PETITION TO LIST CUSK (*Brosme brosme*) AS A THREATENED OR ENDANGERED SPECIES

Photo credit National Marine Fisheries Service

Submitted by the Center for Biological Diversity

July 23, 2025

Howard Lutnick, Secretary
U.S. Department of Commerce
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Dear Secretary Lutnick,

Pursuant to Section 4(b) of the Endangered Species Act (ESA), 16 U.S.C. §1533(b); section 553(e) of the Administrative Procedure Act (APA), 5 U.S.C. §553(e); and 50 C.F.R. §424.14(a), the Center for Biological Diversity herby petitions the Secretary of Commerce, through the U.S. National Marine Fisheries Service (NMFS), to protect the Cusk (*Brosme brosme*) as a threatened or endangered species under the ESA.

This petition requests listing of the Cusk based on overfishing. Petitioner also requests that critical habitat be designated concurrently with the listing, pursuant to 16 U.S.C §1533(a)(3)(A) and 50 C.F.R. §424.12.

The NMFS has jurisdiction over this petition. This petition sets in motion a specific process, placing definite response requirements on NMFS. NMFS must issue an initial finding as to whether the petition "presents substantial scientific or commercial information indicating that the petitioned action may be warranted." 16 U.S.C. §1533 (b)(3)(A). NMFS must make this initial finding "(t)o the maximum extent practicable, within 90 days after receiving the petition."

The Center for Biological Diversity ("Center") is a non-profit, public interest environmental organization dedicated to the protection of native species and their habitats through science, policy, and environmental law, supported by more than 1.7 million members and online activists. The Center works to secure a future for all species, great or small, hovering on the brink of extinction.

We submit this petition on behalf of our staff and members who hold an interest in protecting the Cusk.

Respectfully submitted this 23rd day of July, 2025,

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1. Executive Summary

The cusk (*Brosme brosme*) is a long-lived, bottom-dwelling marine fish endemic to the cold, complex structured habitats of the North Atlantic Ocean. It is the sole member of its genus and exhibits life history traits that make it especially vulnerable to environmental stress and overexploitation, including late maturity, slow growth, low reproductive output, and sedentary behavior. In U.S. waters, cusk are primarily found in the Gulf of Maine, Georges Bank, and adjacent slope areas, typically at depths of 150 to 450 meters. These fish rely heavily on complex benthic habitats—boulder fields, rocky ledges, and deepwater coral structures—which provide essential shelter and feeding opportunities.[1]

Cusk populations have undergone steep and well-documented declines. Fishery-independent surveys in Canada's Scotia-Fundy region show a 93–95% decline over three generations,[2] while U.S. bottom trawl surveys indicate a 75–80% decrease in abundance since the 1960s.[3] Commercial landings in the United States have dropped from over 2,000 metric tons in the 1980s to less than 100 metric tons annually since 2004.[4] Despite these declines, cusk are not currently listed under the Endangered Species Act, nor are they included in any federal fishery management plan in the United States. They remain unprotected, without the regulatory protections or conservation planning that ESA listing would provide.

The threats facing cusk are both significant and ongoing. Bottom-contact fishing gear damages the rocky habitats the species depends on, and bycatch in groundfish fisheries continues to occur without effective mitigation measures. Compounding this is the impact of climate change: warming bottom temperatures in the Gulf of Maine and Georges Bank are expected to shrink and fragment cusk's thermal habitat, particularly in the southern portion of their range.[5]

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[1] McElroy, W. David et al., Life History Assessment of Cusk, a Data-Poor Species, in U.S. Waters, 14 *Marine and Coastal Fisheries* 5 (2022); COSEWIC, COSEWIC Assessment and Status Report on the Cusk (*Brosme brosme*) in Canada, Committee on the Status of Endangered Wildlife in Canada (Ottawa, 2003); Hare, Jonathan A. *et al*., Cusk (*Brosme brosme*) and Climate Change: Assessing the Threat to a Candidate Marine Fish Species under the US Endangered Species Act, 69 *ICES Journal of Marine Science* 10 (2012)

[2] Harris, Lei E. and Alexander Reimund Hanke, Assessment of the Status, Threats and Recovery Potential of Cusk (*Brosme brosme*) (Canadian Science Advisory Secretariat, 2010), 3

[3] Hare et al., 2012, 1755

[4] Hare et al., 2012, 1755; McElroy et al., 2022, 2

[5] Hare, Jonathan A. et al., Cusk (*Brosme Brosme*) and Climate Change: Assessing the Threat to a Candidate Marine Fish Species under the US Endangered Species Act, 69 *ICES Journal of Marine Science* 10 (2012): 1754–55

These changes will likely isolate populations and reduce reproductive success, especially given the species' limited dispersal ability and lack of spawning aggregations.[6]

The inadequacy of existing regulatory mechanisms further places the species at risk. While Canada assessed cusk as "Threatened" under the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) in 2003, the U.S. has no enforceable conservation measures in place. The absence of habitat protections, harvest controls, or monitoring programs means that threats are unaddressed and population status is poorly understood and managed. This regulatory gap is particularly troubling for a species with low resilience and known habitat specialization.[7] Furthermore, despite formerly being identified by NOAA as a species of concern, the cusk did not benefit from proactive federal conservation action, even though it is regularly captured in federal longline surveys designed in part to inform ESA listing decisions.[8]

Listing cusk under the ESA would provide urgently needed protection. It would trigger the development of a recovery plan, critical habitat designations, and federal consultation requirements for activities that could harm the species or its habitat and make recovery efforts eligible for funding under ESA Section 6. Protecting cusk would also benefit the broader benthic ecosystems they inhabit, which support a range of other groundfish species and vulnerable marine invertebrates. Moreover, cusk conservation can serve as a model for improving management of other deepwater, data-poor species in the Northwest Atlantic.

