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Chapter 3k Alaska Arctic Marine Fish Species

Chapter 3. Alaska Arctic Marine Fish Species Accounts

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Abstract

Species accounts provide brief, but thorough descriptions about what is known, and not known, about the natural life histories and functional roles of marine fishes in the Arctic marine ecosystem. Information about human influences on traditional names and resource use and availability is limited, but what information is available provides important insights about marine ecosystem status and condition, seasonal patterns of fish habitat use, and community resilience. This linkage has received limited scientific attention and information is best for marine species occupying inshore and freshwater habitats. Some species, especially the salmonids and coregonids, are important in subsistence fisheries and have traditional values related to sustenance, kinship, and barter. Each account is an autonomous document providing concise information about a species zoogeography, western and Alaska Native taxonomy, life history, niches, and life requirements. Each account is fully referenced with the identification of the most critical literature for Alaska and a more comprehensive listing of referencing from which biological and ecological information was drawn. New-to-science narratives, distributional maps, and vertical profiles, provide quick, reliable sources of information about fish life history and habitat requirements for this segment of the Arctic fauna.

Purpose and Design of Species Accounts

Individual species accounts were prepared for 104 of the 109 confirmed marine fishes for which adequate biological information was available from the U.S. Chukchi and Beaufort Seas. These descriptions are an important source of documentation about Arctic Alaska's marine fish fauna. Although tailored to address the specific needs of BOEM Alaska OCS Region NEPA analysts, the information presented in each species account also is meant to be useful to other users including state and Federal fisheries managers and scientists, commercial and subsistence resource communities, and Arctic residents. Readers interested in obtaining additional information about the taxonomy and identification of marine Arctic fishes are encouraged to consult the *Fishes of Alaska* (Mecklenburg and others, 2002) and *Pacific Arctic Marine Fishes* (Mecklenburg and others, 2016). By design, the species accounts enhance and complement information presented in the *Fishes of Alaska* with more detailed attention to biological and ecological aspects of each species' natural history and, as necessary, updated information on taxonomy and geographic distribution.

Each species account includes a concise summary of the natural history, population dynamics, functional roles, and traditional and economic values of the marine fish found off Alaska. An initial organizational task was to create a standard format for effective information delivery. The species descriptions by Ehrlich and others (1988) were provided to the USGS by BOEM as an example of a creative template for information transfer. Four pilot species accounts, representing well known to poorly known species, were developed, reviewed, and repeatedly revised for improvements, interagency approval, and selection of the final layout and design. Final decisions about content represented the priority needs of BOEM.

More than 1,200 individual scientific publications relevant to Arctic marine fishes were reviewed in preparation of the species accounts. In each species account, the most relevant literature for each species is cited. A shorter list (about 5–10 articles) identifies key Alaskan information sources that, in our opinion, have had the greatest scientific effect on understanding the species of the Arctic area of the United States.

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Limitations of Data

The species accounts reveal many gaps in the biological information needed to conduct vulnerability assessments of the marine fishes of the Beaufort and Chukchi Seas to human interventions. Part of this problem relates to the geographic coverage of existing research and surveys in Alaska as, in many instances, we were required to incorporate the results of investigations conducted outside the region. This raises an important caution because, even though the best available information was used in preparing the species accounts, our reliance on data and information from outside Alaska will introduce uncertainty to EIS expectations. Ideally, and with respect to oil and gas activities, baseline information for fishery resources should be collected from the potentially affected environment to appropriately evaluate the potential effects of oil spills or other possible industrial-related disturbances. However, as has been widely noted (for example, Bluhm and others, 2011), systematic and methodologically comparable data typically are not available from Arctic Alaska marine ecosystems. Evaluating change in populations and communities from natural and anthropogenic stressors is limited by the variable quality and lack of quantitative reports on abundance, distribution, community structure, and demographics for Arctic marine fishes.

In each species account, an attempt was made to incorporate the most reliable baseline information available and offer impressions of information needs. Important ongoing studies sponsored by BOEM, and others, may be addressing some of these needs. The needs assessments for this study considered these efforts to the extent that oral and (or) written communications and preliminary results allowed. The focus of this study was on impressions of the population parameters (Williams and others, 2002) and environmental measurements needed to detect changes in marine fish populations (Reist and others, 2006; Wassmann and others, 2011) and their resilience to a variable and rapidly changing environment (Holland-Bartels and Pierce, 2011). For key marine fish species, examples might include changes in range, community structure, abundance, phenology, behavior, and population growth and survival.

Each species account is designed as a self-contained article; therefore, no references to other accounts are included. Additionally, to reduce complexity in the presentations, only common names were used to identify the major predator and prey species for the marine fish described. Because this document was meant to be a companion document to the *Fishes of Alaska* (Mecklenburg and others, 2002), interested readers are encouraged to consult this book or Page and others (2013) and Mecklenburg and others (2016) for more complete information about the scientific authorities and literature citations associated with the original descriptions of each species. Readers are directed to the references cited in each species account for additional information on the species.

Operational Definitions

In chapter 1, several concepts about the temporal and spatial habitat requirements for Arctic marine fish were introduced. More information is presented in this chapter to explain the vertical distribution and the location of shelf break, as used in this report.

Vertical Distribution

The conceptual design of the species depth profiles (vertical structure by life history stage) was patterned after the “coastal marine life zones” of Allen and Smith (1988). The goal of the profiles is to visualize what is known about a species occurrence and reproductive ecology by depth and location. An idealized characterization of Arctic shelves was designed to visualize these relationships. Additional detail about origins of data was included in the depth profiles to reflect Alaskan records or collections from other Arctic regions. This is important because actual field collections and observations are limited from this region. In many instances, the actual presence of a life stage remains unverified by field sampling. Thus, for many of species, the depth of a fish’s life cycle should be considered untested hypotheses in need of additional testing.

Location of Shelf Break

Early versions of the depth profiles were modified at the request of BOEM with respect to the depiction of the continental shelf break. As a special effect for the Arctic, the species depth profiles were redrawn to depict the change in bathymetry that typically occurs at depths of about 75 m throughout the Chukchi and western Beaufort Seas. This depiction is not an attempt to redefine the oceanographic definition of shelf break. Instead, it highlights the relatively sharp gradient in depths that often occurs near 70- to 80-m contours over much of the region. Although species depth profiles in this report depict an apparent “break” at 75-m, three factors were considered: (1) this is a generalization and the actual shelf break may be geographically close but at a slightly greater depth; (2) shelf edge effects on fish distribution at depths occurring between 75-, 150-, or 200-m are likely negligible due to the gradient and area involved; and (3) the conceptual depictions of depth distributions by life history stage are consistent with accepted oceanographic conventions for continental shelf and slope (despite the magnified view at 75-m) and thus are compatible to the import of biological data obtained elsewhere.

Keystone Species

The concept of keystone species describes the critical role certain organisms are perceived to have in maintaining the structure of biological communities and resilience of ecosystem dynamics (Paine, 1966). Arctic Cod (*Boreogadus saida*) are widely distributed in the Arctic Ocean and by virtue of their abundance and intermediate trophic position between invertebrates and higher-level predators are integral to the movement of nutrients in marine food webs. For this reason, Arctic Cod are considered a keystone species in the Arctic marine (Bradstreet and others, 1986; Walkusz and others, 2011). Arctic Cod are common in United States waters of the Beaufort and Chukchi Seas being considered for energy exploration and development and are an ecological focus of BOEM fishery studies to understand potential effects on the species (Maule and Thorsteinson, 2012).

Outline of Species Accounts

The species accounts are scientifically accurate descriptions of the life histories, populations, habitats, and community values of individual species in the Arctic marine ecosystem. The mix of quantitative and qualitative information presented reflects state-of-the-art knowledge, a faunal assessment of information gaps, and prioritization of priority needs for population and process understanding. Limited information for many Alaskan species required that relevant observations from other geographic locales be included. Each species account attempts to be clear about the geographic origins of data and information, through scientific referencing or special notations in graphics. As an example, *italics* are used in the species accounts to highlight data collections from the Alaska study area. In several instances, species information was so lacking that inferences from a closely related species were required.

The generic species account includes a comprehensive accounting of scientific and cultural information in a standard format. The scientific information addresses multiple disciplinary areas including taxonomy, life history and habitats, ecological relationships including predator-prey interactions and environmental preferences, and population ecology. The population information is critical to evaluations of population status and health, resilience, and vulnerability to natural and anthropogenic changes in the marine environment. Each species account includes a photograph of an adult specimen (or line drawing if an image was not available); distribution maps (horizontal and vertical); and concise descriptions of abundance, life history, and ecology (11 life history categories); major stressors; research needs; and key references. To assist users, a suite of easily recognized icons was developed to provide quick access to specific life history information. In addition, some species attributes regarding life history, population dynamics, and biological interactions are defined in the Glossary (chapter 7).

Information presented in each species account is outlined and described as:

Taxonomic—Scientific and Common Names

The format of the species accounts was, by design, intended to link the biologic and ecologic information presented in this document directly to the species identification guides contained in the "*Fishes of Alaska*." This connection was established by adherence to naming conventions as described by Mecklenburg and others, 2002 (p. 25 and 26). The common names of each marine fish are presented first, followed by scientific and family names. Each scientific name includes a reference to the name of the person (author) who formally described and named the species in the ichthyological literature. The bibliographic data for the authors and dates of publication of scientific names can be found in Eschmeyer's Catalog of Fishes online (http://researcharchive.calacademy.org/research/ichthyology/catalog/fishcatmain.asp) and are not reported here. In some instances, a *Note* (italicized) has been included to describe exceptional details about existing biological data, morphology, nomenclature, taxonomic status, life history strategy, or occurrence of a species in the United States Chukchi and Beaufort Seas.

Iñupiat Name

The existence of colloquial Iñupiat (Iñupiaq) names for the Arctic's marine fish fauna by indigenous peoples is an important component of traditional ecological knowledge. Relatively few marine fish species are abundant or susceptible enough to subsistence fisheries to have received special names. For those species having Iñupiat names, this information is reported to assure that a common vocabulary can facilitate future exchanges of ideas and knowledge across disciplinary boundaries. In this manner, colloquial names can provide a cultural link between local marine resources and science supporting sustainability of Arctic communities and ecosystems.

Ecological Role

Fishes play a pivotal role in marine ecosystems as secondary and higher-level consumers in many marine food webs. In many instances, information about predator-prey relationships is so limited that only preliminary, qualitative assessments of the relative role of each species are possible. The ecological niche describes how an organism or population responds to resources and competitors. Importance or significance descriptors do not diminish the fact that all organisms contribute in ways large or small to the provision of ecosystem goods and services. These descriptors however, may provide useful information about the relative importance of a particular species as an indicator of ecosystem condition and trajectories of change associated with climate change, habitat fragmentation, ecosystem stress, effect of pollutants, or other anthropogenic effects.

Physical Description/Attributes

A brief physical description of the species is summarized from information presented by Mecklenburg and others, (2002) in the *Fishes of Alaska*; the relevant page number is included for quick referral to more comprehensive morphological information. An image of the adult form of each fish is presented with appropriate attribution. High-quality images were selected to highlight the key identifying features of a particular species.

Information about the presence of a swim bladder and antifreeze glycoproteins is included because of its relevance to geo-seismic oil and gas exploration, climate change issues, and evolutionary life history.

Range

The geographic occupancy of the species in United States sectors of Chukchi and Beaufort Seas and adjacent waters is presented in brief narratives and depicted on maps. Known occurrence in the Arctic OCS Planning Areas is highlighted by symbols indicating locations of valid species identifications from properly archived voucher specimens on each map. Although the symbols on the maps may suggest that some of the species are rare in the region, the study of historical collections from the United States and Canadian sectors of the Beaufort Sea, as well as the collections from BOEM surveys in the Beaufort in 2011 and 2012, is still in progress and may reveal that these species are more abundant in deep sectors of the study area than the maps suggest. Definitions of zoogeographic pattern are from the Online Resource 1 (electronic supplemental to Mecklenburg and others, 2011), Mecklenburg and Steinke (2015), and Mecklenburg and others (2016) and relate to ranges of population viability (see chapter 2).

Depth profiles in each species account graphically summarize existing information about the benthic and reproductive distributions of each marine fish. In both depth profiles, the width of areas depicted confers species information about horizontal (onshore-offshore) patterns of distribution. The italicized captions in the depth profiles highlight species information germane to the study area. Areas in the graphs denoted by the orange coloration represent understanding from data collection within the United States Chukchi and Beaufort Seas; olive colors represent data collection outside the study area. For benthic distributions, solid lines in the depth profiles represent species for which no specific information is available about its preferred depth range. Solid lines represent a synthesis of understanding that includes information not necessarily specific to the study area. In some instances, only one record of a species occurrence by depth was available and coding in orange was not meaningful. In these cases, an explanatory comment, in italicized font, with a line pointing to the appropriate depth was included in the graph (for example, see the species account for *Megalocottus platycephalus*). Highlighted depths as indicated through “bolded” (dark black) and dashed segments, represent most common depths where the species has been detected, and depth distribution as has been reported throughout the species range, respectively. Areas denoted with diagonal cross-hatching represents depth distribution of juveniles (immature); adult distributions are not cross-hatched and age-related habitat overlaps, are informed by captioning in the figures.

For reproductive distribution, eggs and larvae (pre-juvenile life stages) of marine fishes are represented with respect to depth and distance from the coast. Orange areas in the reproductive distribution profiles represent data collection in the study area. In many instances, information about spawning habitats and egg and larval distributions is summarized from information reported from throughout a species range. In these cases, dark blue represents species distributions in spawning habitats; light blue represents the geographic distributions of eggs and larvae; and light green is used to highlight areas of substantial habitat overlap (for example, see the species account for *Hippoglossus stenolepsis*). Distribution patterns of eggs and larvae are symbolized by “dots” and “horizontal dashes,” respectively, in the graphs. As for benthic distribution, solid lines represent species-specific information from data collections from throughout the species entire range. Highlighted (dark black lines) segments of solid lines indicate the most common depths where egg and larvae samples have been collected. Dashed lines represent areas of hypothesized distributions for species for which no information is available about egg or larval occurrence. In these instances the hypothesized distributions are based on known patterns for closely related species; the lack of data is stated in captions above the graph.

Relative Abundance

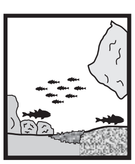
Relative abundance refers to the contribution a species makes to the total abundance of the fishery community. It is a measure that provides an index of the number of individuals present, but not the actual numbers. Relative abundance terms, such as “common,” “uncommon,” or “rare” often are used to express the general population status of a given species, but are most useful when they are defined by something that is measured or estimated in a manner that makes comparison meaningful.

Depth Range

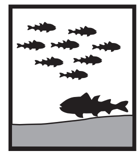
Benthic distribution refers to the spatial arrangement of a particular species at different depths over continental shelf and slope waters. The life cycle of fishes occurs in multiple dimensions in time and space and generally reflects genetically determined life history or behavior that has evolved to maximize fitness (life time reproductive success, see Gross [1987]). Benthic distribution profiles for each species represent the location of important habitats as they are presently known for juvenile and marine fishes. Reproductive distributions depict important habitats for spawning and early life history development.

Life History, Population Dynamics, and Biological Interactions

Life history theory holds that the schedule and duration of key events in a species' lifetime are shaped by natural selection to produce the largest possible number of surviving offspring. These events, notably juvenile development, age of sexual maturity, first reproduction, number of offspring and level of parental investment, senescence, and death, depend on the abiotic and biotic environment of the organism. Specific information about these traits informs understanding of a species' adaptive capacity including major influences on population abundance. A number of fisheries models use basic length-weight and age-at-size relationships to describe the growth and dynamics of fishery populations (for example, von Bertalanffy and Gompertz, growth models and derivatives [Ricker, 1975]). Ecological models estimate transfer of energy or matter along the trophic chain (Gamito, 1998). The parameters that are estimated in these models are individually important indicators of population condition and may be used with other indicators to derive quantitative information about compensatory responses and resilience. Much of this information, including population parameters, has been compiled in FishBase for the Arctic marine fish (Froese and Pauly, 2012).



Habitats and Life History—Basic information about the life history (for example, body size, reproductive ecology, growth) and ecology (for example, mobility, growth, habitat) of a species and the environmental area inhabited by that species is foundational to effective resource management. Habitat is the natural environment that influences and is used by a species population. Information about abiotic (that is, temperature, salinity, other physiochemical factors, depth, and substrate types) and biotic (that is, type and abundance of food, presence of other biota) often are used to describe fish habitats and provide insights about a species environmental preferences and habitat associations (for example, water masses). Maximum body size often is reported and can be an important surrogate of different life history traits (for example, age at maturity, growth, and reproductive output). In population dynamics studies, the relationships between length and weight and size and age form the basis for population growth and production models and quantitative analysis of environmental effects. Length measurements are reported as standard length (SL), total length (TL), and fork length (FL) in fisheries studies.



