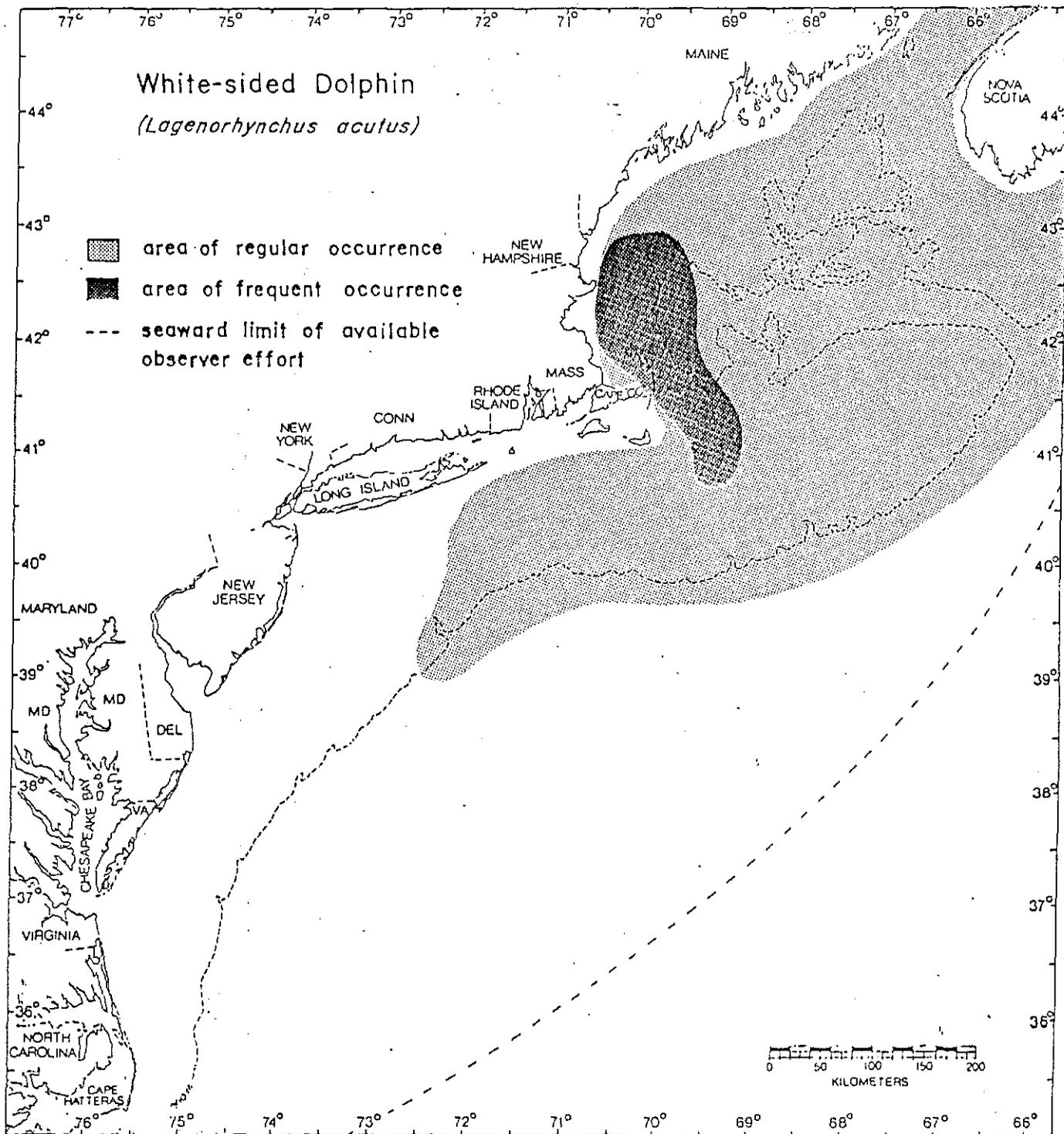


Figure 6. Annual distribution of White-sided Dolphin (*Lagenorhynchus acutus*) off the northeastern United States.

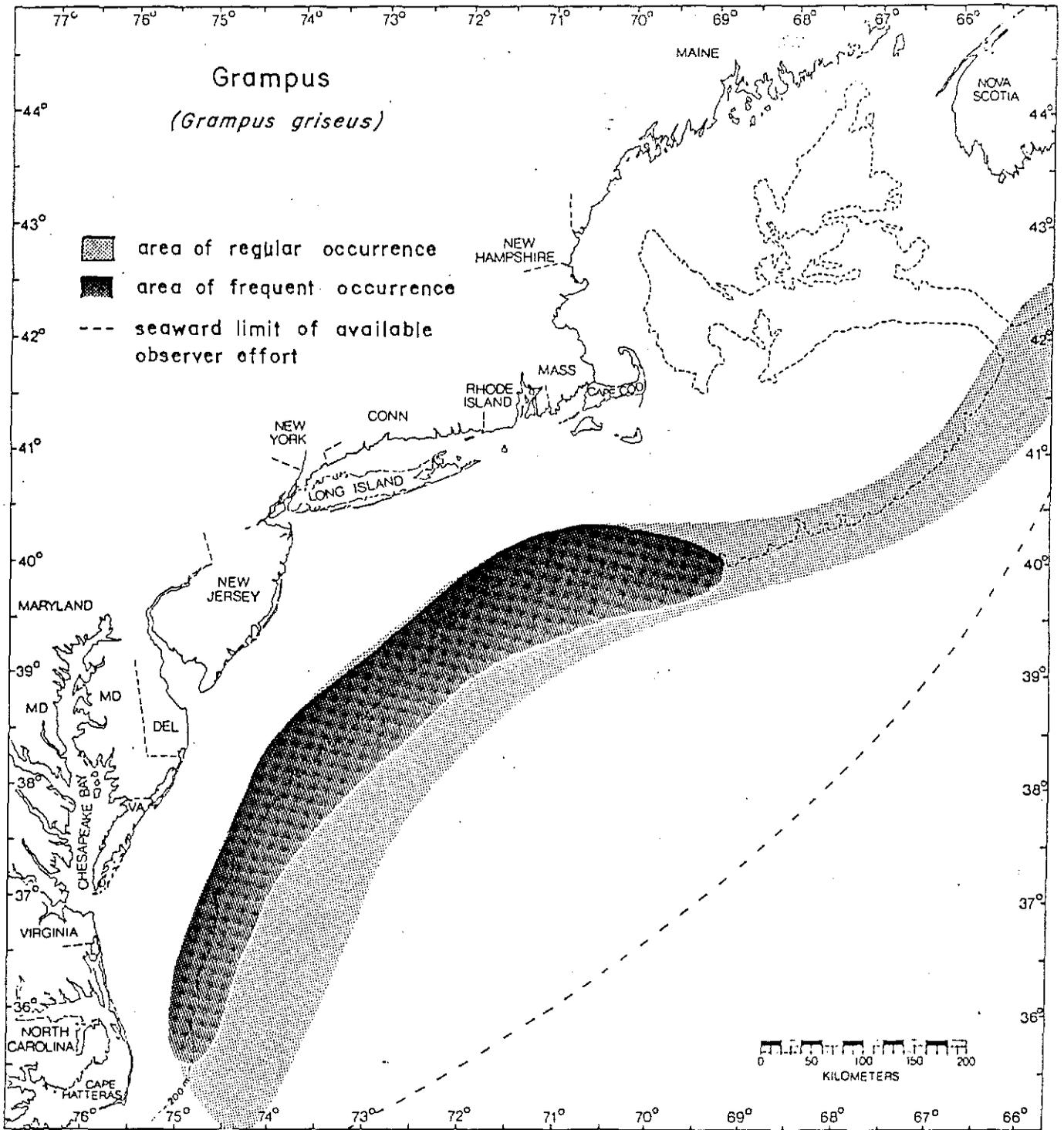


Figure 7. Annual distribution of Grampus or Risso's Dolphin (*Grampus griseus*) off the northeastern United States.

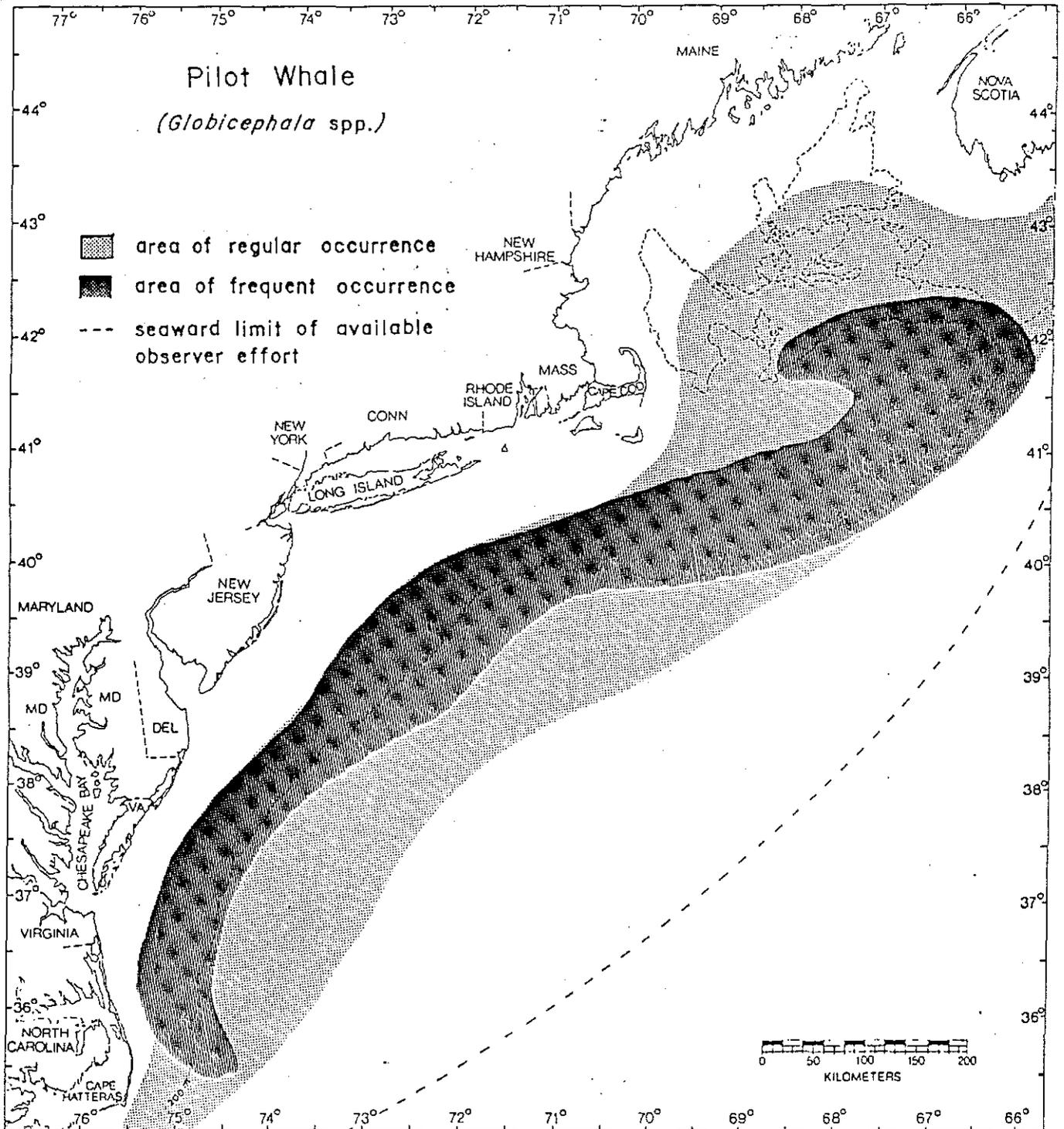


Figure 8. Annual distribution of pilot whales (*Globicephala* spp.) off the northeastern United States.

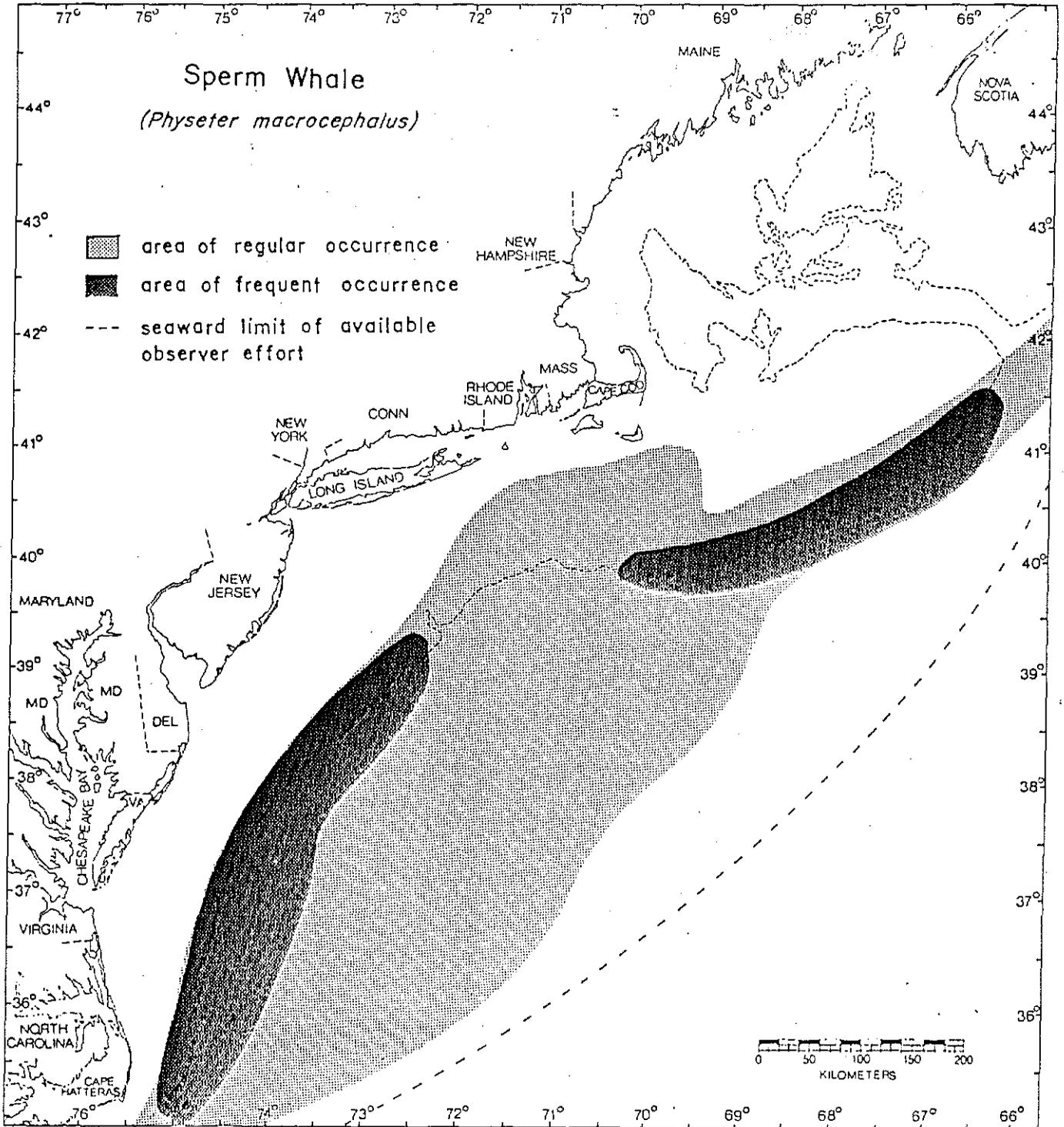


Figure 9. Annual distribution of Sperm Whale (*Physeter macrocephalus*) off the northeastern United States.

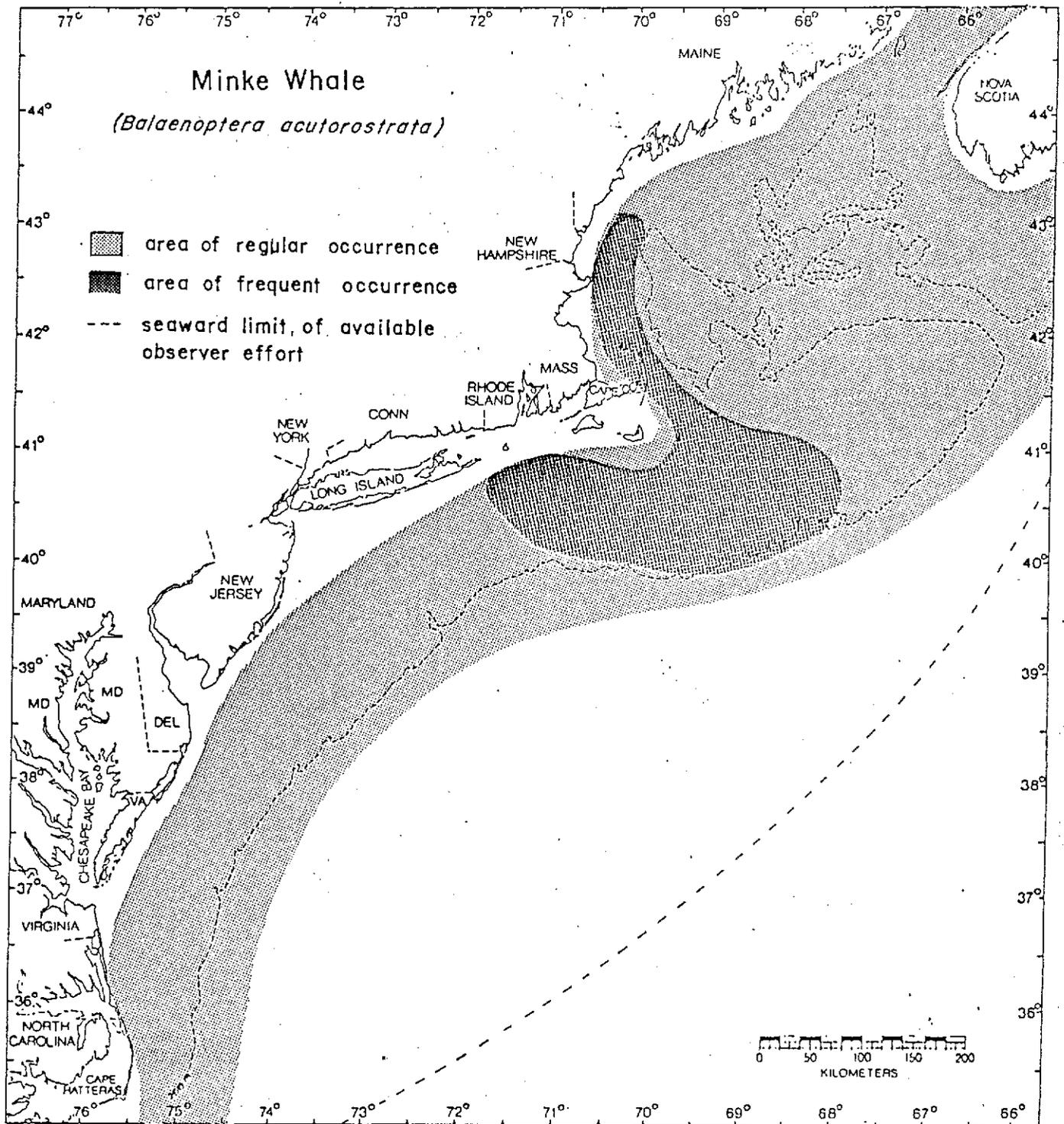


Figure 10. Annual distribution of Minke Whale (*Balaenoptera acutorostrata*) off the northeastern United States.

