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FISH DISTRIBUTION ON GEORGES BANK AND IN THE GULF OF MAINE IN RELATION TO LATERAL AND ALTERNATE LINES OF DEMARCATION BETWEEN THE UNITED STATES AND CANADA

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The Lateral and Alternate lines, as shown on the attached chart, represent potential divisions of jurisdiction between the United States and Canada in the Gulf of Maine-Georges Bank area assuming the extension of national territorial waters to 200 miles. The Lateral line is equidistant between U.S. and Canadian points of land. Virtually all of statistical area 523 and approximately 75% of statistical area 524 are east of the Lateral line. The Alternate line follows the maximum depth contour between Georges and Browns Banks and north through the Gulf of Maine. All of ICNAF Subdivision 5Ze is west of the Alternate line.

The purpose of this report is to summarize the distribution of the major portion of the fishery resource in this area in relation to the location of the two lines.

Cod (*Gadus morhua*): An area of major cod abundance on Georges Bank is found east of the Lateral line during all seasons of the year. There is perhaps some movement of cod across the Alternate line between Georges Bank and Browns Bank, but stocks in these two areas are considered to be distinct and are managed separately by ICNAF. There undoubtedly is also movement of cod across both lines in the Gulf of Maine, although they are probably more abundant east of either line in ICNAF Division 4X (Fritz, 1965; Grosslein and Bowman, 1973).

Haddock (*Melanogrammus aeglefinus*): The area containing the prime concentration of haddock on Georges Bank is east of the Lateral line but west of the Alternate line. Haddock found in this area generally do not move to other areas. Fish found north of Georges Bank are primarily concentrated east of either line (Needler, 1930; Hennemuth *et al.*, 1964; Fritz, 1965; Grosslein and Bowman, 1973; Halliday, 1974).

Redfish (*Sebastes marinus*): Some redfish are located in deep water along the northern and eastern perimeter of Georges Bank east of the Lateral line but west of the Alternate line. Redfish are also found in the vicinity of either line in the Gulf of Maine. The principal concentrations, however, are found in the central and western portions of the Gulf west of either line (Fritz, 1965; Grosslein and Bowman, 1973).

Silver hake (*Merluccius bilinearis*): A sizeable part of the range of silver hake on Georges Bank is east of the Lateral line. The Northern Edge and the southeastern slope of the Bank (*i.e.* Corsair Canyon vicinity and west) are areas of importance. Silver hake are distributed over all of Georges Bank during summer and autumn but retreat to deep waters both north of the Bank and along the southern slopes to overwinter. The Georges Bank stock does not move east of the Alternate line, although a separate stock does inhabit the Scotian Shelf. The most important areas of silver hake concentration on Georges Bank and in the Gulf of Maine are

west of either line (Fritz, 1965; Grosslein and Bowman, 1973; Anderson, 1974).

Red hake (*Urophycis chuss*): This species is distributed over all of Georges Bank during summer and autumn but vacates the shoal areas to overwinter in deep water. A major area of red hake abundance along the southeastern slope of the Bank is east of the Lateral line. There are not any areas of significant abundance east of the Alternate line (Fritz, 1965; Anderson, 1974).

Pollock (*Pollachius virens*): Pollock are found seasonally along the Northern Edge and the Northeast Peak of Georges Bank as the result of migrations following spawning on Browns Bank or in the southwestern part of the Gulf of Maine. Some of these fish originate from the northern part of the Gulf and from the Bay of Fundy and migrate south to spawn during winter. Pollock migrating through the northern part of Georges Bank are, at that time, east of the Lateral line. The area east of the Lateral line is not of major importance since pollock do not spawn or reside there permanently. There are continuous movements across both lines in the Gulf of Maine (Steele, 1963; Fritz, 1965).

Yellowtail flounder (*Limanda ferruginea*): A sizeable portion of the Georges Bank yellowtail flounder stock is east of the Lateral line in statistical area 524. There are seasonal movements of this stock but not to the extent that they move out of the general area entirely. There are no portions of the stock east of the Alternate line (Royce *et al.*, 1959; Lux, 1963; Fritz, 1965; Grosslein and Bowman, 1973).

American dab (*Hippoglossoides platessoides*): Small amounts are found along the Northern Edge east of the Lateral line. Major concentrations are located to the west and north. A separate stock(s) is located along the Scotian Shelf (Fritz, 1965).