Given the severity of population declines, the persistence of multiple compounding threats, the absence of adequate regulatory protections, and the species' biological vulnerability, *Brosme brosme* clearly meets the criteria for listing under the ESA. Formal protection is warranted, scientifically justified, and necessary to prevent further decline and support long-term recovery.

[6] Hare et al., 2012; Knutsen, Halvor et al., Bathymetric Barriers Promoting Genetic Structure in the Deepwater Demersal Fish Tusk (*Brosme brosme*), 18 *Molecular Ecology* 15 (2009)
[7] McElroy et al., 2022; COSEWIC, 2003
[8] McElroy, William David et al., Design, Implementation, and Results of a Cooperative Research Gulf of Maine Longline Survey, 2014-2017, *NOAA Technical Memorandum*, NMFS-NE-249, 2019, 1

2. Introduction

The cusk (*Brosme brosme*) is a unique fish species found in the cold waters of the North Atlantic Ocean, particularly in the Gulf of Maine and southeastern Scotian Shelf.[9] This species stands out due to its solitary and slow-growing nature, with a distinctive appearance marked by a long single dorsal fin and chin barbel. Cusk play a vital ecological role as a bottom-dwelling fish that supports the health of marine ecosystems by contributing to the balance of the food web. Despite their ecological importance, cusk populations have faced drastic declines of over 90% since the 1970s, primarily due to unregulated fishing and increasingly warming waters which are altering their habitats and feeding grounds.[10]

To survive and recover, cusk require protection from overfishing and habitat degradation. Their preference for complex underwater structures like rocky substrates at depths of 150 to 450 meters makes them particularly vulnerable to fishing practices that impact their unique habitat needs. Additionally, as climate change continues to impact their distribution and food availability, it is crucial to implement management strategies that integrate both conservation and fisheries regulations. Securing protections for cusk under the ESA can ensure the sustainability of this remarkable species as part of our marine biodiversity for future generations.

3. Biology

Cusk was first described in 1772. The cusk is a robust, elongate demersal fish characterized by a heavy head, a single long dorsal fin, and a prominent chin barbel—traits that distinguish it from other members of the cod family (Gadidae) in the western North Atlantic.[11] It possesses a single dorsal and a single anal fin, both of which are continuous with the caudal fin but separated by distinct notches, giving the tail a rounded appearance.[12] Its pelvic fins are small with 4–5 rays and are located beneath brush-like pectoral fins, while its body is covered with minute, deeply embedded scales.[13] Coloration varies, typically appearing as light gray to brownish on the upper body and sides, fading to pale or white on the belly, though individuals in western Atlantic waters may also display reddish or greenish tones.[14] Adults can grow to over

[9] Harris and Hanke, 2010, 1
[10] Hare et al., 2012, 1755; COSEWIC, 2003, v
[11] Harris and Hanke, 2010, 1
[12] Harris and Hanke, 2010, 1
[13] Harris and Hanke, 2010, 1
[14] COSEWIC, 2003, 4

100 cm in total length and reach weights up to 30 kg.[15] Cusk have been recorded at lengths up to 118 cm and ages up to 39 years in Canadian waters, reflecting their slow growth and longevity.[16] These physical features, combined with their affinity for deep, structured habitats, make the cusk well-adapted for life along the continental shelf and slope, where it leads a sedentary, bottom-dwelling existence.[17]

a. Reproduction, diet and behavior

Cusk are a long-lived species, reaching up to 39 years of age, but have a late age at maturity, with 50% of females maturing around 5–6 years (or approximately 50 cm in length) and males potentially maturing at even smaller sizes, though their functional maturity remains unclear.[18] However, more recent age validation using radiocarbon bomb dating suggests that female cusk may not reach maturity until closer to 10 years of age, indicating even greater reproductive vulnerability than previously thought.[19] The generation length of cusk is 9 to 15 years.[20] Spawning occurs from April to July, with peak spawning varying by region—late June on the Scotian Shelf and May–June in the Gulf of Maine.[21] Cusk are batch spawners with determinate fecundity, meaning their reproductive output is fixed before the spawning season.[22] While large females can produce up to four million eggs, cusk's late maturity and low gonadal investment suggest a low reproductive resilience, which contributes to the species' vulnerability under sustained fishing pressure and environmental stress.[23] The absence of spawning aggregations and the species' apparent reliance on solitary or dispersed spawning behavior further limits reproductive success.[24]

In terms of diet, cusk are opportunistic benthic predators. They primarily feed on crustaceans, shellfish, and bottom-dwelling fish, indicating a reliance on structured seafloor habitats that support these prey communities, though they can also be found in mud bottom

[15] Knutsen et al., 2009, 3152; McElroy et al., 2022, 1
[16] Harris and Hanke, 2010, 3
[17] Hare et al., 2012, 1754
[18] COSEWIC, 2003, v; McElroy et al., 2022, 1
[19] Harris and Hanke, 2010, 3
[20] Runnebaum, Jocelyn M, Improving Management and Conservation of Cusk (*Brosme Brosme*): Habitat Distribution, Bycatch Interactions, and Conservation Practices, Electronic Theses and Dissertations, 2017, 4
[21] COSEWIC, 2003, v; McElroy et al., 2022, 1
[22] McElroy et al., 2022, 3
[23] COSEWIC, 2003, v; Harris & Hanke, 2010, 3; McElroy et al., 2022, 3
[24] Harris and Hanke, 2010, 9

habitat (but not sand).[25] This dependence on complex bottom habitats not only defines their foraging ecology but also increases their sensitivity to habitat degradation from bottom-contact fishing gear and climate-related changes in benthic ecosystems. The reduction in availability or quality of these habitats could have cascading effects on feeding efficiency and condition, especially following the energetically costly spawning season, during which females show a marked decline in condition.[26] Observations from longline surveys and Canadian industry data confirm that cusk tend to remain close to bottom structures where prey are abundant, reinforcing the importance of rocky habitat integrity for successful feeding.[27]