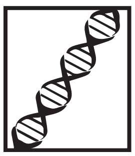
Behavior (see also Glossary [chapter 7]).—Behavior is the manner in which a fish operates or functions within its environment (that is, home range, territoriality, and many others) to procure food, orient to specific locations, or relate to other organisms. Knowing how individuals respond to the environment (physical, chemical, and biological cues) is critical to understanding population processes such as distribution, survival, and reproduction and recruitment and for managing fisheries. Many behaviors are evolutionary adaptations to the physiological and reproductive requirements for a species' survival. For example, migration involves the regular movement of animals between different geographic locations. Migrations can be extensive in terms of time and distance involved (anadromous model) or seasonal (amphidromous and marine models). Each of these models reflects a life strategy adapted for age and growth at sea. Diel relates to daily changes in water column position due to changes in light, temperature, and food supply.

Migratory behaviors are rooted in physiological requirements for food, growth, reproductive, and survival ("scope for growth"). Movement behaviors are more tactical responses to local environmental conditions (for example, variable hydrographic conditions in the nearshore Beaufort Sea). Fish movement can be active or passive and involve large distances in search of suitable habitats and foods. The seasonal nature of migration and movement behaviors are typically related to life history stage, predator-prey distributions, or energetic requirements for growth.

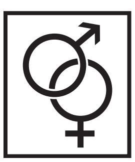
Schooling (that is, social structure of fish of the same species moving in more or less harmonious patterns in the sea) often is related to survival and reproduction. Schooling confers physical benefits to fish movement, safety against predators, search behaviors (for example, foods), population immunology, and reproduction.

The functional feeding morphology of a fish relates to its anatomical adaptations (for example, body size, gape sizes, shape, and body form) to environmental conditions especially food preferences. The adage "function determines morphology and morphology determines way of life" is an important evolutionary concept as it applies to fish feeding behavior, dietary preferences, habitat selection, and trophic stature. Trophic position (within categories of trophic levels) expresses the "tendency of larger (less abundant) fishes feeding on smaller (more abundant) fishes, which themselves feed on zooplankton and all these animals resting upon primary producers" (from Pauly and Watson, 2005). Categories of trophic levels are:

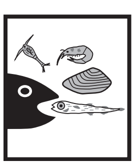
- Trophic level 1 (T1), plants and animals make their own food and are called primary producers;
- Trophic level 2 (T2), herbivores eat plants and are called primary consumers;
- Trophic level 3 (T3), carnivores eat herbivores and are called secondary consumers;
- Trophic level 4 (T4), carnivores eat other carnivores and are called tertiary consumers; and
- Trophic level 5 (T5), apex consumers, which have no predators, are at the top of the food chain.



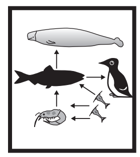
Populations or Stocks—A population often is defined as a group of organisms of the same species occupying a particular space at a particular time with the potential to breed with each other (Williams and others, 2002). Stocks are subpopulations of a particular species of fish that result from reproductive isolation and subdivisions within the biological range. The current state of knowledge about local stocks and their genetic population structure is reported. Grossberg and Cunningham (2001) described the combined effects of demographic, behavioral, genetic, oceanographic, climate, and tectonic processes as major determinants of population structure. These mechanisms act across a range of temporal and spatial scales to determine the rates and patterns of dispersal of different life stages of marine fishes. Dispersal, combined with the successful reproduction and survival of immigrants, control the scale and rate of processes that build or erode structure within and among groups of individuals.



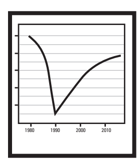
Reproduction Mode—Little information is available about the spawning times and locations, mating behaviors (breeders or nonbreeders), and genetic diversity of Arctic marine fishes. What is known is drawn largely from observations from populations studied outside the United States. For most Arctic marine fish species, there is no information about population or stock structure (for example, age structure, reproductive behavior, sex ratios, age-at-maturity, fecundity, and genetic). These are key population parameters needed for understanding reproductive ecology, population dynamics (for example, growth, survival, and mortality), and assessments of resiliency (response to disturbance).



Food and Feeding—Dietary information is summarized from literature and, unless in italics, is reported from other regions. Fish communities can affect the ecological characteristics of marine ecosystems in response to productivity and abundance patterns, the mobility and migratory behavior of species, and through food influences in different habitats (for example, Grebmeier and others, 2006b). Trophic Index (T) values are reported from FishBase (Froese and Pauly, 2012). The T values for Arctic marine fishes are largely derived from stomach contents analyses, which have correlated well with stable isotopes of nitrogen in tissues. The fractional values (between 1 and 5) realistically address complexities of consumer feeding behaviors (omnivory and feeding across multiple trophic levels) and predator-prey relationships. For example, the mean T value for Blackline Prickleback (*Acantholumpenus mackayi*) is 3.1 (±0.31). This mid food web value is indicative of a primary carnivore that feeds across trophic levels, in this case on lower level herbivores.



Biological Interactions.—The effects organisms in a community have on one another. Competition and consumption (predation, herbivory, or cannibalism) are the best known of the major ecological processes affecting resource abundance, community composition, and ecosystem function. Competition involves interactions between individuals of the same species (intraspecific) or different species (interspecific) in which the fitness of one is lowered by the presence of another. Competition often is related to food and habitat requirements and reproductive behavior. Interspecific competition for foods is greatest for species occupying similar trophic positions in relatively short food chains and for animals living in regions of low biological productivity.

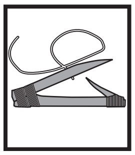


Resilience—In ecology, resilience traditionally refers to the ability of a population or biotic community to sustain or return to its former state after a disturbance. The rate of recovery is a measure of resilience determined by the population processes involved in restoring abundance to healthy, sustainable, or pre-disturbance levels. Four categories of productivity (high, medium, low, and very low) are used to classify reliance in marine fish populations (Musick, 1999). These categories are based on a combination of population parameters for intrinsic rate of growth, growth coefficient, fecundity, age at maturity, and maximum age. Because population parameters were unavailable, resiliency is defined here based on estimated population doubling time where high = <15 months, medium = 1.4–4.4 years, and low = 4.5–14 years.

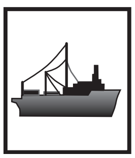
Traditional, Cultural, and Economic Values

In August 2009, the U.S. Secretary of Commerce approved a Fishery Management Plan for the Arctic Management Area. The plan covers U.S. Arctic waters in the

Chukchi and Beaufort Seas, and acknowledges that changing climate may potentially favor the development of commercial fisheries. However, until adequate fisheries resource assessments are completed, the region remains closed to commercial fishing in federal waters. A small salmon fishery exists in Kotzebue Sound; in 2010, a small commercial fishery for Arctic Ciscoes in the Colville River was terminated.



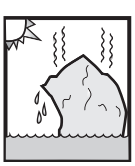
Traditional and Cultural Importance.—Several species of nearshore marine fishes are important in subsistence fisheries. The protection of traditional lifestyles and economies, including these subsistence fisheries, is a responsibility of the Federal government. Subsistence relates to resource use patterns (for example, seasonal round) and values (that is, sustenance, kinship, and barter) in coastal communities of northern Alaska.



Commercial Fisheries.—Currently (2016) there are no offshore marine fisheries in the U.S. Chukchi and Beaufort seas. Changing Arctic environmental conditions and shifting distributions of species in response to warming suggest that there may be fisheries in the future. A precautionary approach by fishery managers has been adopted that requires the collection of reliable baseline information for decision-making and ecosystem management (North Pacific Fishery Management Council [North Pacific Fishery Management Council, 2009; Wilson and Ormseth, 2009]).

Climate Change

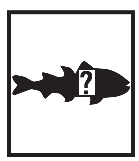
Alaska's climate is changing at more than twice the rate of the rest of the United States (Mellilo and others, 2014). Year-to-year and regional variability in air temperatures are evident and the warming trend currently is being moderated by large-scale cooling associated with the Pacific Decadal Oscillation. Even so, climate effects are pronounced and are being seen in changes in sea ice, timing of snowmelt, widespread glacier retreat, and changes in hydrology (runoff) and coastal processes, such as erosion (Markon and others, 2012). The effects of rising ocean temperatures and ocean acidification on marine food webs are of growing regional concern with respect to the condition and trends in marine ecosystems and human community resilience are of concern. Climate changes potentially can affect marine fish in numerous ways, leading to distributional changes, increased or decreased mortality rates, changes in growth rates, and by altering the timing in reproduction (Clow and others, 2011).



Potential Effects of Climate Change.—A pole-ward shift of many fish distributions is possible as is a reduction or extinction of species that are narrowly adapted to Arctic environments. Generally, the species are expected to increase in abundance if they are currently present in the Bering Sea and decrease if they have very low tolerance for temperatures greater than 1.5–2.0 °C. However, it is hypothesized in current climate projections that temperatures near the ocean floor in the northern Bering Sea will remain cold (<2 °C) due to persistence of winter sea ice (Sigler and others, 2011). Cold-water conditions and other marine ecosystem effects related to seasonal sea ice extent and timing of retreat may effectively block northward migrations and production of exploitable quantities of species, such as pollock and cod, for several decades. Shifts in range and other possible climate-related effects, such as increased predation or competition for food, are identified in the species accounts. Only "loose qualitative generalizations" are presently possible (Reist and others, 2006).

Research Needs

The compilation and review of species information for species in U.S. Arctic waters revealed many gaps in life history understanding and environmental relations. These are evaluated on the basis of a species current fishery and community values and ecological significance in marine ecosystem structure and function. The needs reflect the researcher's perceptions and their understanding that new fishery information is becoming available for the Arctic region and that, although Arctic research is currently a national priority, some aspects of population ecology will take many years of data collection to accurately assess.



Areas for Future Research.—The preparation of individual accounts led to the identification of many information gaps in knowledge about the biology and ecology of marine species including life history, population dynamics, and community associations. Generally, species life history and ecology gaps are most pronounced with respect to: (1) depth and location of pelagic larvae; (2) depth, location, and timing of young-of-the-year habitats; (3) preferred depth ranges for juveniles and adults; (4) spawning seasons; (5) seasonal and ontogenetic movements; (6) population genetics and dynamics; (7) prey–predator relationships and food web relationships; and (8) environmental health (multiple stressor effects on fitness). Behavioral studies for all life stages are virtually non-existent. New information is being developed and, for the lesser-known species, gaps may be slowly addressed over time. Priority needs, for species having special significance in subsistence fisheries and marine food webs or that may be indicator species are emphasized in the species accounts. One of two categories of identified research need is identified for each species. The meaning of the categories **[A]** and **[B]** is as follows:

- **[A]** Many gaps in our understanding of the species life history and ecology remain in Alaska (for example, research areas 1 through 8). These are high profile species in terms of ecological, subsistence, or potential fisheries values. Specific research priorities are briefly discussed.

- **[B]** Most aspects of the species life history and ecology are unknown for Alaska (for example, research areas 1 through 8). Species information will likely accumulate over time and focused studies are not warranted at this time.

References Cited and Bibliography

A thorough review of scientific literature was done in the preparation of the species account. A list of references (References Cited [chapter 8]) is provided for each species for readers seeking additional information. This list identifies key sources of information that make the greatest contributions to current knowledge (2014) and understanding. The Bibliography section provides a full accounting of all scientific literature cited in each species account. For a small number of species from the family Cottidae, only a Bibliography was possible to provide and this is indicative of the lack of information available. Citations are not always in numerical order in species accounts because new information became available during the production phase of this publication and were incorporated into the species accounts as appropriate.

Blackline Prickleback (*Acantholumpenus mackayi*)
(Gilbert, 1896)

Family Stichaeidae

Blackline Prickleback (*Acantholumpenus mackayi*), 125 mm TL, Norton Sound, Bering Sea, 2004. Photograph by C.W. Mecklenburg, Point Stephens Research.

Note: *Except for physical description, relative abundance, and geographic range data, all information is from areas outside of the study area*.

Colloquial Name: *None within U.S. Chukchi and Beaufort Seas.*

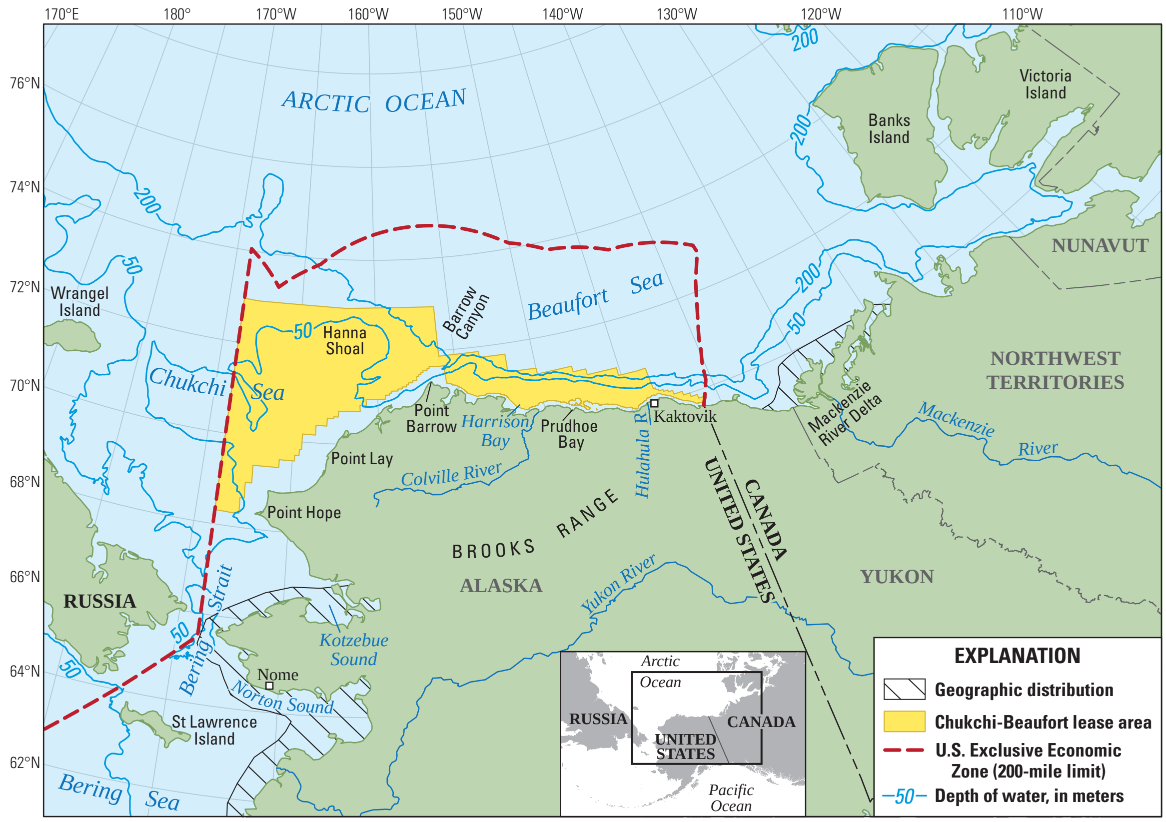
Ecological Role: Blackline Pricklebacks are uncommon in the U.S. Chukchi Sea and have not been reported from the U.S. Beaufort Sea. They are probably of relatively little ecological importance in U.S. Arctic waters.

Physical Description/Attributes: Elongate, compressed, slightly eel-like body colored yellow or brown with a dark line on back at base of dorsal fin and two dark broken lines below. Caudal fin is dark and unbanded. For specific diagnostic characteristics, see *Fishes of Alaska* (Mecklenburg and others, 2002, p. 761) [1]. Swim bladder: Absent [2]. Antifreeze glycoproteins in blood serum: Unknown.

Range: *Southern U.S. Chukchi Sea, documented by one record from Kotzebue Sound and one from northern Bering Strait* [1, 3]. No other records off Arctic Alaska, but presence is assumed from occurrence in Canadian Beaufort Sea off the Mackenzie Delta. Elsewhere in Alaska, in eastern Bering Sea, Aleutian Islands, and Gulf of Alaska. Worldwide, in Sea of Japan and Sea of Okhotsk, along Pacific coast of Hokkaido, Japan, and southeastern Kamchatka Peninsula, Russia; in Canadian Beaufort Sea between Phillips Bay, Yukon Territory, and Wood Bay, Northwest Territories, Canada [3, 4].

Relative Abundance: *Uncommon in U.S. Chukchi Sea with patchy distribution mainly in vicinity of river mouths and deltas* [1]. Common in Sea of Japan and Sea of Okhotsk off Sakhalin Island, Russia [6, 7]. Common in Tuktoyaktuk Harbor and other brackish nearshore waters off the Mackenzie River Delta, Canadian Beaufort Sea [8].