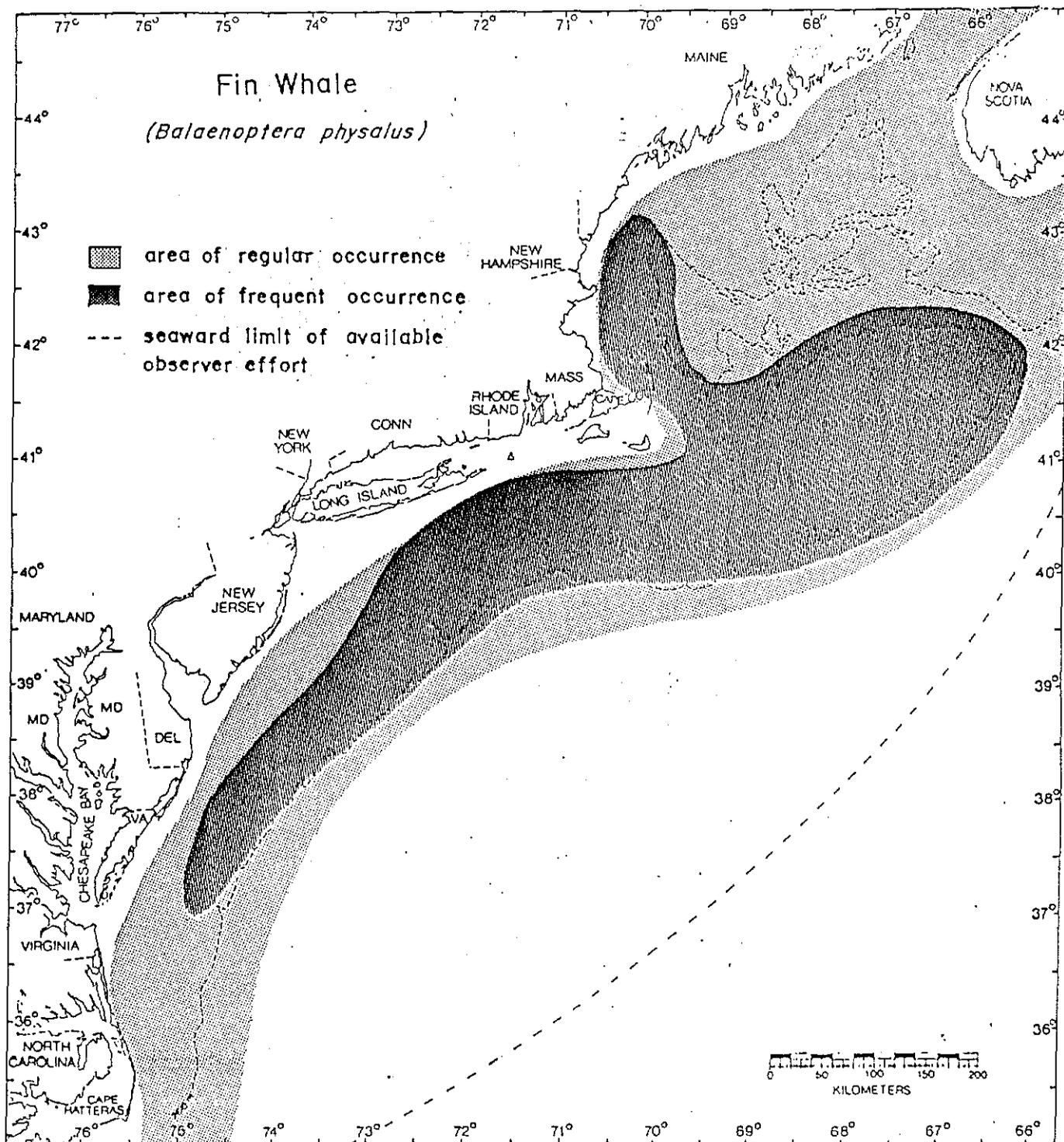


Figure 11. Annual distribution of Fin Whale (*Balaenoptera physalus*) off the north-eastern United States.

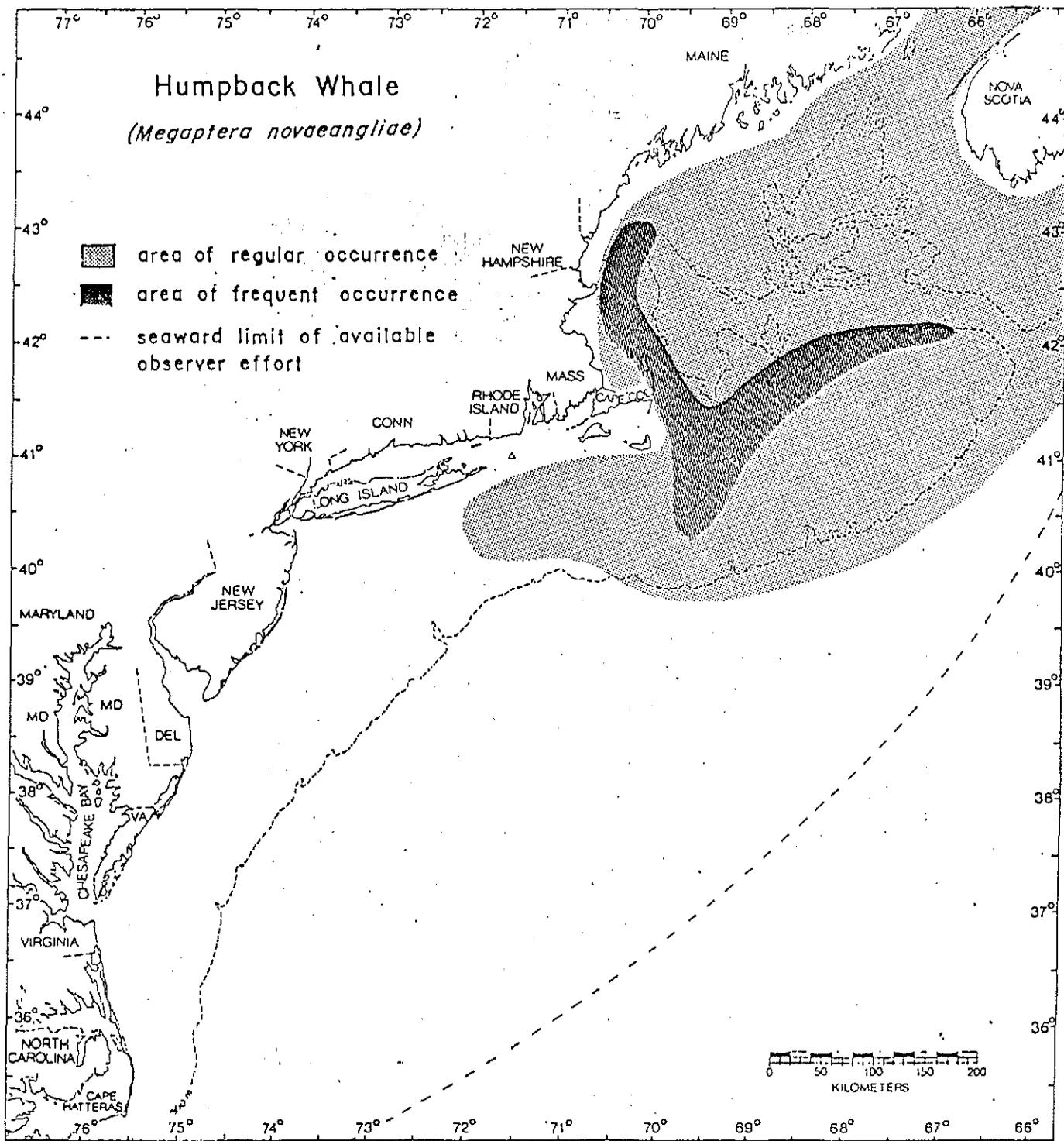


Figure 12. Annual distribution of Humpback Whale (*Megaptera novaeangliae*) off the northeastern United States.

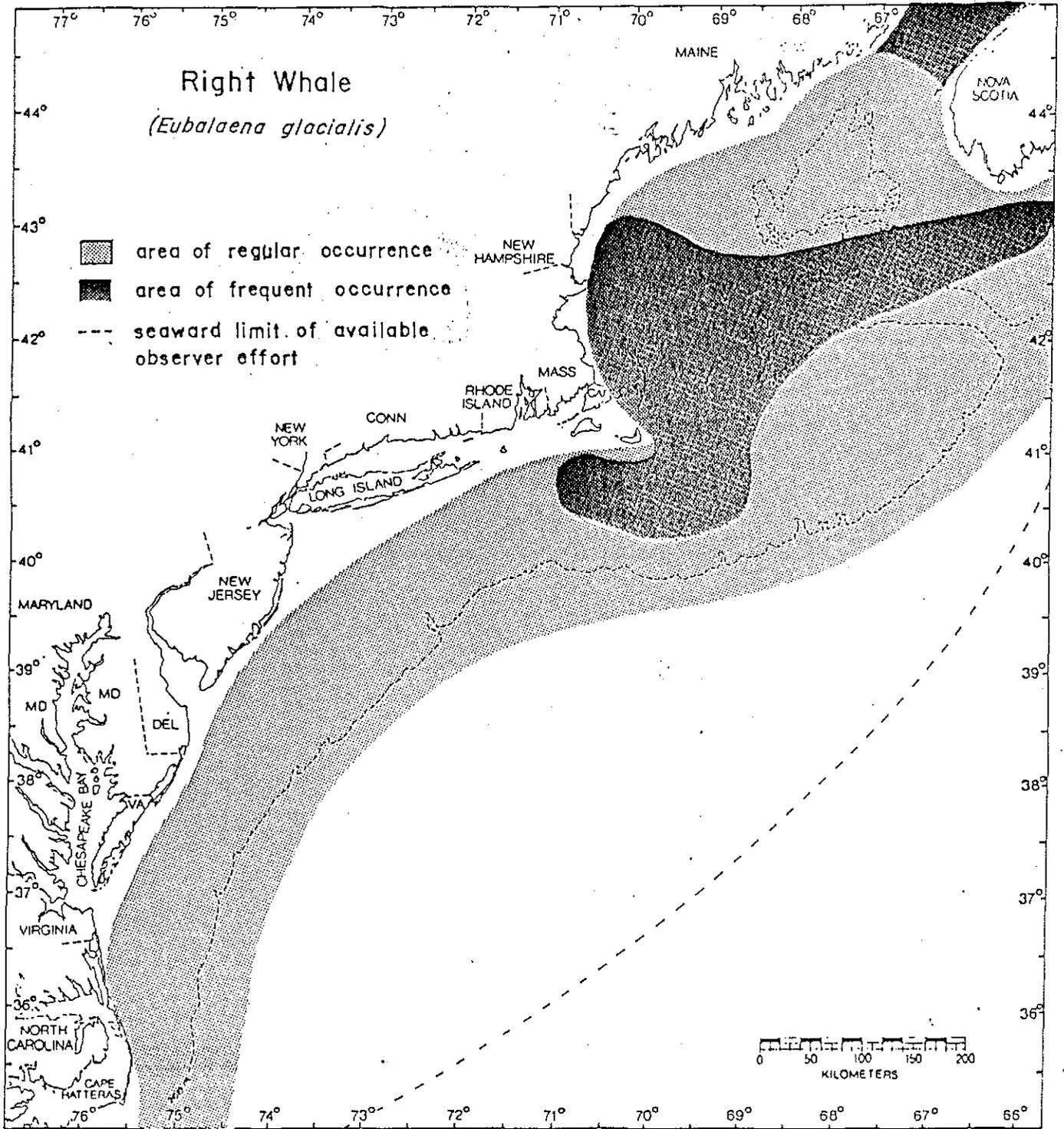


Figure 13. Annual distribution of Right Whale (*Eubalaena glacialis*) off the northeastern United States.

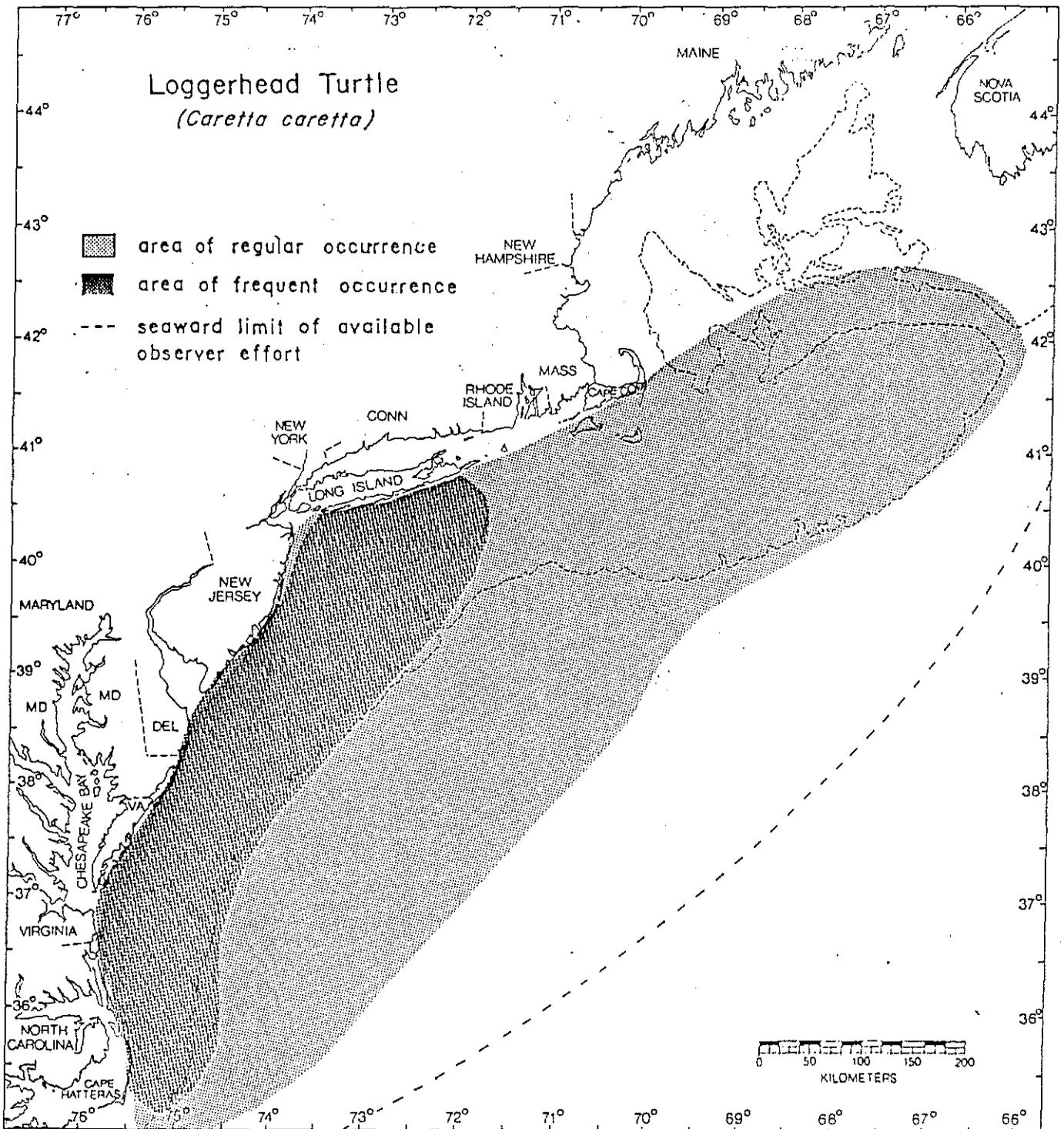


Figure 14. Annual distribution of Loggerhead Turtle (*Caretta caretta*) off the northeastern United States.