Behaviorally, cusk are sedentary and solitary, with little evidence of large-scale movement or aggregation. Adults tend to remain in localized areas and do not appear to form spawning aggregations.[28] This limited mobility restricts their ability to recolonize depleted areas and contributes to strong genetic differentiation among populations separated by deepwater barriers.[29] Their solitary behavior and habitat fidelity mean that localized depletion can have long-term consequences, as nearby populations may not replenish impacted areas. The mating behaviors of cusk are currently unknown, but it has been hypothesized that spawning may occur in confined spaces or in isolated pairs, potentially in "nests" that facilitate fertilization despite low male gonadal investment.[30] Tracking studies and survey data further confirm that cusk are closely tied to specific habitat types and exhibit minimal seasonal or ontogenetic migration, reinforcing their vulnerability to site-specific disturbance.[31]

b. Habitat requirements

Cusk predominantly inhabits the cold, deeper waters of the North Atlantic Ocean, particularly in areas such as the Gulf of Maine, Georges Bank, and the Scotian Shelf.[32] This bottom-dwelling species is typically found at depths ranging from 150 to 450 meters, although it has been observed in shallower waters as deep as 20 meters and in waters as deep as 1185 meters.[33] Cusk prefer complex habitats characterized by rocky substrates, gravel, boulder fields,

[25] McElroy et al., 2022, 1; Runnebaum, 2017, 52
[26] McElroy et al., 2022, 1
[27] McElroy et al., 2019, 4; Harris and Hanke, 2010, 4
[28] Harris and Hanke, 2010, 9; Hare et al., 2012, 1754
[29] Knutsen et al., 2009, 3151–3153
[30] McElroy et al., 2022, 3
[31] Harris and Hanke, 2010, 6–9
[32] COSEWIC, 2003, 6; Hare et al., 2012, 1754
[33] Harris and Hanke, 2010, 6; Knutsen et al., 2009, 3152; Hare et al., 2012, 1754

or pebble bottoms, as these structures provide essential shelter and facilitate foraging. The presence of deepwater corals and other intricate seafloor features further enhances their habitat quality, contributing positively to their survival and reproductive success.[34] These habitat features are also where longline surveys have found cusk to be most concentrated, particularly in high-relief seafloor areas that bottom trawl gear cannot effectively sample.[35]

Cusk are considered strictly demersal after the larval stage. While eggs and larvae are epipelagic and occur in the upper 200 meters of the water column, juveniles settle to the bottom after 1–4 months, at which point they adopt a bottom-dwelling lifestyle for the rest of their lives.[36] Canadian tagging and survey data further confirms that adult cusk show limited vertical or seasonal movement once settled, reinforcing their strong dependence on local benthic habitat.[37]

The cusk's habitat preference is closely tied to specific environmental conditions, particularly bottom temperature. Cusk typically inhabit areas with temperatures between 6°C and 10°C, though they can tolerate a broader range of 2–12°C.[38] These temperature and depth preferences restrict cusk to specific zones on the continental shelf and slope, including the Gulf of Maine, Scotian Shelf, and portions of the Mid-Atlantic Ridge.[39] These narrow environmental preferences make cusk particularly sensitive to climate-induced changes in bottom temperature and oxygen levels, which are projected to increase habitat fragmentation in the southern part of their range.[40]

Their habitat selection is further constrained by bathymetric features. Deep oceanic basins and troughs exceeding 1000 meters can act as barriers, effectively isolating populations and limiting gene flow between regions. This has been demonstrated by genetic studies showing differentiation between cusk populations located on isolated sea mounts (e.g., Rockall Bank and Mid-Atlantic Ridge) and those inhabiting more interconnected shelf areas such as the Nordic Seas and Barents Sea.[41] Habitat connectivity is another crucial aspect for cusk, although the implications of habitat fragmentation on their population dynamics remain poorly understood.

[34] McElroy et al., 2022, 1; Hare et al., 2012, 1754
[35] McElroy et al., 2019, 4
[36] Knutsen et al., 2009, 3152
[37] Harris and Hanke, 2010, 6–9
[38] COSEWIC, 2003, iv
[39] Knutsen et al., 2009, 3152; Hare et al., 2012, 1754
[40] Hare et al., 2012, 1754
[41] Knutsen et al., 2009, 3151–53

Fragmentation or absence of structured bottom habitat, for example on flat, muddy, or sandy sea floors, limits their presence. This has also contributed to the species being poorly represented in standard bottom trawl surveys.[42]

c. Current and historic range

The cusk is a North Atlantic species with a distribution that spans both sides of the ocean basin. In the western North Atlantic, its historical center of abundance lies between 41° and 44°N latitude, encompassing the Gulf of Maine and the southern Scotian Shelf.[43] While it also occurs along the edge of the continental shelf off Newfoundland and Labrador, it is rare in those areas.[44] Only a few individuals have been recorded from the Gulf of St. Lawrence.[45] In U.S. waters, its range includes the Gulf of Maine, Georges Bank, and extends south to the continental shelf slope.[46] There is some indication that the species' range in the western Atlantic may have contracted over time, particularly in shallower areas. While cusk were once reported in waters as shallow as 20 meters, recent surveys have rarely found them in such habitats.[47] However, analysis of spatial survey data in Canada suggests that the overall geographic range has not measurably contracted, even though abundance has dramatically declined, likely due to persistent but low-density occupancy across a wide area.[48]

