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Chapter 3g 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

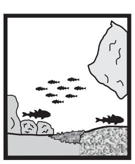
Relative abundance refers to the contribution a species makes to the total abundance of the fishery community. It is a measure that provides an index of the number of individuals present, but not the actual numbers. Relative abundance terms, such as “common,” “uncommon,” or “rare” often are used to express 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

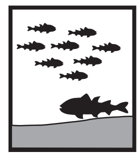
Benthic distribution refers to the spatial arrangement of a particular species at different depths over continental shelf and slope waters. The life cycle of fishes occurs in multiple dimensions in time and space and generally reflects genetically determined life history or behavior that has evolved 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.



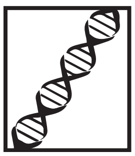
Behavior (see also Glossary [chapter 7]).—Behavior is the manner in which a fish operates or functions within its environment (that is, home range, territoriality, and many others) to procure food, orient to specific locations, or relate to other organisms. Knowing how individuals respond to the environment (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.

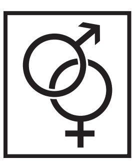
Schooling (that is, social structure of fish of the same species moving in more or less harmonious patterns in the sea) often is related to survival and reproduction. Schooling confers physical benefits to fish movement, safety against predators, search behaviors (for example, foods), population immunology,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

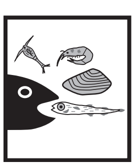
- Trophic level 1 (T1), plants and animals make their own food and are called primary producers;
- Trophic level 2 (T2), herbivores eat plants and are called primary consumers;
- Trophic level 3 (T3), carnivores eat herbivores and are called secondary consumers;
- Trophic level 4 (T4), carnivores eat 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.



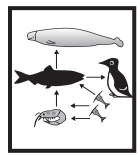
Populations or Stocks—A population often is defined as a group of organisms of the same species occupying a particular space at a particular time with the potential to breed with each other (Williams and others, 2002). Stocks are subpopulations of a particular species of fish that result from reproductive 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.



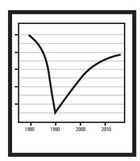
Reproduction Mode—Little information is available about the spawning times and locations, mating behaviors (breeders or nonbreeders), and genetic diversity of Arctic marine fishes. What is known is drawn largely from observations from populations studied outside the United States. For most Arctic marine 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.

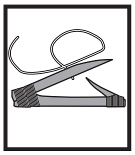


Resilience—In ecology, resilience traditionally refers to the ability of a population or biotic community to sustain or return to its former state after a disturbance. The rate of recovery is a measure of resilience determined by the population processes involved in restoring abundance to healthy, sustainable, 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.

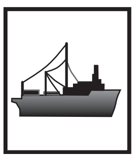
Traditional, Cultural, and Economic Values

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.



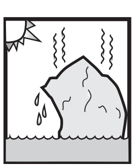
Traditional and Cultural Importance.— Several species of nearshore marine fishes are important in subsistence fisheries. The protection of traditional lifestyles and economies, including these subsistence fisheries, is a responsibility of the Federal government. Subsistence relates to resource use patterns (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

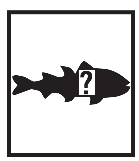
Alaska's climate is changing at more than twice the rate of the rest of the United States (Mellilo and others, 2014). Year-to-year and regional variability in air temperatures are evident and the warming trend currently is being moderated by large-scale cooling associated with the Pacific Decadal Oscillation. 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.

Fourhorn Poacher (*Hypsagonus quadricornis*)

(Valenciennes, 1829)

Family Agonidae

Fourhorn Poacher (*Hypsagonus quadricornis*), 103 mm TL, Bering Strait, 2007. Photograph by C.W. Mecklenburg, Point Stephens Research.

