

1.1.1.1 Atlantic cod

The proposed EFH maps for Atlantic cod eggs and larvae are based on the relative abundance of juvenile cod during 1968-2005 in the fall and spring NMFS trawl surveys at the 90th percentile catch level, and the relative abundance of eggs and larvae during 1978-1987 in the NMFS MARMAP ichthyoplankton surveys at the 90th percentile area level. Ten minute squares located south of 38°N latitude were not included. The proposed maps also include ten minute squares in state waters that met the 10% or more frequency of occurrence criterion for juvenile cod, those bays and estuaries identified by the ELMR program where Atlantic cod eggs or larvae were "common" or "abundant," (see Table 1). These egg and larval designations were referred to as Alternative 2E in the Phase 1 DEIS.¹ The proposed new EFH maps for Atlantic cod eggs and larvae extend further south than the no action maps, which are limited by the distribution of juvenile cod and do not include any area south of southern New England. The new maps also include Nantucket Sound and more areas along the Maine coast than were included in the original maps.

The proposed EFH maps for juvenile and adult Atlantic cod within the NMFS trawl survey area were developed using a GIS depiction of preferred depth and bottom temperature ranges that were determined from graphical 1963-2003 spring and fall NMFS trawl survey data in Lough (2005). They are also based on average catch per tow data in ten minute squares of latitude and longitude in the 1968-2005 spring and fall NMFS trawl surveys mapped at the 90th percentile of catch level and include inshore areas where juveniles or adults were caught in 10% or more of tows made in individual ten minute squares during state trawl surveys, and ELMR information for coastal bays and estuaries. Both maps include ten minute squares along the Maine coast that were either inadequately surveyed (fewer than four tows) or were "filled in" based on input from industry members on the Habitat Committee. The adult map also includes historical cod spawning grounds in coastal Gulf of Maine waters.² The juvenile and adult designations were referred to as Alternative 3E in the Phase 1 DEIS.³

The proposed new juvenile map extends over a similar geographic area as the no action map, but only includes coastal waters in the Gulf of Maine shallower than 120 meters. Considerably more area in southern New England (e.g., Nantucket Sound) and on the southern portion of Georges Bank has been added. A few scattered ten minute squares have also been added in the Mid-Atlantic. The proposed EFH map for adult cod is also more limited to the shallower portion of the Gulf of Maine (<160 meters) than the no action map. It excludes coastal waters off New Jersey and Delaware that were added to the

¹ The 2E map for cod eggs in the DEIS is not accurate: a number of ten minute squares that were not in either of the input data sets were inadvertently filled in.

² Ten minute squares along the Maine and New Hampshire coasts that overlap with historically important spawning grounds, as reported by Ames (2002), were added to the proposed adult EFH map; they were also added to the status quo map in 1998.

³ In both of the maps that were approved for the DEIS in 2007 areas of historical importance that were not represented by the survey data were "filled in" by the Council's Habitat Committee. Also, the adult designation that was approved in 2007 was based on the 75th percentile of the NMFS survey data and did not include continental shelf waters in the Mid-Atlantic that are included in the new 90th percentile map that was approved by the Habitat Committee in 2011.

original maps because of their historical importance for adult cod that migrate (or used to) that far south in the winter. Compared with the maps in the DEIS, a few ten minute squares in the outer Gulf of Maine that do not conform to the maximum depth identified as EFH for juvenile and adult cod have been removed. The most significant change in the proposed adult map is the extension of EFH on to the southern portion of Georges Bank and westward on the continental shelf into the Mid-Atlantic region.

The proposed new text descriptions include more detailed information on the wide variety of substrates utilized by juvenile and adult cod than are in the no action descriptions. The no action descriptions refer only to cobble or gravel, for juveniles, and rocks, pebbles, or gravel for adults; the new designations also identify biogenic features of benthic habitats (e.g., submerged aquatic vegetation and attached epifauna) that are essential for recently settled young-of-the-year juvenile cod.⁴ Another important component of the proposed new EFH designation for juvenile cod is a depth range that specifically includes the intertidal zone and extends into deeper water (120 meters vs. 75 meters in the no action description). As is true for the other managed species included in this amendment, the proposed new EFH text descriptions are much more consistent with the maps.