Blackline Prickleback
Acantholumpenus mackayi

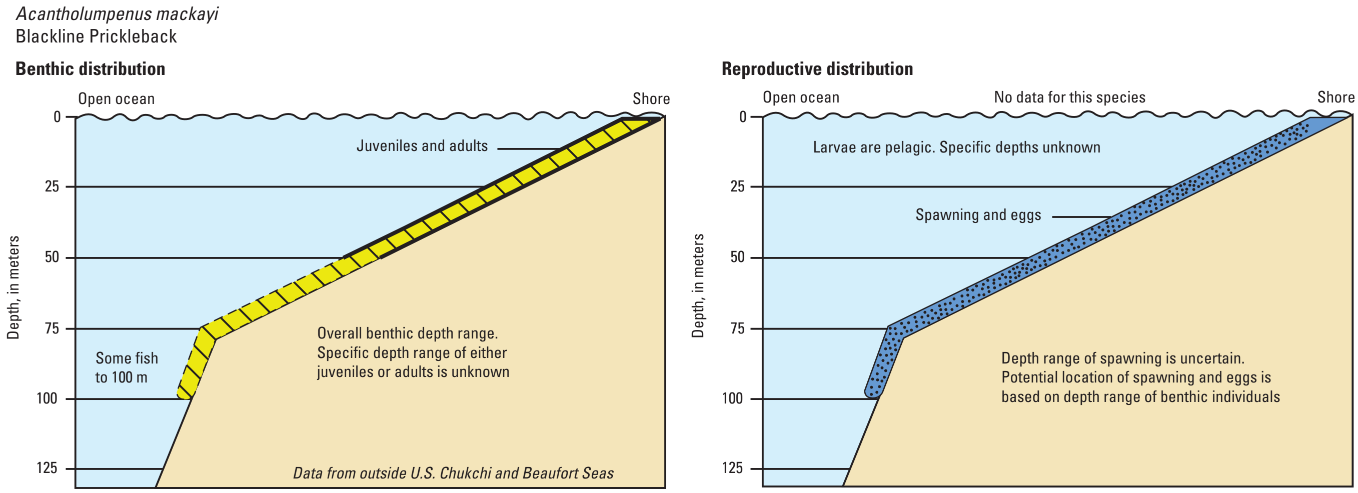


Base modified from USGS and other digital data. U.S.-Russia Maritime Boundary follows the EEZ/200-mile limit line, western edge. Coordinate reference system: projection, Lambert Azimuthal Equal Area; latitude of origin, 75.0°; horizontal datum, North American Datum of 1983.

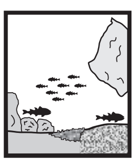
0 50 100 200 MILES
0 50 100 200 KILOMETERS

Geographic distribution of Blackline Prickleback (*Acantholumpenus mackayi*) within Arctic Outer Continental Shelf Planning Area [5] based on review of published literature and specimens from historical and recent collections [1, 3, 4].

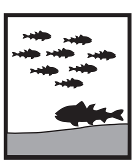
Depth Range: 0.5–100 m, typically less than 50 m in Sea of Okhotsk [4]. In Alaska, documented from shallow water nearshore to depths of 66 m [4].



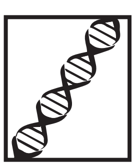
Benthic and reproductive distribution of Blackline Prickleback (*Acantholumpenus mackayi*).



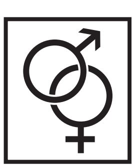
Habitats and Life History
Eggs—Size: 1.0–1.4 mm in diameter [9]. Time to hatching: Unknown. Habitat: Benthic and adhesive [6, 10].
Larvae—Size at hatching: 15.8 mm [11]. Size at juvenile transformation: 21.5 mm [11]. Days to juvenile transformation: Unknown. Habitat: Pelagic [12].
Juveniles—Age and size: Age unknown. From 21.5 to 30–40 cm TL [6, 11]. Habitat: Benthic [12].
Adults—Age and size at first maturity: Off Sakhalin Island in Sea of Japan, both males and females mature between 30 and 40 cm TL [6] and, assuming fishes in Northwest Territories, Canada, have similar growth rates, at around 6 years. Males may be larger at age than females; however, females may be heavier at length than males [11]. Maximum age: 6 years for males and 14 years for females in Northwest Territories [11]. Maximum size: 70 cm SL. Habitat: Benthic [1–3, 6, 8].
Substrate—Sand, silt, or mud [1, 6, 8].
Physical/chemical—Temperature: 2.4–15.0 °C [4]. Salinity: Marine and brackish water (as low as 8 ppt) [6, 8].



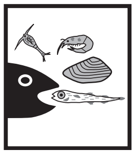
Behavior
Diel—Unknown.
Seasonal—Unknown.
Reproductive—Mature fish may move into shallow waters to spawn [6]. In general, prickleback adults brood their eggs [10].
Schooling—A non-schooling species [6].
Feeding—Feeds on bottom and occasionally in water column [13].



Populations or Stocks
There have been no studies.



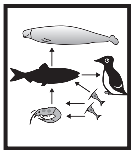
Reproduction
Mode—Oviparous [10].
Spawning season—Likely September off the Northwest Territories, Canada [13]. In Sea of Japan off Sakhalin Island, Russia, fish in post-spawning condition were observed June and July [6].
Fecundity—Unknown.



Food and Feeding

Food items—Primarily amphipods, oligochaetes, and polychaetes, and the occasional clam, copepod, mysids, snail, fish egg, and fish in Canadian Arctic [14, 15].

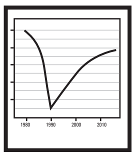
Trophic level—3.1 standard error 0.31 [16].



Biological Interactions

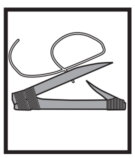
Predators—Off Kamchatka Peninsula, Russia, they are eaten by Great and Plain Sculpins [17].

Competitors—Unknown. Although likely other benthic species, such as smaller sculpins, eelpouts, and flatfishes.



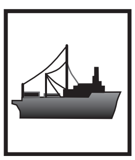
Resilience

Very low, minimum population doubling time: more than 14 years (Preliminary *K* or Fecundity) [16].



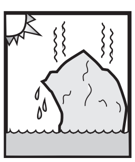
Traditional and Cultural Importance

None reported.



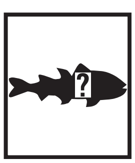
Commercial Fisheries

Currently, Blackline Prickleback are not commercially harvested.



Potential Effects of Climate Change

Blackline Prickleback are a predominantly Boreal species with an affinity for brackish waters, and could become more abundant in or expand into the U.S. Chukchi and Beaufort Seas as Arctic Ocean temperatures increase and the water freshens from increased ice melting.



Areas for Future Research [B]

Little is known about the ecology of this species. In particular, basic life history and habitat information is lacking; however, the species distribution and abundance in the region is limited, thus a need for directed studies is unwarranted at the present time.

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Mecklenburg, C.W., Mecklenburg, T.A., and Thorsteinson, L.K., 2002, Fishes of Alaska: Bethesda, Maryland, American Fisheries Society, 1,116 p. [1]

Mecklenburg, C.W., Møller, P.R., and Steinke, D., 2011, Biodiversity of Arctic marine fishes—Taxonomy and zoogeography: Marine Biodiversity, v. 41, no. 1, p. 109–140, Online Resource 1. [3]

Ratynski, R.A., 1983, Mid-summer ichthyoplankton populations of Tuktoyaktuk Harbor, N.W.T.: Canadian Technical Report of Fisheries and Aquatic Sciences, no.1218, 21 p. [11]

Shchetinnikov, A.S., 1983, Nutrition of *Acantholumpenus mackayi* (Stichaeidae) in the Gulf of Terpenium (Sakhalin Island): Journal of Ichthyology, v. 23, no. 6, p. 155–158. [6]

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Stout Eelblenny (*Anisarchus medius*)

(Reinhardt, 1837)

Family Stichaeidae

Stout Eelblenny (*Anisarchus medius)*, 129 mm TL, Chukchi Sea, 2004. Photograph by C.W. Mecklenburg, Point Stephens Research.

Colloquial Name: *None within U.S. Chukchi and Beaufort Seas.*

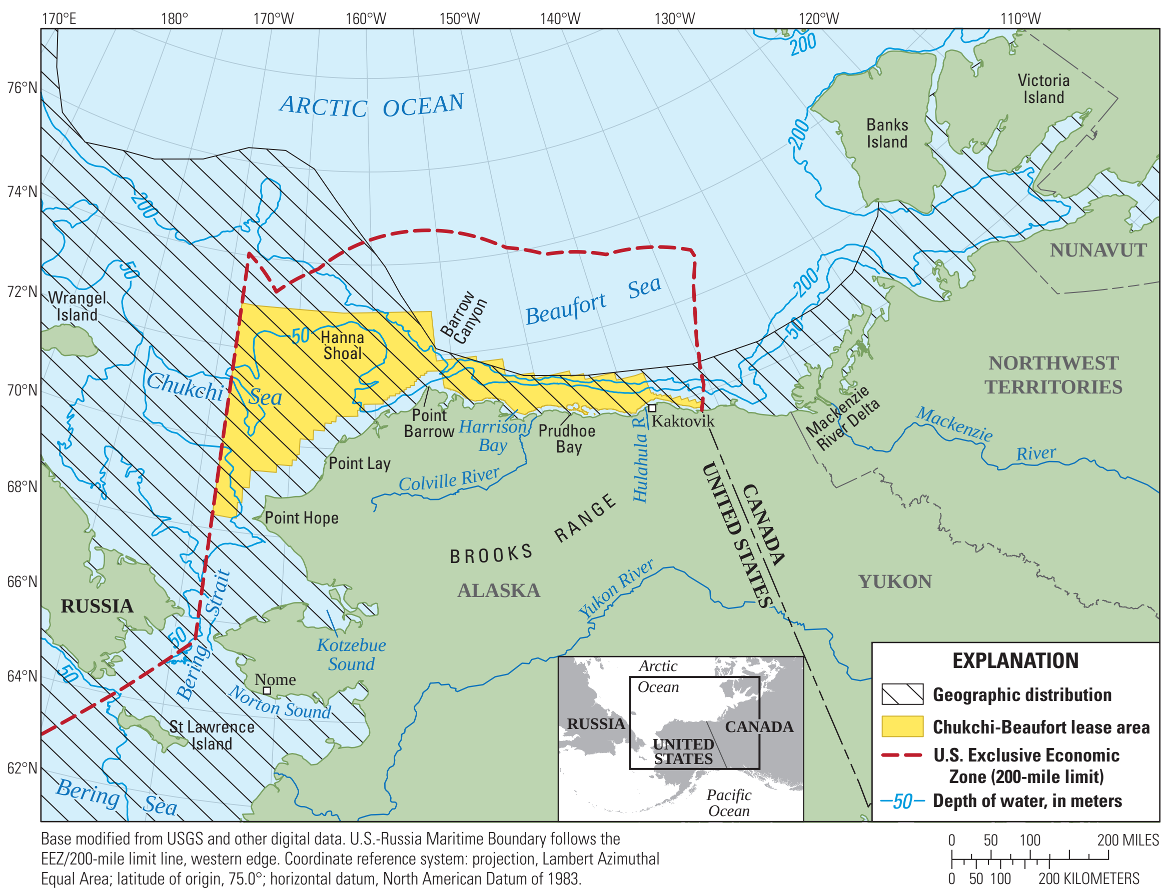
Ecological Role: Although this species has not been reported in the stomach contents of other organisms, its abundance in the U.S. Chukchi Sea and food habits observations elsewhere (for example, Black Guillemots in Hudson Bay) suggests this species could be of modest importance in regional food webs.

Physical Description/Attributes: Elongate, compressed, slightly eel-like body colored creamy white, yellowish or reddish, marked with darker spots. Dorsal fin has oblique brownish orange bars and caudal fin is finely banded. For specific diagnostic characteristics, see *Fishes of Alaska* (Mecklenburg and others, 2002, p. 758) [1]. Swim bladder: Absent [2]. Antifreeze glycoproteins in blood serum: Unknown.

Range: *U.S. Chukchi Sea and Beaufort Seas, northward to the shelf edge and a little beyond* [3–5]. Elsewhere in Alaska, in Bering Sea and Gulf of Alaska. Worldwide, nearly circumpolar in the Arctic Ocean, also found from southern Greenland to the Gulf of St. Lawrence, the Barents Sea and along Siberian coasts to the Tatar Strait (northern Sea of Japan) and Sea of Okhotsk [4].

Relative Abundance: Common in western Chukchi Sea [3, 7] *and U.S. Chukchi Sea in some years* [5]. *Abundance in U.S. Beaufort Sea is unknown.* Common in eastern Bering Sea [8] but rare in Sea of Japan [9]**.**

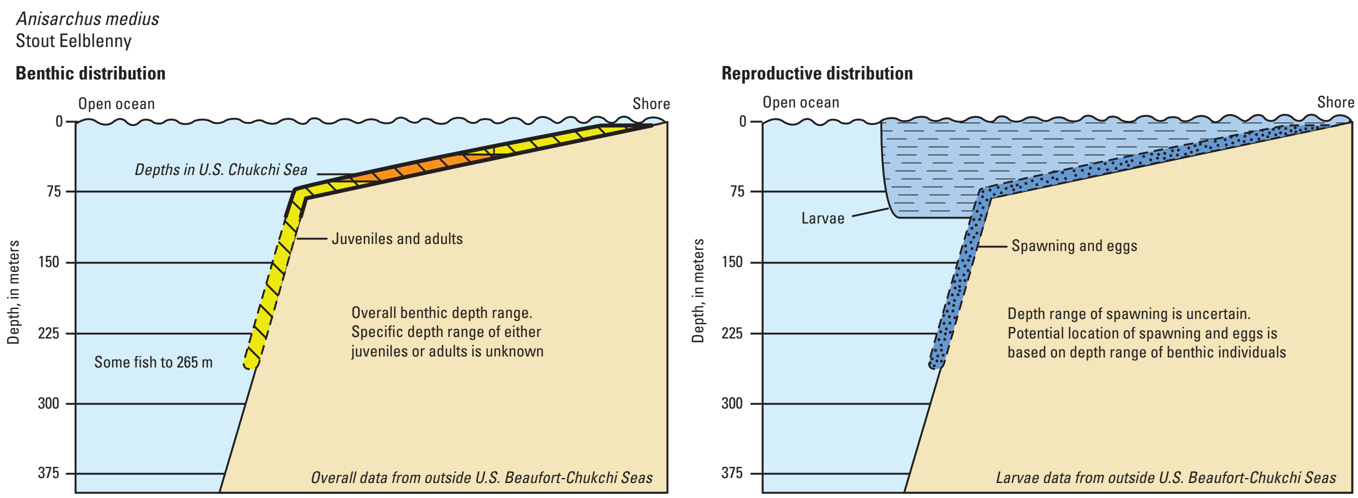
Stout Eelblenny
Anisarchus medius



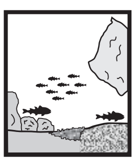
Base modified from USGS and other digital data. U.S.-Russia Maritime Boundary follows the EEZ/200-mile limit line, western edge. Coordinate reference system: projection, Lambert Azimuthal Equal Area; latitude of origin, 75.0°; horizontal datum, North American Datum of 1983.

Geographic distribution of Stout Eelblenny (*Anisarchus medius*) within Arctic Outer Continental Shelf Planning Areas [6] based on review of published literature and specimens from historical and recent collections [1, 3–5].

Depth Range: *From nearshore to 150 m, typically less than 100 m in Chukchi and Beaufort Seas* [1, 3, 5, 7, 10]. Intertidal to 265 m in the northern Sea of Okhotsk [11]. Off Kodiak Island, Gulf of Alaska, larvae were found in 10–90 m of water during day and night [12].

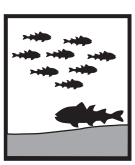


Benthic and reproductive distribution of Stout Eelblenny (*Anisarchus medius*).



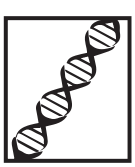
Habitats and Life History

Eggs—Size: Unknown. Time to hatching: Unknown. Habitat: Benthic and adhesive [13].
Larvae—Size at hatching: Unknown. Size at juvenile transformation: Unknown. Days to juvenile transformation: Unknown. Off Kodiak Island, larvae were taken from March to July with densities peaking in April [12]. Off Kamchatka Peninsula, Russia, larvae were taken in June [14]. Habitat: Pelagic [12].
Juveniles—Age and size: Unknown. Habitat: Benthic [15].
Adults—Age and size at first maturity: Unknown. Maximum age: Unknown. Maximum size: 18 cm TL [1]. Habitat: Benthic, coastal species [5]
Substrate—Sand and mud [3, 7, 15].
Physical/chemical—Temperature: *-1.8–7.9 °C* [3, 16], but may prefer temperatures near 0 °C [7, 15]. Salinity: Marine or brackish-water [3, 7, 15].