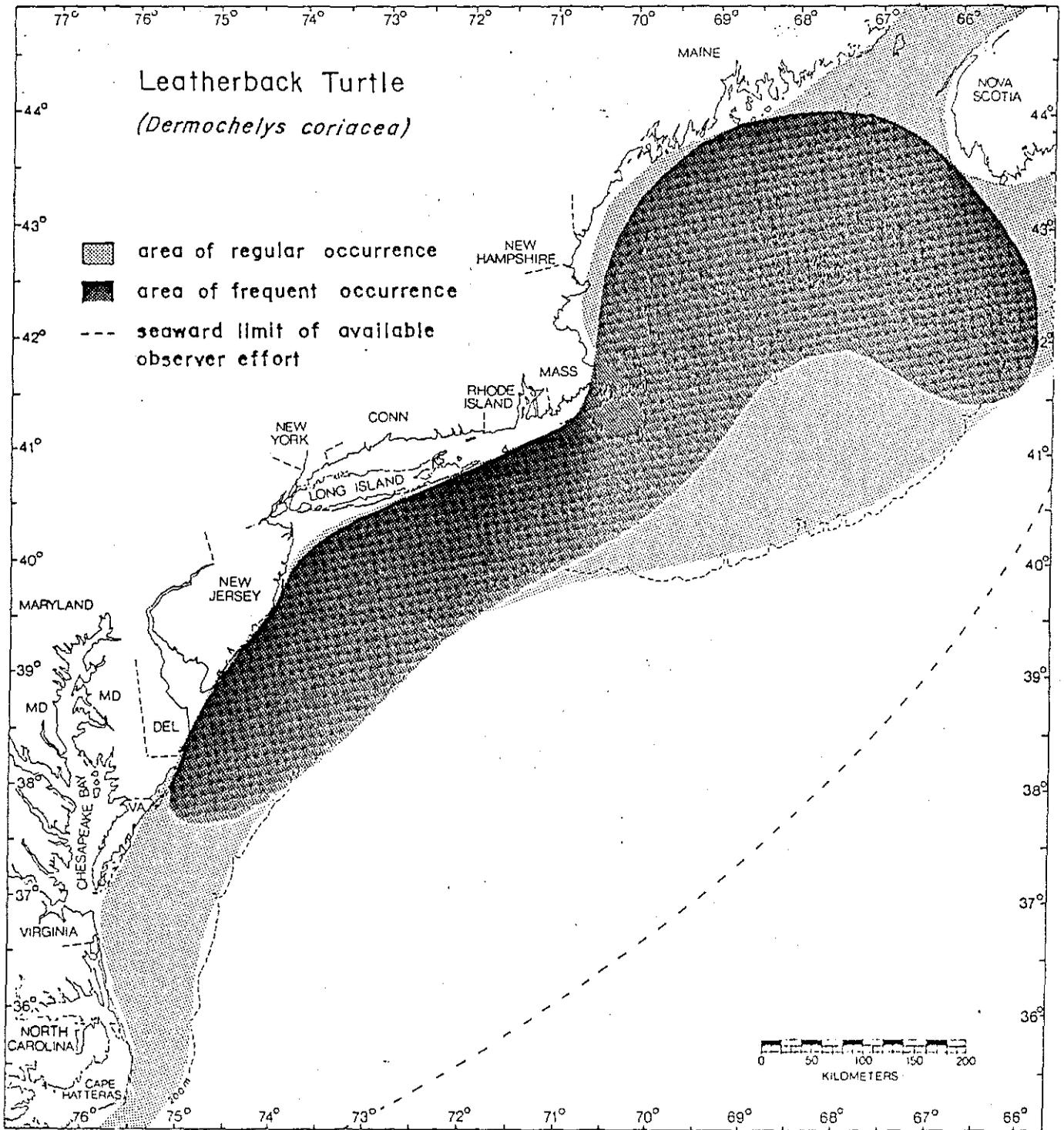


Figure 15. Annual distribution of Leatherback Turtle (*Dermochelys coriacea*) off the northeastern United States.

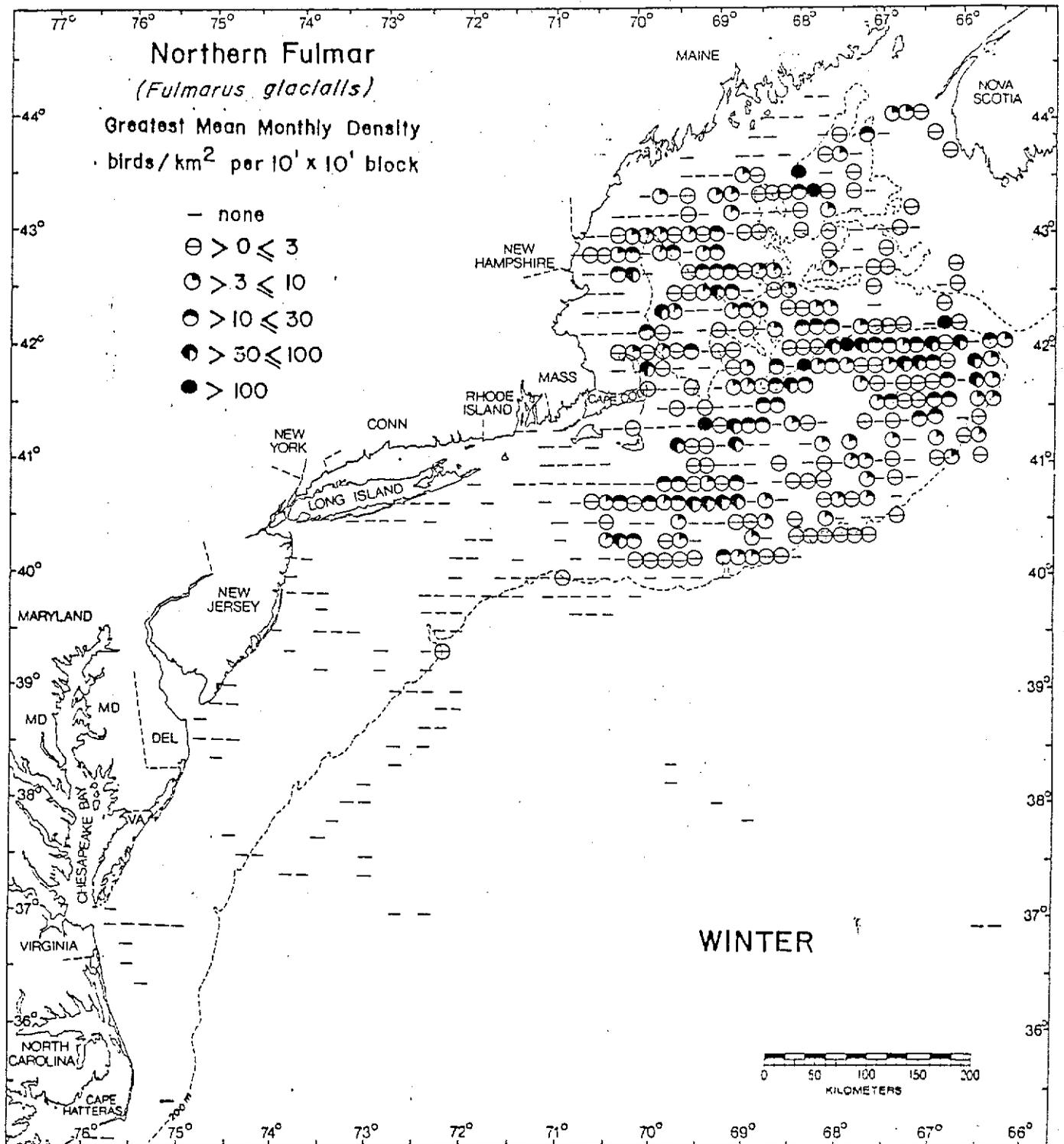


Figure 16. Relative distribution and abundance of Northern Fulmar (*Fulmarus glacialis*) in winter (December to February) off the northeastern United States.

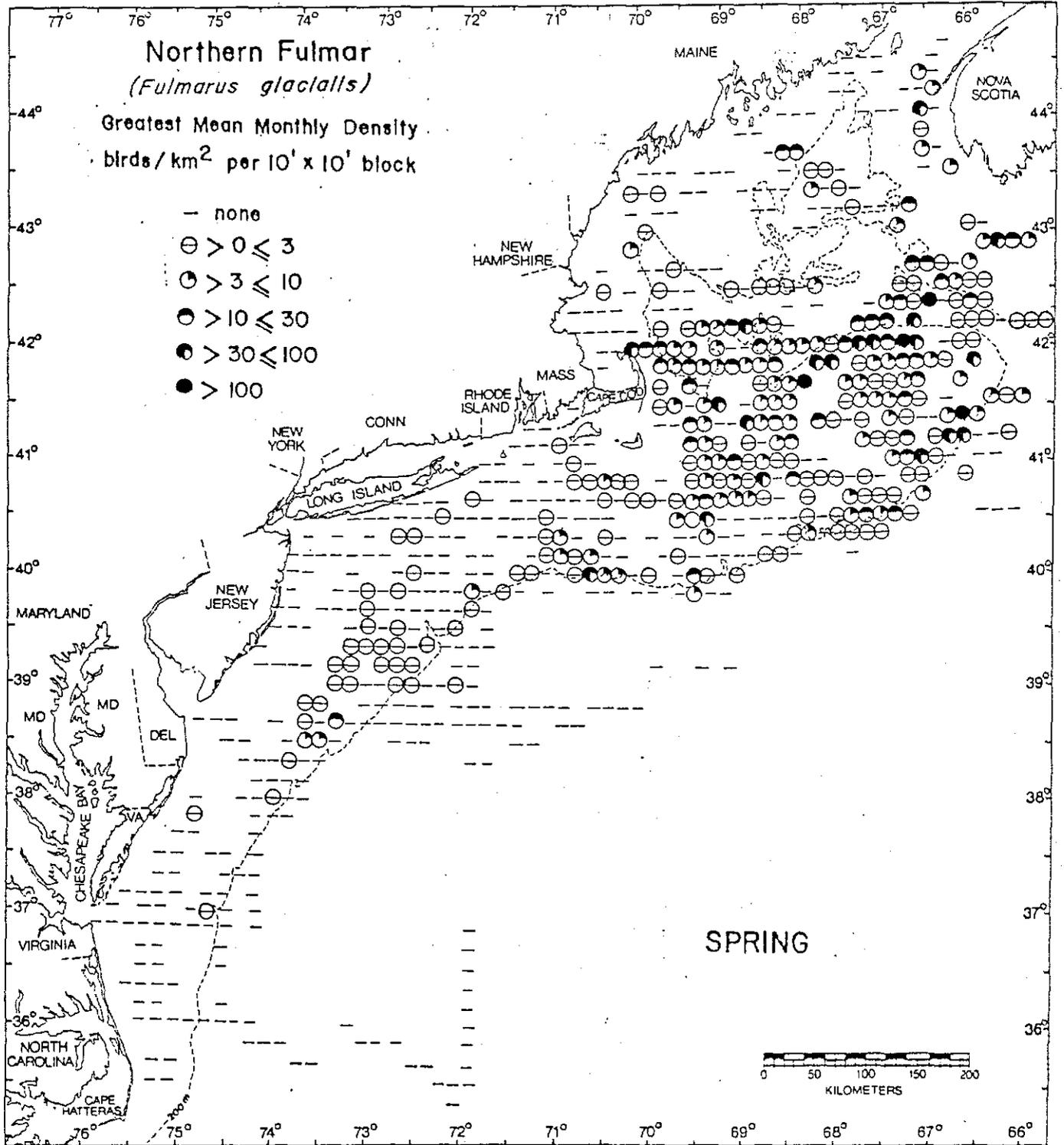


Figure 17. Relative distribution and abundance of Northern Fulmar (*Fulmarus glacialis*) in spring (March to May) off the northeastern United States.

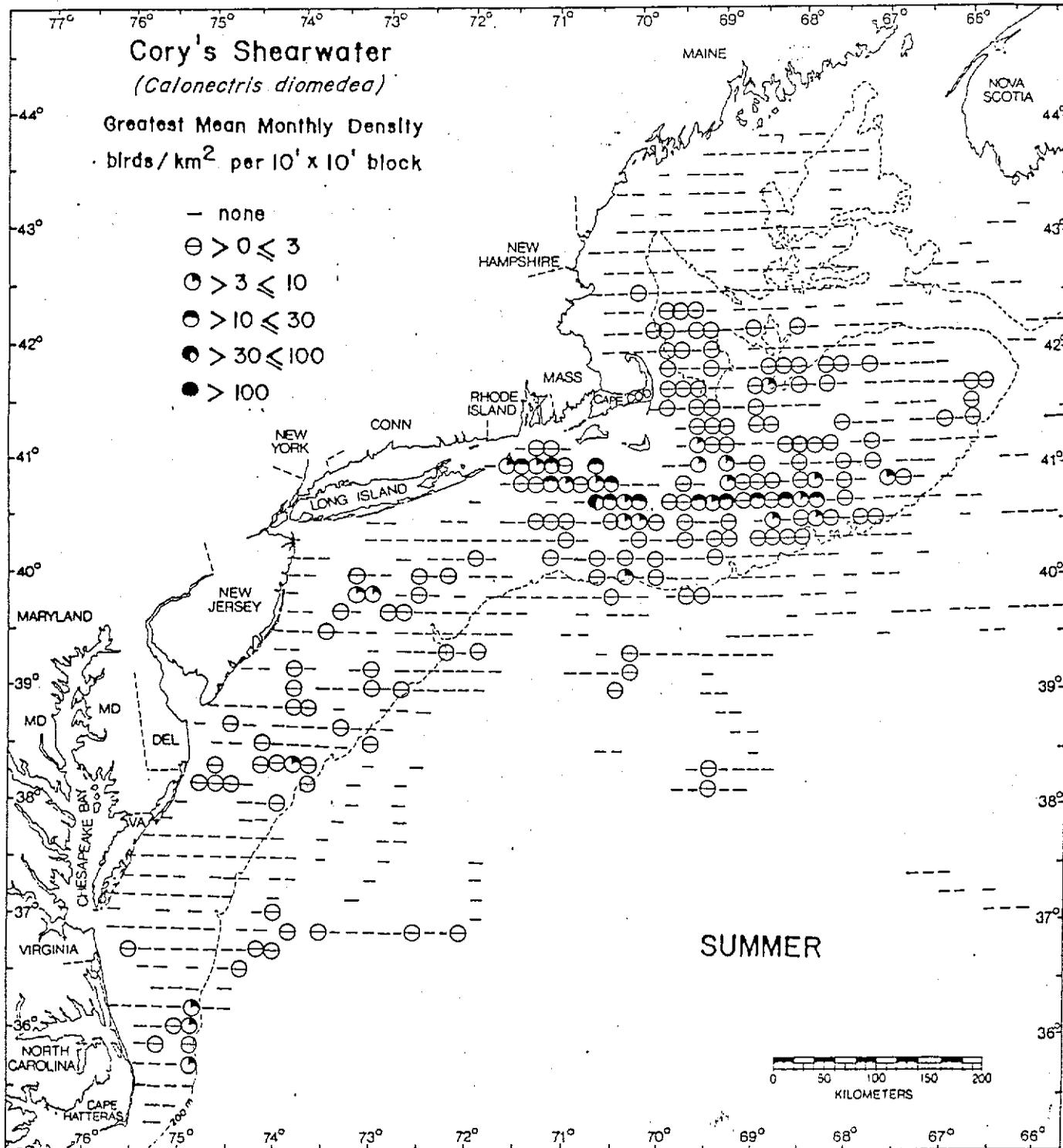


Figure 18. Relative distribution and abundance of Cory's Shearwater (*Calonectris diomedea*) in summer (June to August) off the northeastern United States.

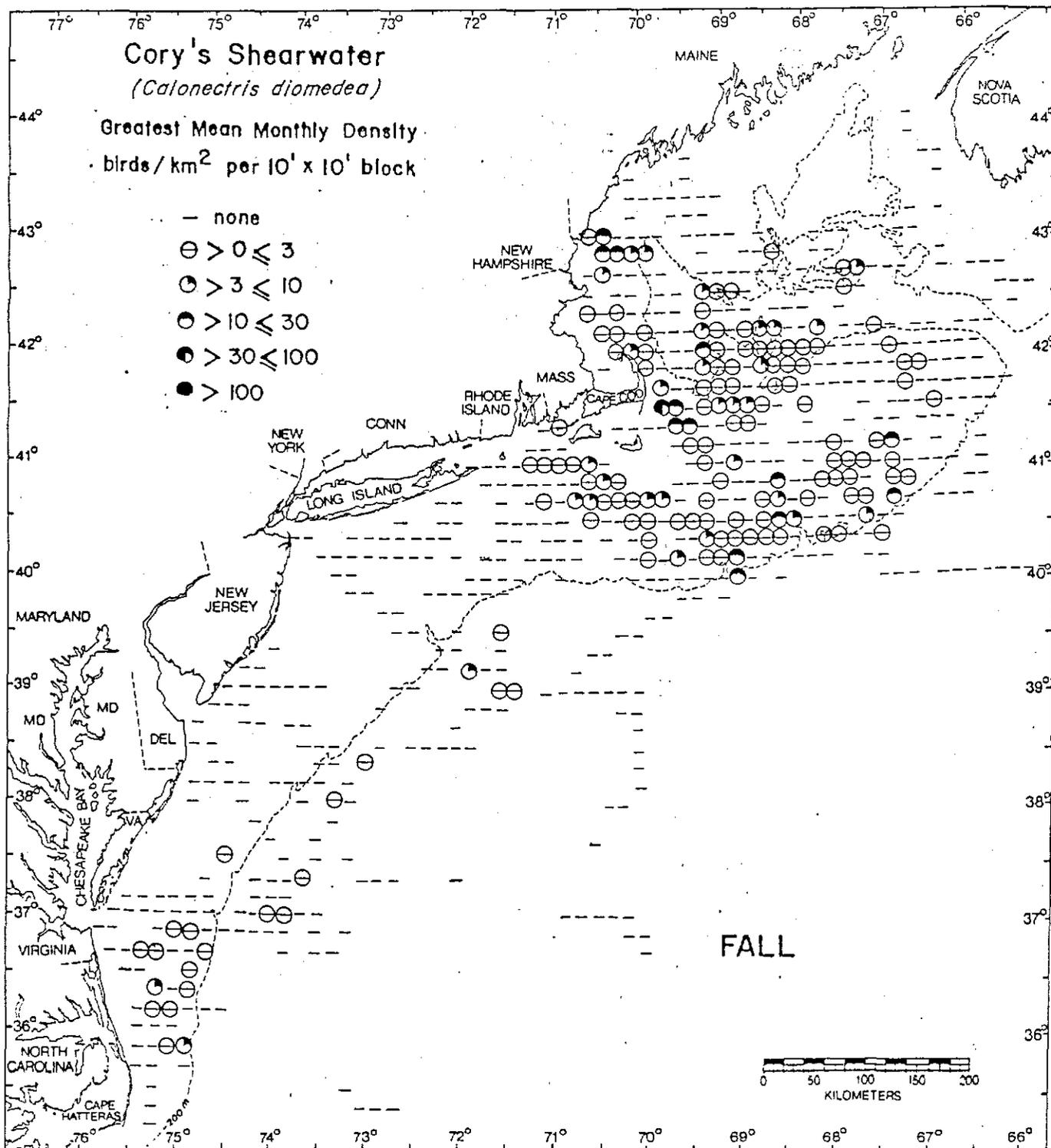


Figure 19. Relative distribution and abundance of Cory's Shearwater (*Calonectris diomedea*) in fall (September to November) off the northeastern United States.