Witch flounder (*Glyptocephalus cynoglossus*): This species is not abundant on Georges Bank but is more common in the Gulf of Maine. Neither line appears to pass near any significant concentrations of witch on the Bank. There appear to be concentrations in deep water north of the Bank, the greatest occurring east of the Lateral line and approximately bisected by the Alternate line (Fritz, 1965).

Winter flounder (*Pseudopleuronectes americanus*): The area on Georges Bank east of the Lateral line contains a sizeable concentration of winter flounder, with statistical area 524 being most important. This area is west of the Alternate line (Grosslein and Bowman, 1973).

Fourspot flounder (*Paralichthys oblongus*): The region of greatest concentration on Georges Bank is the Corsair Canyon area, although

the species is distributed throughout a large part of statistical areas 524 and 523. This portion of its range is east of the Lateral line but west of the Alternate line (Fritz, 1965).

Sand flounder (*Scophthalmus aquosus*): This species is found throughout Georges Bank but is most abundant west of the Lateral line. However, statistical area 524, which is mainly east of the Lateral line, contains sufficient concentrations of sand flounder to support commercial catches (unpublished U.S. groundfish survey trawl data; unpublished U.S. commercial fishery statistics).

White hake (*Urophycis tenuis*): White hake are found in major concentrations in deep waters off the Northern Edge of Georges Bank in the Fundian Channel and also along the southeastern slope to the northeast of Corsair Canyon. These areas are both east of the Lateral line. The first area is bisected by the Alternate line whereas the second area is west of the Alternate line. Some concentrations are found in the northeastern part of the Gulf of Maine near both lines, but the species appears to be more abundant west of the lines (Fritz, 1965).

Spiny dogfish (*Squalus acanthias*): This species is common throughout the area, but major concentrations do not appear to be evident east of the Lateral line. Some concentrations are found along the Northern Edge during spring and at that time are east of the Lateral line (Fritz, 1965; unpublished U.S. groundfish survey trawl data).

Argentine (*Argentina silus*): The main area of concentration is in the Fundian Channel between Georges Bank and Browns Bank with lesser concentrations north of the Bank. The major portion of this stock is east of the Lateral line. The Alternate line passes through the area of greatest concentration (Fritz, 1965).

Herring (*Clupea harengus*): Herring schools migrate around the southeastern part of Georges Bank in summer, coming from overwintering grounds to the southwest, and then move to the Northern Edge and the Georges and Cultivator Shoals areas in autumn to spawn. A major portion of the summer grounds are east of the Lateral line. In the northern part of the Gulf of Maine, both lines pass through an area where there appear to be extensive movements of and possible interchange between the Nova Scotian and Gulf of Maine stocks during virtually all life history stages of herring. The Grand Manan Banks spawning area (Nova Scotia stock) is east of the Alternate line but is divided by the Lateral line. There is considerable uncertainty whether the several herring stocks in ICNAF SA 4-6, which are presently assumed to be separate and are managed independently by ICNAF, are, in fact, discrete populations. Recent Canadian tagging experiments have found that herring tagged in the Bay of Fundy have later been recaptured as far west as southern New England waters and as far east as Cape Breton.

Additional research may indicate that mixing occurs between the previously assumed distinct stocks. It is possible that the most rational management approach in the future will be to regulate the entire herring resource in SA 4-6 as a single unit. A division of the resource by either the Lateral or Alternate line would conflict with this concept of overall stock management (Grosslein and Bowman, 1973; Stobo *et al.*, 1975; Ridgway, 1975).

Mackerel (*Scomber scombrus*): This species is generally not concentrated in the area of Georges Bank east of the Lateral line. However, the southeastern slope of the Bank (east of the Lateral line) is within the overwintering grounds which range from Sable Island to Cape Hatteras. It is likely that there are movements of mackerel through the area during the spring and autumn migrations of fish that overwinter southwest of Georges Bank. There are some mackerel that appear to summer east of the Lateral line in the shoal portions of statistical area 524 (Sette, 1950; Grosslein and Bowman, 1973; Anderson, 1975).

Alewife (*Alosa pseudoharengus*): Alewives are found as far east as statistical area 524 during the warm months but migrate to the mid-Atlantic region to overwinter. It is believed that major concentrations do not occur east of the Lateral line at any time of the year (Grosslein and Bowman, 1973).