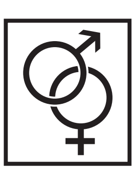
Behavior

Diel—Off Kodiak Island larvae were found in water column during day and night [12].
Seasonal—Unknown.
Reproductive—Unknown. In general, Stout Eelblenny adults brood their eggs [13].
Schooling—Unknown.
Feeding—Unknown.



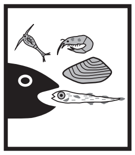
Populations or Stocks

There have been no studies.

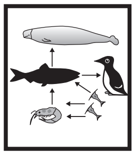


Reproduction

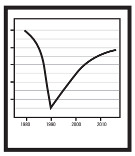
Mode—Oviparous.
Spawning season—Unknown.
Fecundity—Unknown.



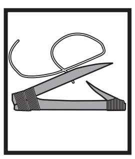
Food and Feeding
Food items—Primarily benthic prey such as polychaetes, bivalves, cumaceans, and amphipods [7].
Trophic level—3.22 standard error 0.36 [17].



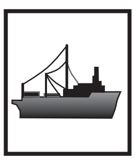
Biological Interactions
Predators—In Hudson Bay, Canada, they are eaten by Black Guillemots [18].
Competitors—Unknown, but likely include other small benthic fishes, such as snailfishes, flatfishes, sculpins, and other pricklebacks.



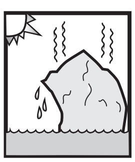
Resilience
Medium, minimum population doubling time: 1.4–4.4 years (Preliminary *K* or Fecundity) [17].



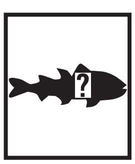
Traditional and Cultural Importance
None reported.



Commercial Fisheries
Currently, Stout Eelblenny are not commercially harvested.



Potential Effects of Climate Change
Stout Eelblenny are widely distributed in Boreal and Arctic waters. It is unclear how populations may shift in response to climate change or respond to marine ecosystem changes.



Areas for Future Research [B]
Little is known about the ecology of this species. In particular, research needs for this species in the study area include: (1) depth and location of pelagic larvae, (2) depth, location, and timing of young-of-the-year benthic recruitment, (3) preferred depth ranges for juveniles and adults, (4) spawning season, (5) seasonal and ontogenetic movements, (6) population studies, (7) prey, and (8) predators.

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Bearded Warbonnet (*Chirolophis snyderi*)

(Taranetz, 1938)

Family Stichaeidae

Bearded Warbonnet (*Chirolophis snyderi*), 122 mm TL, Chukchi Sea, 2010. Photograph by C.W. Mecklenburg, Point Stephens Research. The fish shown had been frozen and thawed before it was photographed, with consequent loss of color.

Note: *Except for geographic range data, all information is from areas outside of the study area.*

Colloquial Name: *None within U.S. Chukchi and Beaufort Seas.*

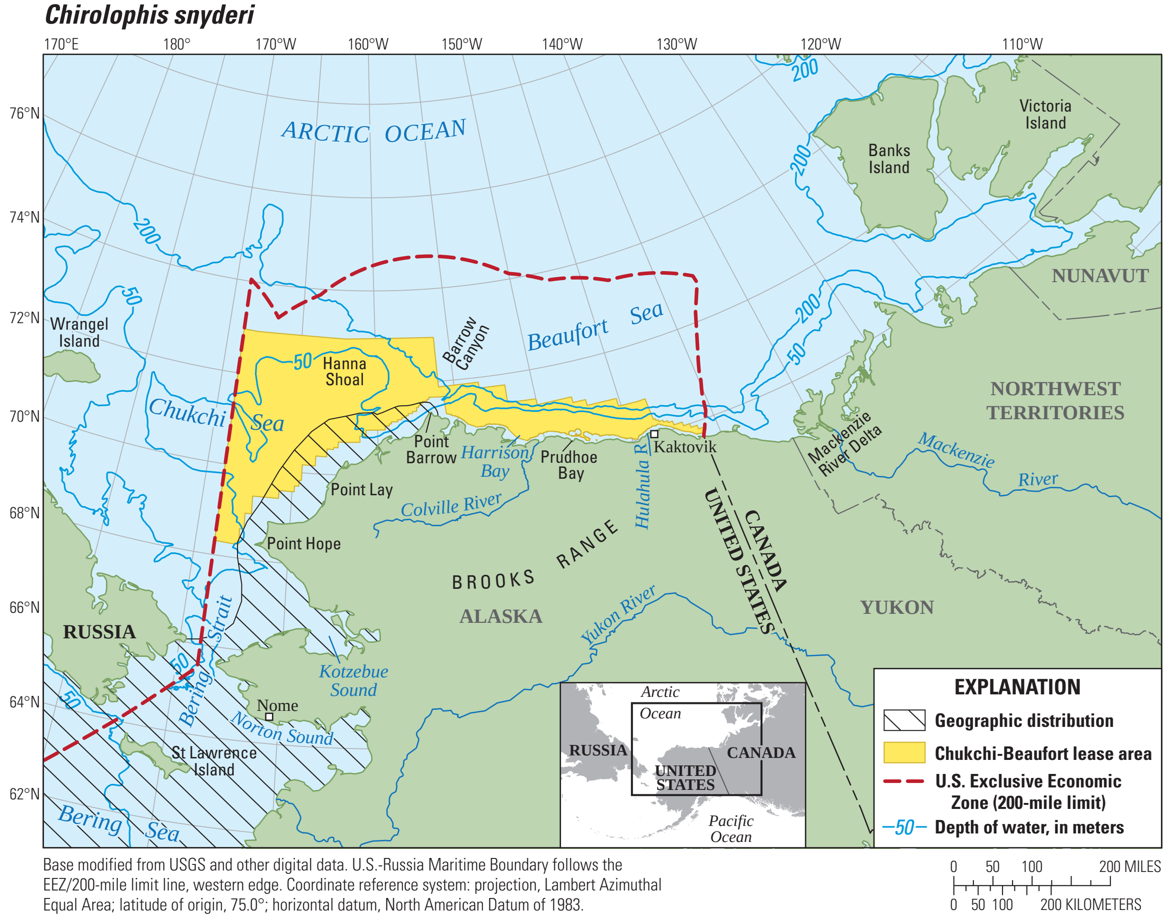
Ecological Role: Bearded Warbonnet are likely of minor ecological significance in the U.S. Arctic.

Physical Description/Attributes: Elongate, compressed, slightly eel-like body colored pinkish orange with lilac-red bands and vague spots on dorsal fins. For specific diagnostic characteristics, see *Fishes of Alaska* (Mecklenburg and others, 2002, p. 752) [1]. Swim bladder: Absent [2]. Antifreeze glycoproteins in blood serum: Unknown.

Range: *Point Barrow, Alaska* [6]. Elsewhere in Alaska, Bering Sea, Aleutian Islands west to Adak Island, and to northwestern Gulf of Alaska [4]. Worldwide, Sea of Okhotsk, west coast of Sakhalin Island, Russia (northern Sea of Japan), and Pacific coast of Hokkaido, Japan [1, 2, 4].

Relative Abundance: *Uncommon in U.S. Chukchi Sea, at least in offshore waters typically sampled, documented by single voucher specimens from five locations* [6]. Possibly common in shallower, nearshore waters, although uncommon north and rare south of the Alaska Peninsula [1].

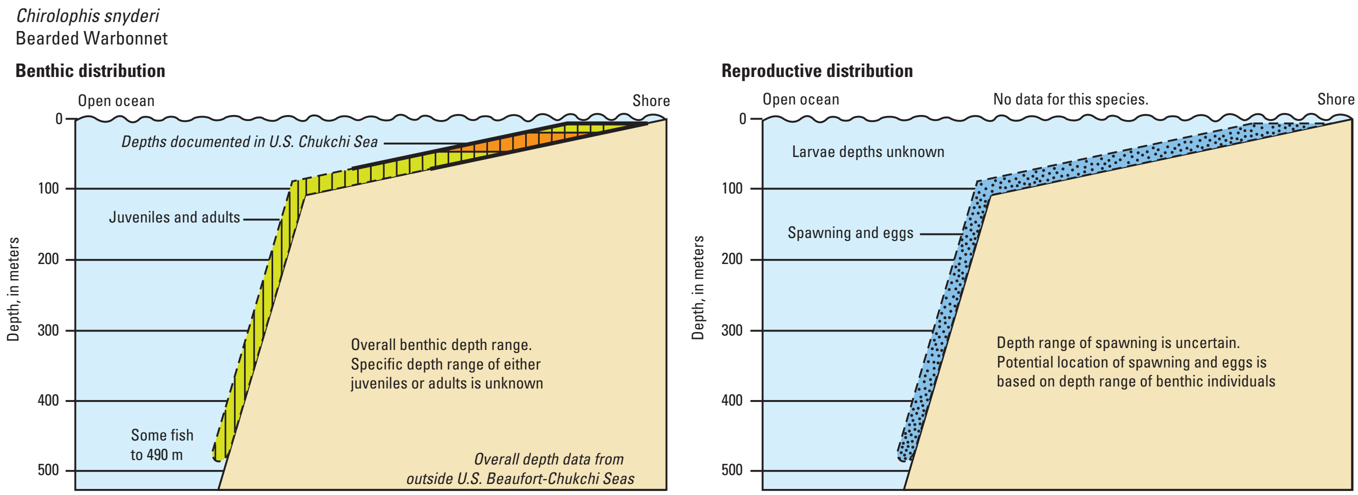
Bearded Warbonnet
Chirolophis snyderi



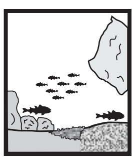
Base modified from USGS and other digital data. U.S.-Russia Maritime Boundary follows the EEZ/200-mile limit line, western edge. Coordinate reference system: projection, Lambert Azimuthal Equal Area; latitude of origin, 75.0°; horizontal datum, North American Datum of 1983.

Geographic distribution of Bearded Warbonnet (*Chirolophis snyderi*) within Arctic OCS Planning Areas [5] based on review of literature and specimens from historical and recent collections [1, 3, 6].

Depth Range: 3–490 m, typically nearshore and less than 70 m [2]. *The five known records from U.S. Chukchi Sea are from 17 to 46 m* [6].

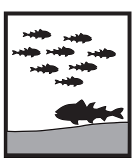


Benthic and reproductive distribution of Bearded Warbonnet (*Chirolophis snyderi*).



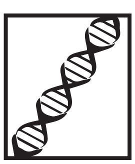
Habitats and Life History

Eggs—Size: Unknown. Time to hatching: Unknown. Habitat: Benthic and adhesive [7].
Larvae—Size at hatching: Unknown. Size at juvenile transformation: Unknown. Days to juvenile transformation: Unknown. Habitat: Unknown.
Juveniles—Age and size: Unknown. Habitat: Benthic [1].
Adults—Age and size at first maturity: Unknown. Maximum age: Unknown. Maximum size: To 41.7 cm TL [4]. Habitat: Benthic, coastal species [1].
Substrate—Soft and rocky bottoms [1].
Physical/chemical—Temperature: 2.4–10.6 °C [6]. Salinity: Unknown.



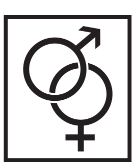
Behavior

Diel—Unknown.
Seasonal—Unknown.
Reproductive—Unknown. In general, warbonnet adults brood their eggs [7].
Schooling—Unknown.
Feeding—Unknown.



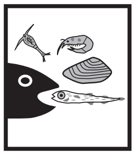
Populations or Stocks

There have been no studies.



Reproduction

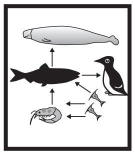
Mode—Oviparous[7].
Spawning season—Unknown.
Fecundity—Unknown.



Food and Feeding

Food items—Unknown. Likely, small benthic invertebrates [2].

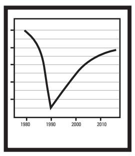
Trophic level—3.48 standard error 0.43 [8].



Biological Interactions

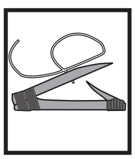
Predators—Unknown.

Competitors—Unknown, but likely to be other pricklebacks, as well as such diminutive benthic species as sculpins, snailfishes, and some eelpouts.



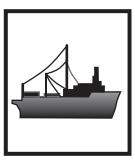
Resilience

Medium, minimum population doubling time: 1.4–4.4 years (Preliminary *K* or Fecundity) [8].



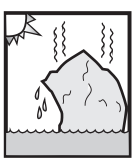
Traditional and Cultural Importance

None reported.



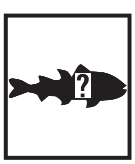
Commercial Fisheries

Currently, Bearded Warbonnet are not commercially harvested.



Potential Effects of Climate Change

Bearded Warbonnet, as a predominantly a Boreal Pacific species already having some presence in the Arctic marine environment [3], would be expected to increase in abundance and expand its distribution in the U.S. Chukchi and Beaufort Seas, wherever suitable shallow nearshore habitat occurs.



Areas for Future Research [B]

Limited information is available regarding the biology and ecology of this species in the U.S. Arctic. Research needs include: (1) depth and location of pelagic larvae, (2) depth, location, and timing of young-of-the-year benthic recruitment, (3) preferred depth ranges for juveniles and adults, (4) spawning season, (5) seasonal and ontogenetic movements, (6) population studies, (7) prey, and (8) predators.

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Mecklenburg, C.W., and Sheiko, B.A., 2004, Family Stichaeidae Gill 1864—Pricklebacks: California Academy of Sciences Annotated Checklists of Fishes no. 35, 36 p. [2]

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Fourline Snakeblenny (*Eumesogrammus praecisus*)

(Krøyer, 1836)

Family Stichaeidae

Fourline Snakeblenny (*Eumesogrammus praecisus*), 150 mm TL, Bering Strait, 2007. Photograph by C.W. Mecklenburg, Point Stephens Research.

Note: *Except for physical description, relative abundance, and geographic range data, all information is from areas outside of the study area.*

Colloquial Name: *None within U.S. Chukchi and Beaufort Seas.*

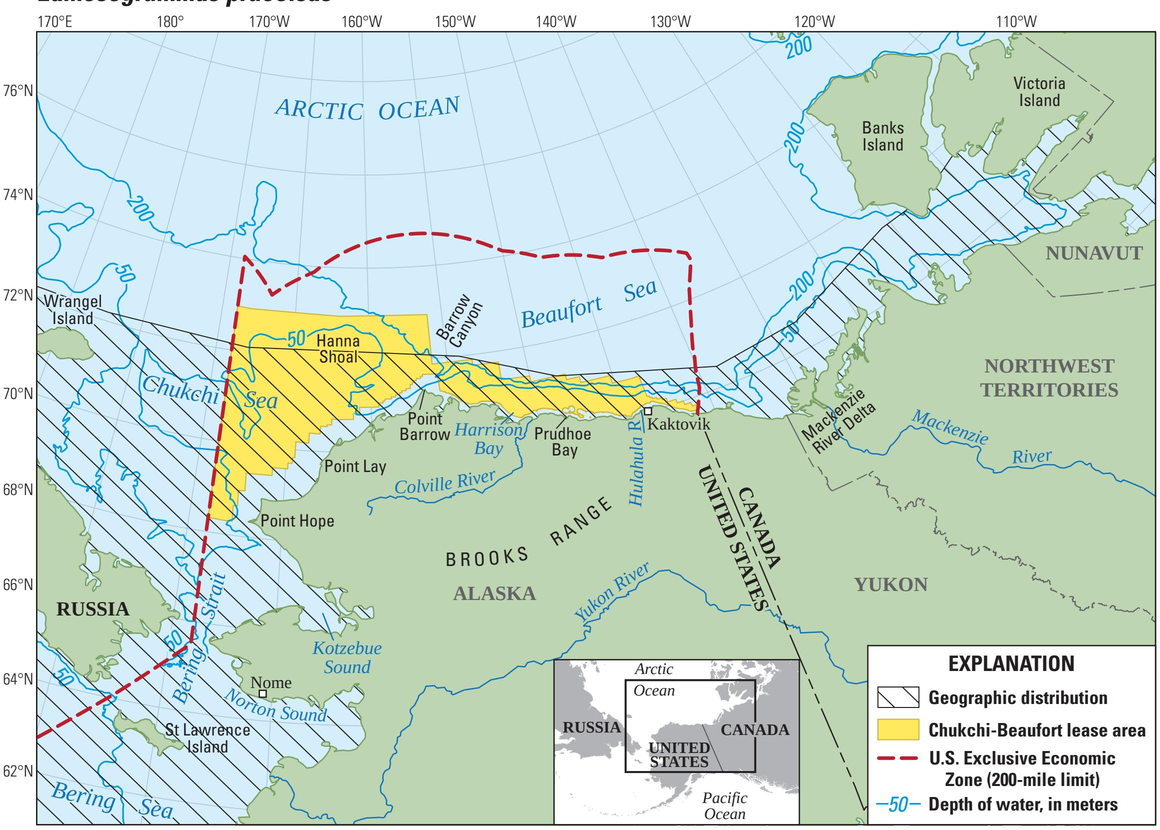
Ecological Role: Unknown, although its abundance in the U.S. Chukchi and western U.S. Beaufort Seas implies potential ecological significance in benthic ecosystems.