Text descriptions:

Essential fish habitat for Atlantic cod (*Gadus morhua*) is designated anywhere within the geographic areas that are shown in Table 1 and the following maps which exhibit the environmental conditions defined in the text descriptions.

Eggs: Pelagic habitats in the Gulf of Maine, on Georges Bank, and in the Mid-Atlantic region, as shown on Map 1, and in the high salinity zones of the bays and estuaries listed in Table 1.

Larvae: Pelagic habitats in the Gulf of Maine, on Georges Bank, and in the Mid-Atlantic region, as shown on Map 2, and in the high salinity zones of the bays and estuaries listed in Table 1.

Juveniles: Intertidal and sub-tidal benthic habitats in the Gulf of Maine, southern New England, and on Georges Bank, to a maximum depth of 120 meters (see Map 3), including high salinity zones in the bays and estuaries listed in Table 1. Structurally-complex habitats, including eelgrass, mixed sand and gravel, and rocky habitats (gravel pavements, cobble, and boulder) with and without attached macroalgae and emergent epifauna, are essential habitats for juvenile cod. In inshore waters, young-of-the-year juveniles prefer gravel and cobble habitats and eelgrass beds after settlement, but in the absence of predators also utilize adjacent un-vegetated sandy habitats for feeding. Survival rates for young-of-the-

⁴ The proposed juvenile cod text description is the only one that includes some level 3 information describing habitats where growth and survival are high for the young-of-the-year.

year cod are higher in more structured rocky habitats than in flat sand or eelgrass; growth rates are higher in eelgrass. Older juveniles move into deeper water and are associated with gravel, cobble, and boulder habitats, particularly those with attached organisms. Gravel is a preferred substrate for young-of-the-year juveniles on Georges Bank and they have also been observed along the small boulders and cobble margins of rocky reefs in the Gulf of Maine.

Adults: Sub-tidal benthic habitats in the Gulf of Maine, south of Cape Cod, and on Georges Bank, between 30 and 160 meters (see Map 4), including high salinity zones in the bays and estuaries listed in Table 1. Structurally complex hard bottom habitats composed of gravel, cobble, and boulder substrates with and without emergent epifauna and macroalgae are essential habitats for adult cod. Adult cod are also found on sandy substrates and frequent deeper slopes of ledges along shore. South of Cape Cod, spawning occurs in nearshore areas and on the continental shelf, usually in depths less than 70 meters.

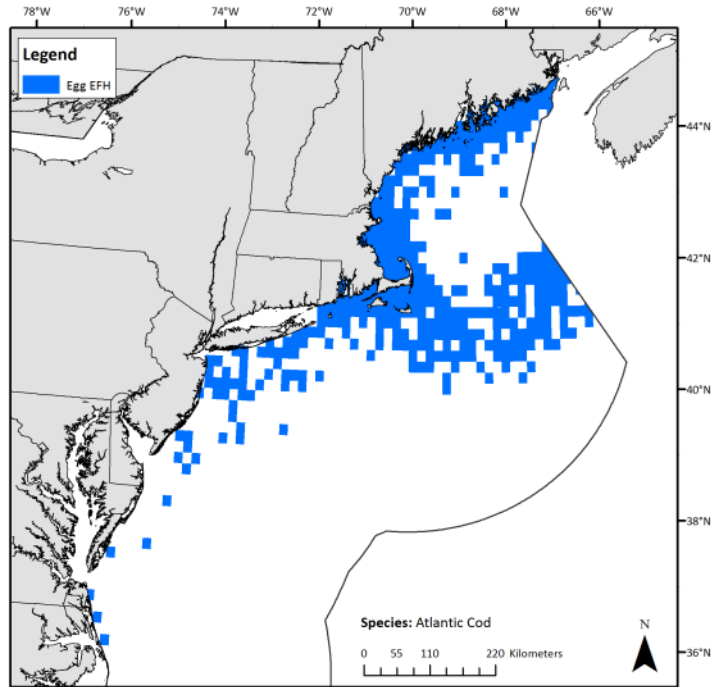
Table 1 – Atlantic cod EFH designation for estuaries and embayments.