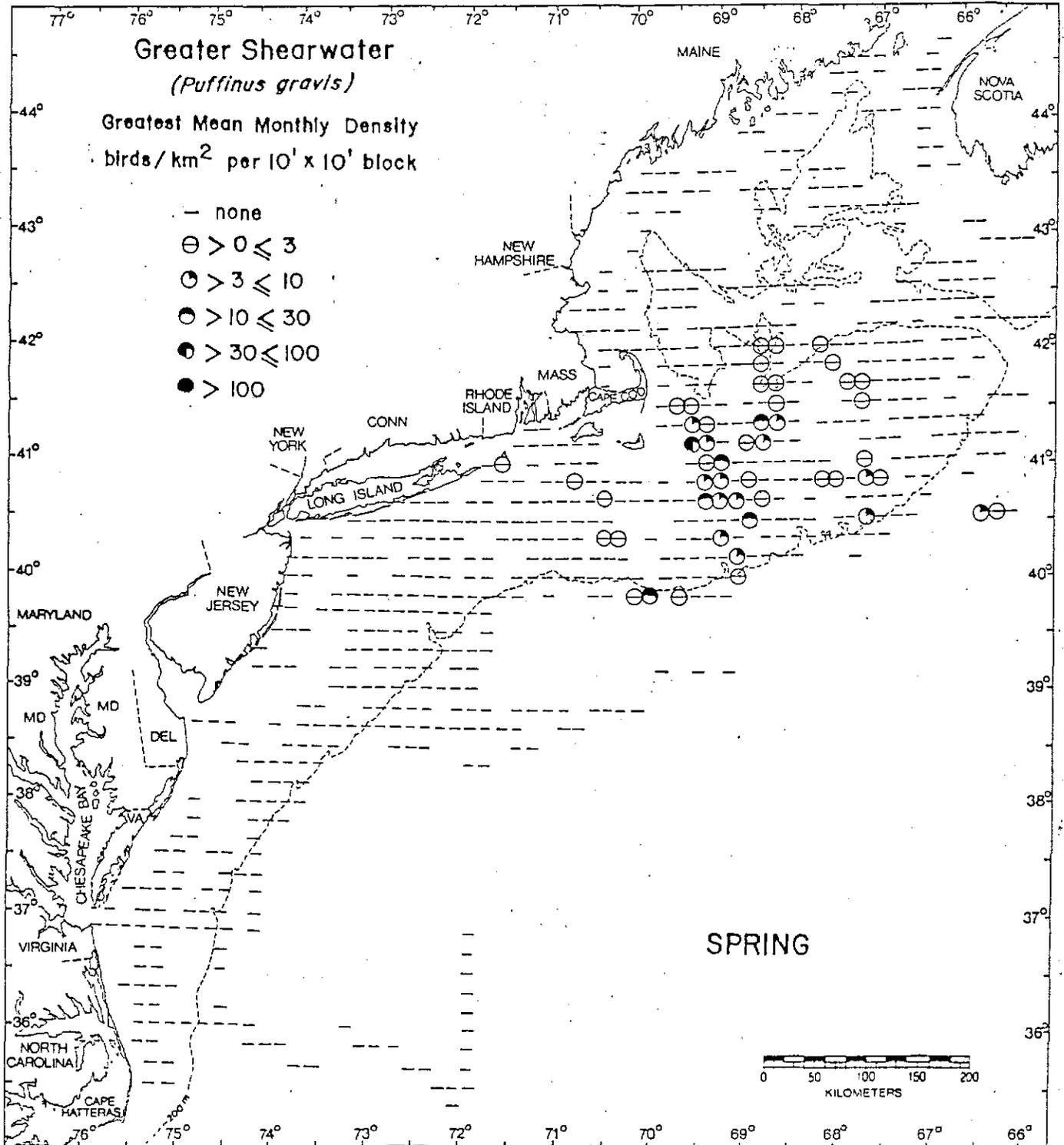


Figure 20. Relative distribution and abundance of Greater Shearwater (*Puffinus gravis*) in spring (March to May) off the northeastern United States.

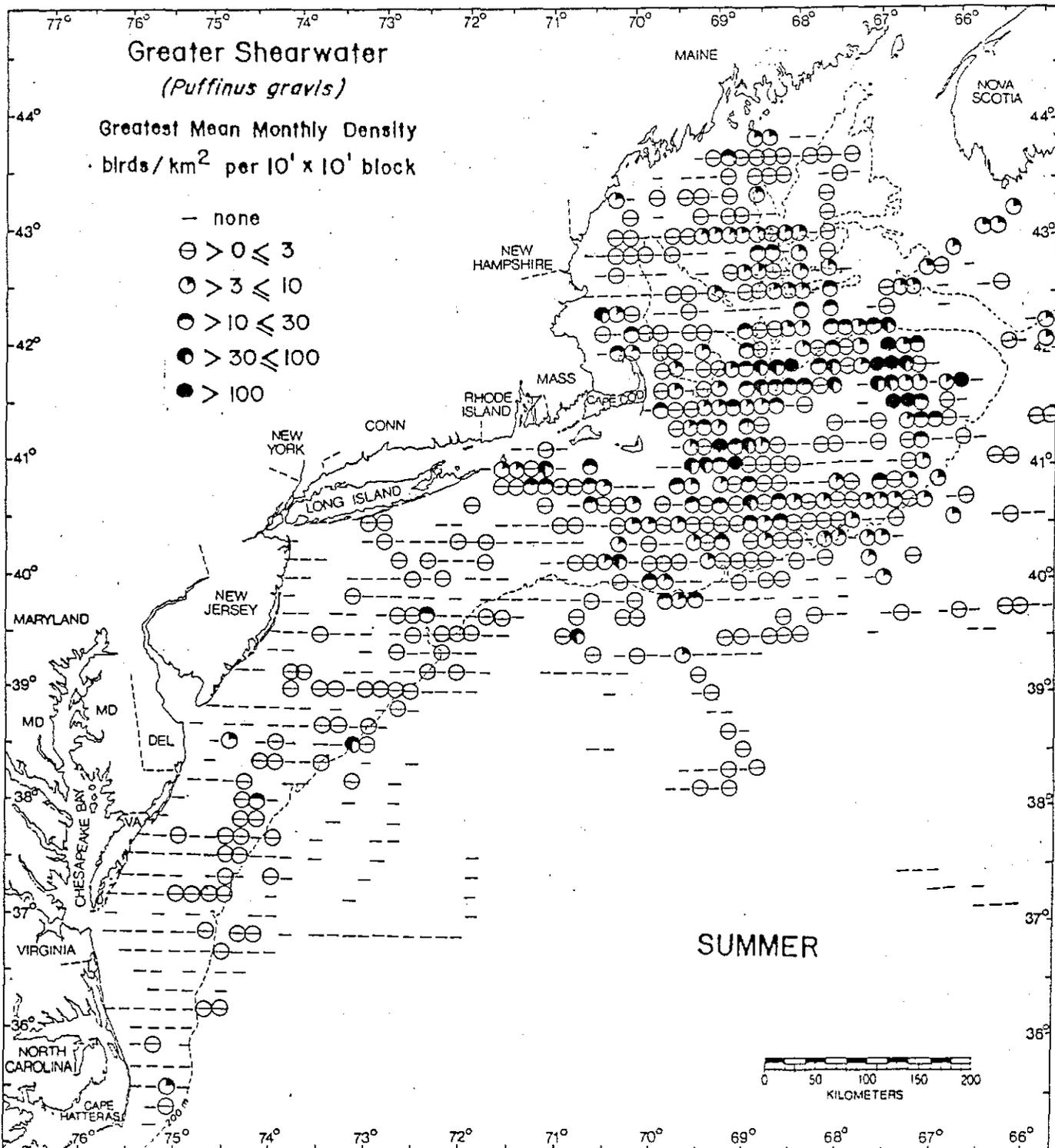


Figure 21. Relative distribution and abundance of Greater Shearwater (*Puffinus gravis*) in summer (June to August) off the northeastern United States.

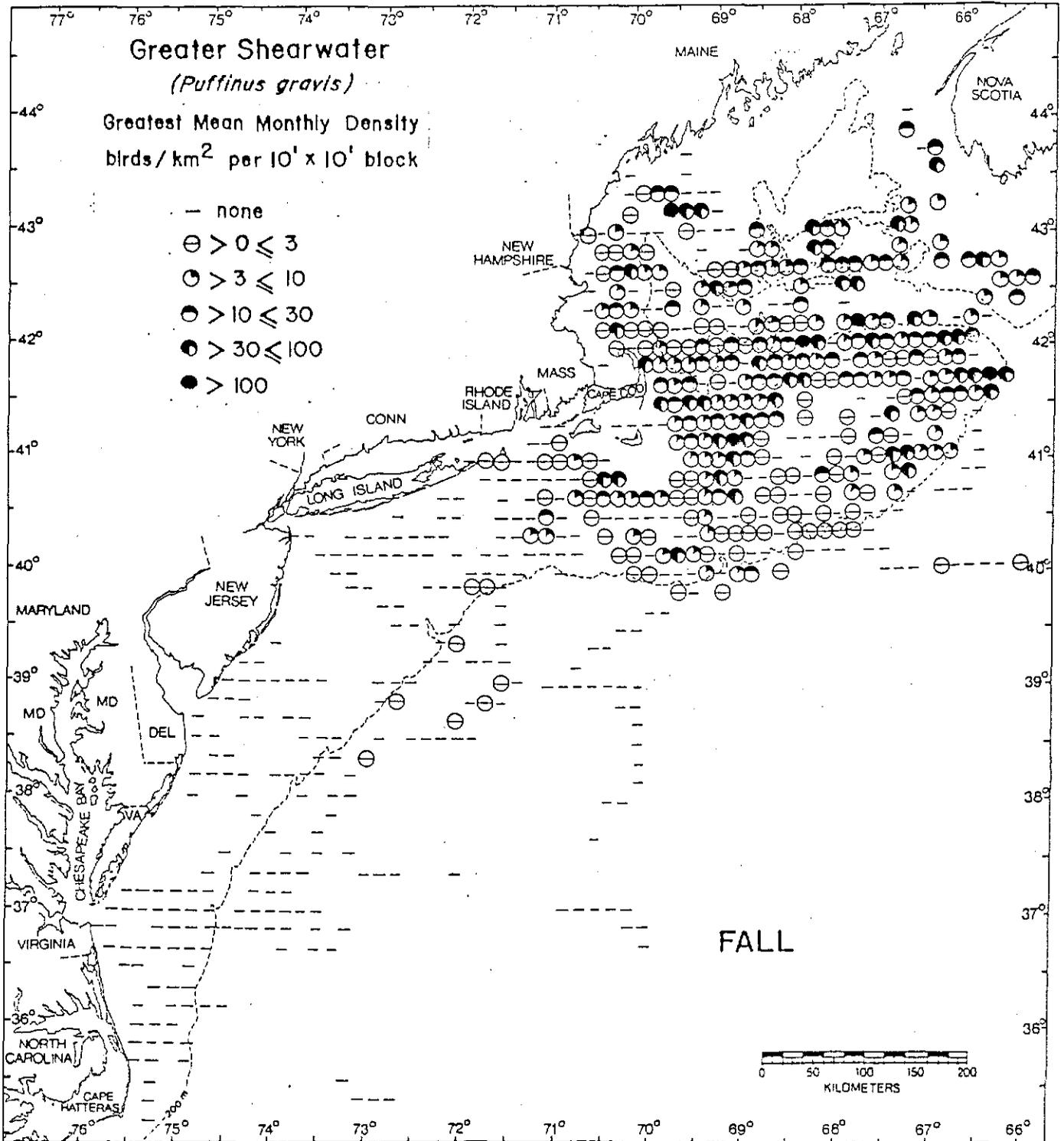


Figure 22. Relative distribution and abundance of Greater Shearwater (*Puffinus gravis*) in fall (September to November) off the northeastern United States.

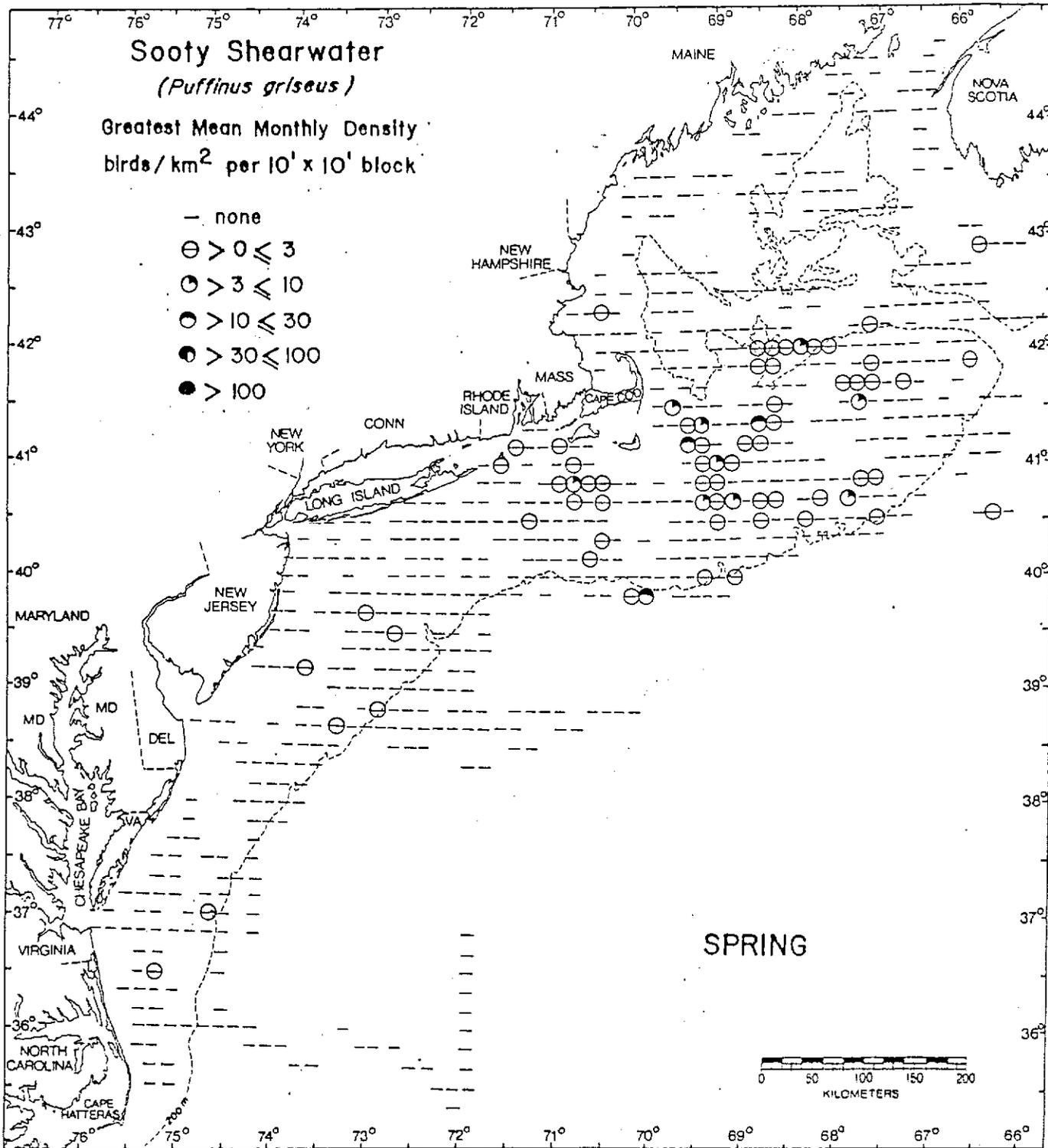


Figure 23. Relative distribution and abundance of Sooty Shearwater (*Puffinus griseus*) in spring (March to May) off the northeastern United States.