Physical Description/Attributes: Elongate, compressed, slightly eel-like chocolate brown to gray body with vague, darker bands; 1–3 black spots, often ringed with white, near front of dorsal fin. For specific diagnostic characteristics, see *Fishes of Alaska* (Mecklenburg and others, 2002, p. 746) [1]. Swim bladder: Absent [2]. Antifreeze glycoproteins in blood serum: Unknown.

Range: *U.S. Chukchi and Beaufort Seas* [3]. Elsewhere in Alaska, in northeastern Bering Sea. Worldwide, East Siberian Sea through North American Arctic to west Greenland and south to Sea of Okhotsk and Gulf of St. Lawrence [1, 3].

Relative Abundance: *Uncommon in U.S. Chukchi and Beaufort Seas* [5]. Common off northwest and southwest Greenland [3].

Fourline Snakeblenny
Eumesogrammus praecisus

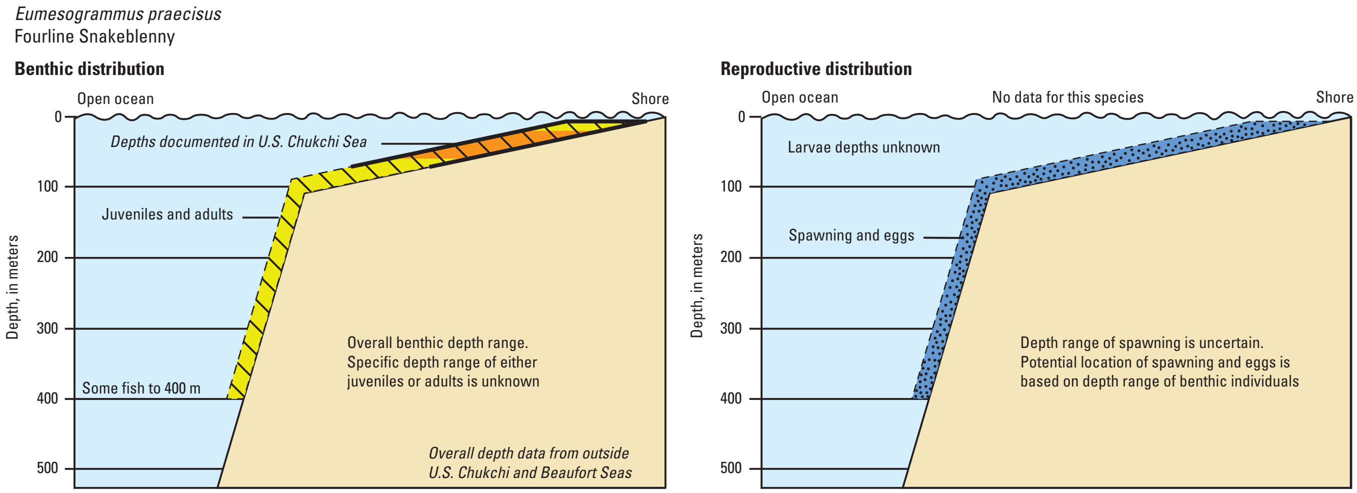


Base modified from USGS and other digital data. U.S.-Russia Maritime Boundary follows the EEZ/200-mile limit line, western edge. Coordinate reference system: projection, Lambert Azimuthal Equal Area; latitude of origin, 75.0°; horizontal datum, North American Datum of 1983.

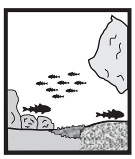
0 50 100 200 MILES
0 50 100 200 KILOMETERS

Geographic distribution of Fourline Snakeblenny (*Eumesogrammus praecisus*) within 2008–09 lease areas [4] based on review of published literature and specimens from historical and recent collections [1, 3, 5].

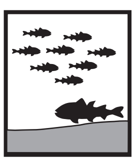
Depth Range: 5–6 m [5] to 400 m, typically less than 70 m [1–3]. *Taken in U.S. Chukchi Sea at 14–60 m* [5, 6] *and in U.S. Beaufort Sea at 183 m* [5].



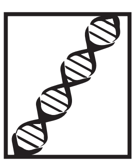
Benthic and reproductive distribution of Fourline Snakeblenny (*Eumesogrammus praecisus*).



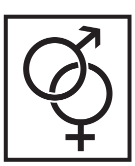
Habitats and Life History
Eggs—Size: Unknown. Time to hatching: Unknown. Habitat: Benthic and adhesive [6].
Larvae—Size at hatching: Unknown. Size at juvenile transformation: Unknown. Days to juvenile transformation: Unknown. Habitat: Unknown.
Juveniles—Age and size: Unknown. Habitat: Benthic [3].
Adults—Age and size at first maturity: Unknown. Maximum age: Unknown. Maximum size: 23 cm TL [1]. Habitat: Benthic [3]. Coastal algae-rock areas off Greenland [7].
Substrate—Sand or slightly silty bottom mixed with stones, pebbles, and gravel [1, 7].
Physical/chemical—Temperature: From -1.3–4 °C [5], to 2 °C or more in the Bering Sea [7]. Salinity: Marine [7].



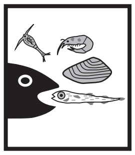
Behavior
Diel—Unknown.
Seasonal—Unknown.
Reproductive—In general, Fourline Snakeblenny adults brood their eggs [9].
Schooling—Unknown.
Feeding—Unknown.



Populations or Stocks
There have been no studies.



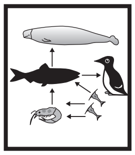
Reproduction
Mode—Oviparous [9].
Spawning season—Unknown.
Fecundity—Unknown.



Food and Feeding

Food items—Amphipods in Greenland [7]. Likely, small benthic invertebrates [2].

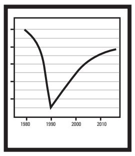
Trophic level—3.5 standard error 0.50 [10].



Biological Interactions

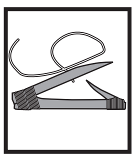
Predators—Black Guillemots in Hudson Bay [11].

Competitors—Unknown, but likely other small and benthic fishes, such as sculpins, snailfishes, and flatfishes.



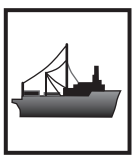
Resilience

Medium, minimum population doubling time: 1.4–4.4 years (Preliminary *K* or Fecundity) [10].



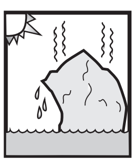
Traditional and Cultural Importance

None reported.



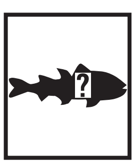
Commercial Fisheries

Fourline Snakeblenny are not commercially harvested currently.



Potential Effects of Climate Change

Fourline Snakeblenny reproduce in Arctic and Boreal Pacific waters and in the western North Atlantic. The species appears to be reestablishing a circumpolar distribution in response to long-term climate change (believed to be circumpolar in pre-Bering Land Bridge times) [3].



Areas for Future Research [B]

Little is known about the ecology of this species. Research needs include: (1) depth and location of pelagic larvae, (2) depth, location, and timing of young-of-the-year benthic recruitment, (3) preferred depth ranges for juveniles and adults, (4) spawning season, (5) seasonal and ontogenetic movements, (6) population studies, (7) prey, and (8) predators.

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Andriashev, A.P., 1954, Fishes of the northern seas of the U.S.S.R.—Keys to the fauna of the U.S.S.R.: Academy of Sciences of the U.S.S.R., Zoological Institute, no. 53, 566 p. [In Russian, translation by Israel Program for Scientific Translation, Jerusalem, 1964, 617 p., available from U.S. Department of Commerce, Springfield, Virginia.] [7]

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Daubed Shanny (*Leptoclinus maculatus*)

(Fries, 1838)

Family Stichaeidae

Daubed Shanny (*Leptoclinus maculatus*), 155 mm TL, Chukchi Sea, 2007. Photograph by C.W. Mecklenburg, Point Stephens Research.

Note: *Except for physical description, relative abundance, and geographic range data, all information is from areas outside of the study area*.

Colloquial Name: *None within U.S. Chukchi and Beaufort Seas*.

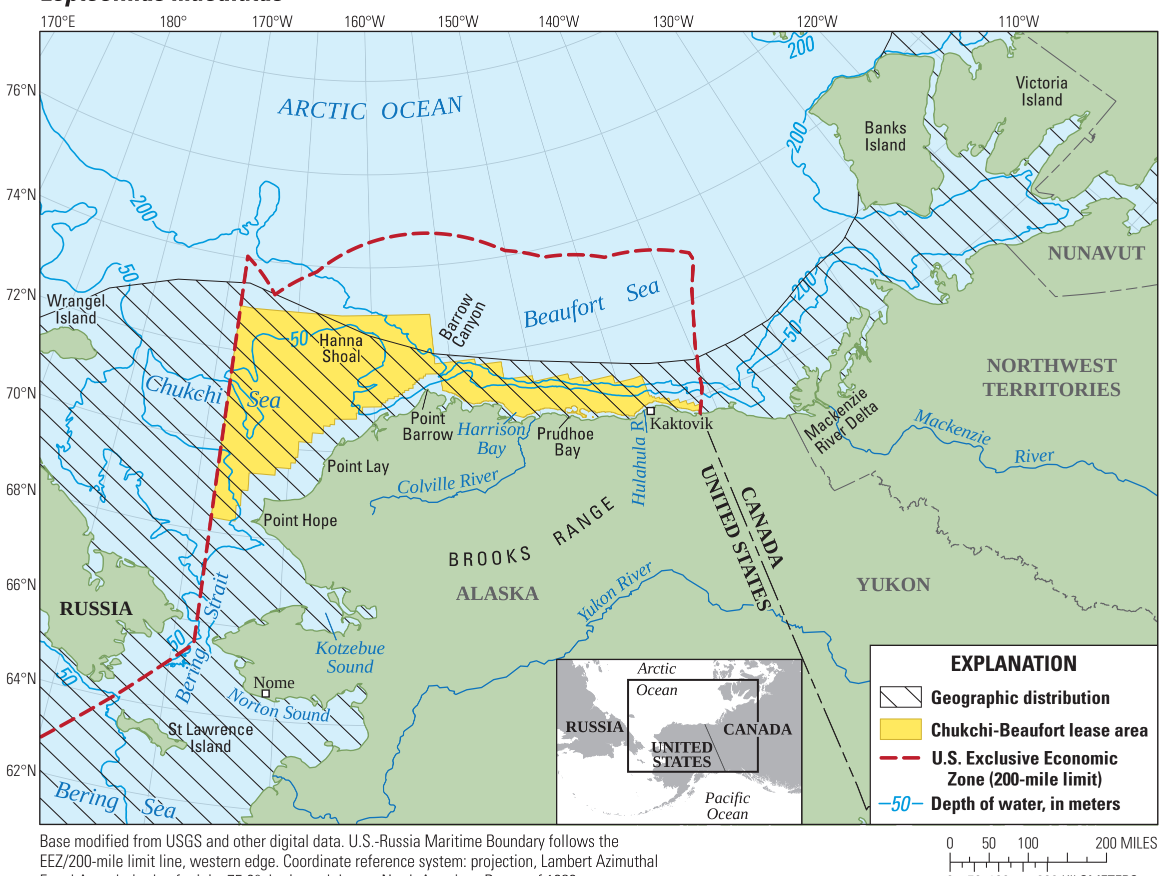
Ecological Role: Unknown, but its scarcity in the U.S. Arctic implies it is of minimal ecological importance.

Physical Description/Attributes: Elongate, compressed, slightly eel-like body colored creamy white to yellowish brown with dark blotches, including four or five blackish brown saddles. Dorsal fin has dark spots or oblique bars, the caudal fin has three to five narrow dark bands, and other fins are unmarked and yellowish [1]. For specific diagnostic characteristics, see *Fishes of Alaska* (Mecklenburg and others, 2002, p. 756) [1]. Swim bladder: Absent [2]. Antifreeze glycoproteins in blood serum: Present [3].

Range: *U.S. Chukchi and Beaufort Seas* [4]. Elsewhere in Alaska, from Bering Sea to Gulf of Alaska. Worldwide, from East Siberian and western (Russian) Chukchi Seas to Arctic Canada and southward to Sea of Okhotsk and Tatar Strait, Sea of Japan and Puget Sound, Washington. In the Atlantic Ocean, they also are found from Barents Sea, Svalbard Island and White Sea, Iceland and southward to southern Greenland, and Cape Cod, Massachusetts [4].

Relative Abundance: *Common in U.S. Chukchi and Beaufort Seas* [6]. Common in the eastern Bering Sea [7].

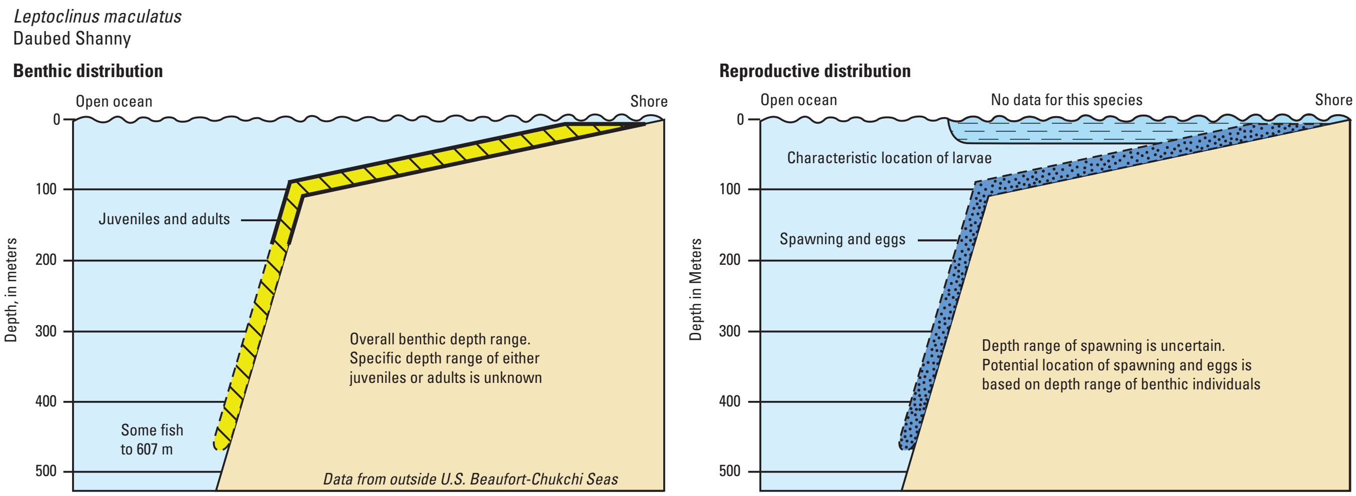
Daubed Shanny
Leptoclinus maculatus



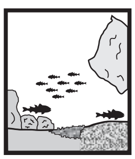
Base modified from USGS and other digital data. U.S.-Russia Maritime Boundary follows the EEZ/200-mile limit line, western edge. Coordinate reference system: projection, Lambert Azimuthal Equal Area; latitude of origin, 75.0°; horizontal datum, North American Datum of 1983.

Geographic distribution of Daubed Shanny (*Leptoclinus maculatus*) within Arctic OCS Planning Areas [5] based on review of literature and specimens from historical and recent collections [1, 4, 6].

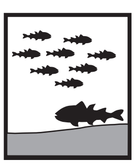
Depth Range: 2–773 m, usually less than 170 m [1, 4, 6], and possibly to 607 m [8]. Larvae were taken in near-surface waters off Kodiak Island [9]. May spawn in shallow waters [10].



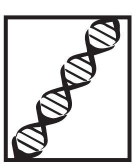
Benthic and reproductive distribution of Daubed Shanny (*Leptoclinus maculatus*).



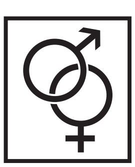
Habitats and Life History
Eggs—Size: 1.5 mm [3]. Time to hatching: Unknown. Habitat: Benthic and adhesive [3, 11].
Larvae—Size at hatching: Unknown. Size at juvenile transformation: 7–8 cm [3, 12] Days to juvenile transformation: 2–3 years [3]. Habitat: Pelagic [3]. Off Kodiak Island, larvae were taken from April to August, with highest densities in April [9].
Juveniles—Age and size: At least 2 years and 7 cm [3]. Habitat: Young juveniles are pelagic [3] and older juvenile are benthic [3, 4].
Adults—Age and size at first maturity: Unknown. Maximum age: Unknown. Maximum size: 22 cm TL [13]. Habitat: Benthic, soft and low-relief hard sea floors [1, 3, 4, 14].
Substrate—Mud, sand, or stone and pebble bottoms [1].
Physical/chemical—Temperature: -1.6–11.5 °C [6]. Salinity: Marine and slightly brackish (as low as 26 ppt) [14, 15].