| Estuaries and Embayments | Eggs | Larvae | Juveniles | Adults |
|---------------------------------|-------------|---------------|------------------|---------------|
| Passamaquoddy Bay | | S | S | S |
| Englishman/Machias Bay | S | S | S | S |
| Narraguagus Bay | S | S | S | S |
| Blue Hill Bay | S | S | S | S |
| Penobscot Bay | | S | S | S |
| Muscongus Bay | | | S | S |
| Damariscotta River | | | S | S |
| Sheepscot River | S | S | S | S |
| Kennebec / Androscoggin | | | S | S |
| Casco Bay | S | S | S | S |
| Saco Bay | S | S | S | S |
| Great Bay | S | S | | |
| Massachusetts Bay | S | S | S | S |
| Boston Harbor | S | S | S,M | S,M |
| Cape Cod Bay | S | S | S | S |
| Buzzards Bay | S | S | S | S |

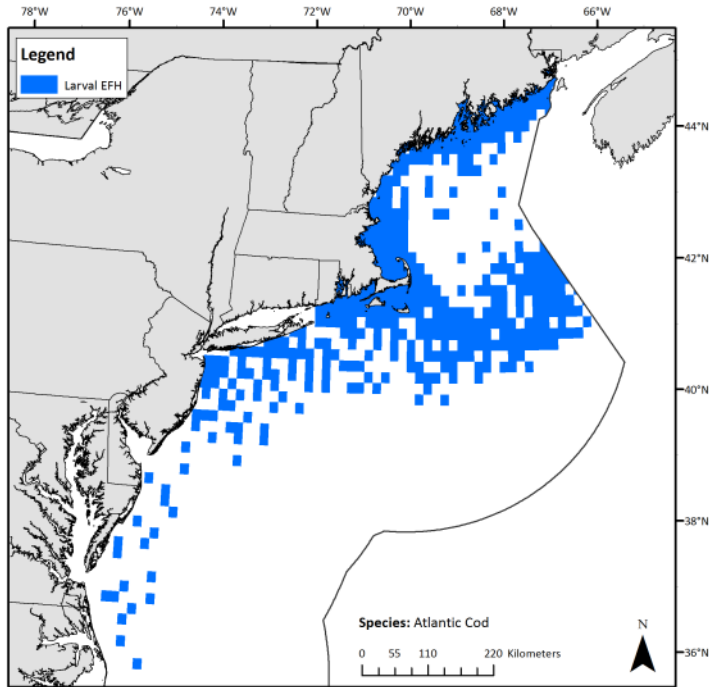
S = The EFH designation for this species includes the seawater salinity zone of this bay or estuary (salinity > 25.0‰).

M = The EFH designation for this species includes the mixing water / brackish salinity zone of this bay or estuary (0.5 < salinity < 25.0‰).

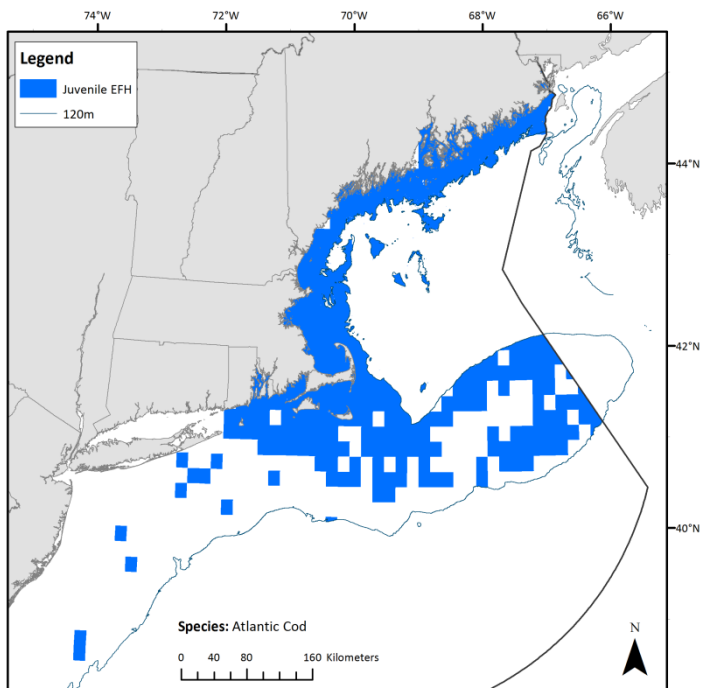
Map 1 – Atlantic cod egg EFH.



Map 2 – Atlantic cod larval EFH.



Map 3 – Atlantic cod juvenile EFH.



Map 4 – Atlantic cod adult EFH.