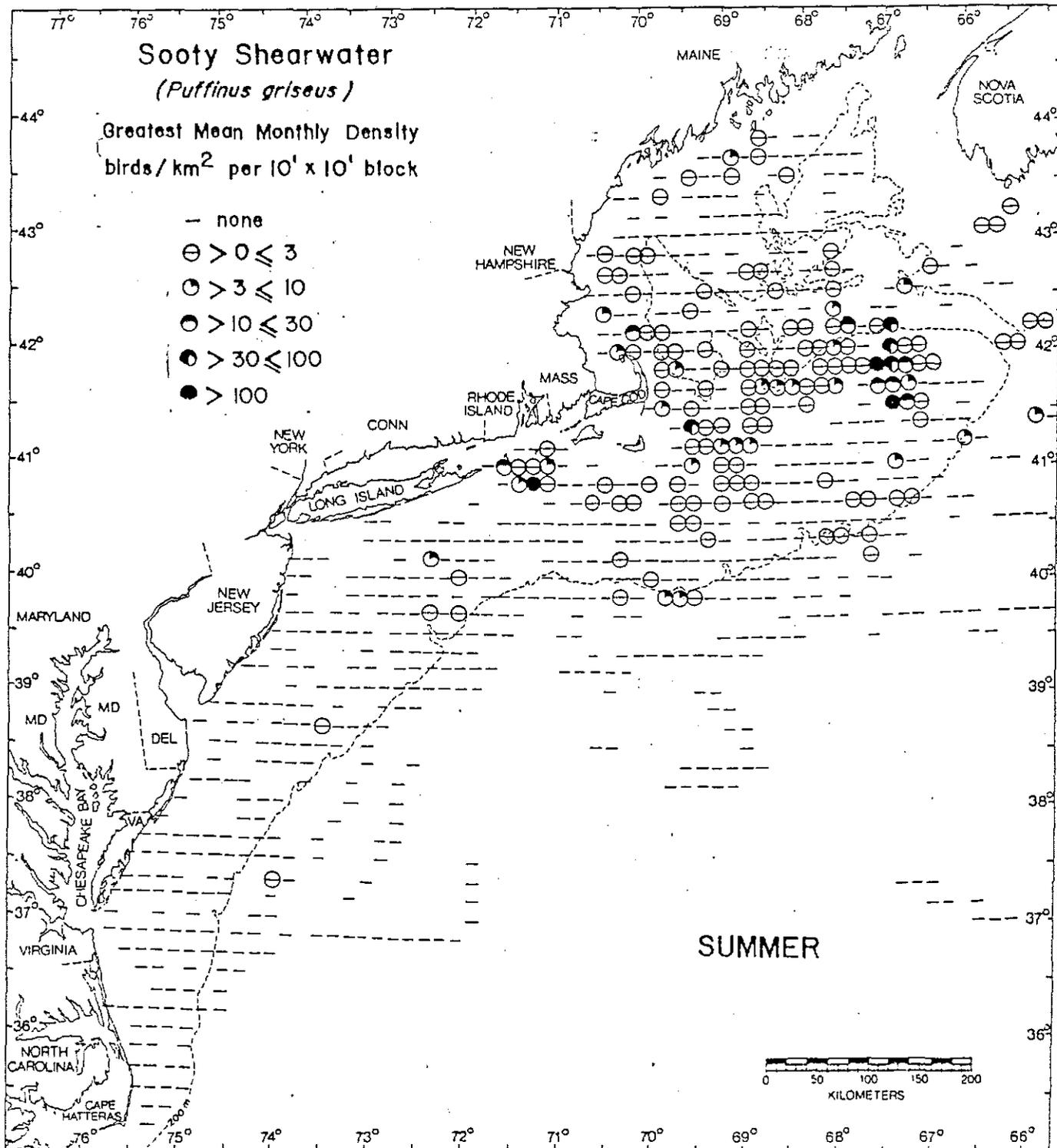


Figure 24. Relative distribution and abundance of Sooty Shearwater (*Puffinus griseus*) in summer (June to August) off the northeastern United States.

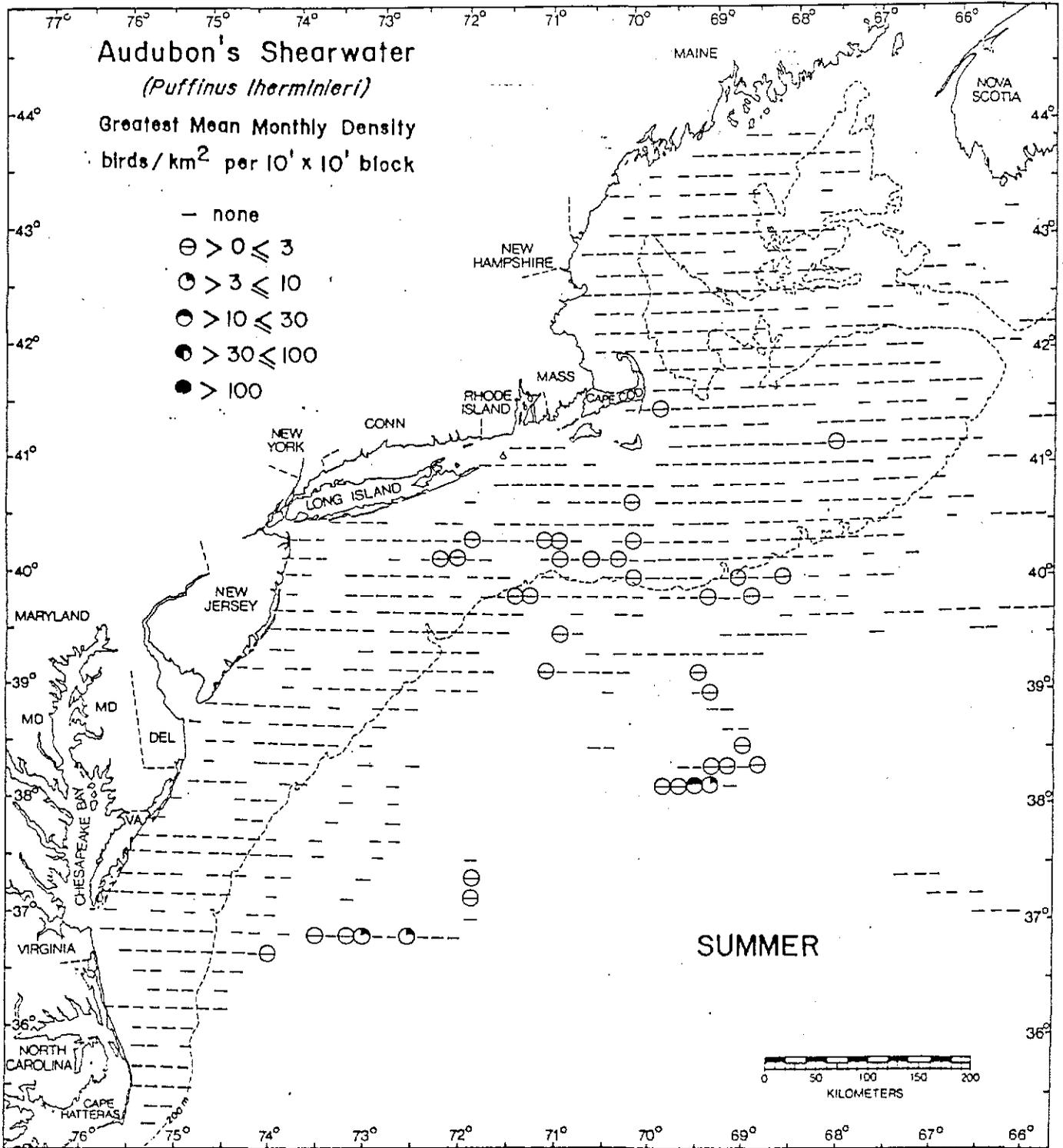


Figure 25. Relative distribution and abundance of Audubon's Shearwater (*Puffinus lherminieri*) in summer (June to August) off the northeastern United States.

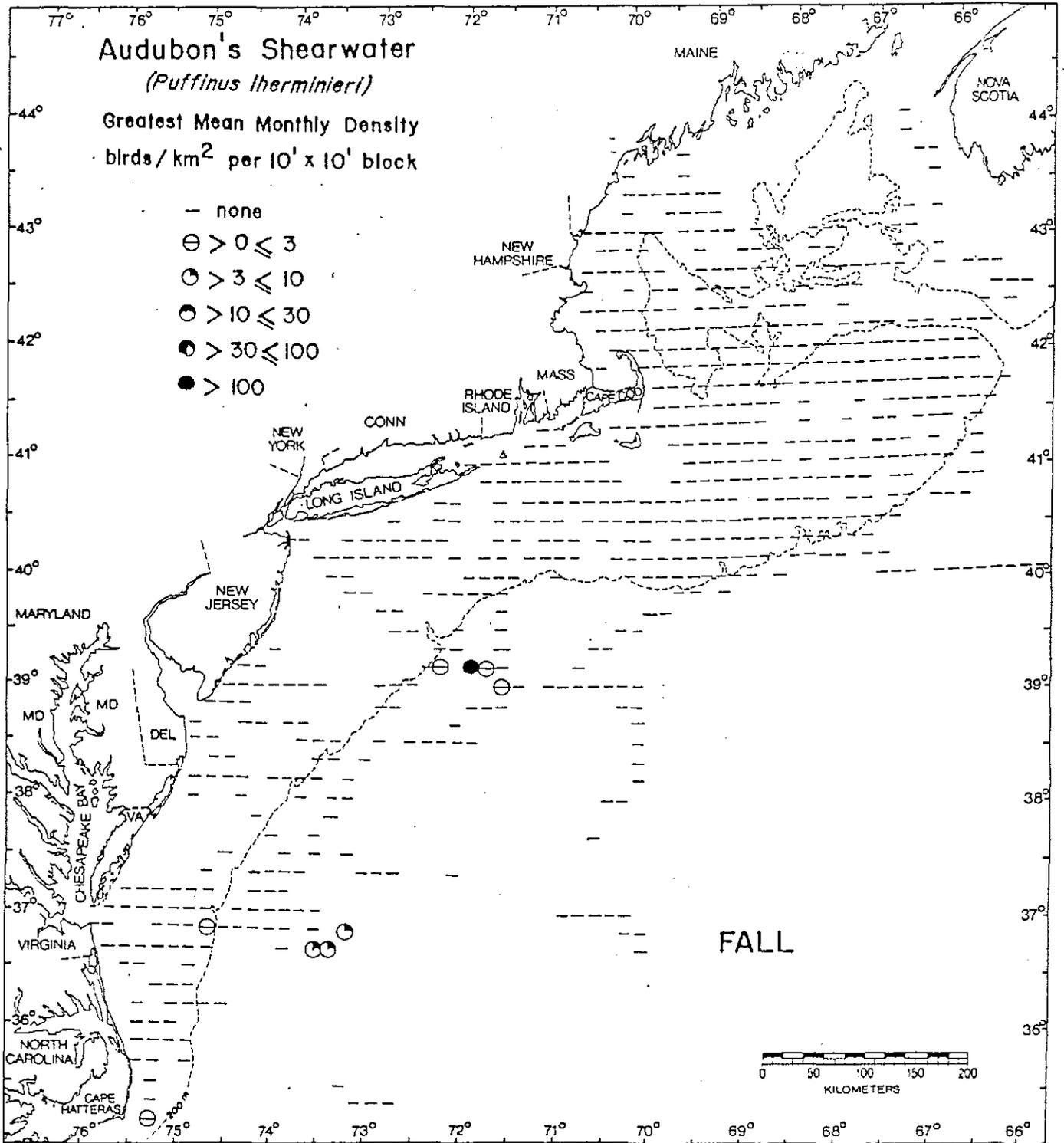


Figure 26. Relative distribution and abundance of Audubon's Shearwater (*Puffinus lherminieri*) in fall (September to November) off the northeastern United States.

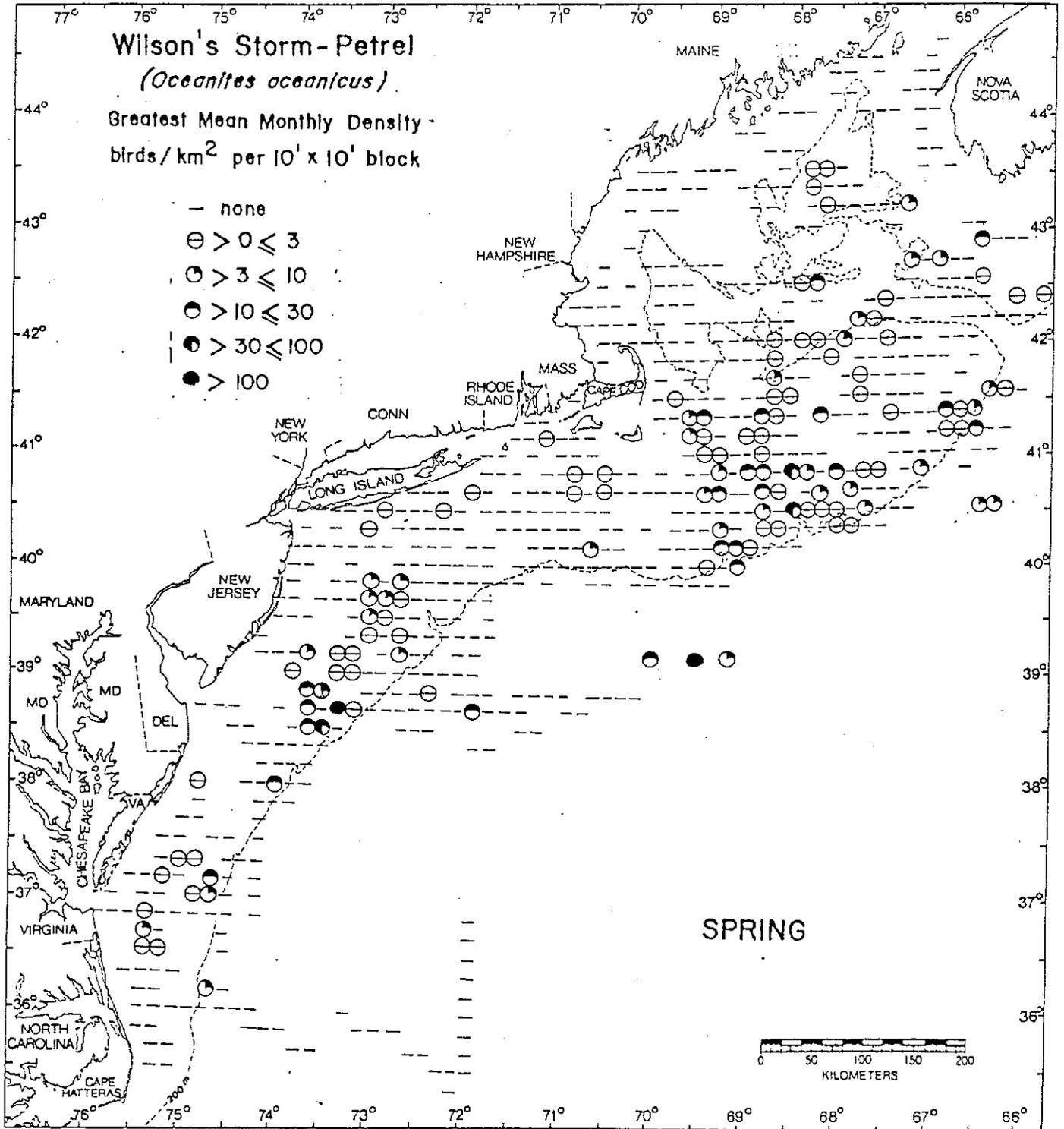


Figure 27. Relative distribution and abundance of Wilson's Storm-Petrel (*Oceanites oceanicus*) in spring (March to May) off the northeastern United States.

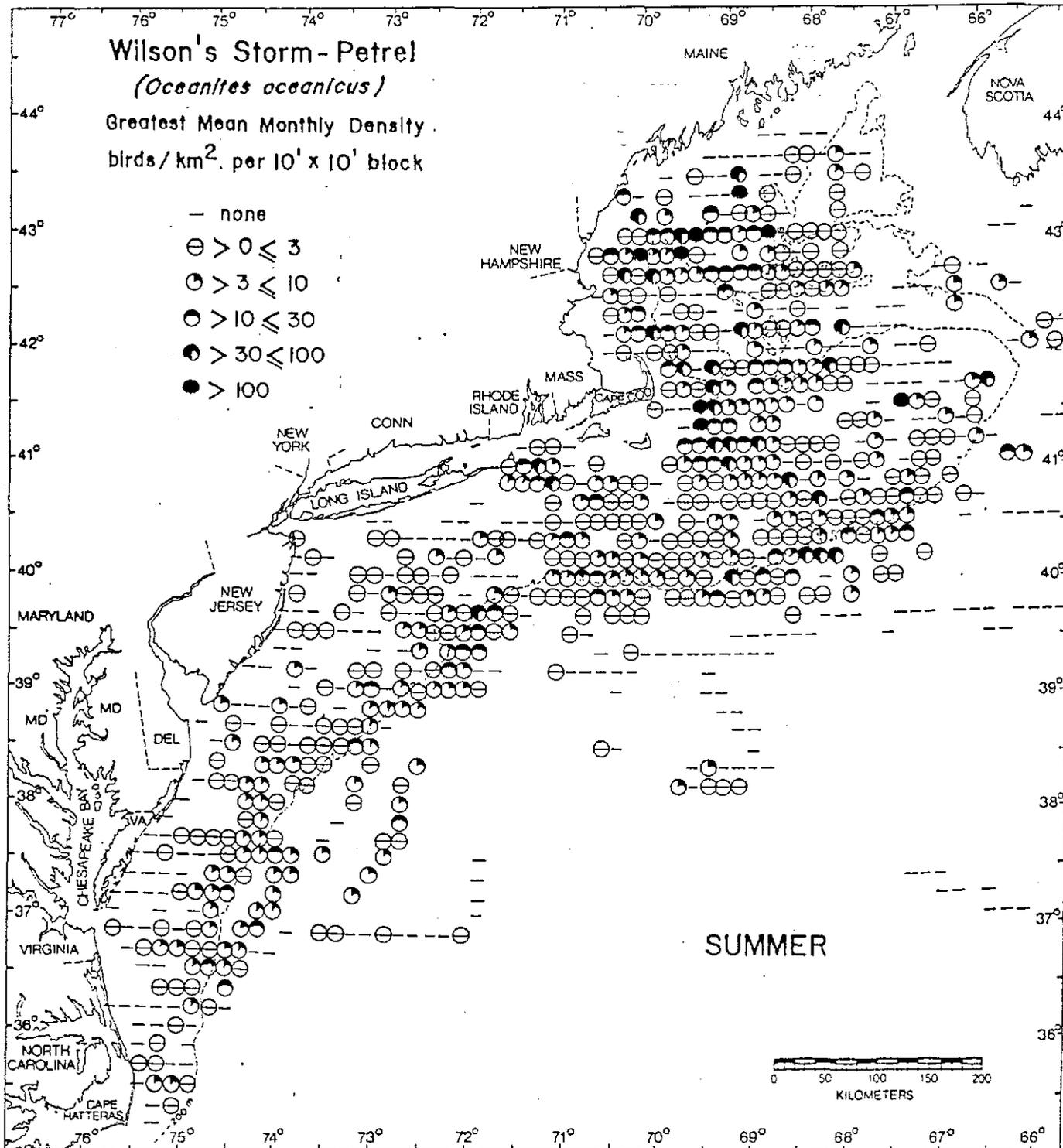


Figure 28. Relative distribution and abundance of Wilson's Storm-Petrel (*Oceanites oceanicus*) in summer (June to August) off the northeastern United States.