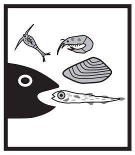
Behavior
Diel—Unknown.
Seasonal—Unknown.
Reproductive—May come into shallow waters to spawn [10]. In general, Daubed Shanny adults brood their eggs [11].
Schooling—Unknown.
Feeding—Unknown.



Populations or Stocks
There have been no studies.

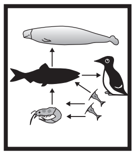


Reproduction
Mode—Oviparous [11].
Spawning season—Perhaps winter in Russia [14]. December–February in North Atlantic [16].
Fecundity—One female contained 970 eggs [14].



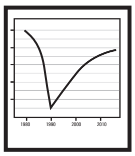
Food and Feeding

Food items—Small crustaceans and polychaetes [14]. Post-larval fish feed primarily on copepods [3].
Trophic level—3 standard error 0.00 [17].



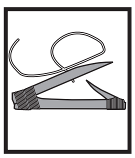
Biological Interactions

Predators—In Canadian Arctic waters, Daubed Shanny are eaten by Black Guillemots and Thick-billed Murres [18]. In the North Pacific and Bering Sea, predators include Arrowtooth Flounder, Kamchatka Flounder, Greenland Halibut, Pacific Cod, Arctic Cod, skates, Walleye Pollock, Steller sea lions, and seals [3, 19–24].
Competitors—Unknown, but likely other small, benthic fishes (for example, sculpins, snailfishes, eelpouts, and pricklebacks).



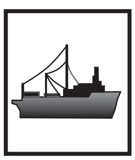
Resilience

Medium, minimum population doubling time: 1.4–4.4 years (Preliminary *K* or Fecundity) [17].



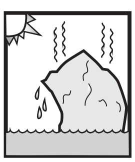
Traditional and Cultural Importance

None reported.



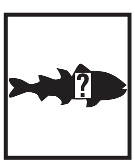
Commercial Fisheries

Currently, Daubed Shanny are not commercially harvested.



Potential Effects of Climate Change

Daubed Shanny have an Arctic-Boreal pattern of distribution. Populations are located in the North Pacific and North Atlantic Oceans. A possible effect of climate warming could be an increase in abundance of the species in Arctic seas as it reestablishes its former circumpolar Arctic distribution of pre-Bering Land Bridge times [3].



Areas for Future Research [B]

Little is known about the species from the region. Research needs include: (1) depth and location of pelagic larvae, (2) depth, location, and timing of young-of-the-year benthic recruitment, (3) preferred depth ranges for juveniles and adults, (4) spawning season, (5) seasonal and ontogenetic movements, (6) population studies, (7) prey, and (8) predators.

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Slender Eelblenny (*Lumpenus fabricii*)
Reinhardt, 1836

Family Stichaeidae

Slender Eelblenny (*Lumpenus fabricii*), 136 mm TL, Chukchi Sea, 2004. Photograph by C.W. Mecklenburg, Point Stephens Research.

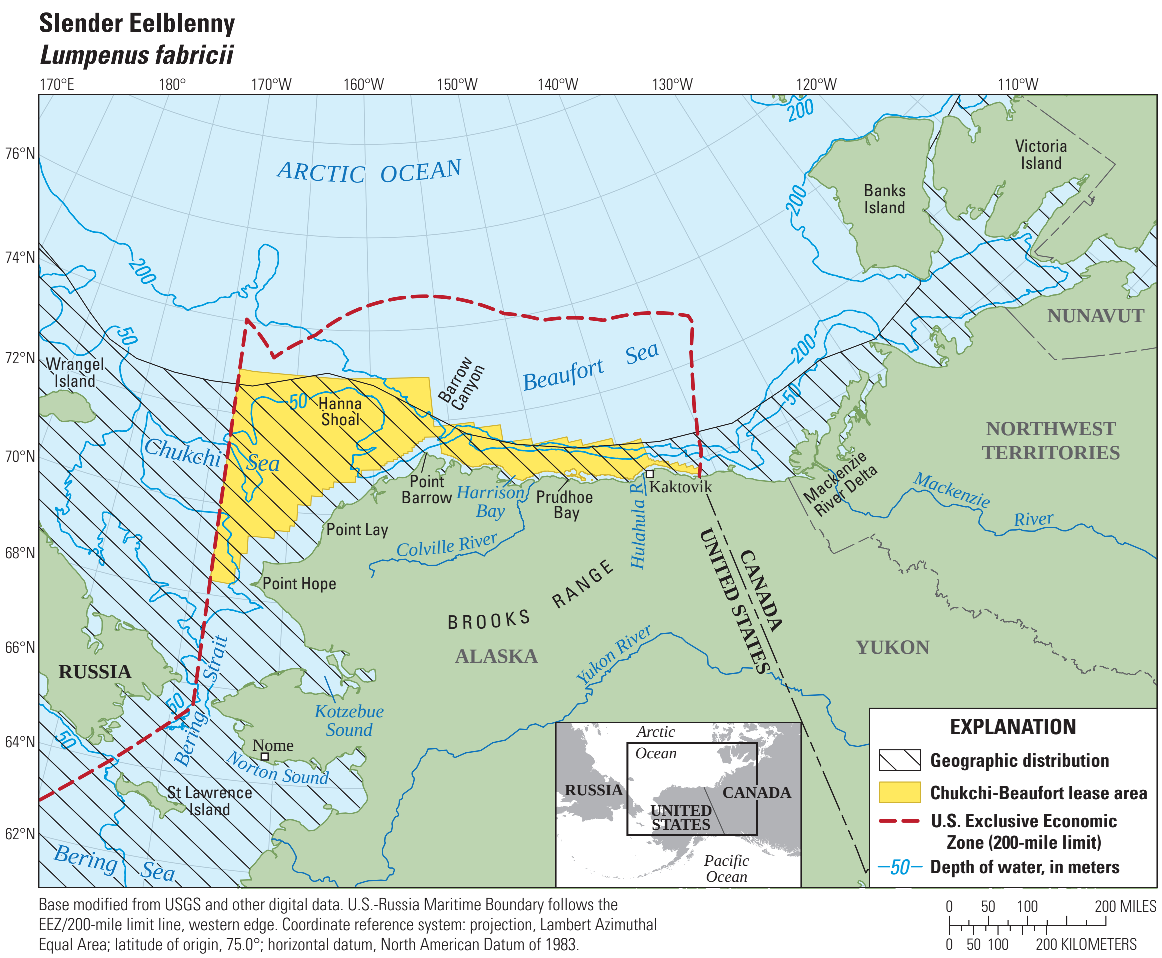
Colloquial Name: *None within U.S. Chukchi and Beaufort Seas.*

Ecological Role: Unknown in U.S. Chukchi and Beaufort Seas. However, this species is common in these waters and is important prey for seabirds, marine mammals, and fishes in other parts of its range.

Physical Description/Attributes: Elongate, compressed, eel-shaped tan or cream colored body with irregular brown blotches or broken diagonal bars extending from the back to the lower sides. For specific diagnostic characteristics, see *Fishes of Alaska* (Mecklenburg and others, 2002, p. 759) [1]. Swim bladder: Absent [2]. Antifreeze glycoproteins in blood serum: Unknown.

Range: *U.S. Chukchi and Beaufort Seas* [1, 3]. Elsewhere in Alaska, from eastern Bering Sea to Auke Bay, Alaska, in the eastern Gulf of Alaska [1] and Unalaska Island in the Aleutian Islands [4]. Worldwide, from the Barents Sea, eastward across Siberia and Arctic North America to western Greenland and south to Nova Scotia and southward in Pacific Ocean to western Bering Sea (off Pavla and Nataliya Bays) and northern Sea of Okhotsk; not in the eastern North Atlantic and Canadian High Arctic archipelago [3, 4].

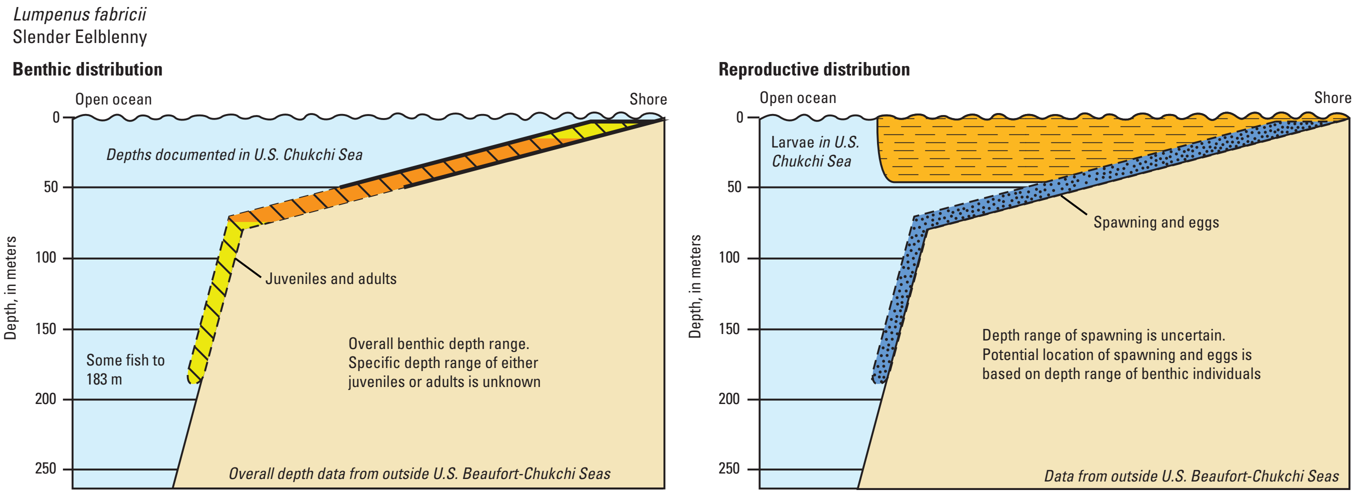
Relative Abundance: *Common throughout central and eastern U.S. Chukchi Sea, and U.S. Beaufort Sea* [6–9]. Common in Canadian Beaufort Sea at least as far eastward as Tuktoyaktuk Harbor, Yukon Territory, Canada, [10] and in eastern Bering Sea [11]. Uncommon in Gulf of Alaska [12].



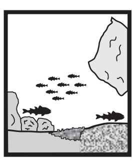
Base modified from USGS and other digital data. U.S.-Russia Maritime Boundary follows the EEZ/200-mile limit line, western edge. Coordinate reference system: projection, Lambert Azimuthal Equal Area; latitude of origin, 75.0°; horizontal datum, North American Datum of 1983.

Geographic distribution of Slender Eelblenny (*Lumpenus fabricii*) within Arctic Outer Continental Shelf Planning Areas [5] based on review of published literature and specimens from historical and recent collections [1, 3, 4].

Depth Range: From subtidal to 183 m, typically less than 50 m; rarely intertidal [12–14]. Primarily inhabits the inner continental shelf [12]. *Taken in U.S. Chukchi Sea at less than 14–72 m* [6, 9, 13]. Pelagic larvae were found between surface and 48 m in western Chukchi Sea [13].



Benthic and reproductive distribution of Slender Eelblenny (*Lumpenus fabricii*).



Habitats and Life History

Eggs—Size: Unknown. Time to hatching: Unknown. In James Bay, eastern Arctic Canada, eggs are reported to hatch in May and June [15]. Habitat: Benthic [14].

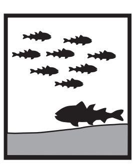
Larvae—Size at hatching: Unknown. Size at juvenile transformation: Unknown. Days to juvenile transformation: Unknown. Habitat: Pelagic [13].

Juveniles—Age and size: Unknown. *Juveniles as small as 50 mm TL have been taken in bottom trawls* [6]. Habitat: Pelagic to benthic [1, 3, 13].

Adults—Age and size at first maturity: Unknown. One Kara Sea female with ripe eggs was 16.4 cm [14]. Maximum age: 17 years [10]. Maximum size: 36.5 cm TL [1]. Males may be larger at age (particularly in older fish) and may live longer [10]. Habitat: Benthic [1, 3], fish as large as 20.9 cm TL have been taken in water column [16]. Substrate-oriented, living among eelgrass, in algal beds, over rocky reefs [17, 18], and on relatively featureless seafloors of rock, sand, mud, and even anoxic mud [9].

Substrate—Rock, sand, mud, and *mixed bottoms* [9, 17, 18].

Physical/chemical—Temperature: *-1.8–15.6 °C* [9, 17]. Salinity: Marine and estuarine (to as low as 12 ppt [19, 20].



Behavior

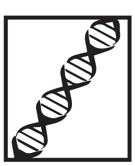
Diel—Unknown.

Seasonal—Unknown**.**

Reproductive—Lays its eggs among algae [14]. In general, adults of the Stichaeidae family brood their eggs [21].

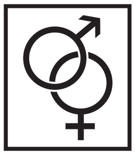
Schooling—Unknown.

Feeding—Unknown.

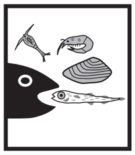


Populations or Stocks

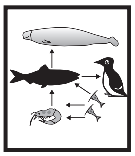
There have been no studies.



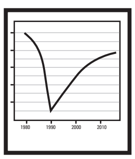
Reproduction
Mode—Oviparous.
Spawning season—Autumn in Russian Arctic and in southeastern Beaufort Sea [19, 22] and July off west Greenland [14].
Fecundity—One female contained 490 eggs [19].



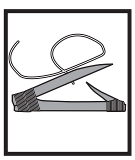
Food and Feeding
Food items—In southeastern Beaufort Sea, a diverse array of benthic and epibenthic prey including polychaetes, amphipods, snails, fish eggs, clam siphons, insects, bryozoans, and priapulids [23, 24].
Trophic level—3.28 standard error 0.37 [25].



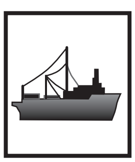
Biological Interactions
Predators—In the eastern Canadian, Arctic Cod, ringed seals, and Black Guillemots [26–28]. Elsewhere, Great and Plain Sculpins, Pacific Cod, Pacific Halibut, Starry Flounder, and Walleye Pollock [29–32].
Competitors—Unknown, but likely many small, benthic fishes (for example, sculpins, snailfishes, flatfishes, and pricklebacks).



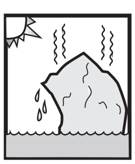
Resilience
Very low, minimum population doubling time: more than 14 years (Preliminary *K* or Fecundity) [25].



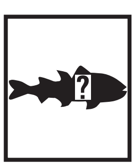
Traditional and Cultural Importance
None reported.



Commercial Fisheries
Currently, Slender Eelblenny are not commercially harvested.



Potential Effects of Climate Change
Slender Eelblenny reproduce in Arctic and Boreal waters. Warming Arctic waters appear to be reestablishing the circumpolar distribution they perhaps enjoyed in pre-Bering Land Bridge times [3].



Areas for Future Research [B]
Little is known about the ecology of this species from the region. Research needs include: (1) depth and location of pelagic larvae, (2) depth, location, and timing of young-of-the-year benthic recruitment, (3) preferred depth ranges for juveniles and adults, (4) spawning season, (5) seasonal and ontogenetic movements, (6) population studies, (7) prey, and (8) predators.

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Snake Prickleback (*Lumpenus sagitta*)
Wilimovsky, 1956

Snake Prickleback (*Lumpenus sagitta*), 201 mm, northern Bering Sea, 2011. Photograph by C.W. Mecklenburg, Point Stephens Research.