In the eastern North Atlantic, cusk are found from the southern coast of Ireland and the North Sea northward to the Barents Sea and Spitzbergen. They are also present off East Greenland, Iceland, and the Faroe Islands. A 2021 longline survey caught 182 cusk as bycatch off the coast of Norway, predominantly in northern survey stations at depths <250 m.[49] Along the Mid-Atlantic Ridge, their southern distribution extends to the Charlie-Gibbs Fracture Zone at approximately 52°N.[50]

[42] McElroy et al., 2022, 1; McElroy et al., 2019, 2; Harris and Hanke, 2010, 4
[43] Harris and Hanke, 2010, 1
[44] Harris and Hanke, 2010, 1
[45] Harris and Hanke, 2010, 1
[46] Hare et al., 2012, 1754; McElroy et al., 2022, 3
[47] Hare et al., 2012, 1754
[48] Harris and Hanke, 2010, 18
[49] Andrade, Hector et al., A Longline Survey for Spurdog Distribution and Life History along the Norwegian Coast, 31 *Fisheries Management and Ecology* 2 (2024)
[50] Knutsen et al., 2009, 3152

4. Population status

Despite being commercially fished for centuries, cusk abundance remained relatively stable until the mid-20th century, after which consistent declines began. This coincided with the expansion of industrialized fishing and improved fishing gear.[51]

Assessing the abundance and population trends of cusk is particularly challenging due to the species' habitat preferences and the limitations of standard survey methods. Cusk primarily inhabit areas that are poorly sampled by conventional bottom trawl surveys, which are typically designed for smoother sea floors.[52] This mismatch between habitat and sampling gear has contributed to the underrepresentation of cusk in fishery-independent surveys, particularly in U.S. waters, leading to uncertainty in stock assessments.[53] The difficulty of detecting cusk in routine surveys has even led to the development of the "hyperdepletion" hypothesis, where survey indices decline faster than actual population abundance due to decreasing catchability at low densities.[54] Both Canadian and U.S. agencies have acknowledged that bottom trawl surveys may significantly underestimate cusk abundance due to the species' association with rocky habitat and tendency to seek shelter in crevices, where they are not accessible to trawl gear.[55]

Despite these limitations, the available scientific and commercial data suggest that cusk populations have declined significantly over recent decades. In Canada's Scotia-Fundy region, standardized research vessel surveys documented a 93.4% decline in catch per unit effort (CPUE) from 1970 to 2001—a period spanning approximately 3.5 generations of cusk.[56] For fish above 50 cm in length (the size at which 50% of individuals are mature), the estimated population declined by 95.5% over the same timeframe.[57] Combined fishery-independent data from the entire Northwest Atlantic showed a 90.4% decline in cusk numbers per tow from 1970 to 1994,[58] and U.S. bottom trawl surveys indicated a 75–80% decline in abundance over the last 50 years.[59] These declines have been echoed in commercial landings, which fell from over 2,000

[51] Knutsen et al., 2009, 3152; Harris and Hanke, 2010, 3
[52] McElroy et al., 2022, 1; Harris and Hanke, 2010, 4
[53] Hare et al., 2012, 1755
[54] COSEWIC, 2003, 21; Hare et al., 2012, 1755
[55] Harris and Hanke, 2010, 4; McElroy et al., 2019, 2
[56] Harris and Hanke, 2010, 3
[57] Harris and Hanke, 2010, 3
[58] COSEWIC, 2003, 17
[59] Hare et al., 2012, 1755

metric tons in the 1980s to less than 100 metric tons annually since 2004.[60] More recent data shows the decline is continuing: cusk landings have dropped steadily from over 1,000 metric tons in 2007 to just 140 metric tons in 2017 and 126 metric tons in 2018.[61] In the U.S. Northeast, commercial landings began dropping significantly after the 1980s. The ratio of landings to survey indices increased after 1986, which implies rising exploitation rates despite falling abundance—a warning sign of overfishing.[62] New data from longline surveys reinforce the concern that traditional survey methods have failed to track the species accurately, making these declines potentially even more severe than current estimates suggest.[63]

5. Threats

a. Present or threatened destruction, curtailment, or modification of habitat or range

The most significant threats to cusk habitat stem from both human activity and climate-driven environmental change, each contributing to the degradation, fragmentation, or loss of the structured, deepwater environments that cusk require. Chief among these is the impact of bottom-contact fishing gear, such as trawls and longlines, which can physically disrupt and flatten the rocky and coral-rich substrates that are critical for cusk shelter and feeding. These structured habitats are essential for the species, and their alteration can result in reduced habitat quality, diminished prey availability, and possibly the displacement of individuals.[64] The importance of these habitats is highlighted by the species' absence from sandy areas and their underrepresentation in areas regularly trawled.[65] Although much of the cusk catch is bycatch in longline fisheries targeting other groundfish species, gear deployment in complex habitats still poses a direct threat to benthic structure and habitat integrity.[66] In Canadian waters, lobster gear is also a major source of cusk bycatch and associated habitat disturbance, with estimated bycatch exceeding 400 metric tons in a single year in Lobster Fishing Area 34 alone.[67]

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[60] Hare et al., 2012, 1755; McElroy et al., 2022, 2
[61] Fisheries and Oceans Canada. (2019). Stock status update of cusk (*Brosme brosme*) in NAFO Divisions 4VWX5YZ (Science Response 2019/013). Canadian Science Advisory Secretariat. https://www.dfo-mpo.gc.ca/csas-sccs/Publications/ScR-RS/2019/2019_013-eng.html
[62] COSEWIC, 2003, 21
[63] McElroy et al., 2019, 4
[64] Hare et al., 2012, 1754; McElroy et al., 2022, 1
[65] Harris and Hanke, 2010, 4
[66] Harris and Hanke, 2010, 4
[67] Harris and Hanke, 2010, Table 3