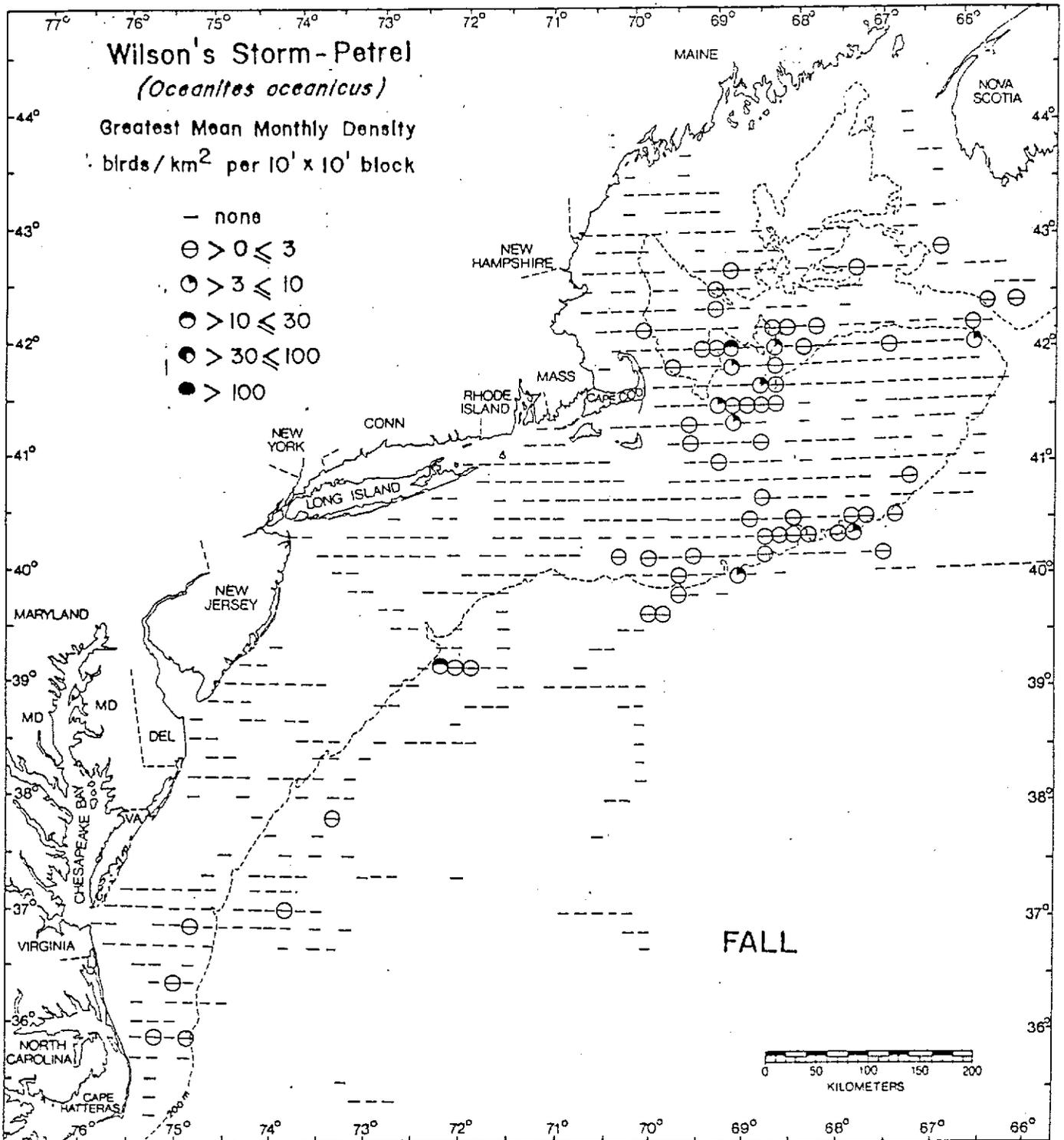


Figure 29. Relative distribution and abundance of Wilson's Storm-Petrel (*Oceanites oceanicus*) in fall (September to November) off the northeastern United States.

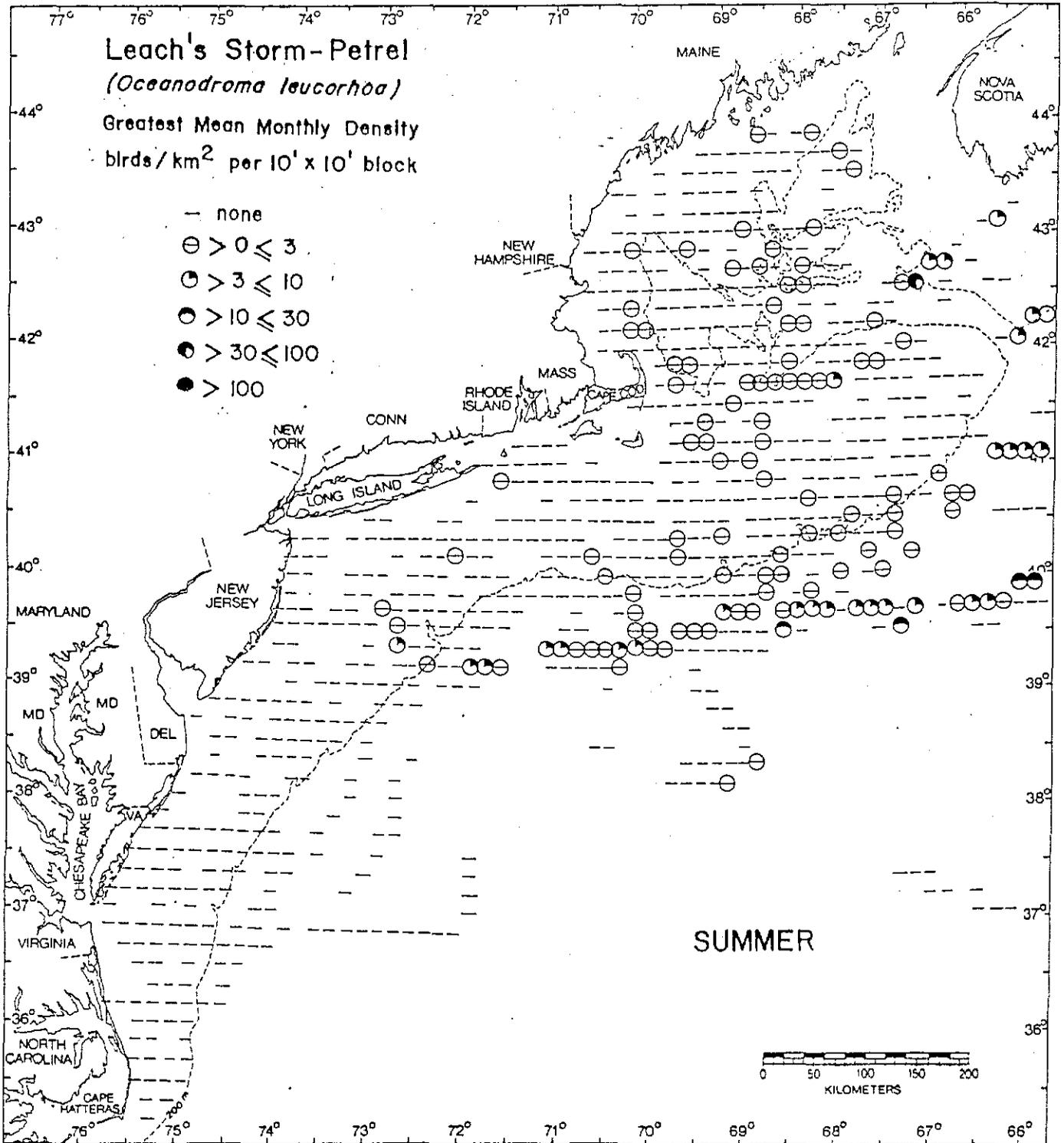


Figure 30. Relative distribution and abundance of Leach's Storm Petrel (*Oceanodroma leucorhoa*) in summer (June to August) off the northeastern United States.

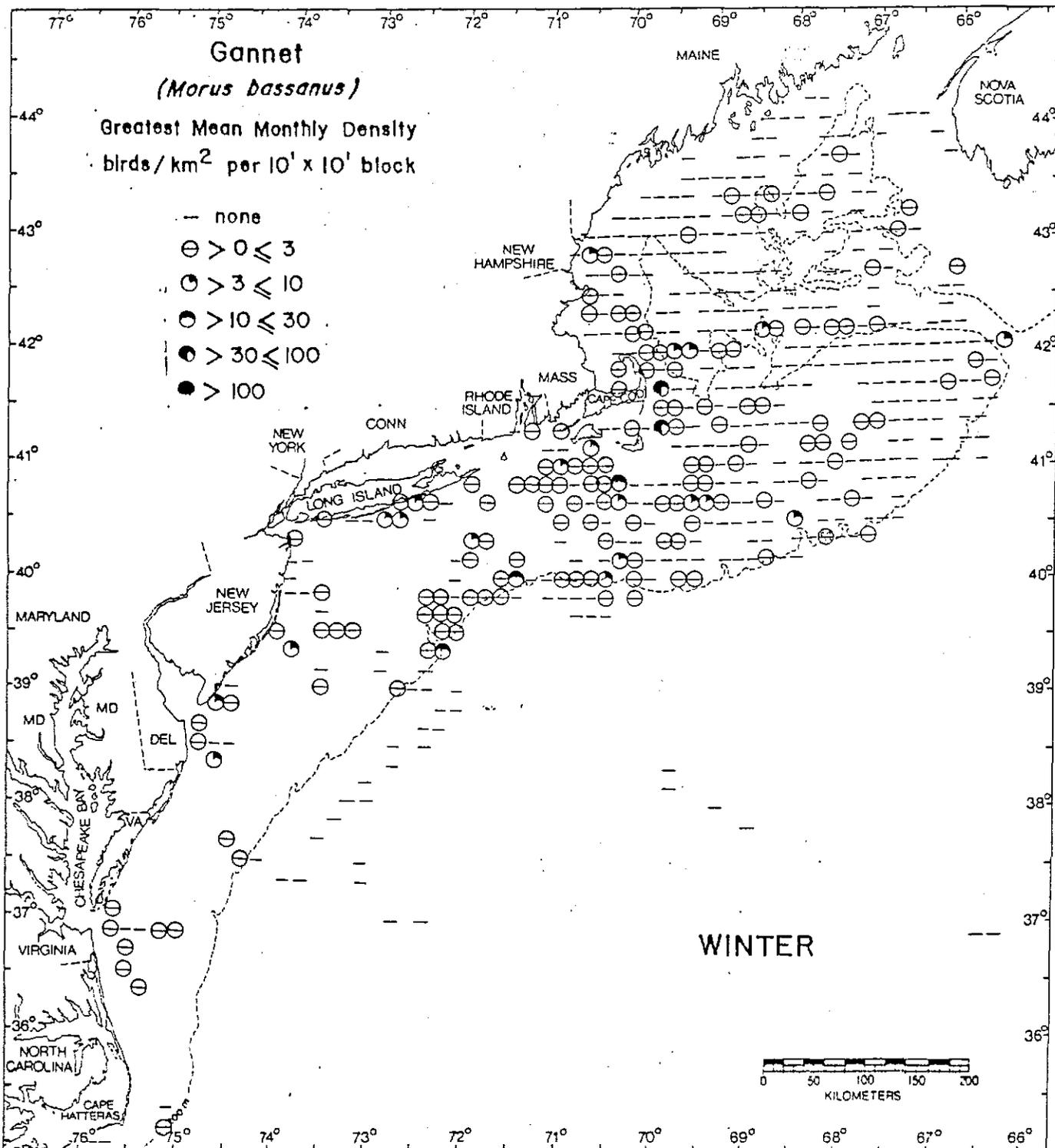


Figure 31. Relative distribution and abundance of Gannet (*Morus bassana*) in winter (December to February) off the northeastern United States.

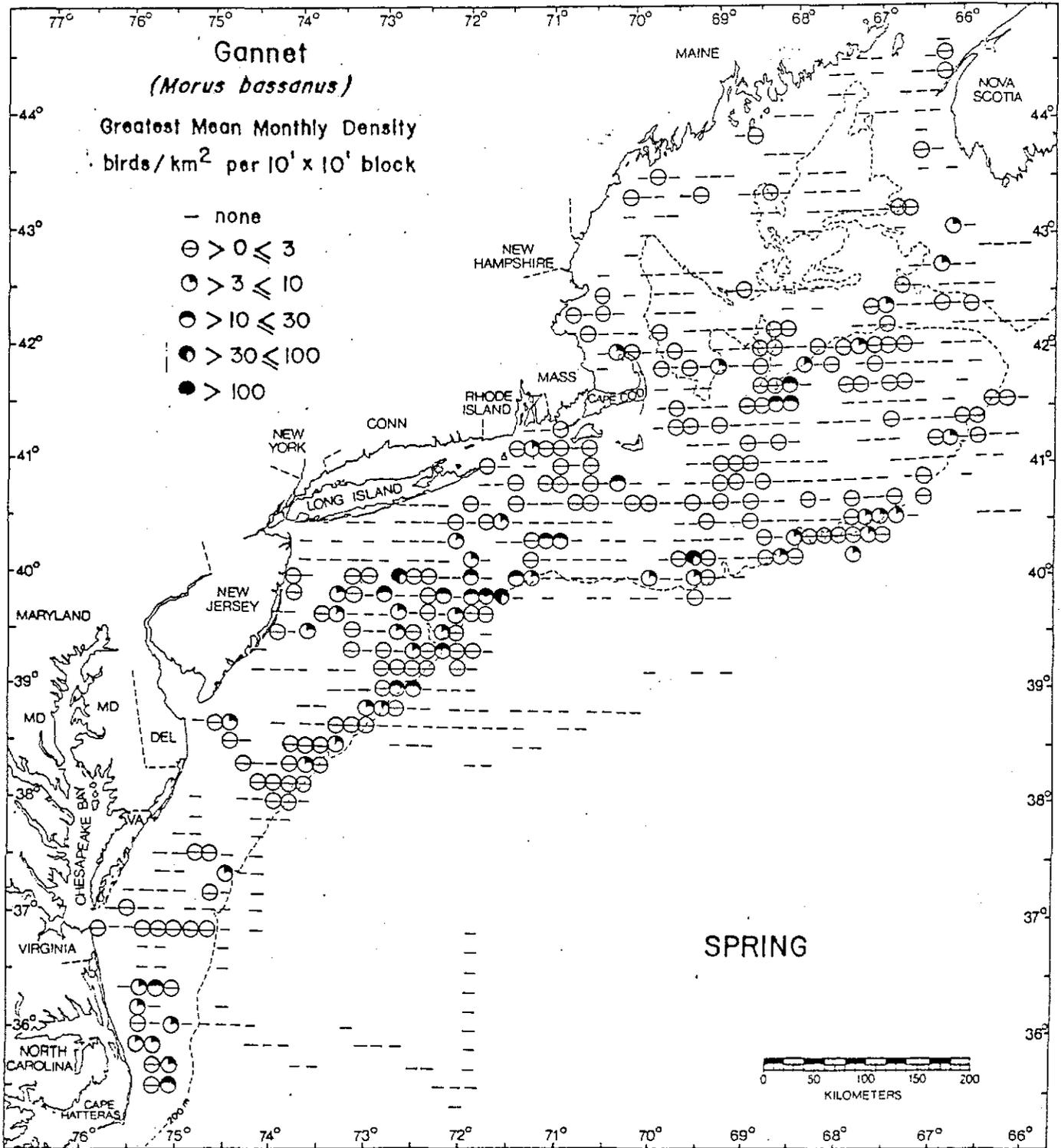


Figure 32. Relative distribution and abundance of Gannet (*Morus bassana*) in spring (March to May) off the northeastern United States.