Family Stichaeidae

Colloquial Name: *None within U.S. Chukchi and Beaufort Seas.*

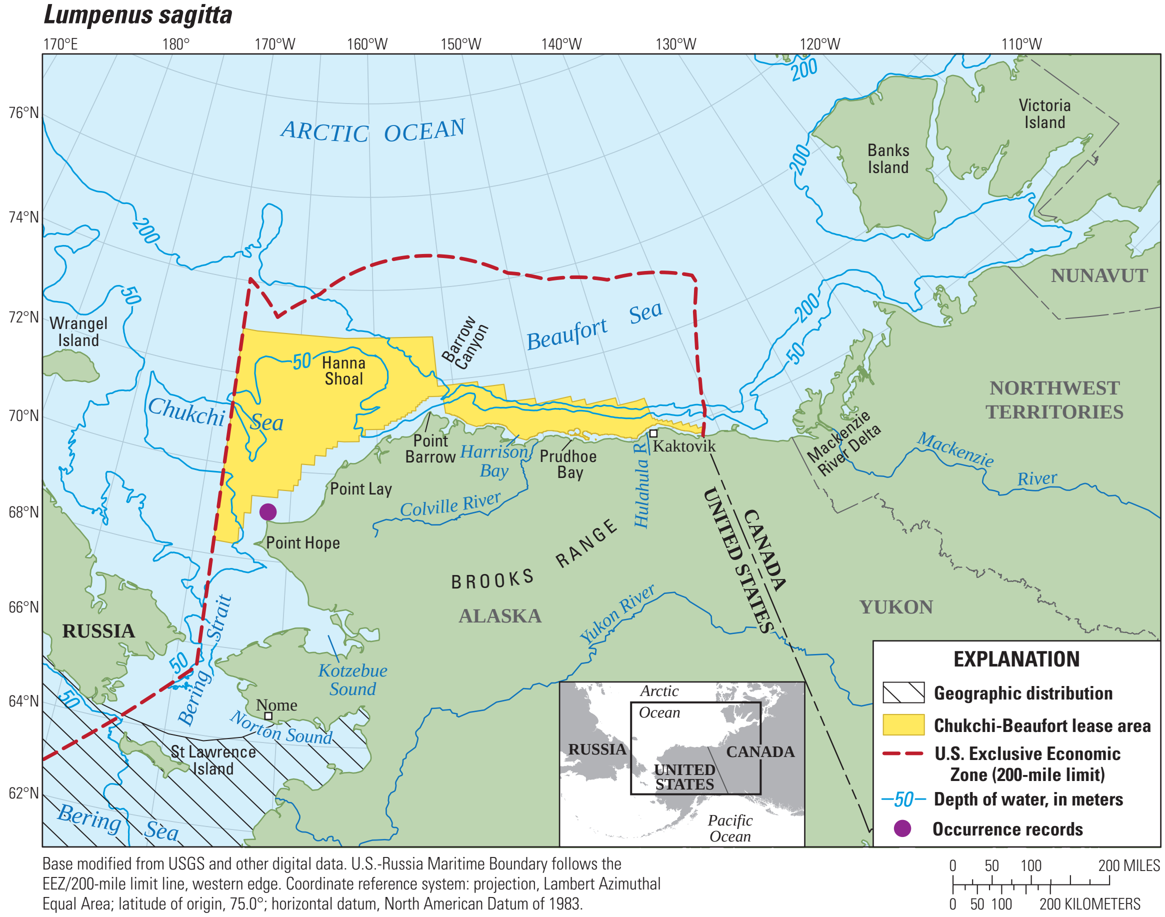
Ecological Role: Unknown. This species is known in the U.S. Chukchi Sea from only one record. It has not been reported from the Beaufort Sea. In these Arctic waters, it is replaced by the Slender Eelblenny (*L. fabricii*).

Physical Description/Attributes: Elongate, compressed, slightly eel-like body colored light green to tannish or gray dorsally and cream ventrally. Midbody has row of dark, dash-like or oval marks and upper body has small dark blotches or streaks. For specific diagnostic characteristics, see *Fishes of Alaska* (Mecklenburg and others, 2002, p. 760) [1]. Swim bladder: Absent [2]. Antifreeze glycoproteins in blood serum: Unknown.

Range: *One (uncertain) record from U.S. Chukchi Sea north of Cape Lisburne at 69°04'N, 166°12'W* [3, 4]. Elsewhere in Alaska, from Bering Sea to eastern Aleutian Islands and southeastern Gulf of Alaska. Worldwide, in Sea of Japan and Sea of Okhotsk to Commander Islands, Russia, and south to Humboldt Bay, northern California [1, 3].

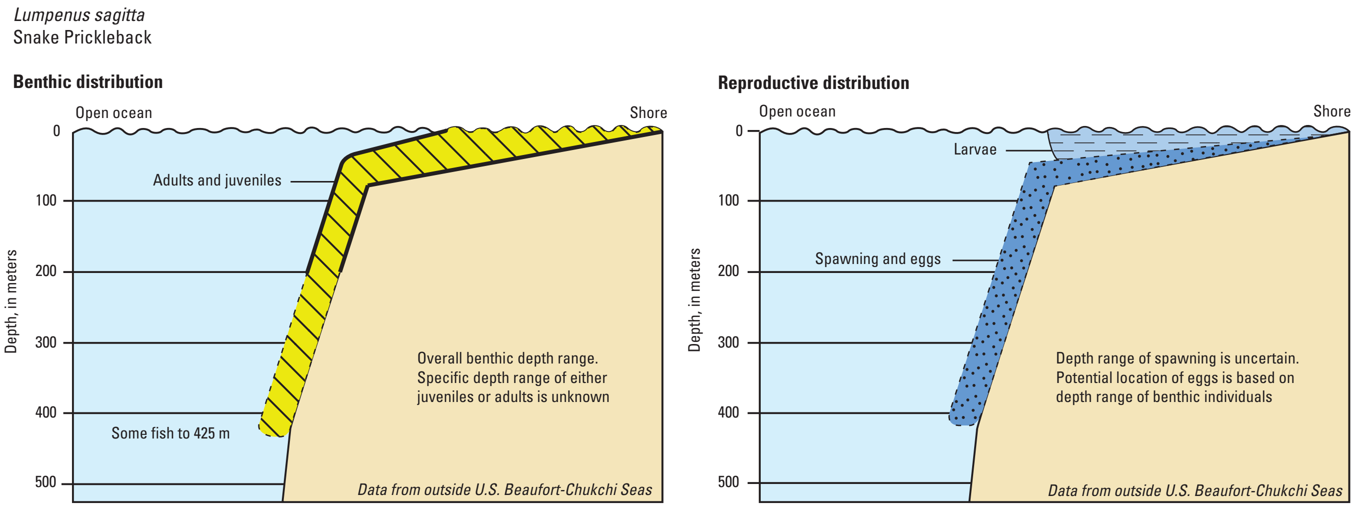
Relative Abundance: *If present, rare in U.S. Chukchi Sea* [3]. Common in southeastern Alaska [6]. Common in Sea of Japan [7].

Snake Prickleback
Lumpenus sagitta

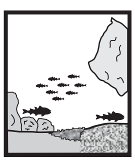


Geographic distribution of Snake Prickleback (*Lumpenus sagittal*) within Arctic Outer Continental Shelf Planning Areas [5] based on review of published literature and specimens from historical and recent collections [3, 4].

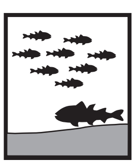
Depth Range: Nearshore at intertidal depths to 425 m [1, 3], typically shallower than 200 m [3]. Larvae are pelagic, in surface waters [8, 9].



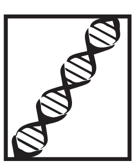
Benthic and reproductive distribution of Snake Prickleback (*Lumpenus sagittal*).



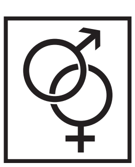
Habitats and Life History
Eggs—Size: Unknown. Time to hatching: Unknown. Larvae have been taken as early as February in Gulf of Alaska [8]. Habitat: Likely benthic [8].
Larvae—Size at hatching: 5 mm [10]. Size at juvenile transformation: 48–52 mm SL [10, 11]. Days to juvenile transformation: Unknown. Habitat: Pelagic [8, 9].
Juveniles—Age and size: Habitat: Benthic, among eelgrass, kelp, and bare bottoms [1, 3, 6].
Adults—Age and size at first maturity: Unknown. Maximum age: Unknown. Maximum size: 51 cm TL [1]. Habitat: Benthic, shelf species [1], among eelgrass, kelp, and over bare bottoms [3, 6, 8].
Substrate—Sand and mud bottoms, sometimes with small pebbles or broken shells, and cobble [11, 12].
Physical/chemical—Temperature: Unknown. Salinity: Nearly fresh water to marine [13].



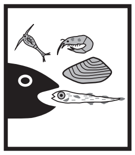
Behavior
Diel—Unknown.
Seasonal—Migrates into shallow waters in summer and early autumn off British Columbia, Canada [14].
Reproductive—Unknown. In general, adult prickleback brood their eggs [15].
Schooling—Unknown.
Feeding—Mostly benthic feeder [16].



Populations or Stocks
There have been no studies.



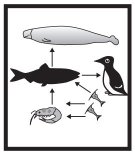
Reproduction
Mode—Oviparous [15].
Spawning season—Unknown.
Fecundity—Unknown.



Food and Feeding

Food items—Mainly benthic organisms. In Puget Sound and the Strait of Juan de Fuca, bivalves dominated, followed by tanaids and polychaetes, and then gammarids and harpacticoids [16]. Juveniles in the nearshore zone of Kodiak Island, Alaska, fed on polychaetes, gammarids, clam siphons, ostracods, and fish eggs [17]. Larval diets consist almost entirely of copepods [9]

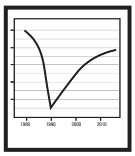
Trophic level—3.1 standard error 0.32 [18].



Biological Interactions

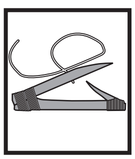
Predators—A wide variety of fishes including Pacific Halibut, Pacific Cod, Flathead Sole, Pacific Staghorn Sculpin, Okhotsk Snailfish, Chinook Salmon, Sand Sole, and Spotted Spiny Dogfish [19–24]; harbor and ribbon seals [25, 26]; and cormorants, pigeon guillemots, and common murres [27–29].

Competitors—Unknown, but likely to be various small benthic-feeding taxa, including other pricklebacks, sculpins, and flatfishes.



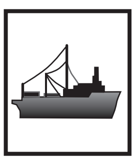
Resilience

Very low, minimum population doubling time: more than 14 years (Preliminary *K* or Fecundity) [18].



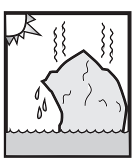
Traditional and Cultural Importance

None reported.



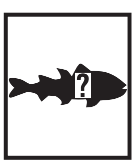
Commercial Fisheries

Currently, Snake Prickleback are not commercially harvested.



Potential Effects of Climate Change

The Snake Prickleback are predominantly a Boreal Pacific species. A northward shift if the species distribution could be expected.



Areas for Future Research [B]

Little is known about this species from the region. Research needs include: (1) depth and location of pelagic larvae, (2) depth, location, and timing of young-of-the-year benthic recruitment, (3) preferred depth ranges for juveniles and adults, (4) spawning season, (5) seasonal and ontogenetic movements, (6) population studies, (7) prey, and (8) predators.

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Arctic Shanny (*Stichaeus punctatus*)

(Fabricius, 1780)

Family Stichaeidae

Colloquial Name: *None within U.S. Chukchi and Beaufort Seas.*

Ecological Role: *Unknown in the U.S. Chukchi and Beaufort Seas.* In the eastern Bering Sea and Hudson Bay, they are preyed upon by Black Guillemots and Thick-billed Murres [1, 2].

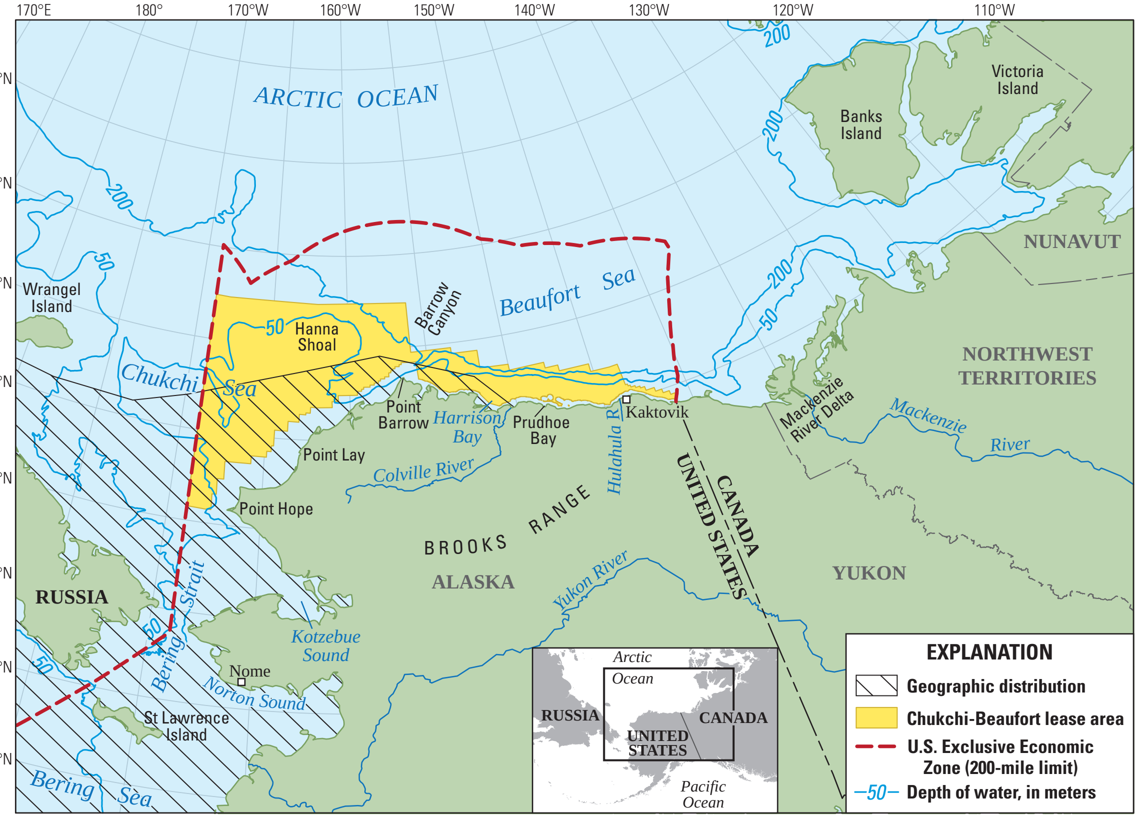
Arctic Shanny (*Stichaeus punctatus*), 105 mm, Chukchi Sea, 2009. Photograph by C.W. Mecklenburg, Point Stephens Research.

Physical Description/Attributes: Elongate, compressed, slightly eel-like body colored yellowish brown to bright scarlet with brown streaks and blotches. For specific diagnostic characteristics, see *Fishes of Alaska* (Mecklenburg and others, 2002, p. 747) [3]. Swim bladder: Absent [4]. Antifreeze glycoproteins in blood serum: Unknown.

Range: *U.S. Chukchi and Beaufort Seas* [5]. Found in all Alaskan marine waters. Worldwide, from East Siberian Sea through Canadian Arctic to west Greenland, southward to Okhotsk and Japan Seas, northern British Columbia, Hudson Bay, Gulf of St. Lawrence, and banks off Newfoundland and Nova Scotia to Gulf of Maine [5].

Relative Abundance: *Common in U.S. Chukchi and Beaufort Seas* [5, 8]. In Pacific region, common at least in Cook Inlet, eastern and northern Bering Sea, and in northern Sea of Okhotsk, [9–11].

Arctic Shanny
Stichaeus punctatus

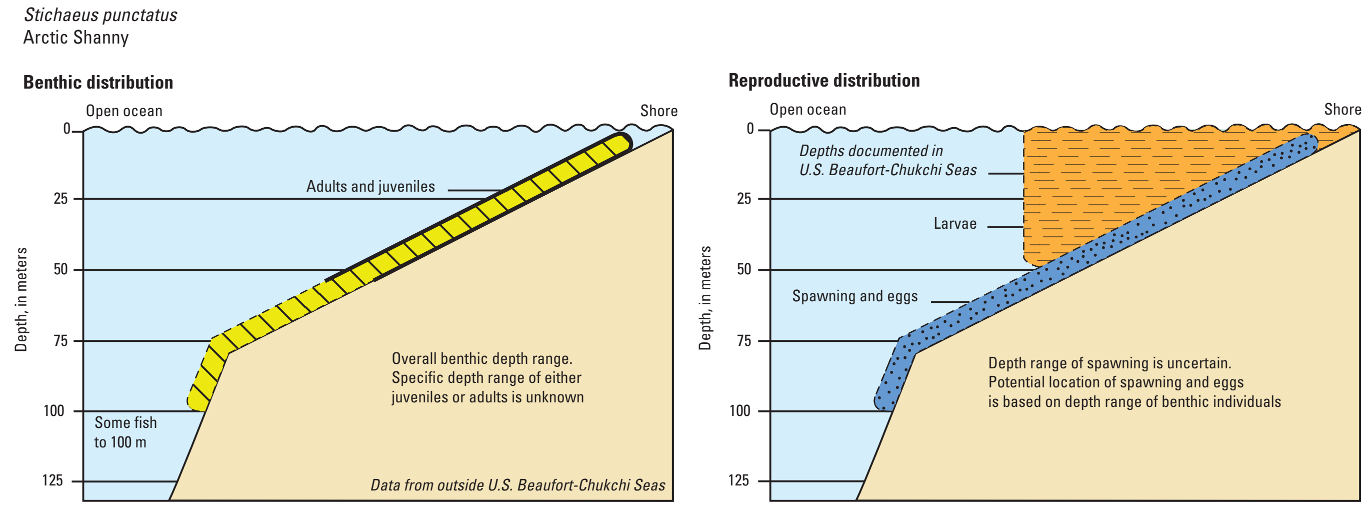


Base modified from USGS and other digital data. U.S.-Russia Maritime Boundary follows the EEZ/200-mile limit line, western edge. Coordinate reference system: projection, Lambert Azimuthal Equal Area; latitude of origin, 75.0°; horizontal datum, North American Datum of 1983.