In addition to direct physical damage from fishing activities, climate change presents an increasingly serious and complex threat to the cusk's habitat and range. The Gulf of Maine is warming faster than 99 percent of the world's oceans, and this has contributed to the collapse of Atlantic cod and negative impacts to protected species.[68] The Gulf of Maine is also likely more susceptible to ocean acidification than previously thought.[69] A structured climate vulnerability assessment by NMFS classified cusk as having high overall vulnerability to climate change, based on both high exposure to ocean warming and acidification, as well as cusk's biological traits like low adult mobility and habitat specialization.[70] The report also rated the directional effect of climate change on cusk as negative, suggesting a decline in productivity or abundance over the coming decades.[71]

Rising bottom temperatures in the Northwest Atlantic are projected to reduce the availability of suitable thermal habitat for cusk, especially in the southern parts of their range such as the Gulf of Maine and Georges Bank.[72] Coupled niche-climate models suggest that future habitat will not only shrink but also become more fragmented, with fewer areas meeting the combined requirements of cold temperature and seafloor complexity.[73] This fragmentation could isolate subpopulations, disrupt connectivity, and limit recolonization potential following localized declines.[74] Such fragmentation particularly concerning given cusk's limited adult mobility and lack of long-distance dispersal. Longline survey results further suggest that cusk may be retreating into deeper, more thermally stable habitats as warming progresses, potentially increasing their vulnerability to localized habitat degradation and detection failure.[75]

Furthermore, historical data indicate that cusk may have already experienced a contraction of their range into deeper waters, possibly as a response to warming or overfishing in shallower areas. While earlier accounts documented the species in waters as shallow as 20

[68] Pershing, Andrew J. et al., Slow Adaptation in the Face of Rapid Warming Leads to Collapse of the Gulf of Maine Cod Fishery, 350 *Science* 6262 (2015); Pershing, Andrew J. et al., Climate Impacts on the Gulf of Maine Ecosystem: A Review of Observed and Expected Changes in 2050 from Rising Temperatures, 9 *Elementa: Science of the Anthropocene* 1 (2021)
[69] Wang, Zhaohui Aleck et al., Seasonal Controls of Aragonite Saturation States in the Gulf of Maine, 122 *Journal of Geophysical Research: Oceans* 1 (2017)
[70] Hare, Jonathan A. et al., A Vulnerability Assessment of Fish and Invertebrates to Climate Change on the Northeast U.S. Continental Shelf, 11 *PLOS ONE* 2 (2016): 14
[71] Ibid., 15
[72] Hare et al., 2012, 1754
[73] Ibid., 1754–1755
[74] Knutsen et al., 2009, 3151–53
[75] McElroy et al., 2019, 4

meters, they are now rarely detected outside of their typical 150–450 meter depth range.[76] Canadian survey analyses suggest that the spatial distribution of cusk has not measurably contracted, but densities have declined so severely that detectability in former habitats has dropped below the threshold of standard survey methods.[77]

The threat of habitat fragmentation is particularly acute because of the cusk's strong dependence on localized, high-relief seafloor features, such as boulders, ledges, and deepwater coral areas.[78] These habitats are not continuous, and when lost or degraded, they may not be easily replaced within the same area. Additionally, because these features are typically patchy and interspersed with uninhabitable soft-bottom areas, even small-scale disturbances can create effective barriers to movement or dispersal. Yet, the full implications of habitat patch isolation on cusk population dynamics remain poorly understood and have not been fully incorporated into conservation planning or fishery management.

Altogether, the destruction and modification of benthic habitat by fishing, combined with the thermal and spatial effects of climate change, represent the most immediate and compounding threats to the persistence of cusk in much of their range. These factors not only reduce the availability of suitable habitat but also diminish the ecological stability of remaining populations, particularly in regions already experiencing steep declines in abundance.

b. Overutilization for commercial, recreational, scientific, or educational purposes

Cusk face targeted and incidental fishing pressure, and overutilization through commercial harvest is widely recognized as a key driver of the species' decline. In Canadian waters, particularly in the Northwest Atlantic Fishery Organization (NAFO) fishing area 4X (Bay of Fundy, southwest Nova Scotia, Browns Bank), cusk were heavily fished until restrictions were implemented in the late 1990s. During the years of unrestricted harvest, annual catches averaged around 3,469 metric tons, with about 80% of landings coming from this single region.[79] While much of the catch occurred as bycatch in longline fisheries targeting halibut, cod, haddock, and pollock, cusk were also targeted directly at times, prompting the Department of Fisheries and Oceans (DFO) to recommend elimination of directed cusk fishing to allow stock

[76] Hare et al., 2012, 1754
[77] Harris and Hanke, 2010, 18
[78] McElroy et al., 2022, 1; COSEWIC, 2003, 7
[79] Harris and Hanke, 2010, 3

recovery.[80] Additionally, bycatch in other fisheries—especially lobster traps—remains a major and underregulated source of mortality. In 2002, estimated bycatch from lobster gear in LFA 34 alone exceeded 400 metric tons, potentially surpassing all legal landings.[81] Detailed analysis of lobster trap bycatch reveals that between 2 and 9 cusk are caught per 10,000 trap hauls, with regional variation based on habitat overlap and effort.[82] This supports prior estimates of substantial discard mortality in the lobster fishery and demonstrates a quantifiable and ongoing source of unregulated fishing pressure on the species.