Butterfish (*Peprilus triacanthus*): Butterfish extend over all of Georges Bank during summer and autumn and overwinter offshore along the entire continental shelf. Although areas of high concentration are to the southwest, a part of the summer range is east of the Lateral line (Fritz, 1965; Waring, 1975).

Goosefish (*Lophius americanus*): A principal area of goosefish abundance is east of the Lateral line along the Northern Edge of Georges Bank. The species is also found around the entire northeast-southeast perimeter of the Bank which is east of the Lateral line (Fritz, 1965).

Longhorn sculpin (*Myoxocephalus octodecemspinosus*): The area east of the Lateral line includes the major concentration of this species on Georges Bank, primarily the Northern Edge, Winter Fishing Ground, and Northeast Peak (Fritz, 1965).

Skates (*Raja* spp.): Moderate concentrations of several species of skates including little skates (*Raja erinacea*), big skates (*Raja ocellata*), and thorny skates (*Raja radiata*) are east of the Lateral line (Fritz, 1965; unpublished U.S. groundfish survey trawl data).

Longfin squid (*Loligo pealei*): The Lateral line represents the approximate northern extent of the range of this species although some are found during the warm months east of the Lateral line (Grosslein and Bowman, 1973; Tibbetts, 1975).

Shortfin squid (*Illex illecebrosus*): This species ranges between Florida and Labrador, migrates inshore during the warm months, and overwinters offshore. The area east of the Lateral line includes part of its summer range, but it is not known if major concentrations exist there (Tibbetts, 1975).

Sea scallops (*Placopecten magellanicus*): Although the sea scallop resource is distributed throughout Georges Bank, the area east of the Lateral line constitutes the most highly productive grounds in the Northwest Atlantic. Specifically, statistical area 523 (Northern Edge) has been the prime area. This resource is west of the Alternate line (Merrill and Posgay, 1964).

Lobster (*Homarus americanus*): Important concentrations of lobsters are found on the southeastern slope of Georges Bank, especially in and around Corsair Canyon, east of the Lateral line. During summer and autumn these lobsters migrate onto the shoals of the Bank from the deeper slope areas. Although important concentrations occur in other areas of Georges Bank to the west, a portion of this resource is found east of the Lateral line (Grosslein and Bowman, 1973).

The preceding summaries indicate, with few exceptions, that the portion of Georges Bank east of the Lateral line represents the location of a major component of the fishery resource traditionally harvested by U.S. fishermen. In the case of many species, this area is the site of principal abundance or availability. Some species live in this area throughout the year whereas others occupy it seasonally. The Lateral line intersects the distribution range of virtually every stock found on Georges Bank and, in the case of species highly important to U.S. fishermen (*e.g.* cod, haddock, yellowtail flounder, sea scallops, etc.), major areas of concentration are east of the Lateral line. The Alternate line also intersects the distribution range of some stocks.

The current philosophy in international fishery management in the ICNAF area is towards an overall ecosystem approach whereby the total fishable biomass is regulated by an overall catch limit (perhaps eventually by an effort limit) which is less than the sum of the quotas which would be set for individual species-stocks. Such an approach is necessary owing to the extensive interspecific prey-predator and food web relationships existing (but not yet adequately understood by scientists) among the numerous species, as well as the fact that few, if any, species can be harvested without catching other species.

A division of the Georges Bank fishery resource by the Lateral line resulting in independent management of the divided stocks would be unwise from a scientific standpoint (Table 1). On the other hand, the Alternate line would divide a much smaller number of stocks and would

allow a more logical management situation for the majority of stocks. However, for the respective stocks that are either distributed across the Alternate line or which migrate seasonally across the line, independent management would be undesirable or impossible.

Table 1. Advisability from a scientific standpoint of managing species-stocks in the Georges Bank area as delineated by the Lateral line or the Alternate line.