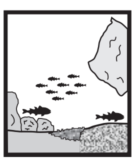
0 50 100 200 MILES
0 50 100 200 KILOMETERS

Geographic distribution of Arctic Shanny (*Stichaeus punctatus*) within Arctic Outer Continental Shelf Planning Areas [6] based on review of published literature and specimens from historical and recent collections [3, 5, 7].

Depth Range: Shallow subtidal to 100 m, typically less than 55 m [3, 4, 11, 12]. Larvae have been taken from the surface to 110 m [13]. *In U.S. Chukchi Sea, 3 pelagic larvae were collected between the surface and 48 m* [14].



Benthic and reproductive distribution of Arctic Shanny (*Stichaeus punctatus*).



Habitats and Life History

Eggs—Size: 1.7 mm [13]. Time to hatching: Unknown. Habitat: Benthic [13].

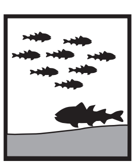
Larvae—Size at hatching: Unknown. Size at juvenile transformation: As small as 2.5–3.0 cm TL [15, 16]. Days to juvenile transformation: Unknown. Habitat: Pelagic [16].

Juveniles—Age and size: 2.5 to at least 11 cm [16]. Habitat: Benthic [3, 5], structure-covered, nearshore sea floors among eelgrass beds and understory kelps [15, 17–19].

Adults—Age and size at first maturity: Age unknown. A few mature at 11.0 cm SL [15]. Maximum age: 5 years [15]. Maximum size: 22 cm TL [3]. Habitat: Benthic [3, 5], structure-covered, nearshore sea floors and eelgrass beds [15, 17–19], as well as offshore [3, 11].

Substrate—In the northwest Atlantic Ocean, juveniles are found most often in pebble and fine cobble and adults in coarse cobble and boulders [15]. *In U.S. Chukchi Sea, juveniles and adults were collected on shell hash, gravel, rock, sand, and mud* [11].

Physical/chemical—Temperature: 1.4–10.5 °C [11, 20]. Salinity: Marine and, at least occasionally brackish waters [9, 15]. Collected from Bering Strait at salinities of 30.62–32.56 ppt [11].



Behavior

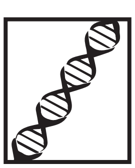
Diel—Off Newfoundland, Canada, juveniles are territorial, a behavior which appears to decrease with age [13].

Seasonal—*Larvae have been collected in August in U.S. Chukchi Sea* [14] and small larvae are present in Gulf of Alaska in spring [16]. Off Newfoundland, larger fish move into shallow waters in June and July and by November, most fish of all sizes appear to migrate out of those waters [13].

Reproductive—*Unknown*. In general, members of the Stichaeidae family brood their eggs [21].

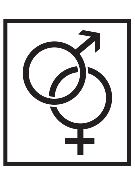
Schooling—Unknown.

Feeding—Unknown.



Populations or Stocks

There have been no studies.

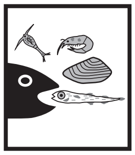


Reproduction

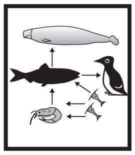
Mode—Oviparous.

Spawning season—Off Newfoundland, probably in mid-winter, perhaps in February and March [15].

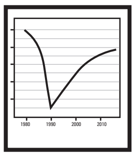
Fecundity—At least 1,624–2,475 eggs, based on two females taken off Newfoundland and off Greenland [15].



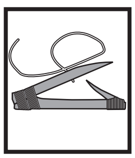
Food and Feeding
Food items—Off Newfoundland, fish up to 2 years feed on copepods, amphipods, and smaller quantities of polychaetes, isopods, mysids, and ostracods [15].
Trophic level—3.08 standard error 0.23 [22].



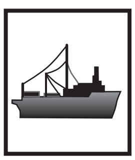
Biological Interactions
Predators—In eastern Bering Sea and Hudson Bay, Black Guillemots and Thick-billed Murres [1, 2].
Competitors—Unknown, but likely to be a range of small, benthic fishes, including various sculpins, flatfishes, and eelpouts.



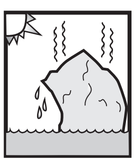
Resilience
Medium, minimum population doubling time: 1.4–4.4 years (*K*=0.24) [22].



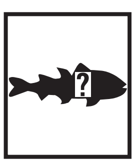
Traditional and Cultural Importance
None reported.



Commercial Fisheries
Currently, Arctic Shanny are not commercially harvested.



Potential Effects of Climate Change
Arctic Shanny reproduce in Arctic and Boreal Pacific waters. Changes in marine habitat conditions with climate warming may allow the species to reestablish the circumpolar distribution it is believed to have held in the past [5].



Areas for Future Research [B]
Little is known about the biology and ecology of this species from the region. Research needs include: (1) depth and location of pelagic larvae, (2) depth, location, and timing of young-of-the-year benthic recruitment, (3) preferred depth ranges for juveniles and adults, (4) spawning season, (5) seasonal and ontogenetic movements, (6) population studies, (7) prey, and (8) predators.

Remarks

Farwell and others (1976) [15] give a maximum age of 6 years. However, they labeled individuals that are less than 1 year old (young-of-the-year) as “1 year olds.” Thus, the three fish designated as 6 years old are actually age-5 fish.

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Banded Gunnel (*Pholis fasciata*)

(Bloch & Schneider, 1801)

Family Pholidae

Note: *Except for geographic range data, all information is from areas outside of the study area.*

Banded Gunnel (*Pholis fasciata*), 159 mm, eastern Bering Strait, 2004. Photograph by C.W. Mecklenburg, Point Stephens Research.

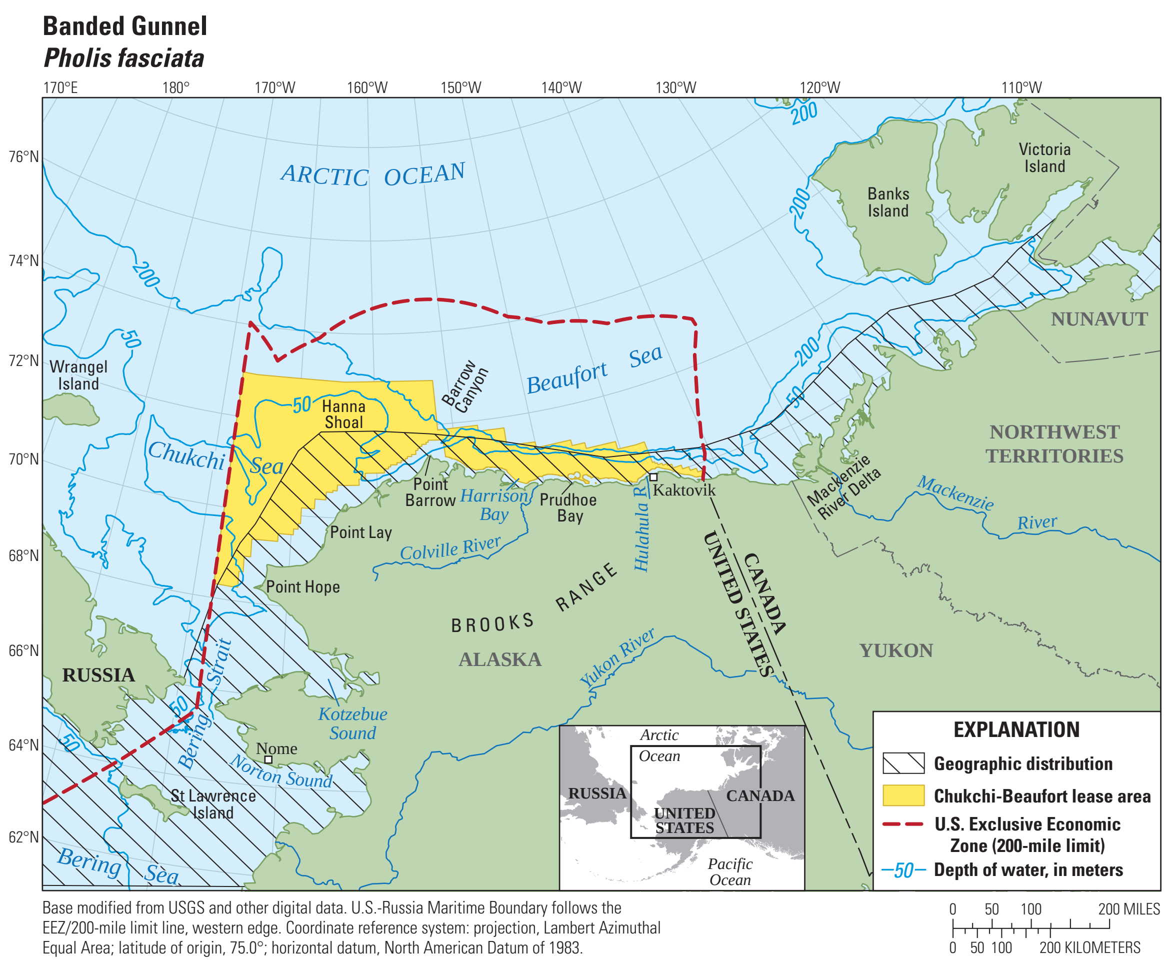
Colloquial Name: *None within U.S. Chukchi and Beaufort Seas.*

Ecological Role: Its apparent scarceness in the U.S. Chukchi and Beaufort Seas implies this species is of little ecological importance.

Physical Description/Attributes: Body elongate and strongly compressed. Bright reddish orange to greenish yellow with sinuous reddish black bands reaching the ventral surface, white blotches along the back and dorsal fin containing black spots [1]. For specific diagnostic characteristics, see *Fishes of Alaska* (Mecklenburg and others, 2002, p. 777) [1]. Swim bladder: Absent [1]. Antifreeze glycoproteins in blood serum: Unknown.

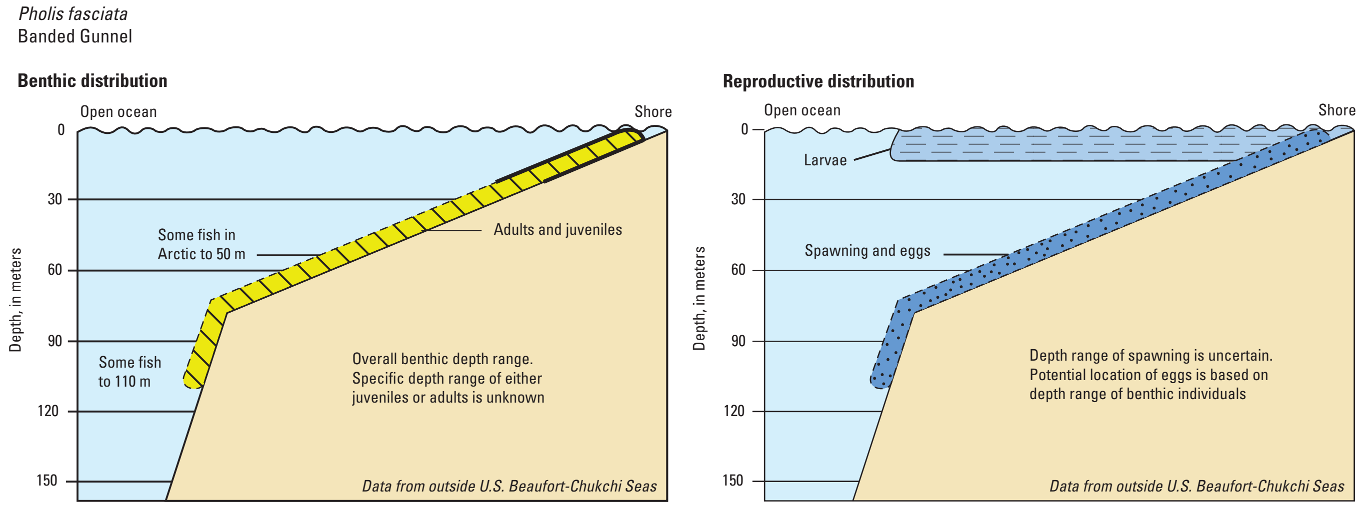
Range: *U.S. Chukchi Sea (and presumably U.S. Beaufort Sea* [4]. Elsewhere in Alaska, Bering Sea to western Gulf of Alaska at Kodiak Island. Worldwide, Canadian Beaufort Sea eastward to west Greenland, southward to Bay of Fundy and banks off Nova Scotia, and southward to Seas of Okhotsk and Japan [2].

Relative Abundance: *Occasional in U.S. Chukchi Sea. As yet, no records from the U.S. Beaufort Sea* [2]. Common off Greenland [5].

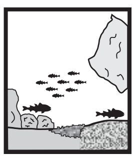


Geographic distribution of Banded Gunnel (*Pholis fasciata*) within Arctic Outer Continental Shelf Planning Areas [3] based on review of published literature and specimens from historical and recent collections [1, 2, 4].

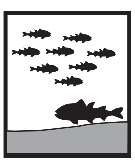
Depth Range: Shallow subtidal to 110 m [1, 5]. Less than 50 m in the Arctic Ocean, typically shallower than 20 m [1]. Documented in Bering Strait at 50 m [6, 7] Pelagic larvae were taken from 0 to 7 m in James Bay, Canada [8].



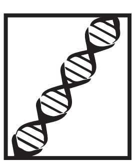
Benthic and reproductive distribution of Banded Gunnel (*Pholis fasciata*).



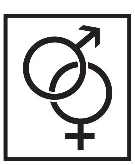
Habitats and Life History
Eggs—Size: Unknown. Time to hatching: Unknown. Habitat: Benthic, adhesive [9].
Larvae—Size at hatching: Unknown. Yolk-sac larvae taken in James Bay were 11–14 mm TL [8]. Size at juvenile transformation: Unknown. Days to juvenile transformation: Unknown. Habitat: Pelagic [9].
Juveniles—Age and size: Unknown. Habitat: Benthic, over rocky substrate and among clumps of algae [1].
Adults—Age and size at first maturity: Unknown. Maximum age: Unknown. Maximum size: 30 cm TL [1]. Habitat: Benthic, over rocky substrate and among clumps of algae [1].
Substrate—Sand, broken shell, gravel, and rock [1, 7].
Physical/chemical—Temperature: -1.0–10.5 °C [7, 8]. Salinity: Marine. Pelagic larvae were taken between 4.0 and 17.0 ppt [8].



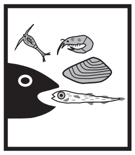
Behavior
Diel—Unknown.
Seasonal—Unknown.
Reproductive—Unknown. Gunnels in general tend to guard their eggs [9].
Schooling—Unknown.
Feeding—Unknown.



Populations or Stocks
There have been no studies.

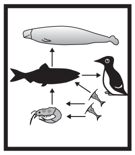


Reproduction
Mode—Oviparous [9].
Spawning season—May and early June in James Bay, Canada [8].
Fecundity—Unknown.



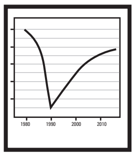
Food and Feeding

Food items—Unknown. Small crustaceans and mollusks for gunnels in general [10].
Trophic level—3.27 standard error 0.39 [11].



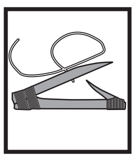
Biological Interactions

Predators—Black Guillemots in Hudson Bay in summer [12]. Sculpins, cods, other bottom fishes, and seabirds [13].
Competitors—Likely other microcarnivores, including sculpins, gunnels, and flatfishes.



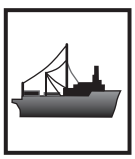
Resilience

Medium, minimum population doubling time: 1.4–4.4 years (Preliminary *K* or Fecundity) [11].



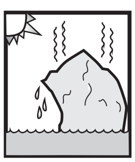
Traditional and Cultural Importance

None reported.



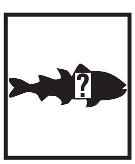
Commercial Fisheries

Currently, Banded Gunnel are not commercially harvested.



Potential Effects of Climate Change

Unknown.



Areas for Future Research [B]

Little is known about the ecology and life history of this species. Research needs include: (1) depth and location of pelagic larvae, (2) depth, location, and timing of young-of-the-year benthic recruitment, (3) preferred depth ranges for juveniles and adults, (4) spawning season, (5) seasonal and ontogenetic movements, (6) population studies, (7) prey, and (8) predators.

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