In the United States, cusk have experienced similar pressures. Commercial landings declined sharply from 500–2,400 metric tons per year in the 1960s–1990s to less than 100 metric tons annually since 2004.[83] Although much of this reduction may be attributed to shifts in fishing practices or effort, the persistently low landings, combined with the species' low reproductive rate and delayed maturity, have raised significant concern. In fact, the ratio of landings to bottom trawl survey indices has increased since the mid-1980s, implying that fishing mortality may have remained high even as populations declined—a classic indicator of overexploitation.[84] In the Northeast Atlantic, total cusk landings have dropped from over 12,000 tons per year in the early 1990s to under 5,000 tons annually in recent years, despite sustained multispecies fishing effort.[85] This trend mirrors declines seen in western Atlantic fisheries and reflects regional-scale exploitation pressures.[86]

Market substitution also contributes to the overutilization of cusk. DNA barcoding studies have revealed that cusk is sometimes mislabeled and sold as other commercially valuable gadoid species, such as cod (*Gadus morhua*) and pollock (*Pollachius virens*), particularly in processed products.[87] In one analysis, 30% of battered cod chunk products were genetically identified as cusk. This mislabeling inflates unreported demand and masks true exploitation

[80] Harris and Hanke, 2010, 3
[81] Harris and Hanke, 2010, Table 3
[82] Runnebaum, Jocelyn M, Improving Management and Conservation of Cusk (*Brosme brosme*): Habitat Distribution, Bycatch Interactions, and Conservation Practices, Electronic Theses and Dissertations, (2017), 125, Table 5.4
[83] McElroy et al., 2022, 2; Hare et al., 2012, 1755
[84] Harris and Hanke, 2010, 4; McElroy et al., 2022, 3; Hare et al., 2012, 1755
[85] ICES, Tusk (*Brosme Brosme*) in Subareas 4 and 7–9, and in Divisions 3.a, 5.b, 6.a, and 12.b (Northeast Atlantic), report (ICES Advice: Recurrent Advice, 2023)
[86] *Ibid.* at 6
[87] Di Pinto, Angela et al., DNA Barcoding for Detecting Market Substitution in Salted Cod Fillets and Battered Cod Chunks, 141 *Food Chemistry* 3 (2013)

levels, making it difficult to accurately assess population status. The resulting data gaps further undermine effective monitoring and conservation of this already vulnerable species.

c. Disease or predation

The primary predators of cusk include cod, halibut, and hooded seals, but these natural interactions are not considered to be contributing meaningfully to population declines .[88] There is no evidence in the current literature or available assessments that disease plays any role in cusk mortality or population trends.

d. Inadequacy of existing regulatory mechanisms

Despite clear evidence of long-term population declines and high vulnerability, regulatory mechanisms for cusk in U.S. waters remain limited and fragmented. The species is not currently managed under a federal fishery management plan in the United States, nor is it subject to harvest limits or habitat protections under existing regulations.[89] Although a status review was initiated in 2007 under the ESA,[90] cusk has only ever been a candidate species, meaning it has received no formal protections under the ESA or associated critical habitat provisions.[91] As a result, the species continues to be vulnerable to incidental capture in groundfish fisheries and to habitat degradation from bottom-contact fishing gear.Despite the species' vulnerability, there are no binding conservation measures in place to mitigate these threats. Notably, cusk were identified by NOAA as a species of concern specifically for their vulnerability to under-sampling and insufficient data, prompting the development of a dedicated cooperative longline survey to better inform ESA decisions.[92] However, no regulatory changes followed from these findings, leaving the species in regulatory limbo despite being federally recognized as at risk.

By contrast, Canada has taken steps toward protecting cusk, assessing the species as Threatened under COSEWIC in 2003 and Endangered in 2012,[93] based on more than a 90% decline over three generations.[94] Subsequent recovery potential assessments reinforced this listing, highlighting low resilience, poor survey detectability, and high bycatch ratesas ongoing

[88] Harris and Hanke, 2010, 4
[89] Hare et al., 2012, 1755; McElroy et al., 2022, 2
[90] 72 Fed. Reg. 10,710 (Mar. 9, 2007)
[91] McElroy et al., 2022, 2; Hare et al., 2012, 1755
[92] McElroy et al., 2019, 1
[93] COSEWIC, COSEWIC Assessment and Status Report on the Cusk, *Brosme Brosme*, in Canada (Ottawa, ON: Committee on the Status of Endangered Wildlife in Canada, 2012), https://wildlife-species.canada.ca/species-risk-registry/virtual_sara/files/cosewic/sr_brosme_cusk_1113_e.pdf
[94] COSEWIC, 2003, iv

obstacles to recovery.[95] However the Canadian government did not add cusk to the protections of the Species at Risk Act (SARA) which could have provided take and critical habitat protections analogous to those in the U.S.[96] They cited proposed management measures, cost, and the concerns of stakeholders for not listing the species under SARA. However, concerns remain regarding the effectiveness of management, particularly around bycatch in Canadian groundfish fisheries.[97] To manage cusk bycatch, Canada uses bycatch caps and trip limits, but these measures have not been enough to support recovery. The most recent stock assessment placed the biomass index (the average catch per unit effort from standardized longline surveys) at 16.7 kilograms for 2016–2018, which is above the minimum threshold but still below the level considered healthy (Upper Stock Reference).[98] Because cusk grow slowly and take many years to mature, they are unlikely to recover under limited or reactive management alone.