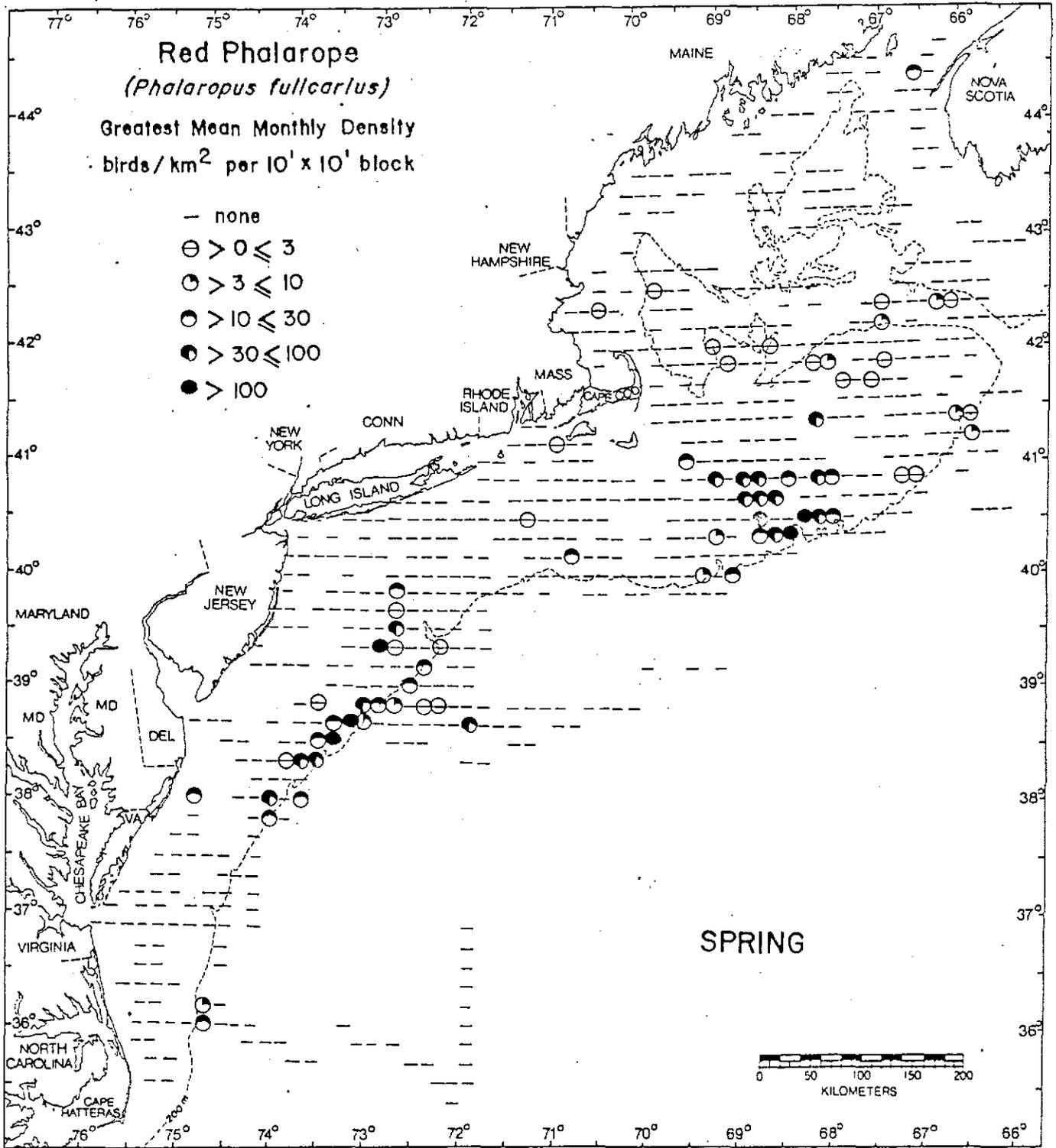


Figure 33. Relative distribution and abundance of Red Phalarope (*Phalaropus fulicarius*) in spring (March to May) off the northeastern United States.

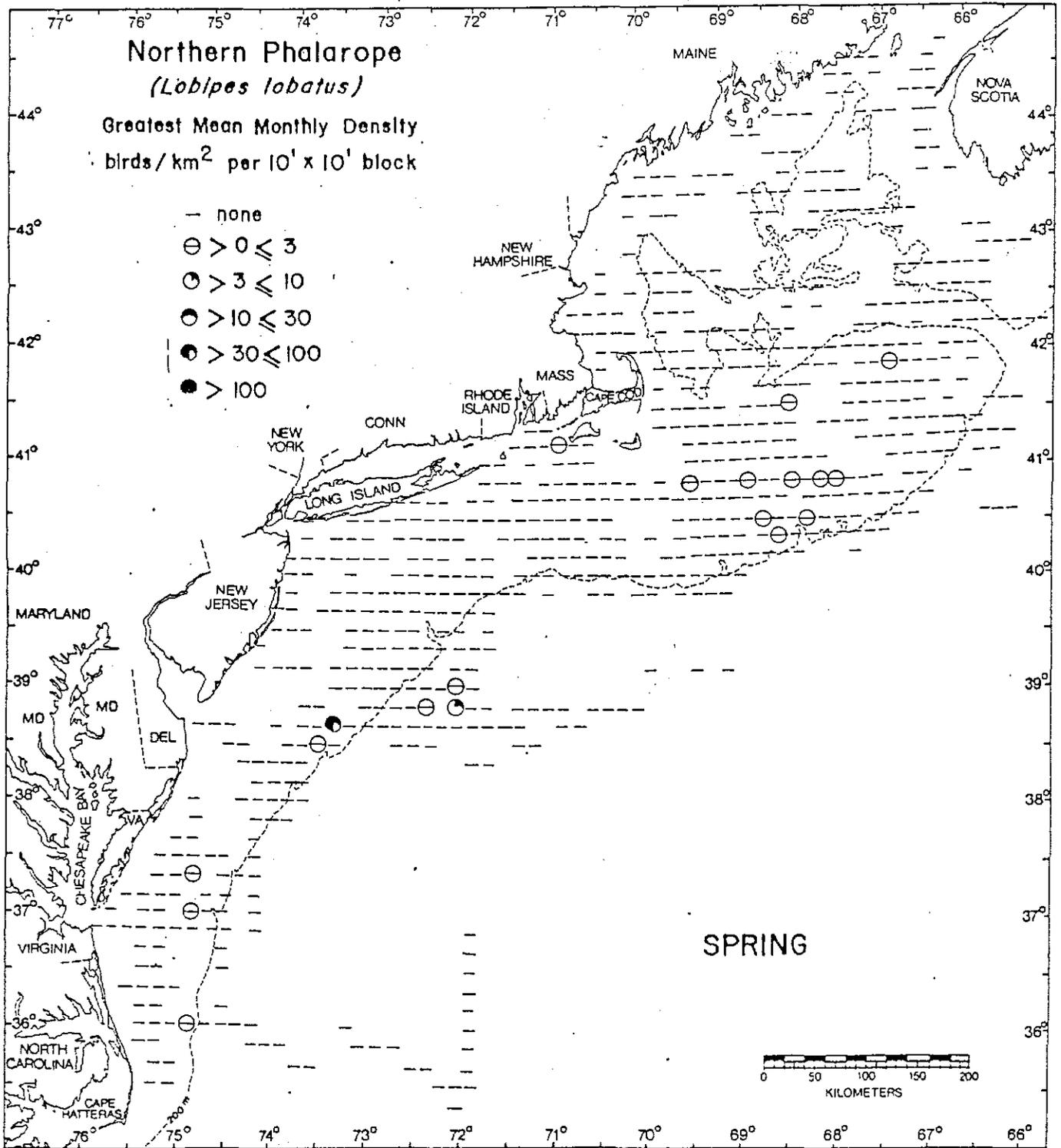


Figure 34. Relative distribution and abundance of Northern Phalarope (*Lobipes lobatus*) in spring (March to May) off the northeastern United States.

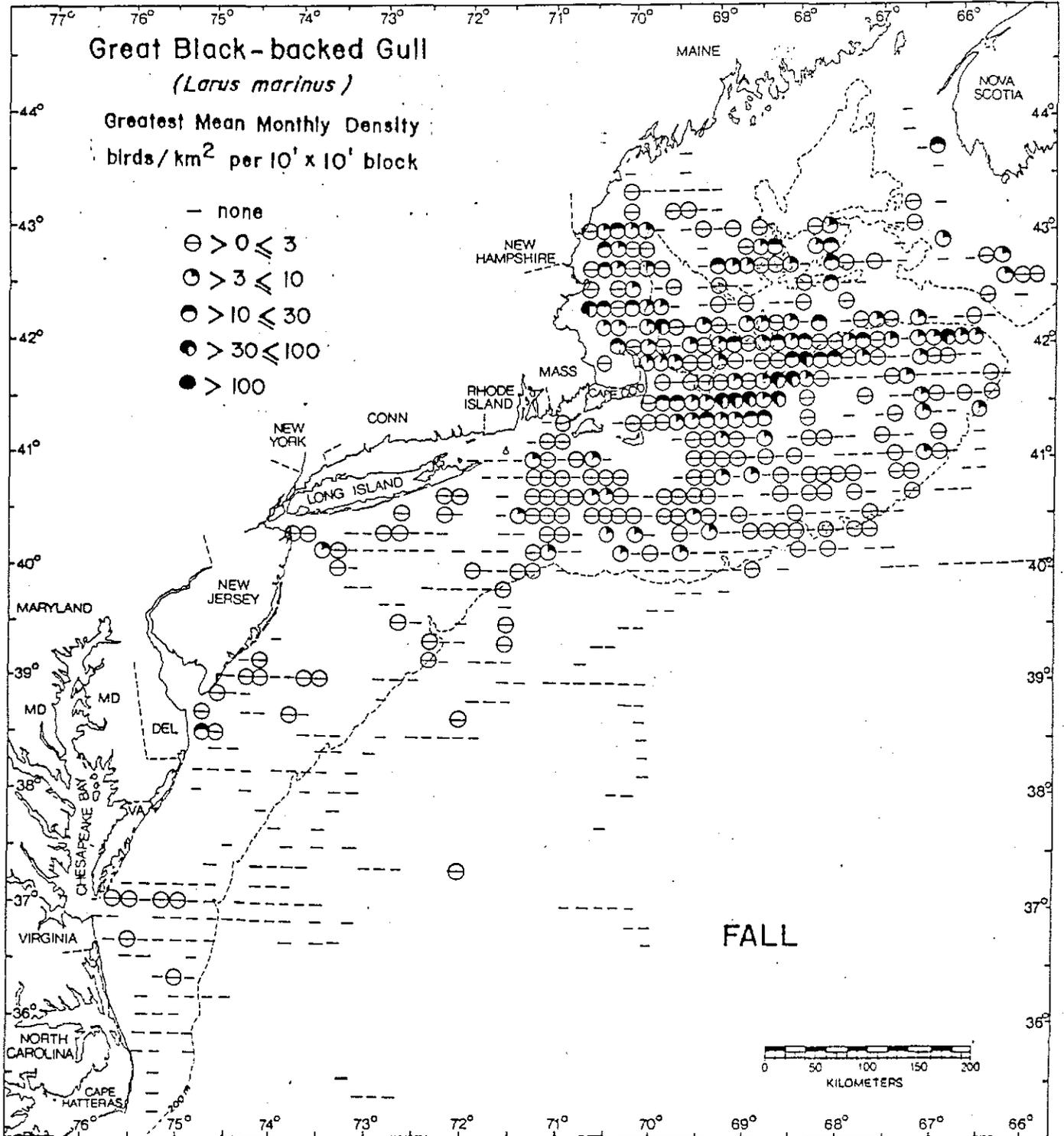


Figure 35. Relative distribution and abundance of Great Black-backed Gull (*Larus marinus*) in fall (September to November) off the northeastern United States.

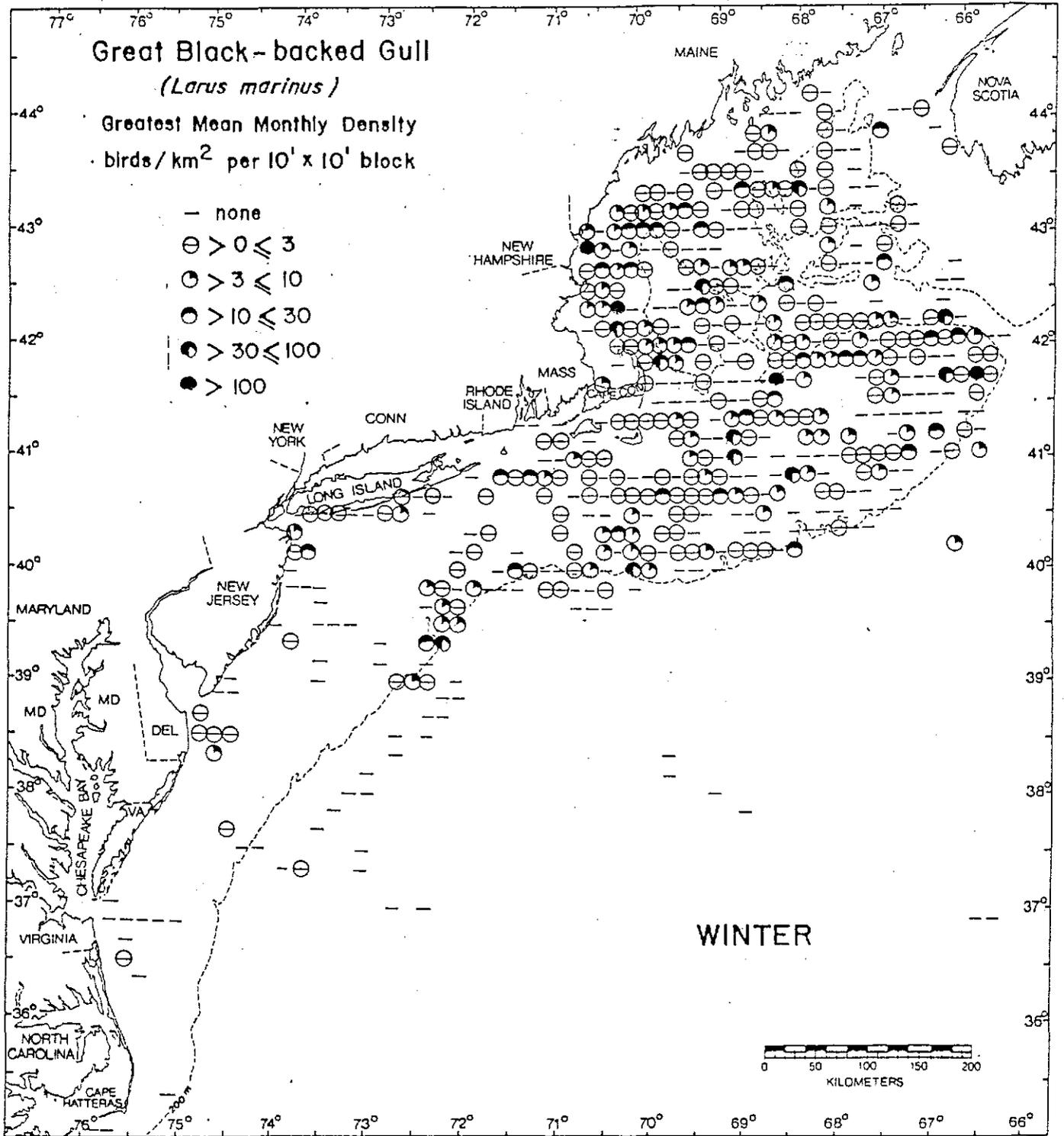


Figure 36. Relative distribution and abundance of Great Black-backed Gull (*Larus marinus*) in winter (December to February) off the northeastern United States.

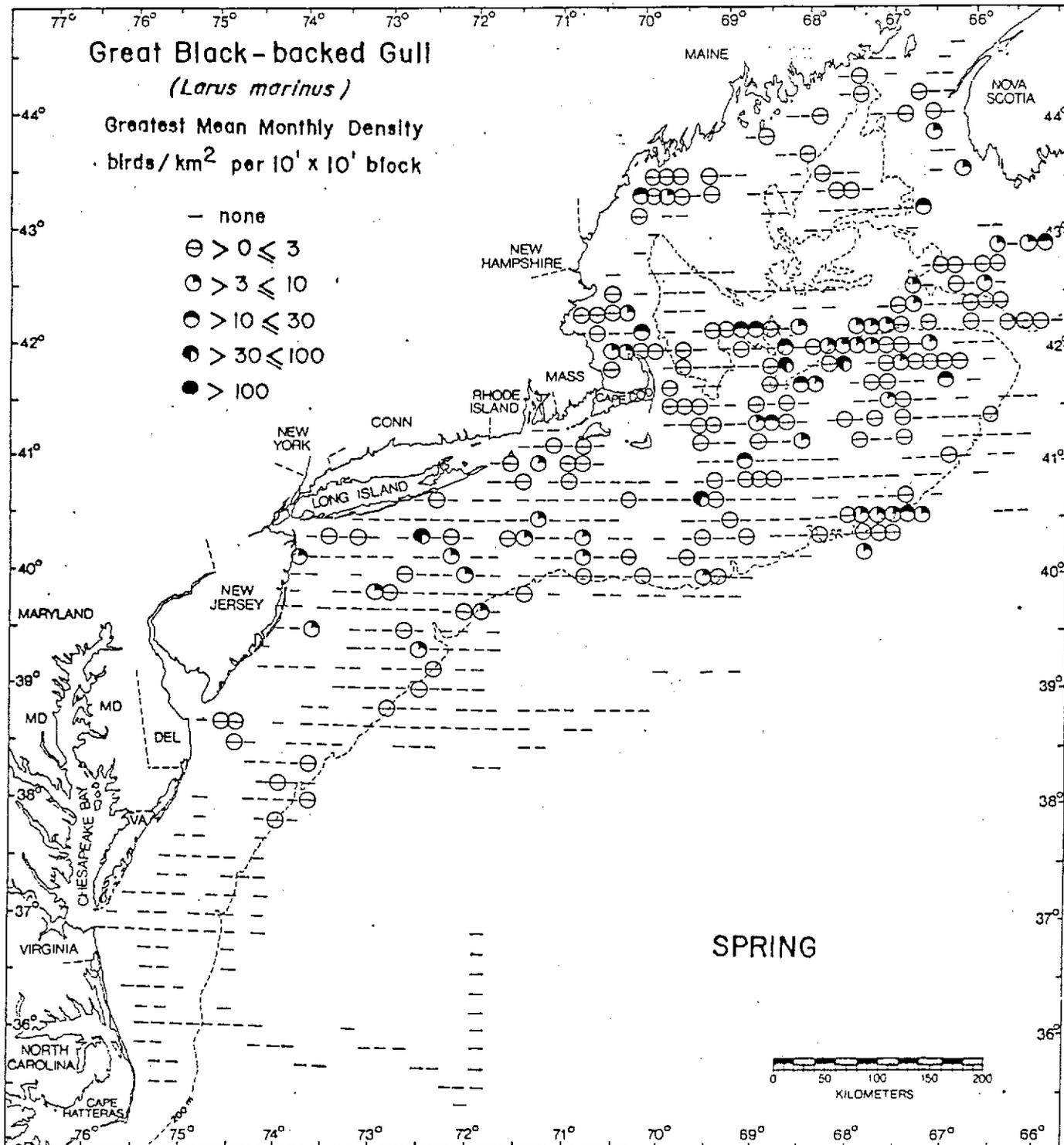


Figure 37. Relative distribution and abundance of Great Black-backed Gull (*Larus marinus*) in spring (March to May) off the northeastern United States.