Species	Lateral line	Alternate line
Cod	No	Yes
Haddock	No	Yes
Redfish	No	Yes
Silver hake	No	Yes
Red hake	No	Yes
Pollock	No	No
Yellowtail flounder	No	Yes
American dab	No	Yes
Witch flounder	Yes	Yes
Winter flounder	No	Yes
Fourspot flounder	No	Yes
Sand flounder	No	Yes
White hake	No	No
Spiny dogfish	No	Yes
Argentine	No	No
Herring	No	No
Mackerel	No	No
Alewife	No	Yes
Butterfish	No	Yes
Goosefish	No	Yes
Longhorn sculpin	No	Yes
Skates	No	Yes
Longfin squid	No	Yes
Shortfin squid	No	No
Sea scallops	No	Yes
Lobster	No	Yes
Total biomass	No	No

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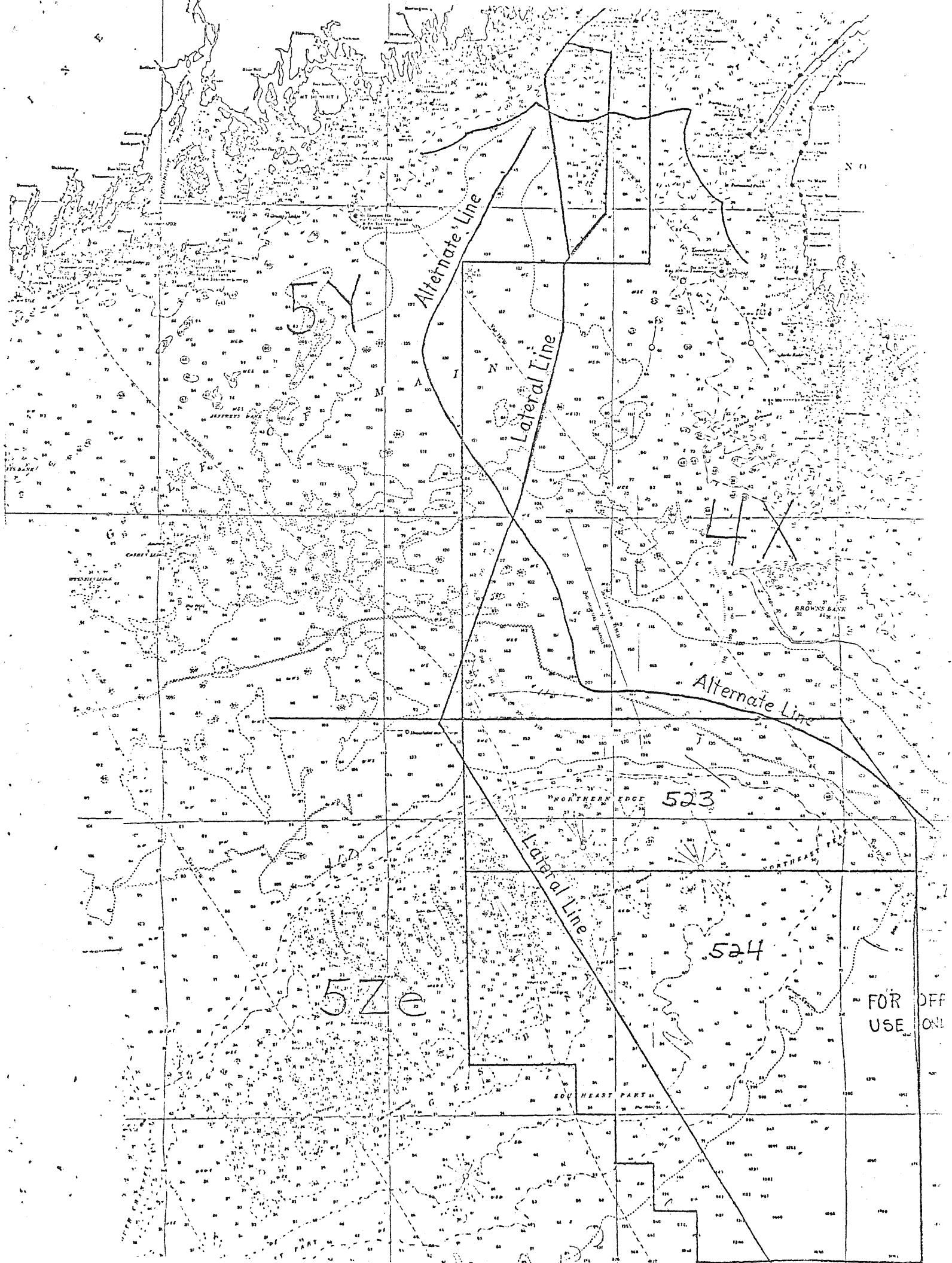

Alternate Line
Lateral Line
5Y
4X
Alternate Line
Lateral Line
523
524
5Ze
NORTHERN EDGE
BROWNS BANK
SOUTHEAST PART
FOR OFF
USE ONL