In both countries, a lack of targeted management (e.g. bycatch reduction measures, habitat closures, or species-specific quotas) means that cusk are largely managed indirectly, if at all. An additional regulatory shortcoming is the lack of adequate bycatch reporting. Because the current reporting requirements fisheries are inadequate to assess the rate and type of interactions occurring with cusk, is also a threat of high concern for the species. These regulatory gaps are particularly problematic given the species' life history traits and the difficulty in monitoring its populations effectively. Without more comprehensive legal protections and management frameworks, the species remains at continued risk from cumulative threats.[99]

Regulatory mechanisms regarding treatment of cusk bycatch could substantially increase survival. Experimental studies have shown that cusk recompressed shortly after capture can survive at rates of approximately 75% over 4 to 14 days.[100] However, no regulatory requirements exist to promote recompression or otherwise reduce barotrauma-induced mortality. As a result, a large proportion of cusk caught incidentally in lobster gear likely perish needlessly, contributing

[95] Harris and Hanke, 2010, 3–4, 18
[96] Legislative Services Branch, Consolidated Federal Laws of Canada, List of Wildlife Species at Risk (Decisions Not to Add Certain Species) Order, 2013, https://laws.justice.gc.ca/eng/regulations/SI-2013-27/FullText.html
[97] Ibid., 4
[98] Government of Canada, Fisheries and Oceans Canada, Stock Status Update of Cusk (*Brosme Brosme*) in NAFO Divisions 4VWX5YZ, 2019, 1, 3
[99] *Accord*, U.S. Dep't of Com., Nat'l Oceanic & Atmospheric Admin., Nat'l Marine Fisheries Serv., Main Hawaiian Islands Insular False Killer Whale (Pseudorca crassidens) Distinct Population Segment 5-Year Review (Apr. 25, 2022) (citing insufficient bycatch reporting as evidence of inadequate regulatory mechanisms).
[100] Runnebaum, 2017, 91

to population declines despite feasible mitigation strategies. Runnebaum (2017) used stock assessment simulations to evaluate whether reducing cusk bycatch in the Maine lobster fishery would meaningfully improve population status.[101] The results showed that decreasing mortality from lobster gear alone, even assuming high recompression survival, would not be sufficient to reverse the decline. This finding reinforces that *partial* mitigation strategies are inadequate in isolation, and that comprehensive protective measures across multiple sectors are necessary to conserve the species.

Climate change threats to cusk and their habitat are inadequately controlled by regulation. International mechanisms are non-binding, interim targets have not been met to date, and, even if adhered to by all parties, these mechanisms fail to mandate greenhouse gas emission reductions sufficient to protect cusk. Domestic U.S. climate change law is also insufficient to protect cusk from effects of climate change. To date, federal agencies have failed to fully capitalize on existing authority under domestic law to reduce greenhouse gas emissions to levels that would be protective of species.

In addition to inadequate regulatory mechanisms, there is a lack of data about the current state of cusk populations in the Eastern Atlantic. But Knutsen et al. (2009) emphasize that genetic differentiation and regional isolation should be considered in conservation planning, as localized populations in this area may require region-specific management approaches.[102]

e. Other natural or manmade factors affecting the continued existence of the species

While not a direct threat, poor detectability and data limitations make it difficult to track the status of cusk populations accurately. Because traditional bottom trawl surveys poorly sample cusk habitat, there's a risk that declining populations may go undetected or that assessments may not reflect true abundance.[103] This management blind spot could delay recovery actions or cause underestimation of extinction risk. This issue is especially important for a species already considered "data poor."[104] Both NOAA and Canadian scientists have emphasized that bottom trawl surveys are ineffective for detecting cusk in their preferred rocky habitats and

[101] Ibid., 130
[102] Knutsen et al., 2009
[103] McElroy et al., 2022, 1; Hare et al., 2012, 1755
[104] McElroy et al., 2022, 2

have called for longline-based alternatives to improve data quality.[105] Despite implementation of some improved survey methods, such as cooperative longline surveys in the Gulf of Maine, these efforts have not yet been incorporated into formal stock assessments or recovery planning.[106]

Mercury pollution is an emerging threat to cusk, particularly in coastal and fjord environments where contamination levels are high. Studies show that cusk accumulate significant mercury burdens in both liver and muscle tissue, with chronic exposure linked to biological stress. Rua-Ibarz et al. (2019) found that mercury levels in cusk reflect long-term environmental exposure, especially in areas with limited water exchange.[107] Building on this, Olsvik et al. (2021) documented that elevated mercury concentrations cause widespread changes in liver gene expression, including disruptions to protein folding, lipid metabolism, and cellular signaling.[108] These physiological effects may reduce fitness, reproduction, and resilience, compounding the species' vulnerability to other stressors like fishing and habitat loss.

Additionally, cusk's biological traits—long lifespan, slow growth, delayed maturity, and lack of spawning aggregations—contribute to their vulnerability. These characteristics aren't threats in themselves, but they reduce resilience to external pressures and increase the time needed for population recovery.[109] In this sense, they function as intrinsic limiting factors affecting the species' continued existence under current environmental and fishery conditions. Recent Canadian assessments have also noted that these traits significantly reduce the feasibility of recovery within short management timeframes, particularly if threats such as bycatch and habitat degradation are not addressed concurrently.[110]

6. Request for critical habitat

Within U.S. waters, the central Gulf of Maine emerges as a key geographic region for cusk conservation, particularly the rocky ledges and offshore areas along the northern edge of Georges Bank. This area contains deep, structured habitats that are strongly associated with cusk presence. Samples collected from commercial vessels and research programs have consistently

[105] McElroy et al., 2019, 2; Harris and Hanke, 2010, 4
[106] McElroy et al., 2019, 1
[107] Rua-Ibarz, Ana et al., Tracing Mercury Pollution along the Norwegian Coast via Elemental, Speciation, and Isotopic Analysis of Liver and Muscle Tissue of Deep-Water Marine Fish (*Brosme Brosme*), 53 *Environmental Science & Technology* 4 (2019)
[108] Olsvik, Pål A., Atabak M. Azad, and Fekadu Yadetie, Bioaccumulation of Mercury and Transcriptional Responses in Tusk (*Brosme Brosme*), a Deep-Water Fish from a Norwegian Fjord, 279 *Chemosphere* (2021)
[109] COSEWIC, 2003, v; McElroy et al., 2022, 1
[110] Harris and Hanke, 2010, 3

shown that cusk occur most frequently in these rocky regions, especially on the ledges of the central Gulf of Maine and along Georges Bank.[111] These areas feature the boulder fields and complex substrates essential to cusk for shelter and foraging,.[112] Data from NOAA's 2014–2017 longline survey confirm that cusk were more frequently caught in rough-bottom habitats and were absent or rare in smoother areas sampled by trawl surveys.[113] These findings reinforce the biological importance of this region and the technical need to manage and monitor it with habitat-appropriate methods.