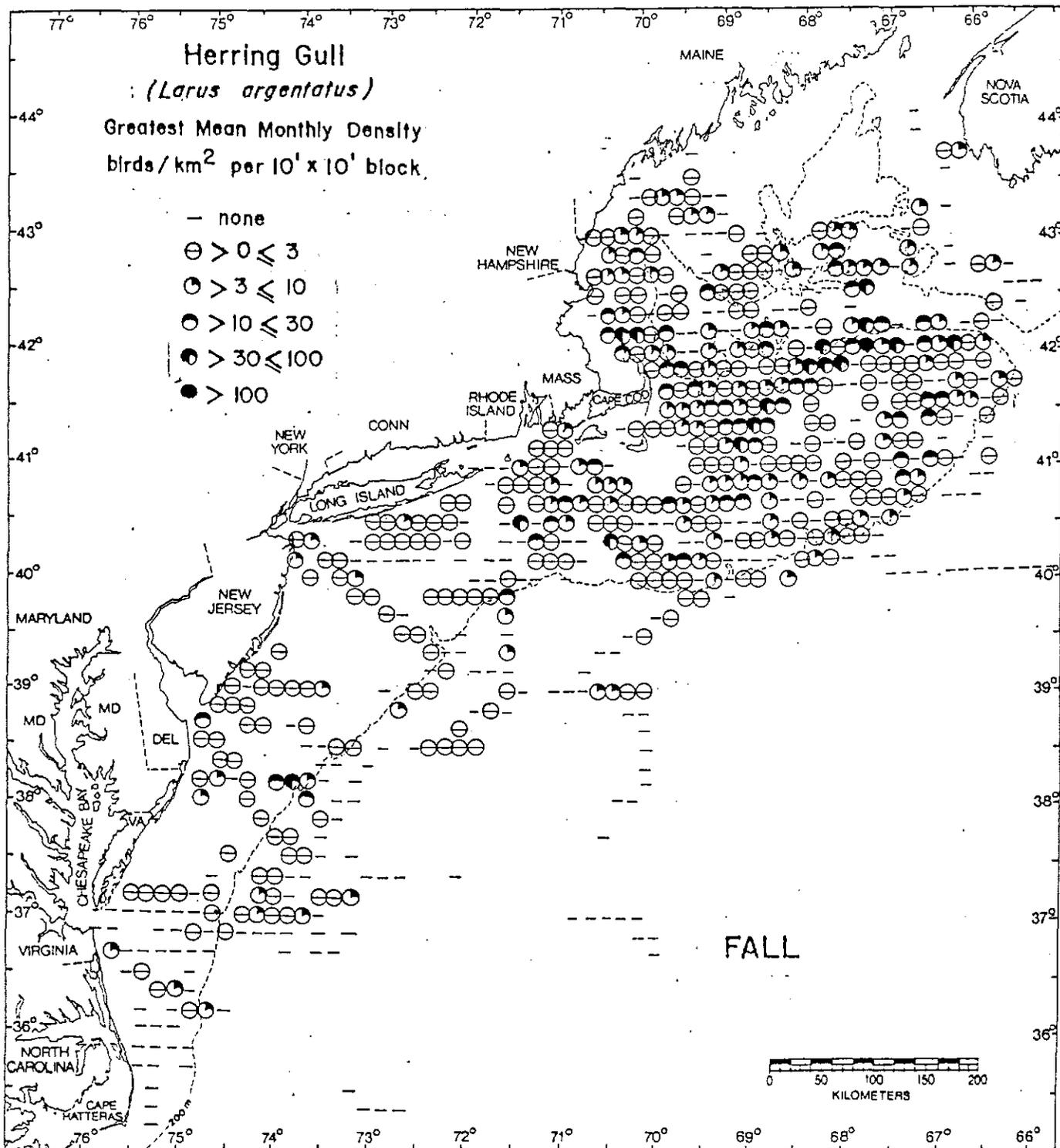


Figure 38. Relative distribution and abundance of Herring Gull (*Larus argentatus*) in fall (September to November) off the northeastern United States.

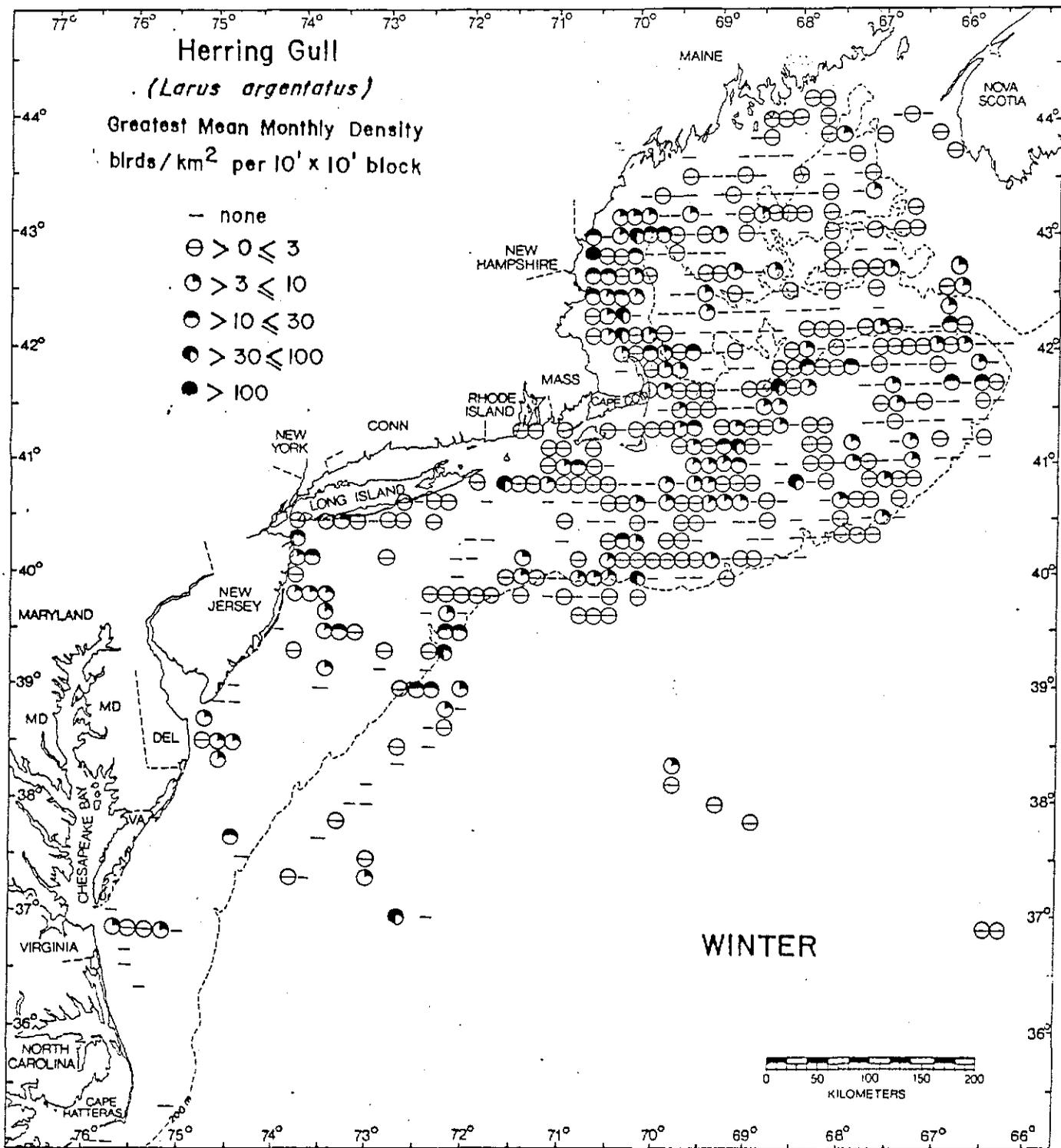


Figure 39. Relative distribution and abundance of Herring Gull (*Larus argentatus*) in winter (December to February) off the northeastern United States.

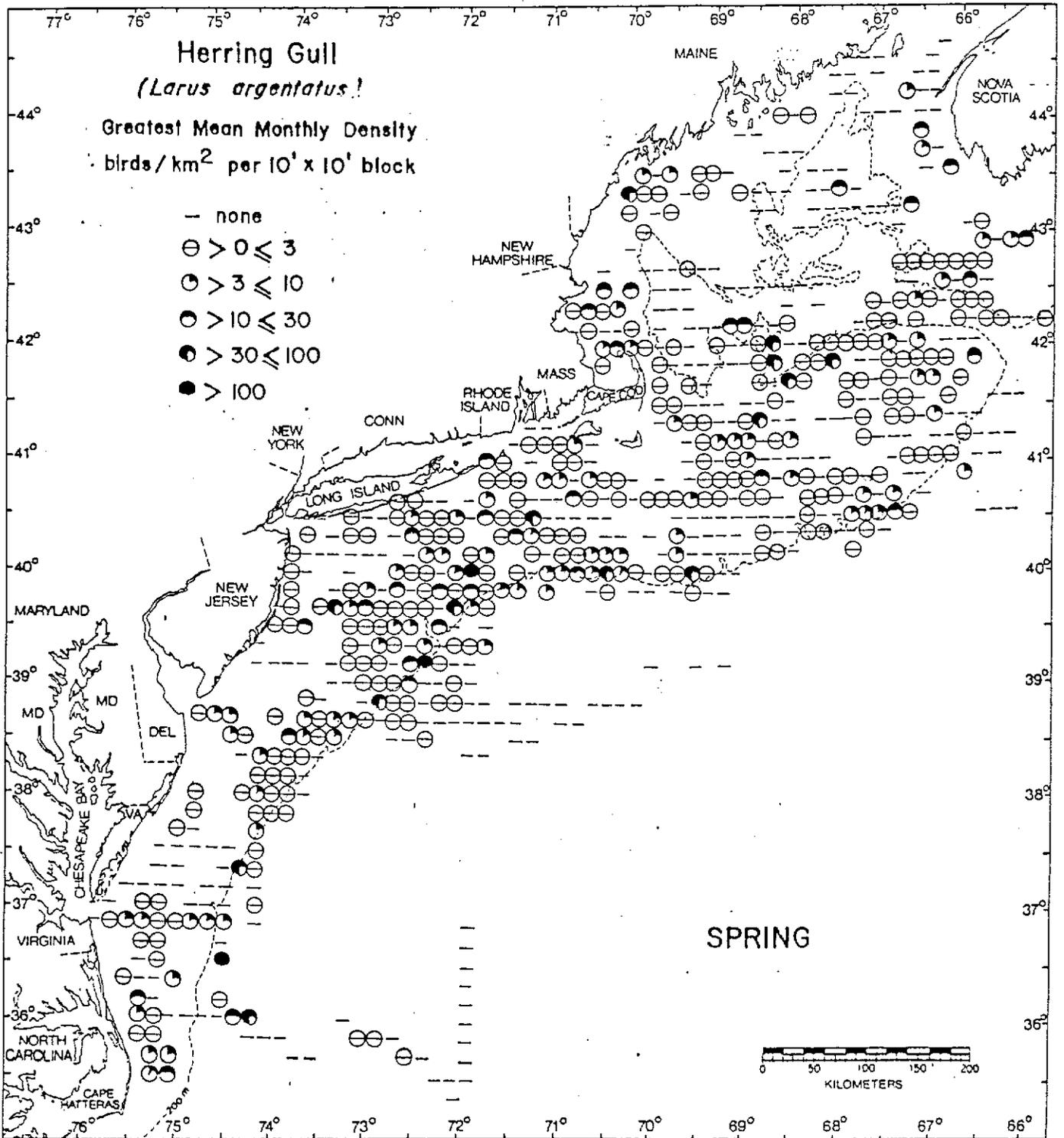


Figure 40. Relative distribution and abundance of Herring Gull (*Larus argentatus*) in spring (March to May) off the northeastern United States.

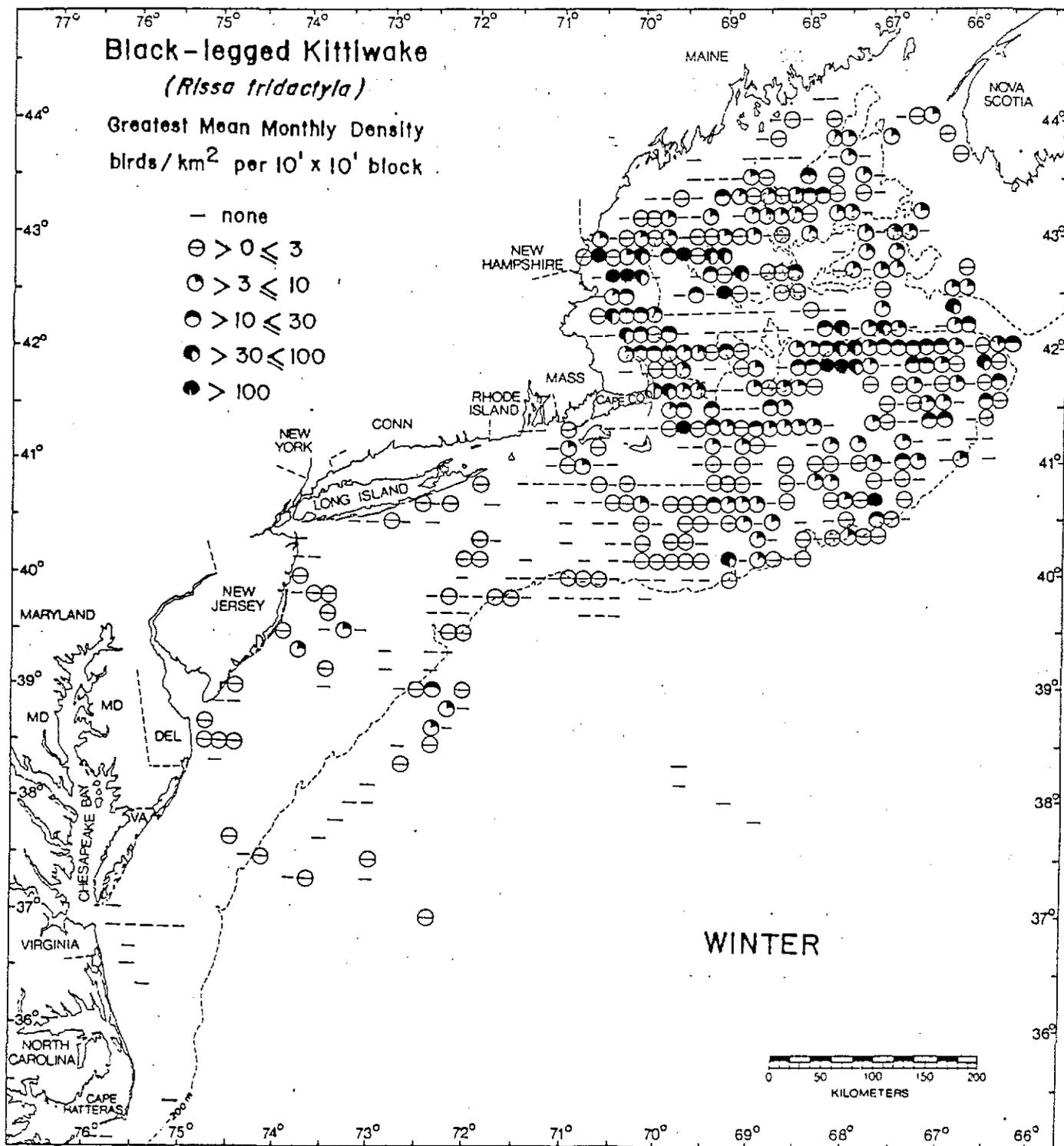


Figure 41. Relative distribution and abundance of Black-legged Kittiwake (*Rissa tridactyla*) in winter (December to February) off the northeastern United States.