This region also represents the southernmost extent of the cusk's distribution in the North Atlantic, making it especially vulnerable to climate change. Cusk has a very high level of exposure to climate hazards; among 41 deep-sea species scientists ranked its exposure to climate hazards fifth highest.[114] Rising ocean temperatures in the Gulf of Maine are expected to reduce suitable thermal habitat and increase habitat fragmentation, particularly in areas where complex seafloor structure and cold-water conditions no longer overlap.[115] Because southern populations are often among the first to experience range contractions, protecting high-quality habitat in this area could be critical to maintaining population stability and genetic diversity in a changing climate. This concern is echoed in Canadian assessments, which note that populations on the periphery of the species' range may be disproportionately vulnerable to warming and localized collapse.[116]

Fishing pressure has also historically been high in the Gulf of Maine, and while cusk are not typically targeted, they are frequently caught as bycatch in longline and other groundfish fisheries. Combined with the challenge of monitoring cusk in these untrawlable habitats, this has made it difficult to assess population trends and implement effective protections (McElroy et al. 2022, p. 2).[117] Despite this, no specific habitat protections have been implemented to safeguard known cusk habitat, and ESA candidate status has not led to formal spatial management or bycatch mitigation in these critical areas (NOAA 2019, p. 1).[118] For these reasons, protecting

[111] McElroy et al., 2022, 3
[112] Ibid., 1; Hare et al., 2012, 1754
[113] McElroy et al., 2019, 4
[114] FAO, Deep-Ocean Climate Change Impacts on Habitat, Fish and Fisheries, vol. 638 (Rome: FAO Fisheries and Aquaculture Technical Paper, 2018)
[115] Hare et al., 2012, 1753–1754
[116] Harris and Hanke, 2010, 18
[117] McElroy et al., 2022, 2
[118] McElroy et al., 2019, 1

rocky ledges and structured seafloor areas in the central Gulf of Maine and northern Georges Bank would directly address the primary threats to cusk and safeguard some of the most biologically important and vulnerable portions of their U.S. range.

The critical habitat designation for yelloweye rockfish in the Puget Sound demonstrates why habitat designation for cusk is critical. Like yelloweye rockfish, cusk are long-lived, slow-growing demersal fishes that occupy complex benthic habitats such as rocky substrates and boulder-cobble fields, which provide shelter, feeding, and spawning sites.[119] As with the listed rockfish, cusk exhibit physiological vulnerability to barotrauma and are highly sensitive to displacement from high-relief habitats.[120] In the rockfish designation, NMFS concluded that seafloor complexity and vertical structure were essential features of critical habitat due to their role in promoting adult survival and site fidelity—traits also documented in cusk.[121] This aligns with the best available science on cusk in the Gulf of Maine, where similar habitats are under pressure from fishing gear impacts and environmental degradation. Likewise, NMFS should designate critical habitat for cusk.

7. Conclusion

Cusk populations have undergone significant long-term declines, over 90% in some regions, due to a combination of overfishing, habitat degradation, and climate-related range contraction. Their life history traits, including late maturity, long lifespan, and low mobility, make them especially vulnerable to exploitation and slow to recover from disturbance. These declines have been compounded by the species' preference for deep, complex habitats that are difficult to monitor and are increasingly threatened by bottom-contact fishing gear and warming bottom waters. Despite these risks, cusk remain unmanaged in U.S. federal waters and are not currently listed under the ESA, leaving them without formal protections at a time of growing ecological pressure.[122]

Listing cusk under the Endangered Species Act would trigger critical conservation actions, including the development of a recovery plan, evaluation of critical habitat, and consideration of cusk impacts in federal fishery and development projects. It would also promote

[119] National Marine Fisheries Service, Endangered and Threatened Species; Designation of Critical Habitat for the Puget Sound/Georgia Basin Distinct Population Segments of Yelloweye Rockfish, Canary Rockfish and Bocaccio, 79 Fed. Reg. 68042, 68045–46 (Nov. 13, 2014).
[120] *Id.* at 68045.
[121] *Id*. at 68046.
[122] COSEWIC, 2003, iv; Hare et al., 2012, 1754–55; McElroy et al., 2022, 2

more coordinated research and data collection efforts, filling knowledge gaps related to habitat use, population structure, and climate vulnerability. Given their reliance on complex structured seafloor habitats and their susceptibility to cumulative threats, even modest regulatory changes such as gear restrictions in key habitats or bycatch mitigation measures could have a significant positive effect on the species' trajectory.

Protecting cusk would also yield broader ecological and management benefits. As a solitary, benthic predator, cusk play a role in regulating prey communities and maintaining the health of deep-reef ecosystems. Their conservation would likely support a suite of other species dependent on similar habitats, including deepwater corals and other groundfish. Moreover, protecting cusk could serve as a model for managing other data-poor, habitat-dependent species in the Northwest Atlantic, helping to strengthen ecosystem-based management across the region.