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.*

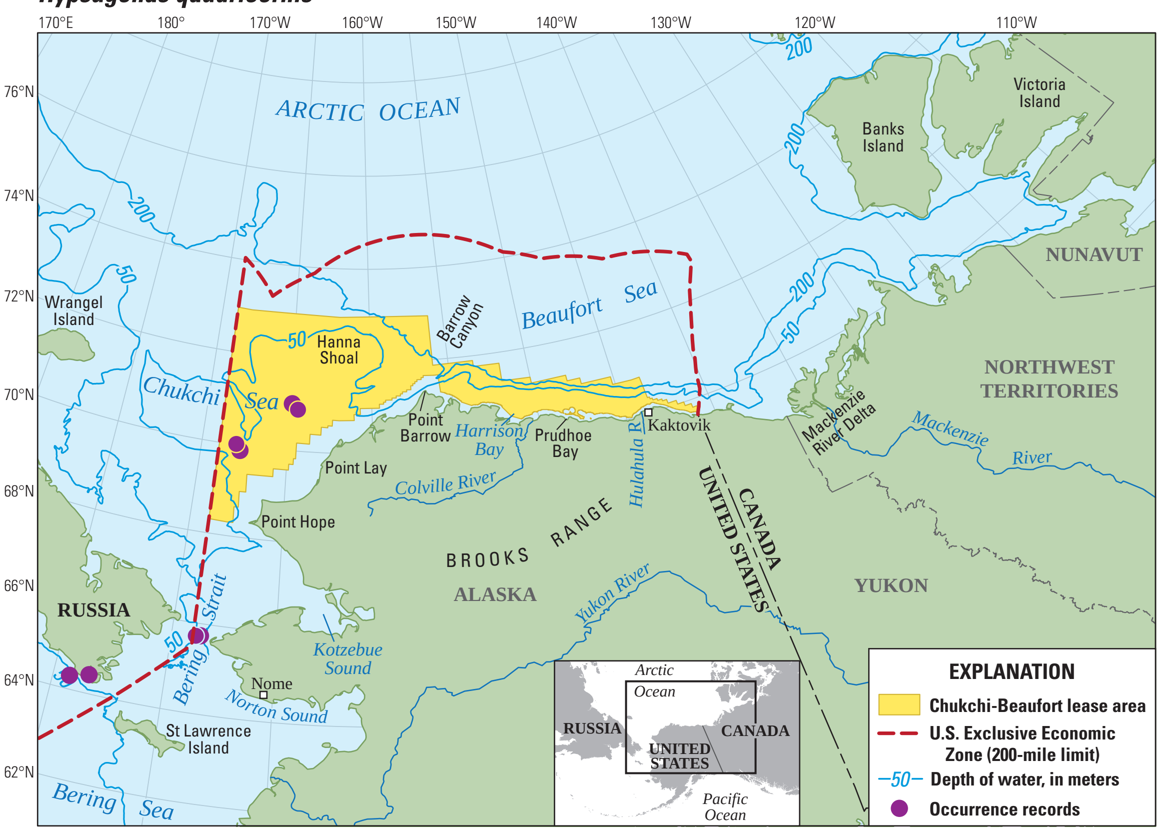
Ecological Role: Current information about the occurrence of this fish is limited in the U.S. Chukchi Sea. Its rare occurrence suggests it is not important in local or regional food webs.

Physical Description/Attributes: Reddish brown and bony-plated with cryptic coloration of white, yellow, red, and brown bands and blotches, and a dark vertical band along margin of caudal fin. For specific diagnostic characteristics, see *Fishes of Alaska* (Mecklenburg and others, 2002, p. 531) [1]. Swim bladder: Absent [2]. Antifreeze glycoproteins in blood serum: Unknown.

Range: *From Bering Strait to northeastern Chukchi Sea west of Point Lay* [3]. *Found in the U.S. Chukchi Sea for the first time in 2007 in a region, which had been extensively sampled, this boreal species could be new to the Arctic* [3, 4]. Elsewhere, from Commander–Aleutian Islands chain and southern Bering Sea southward to Puget Sound, Washington, and to Sea of Okhotsk and northern Sea of Japan [1, 3–7].

Relative Abundance: *Rare in U.S. Chukchi Sea* [3]. Elsewhere in Alaska, rare north of 57°N in Bering Sea [3]. Common around the Aleutian Islands, Pribilof Islands, and eastward to Cook Inlet, Gulf of Alaska, southward to Puget Sound, Washington, and around the Kuril Islands and Kamchatka Peninsula, Russia.

Fourhorn Poacher
Hypsagonus quadricornis

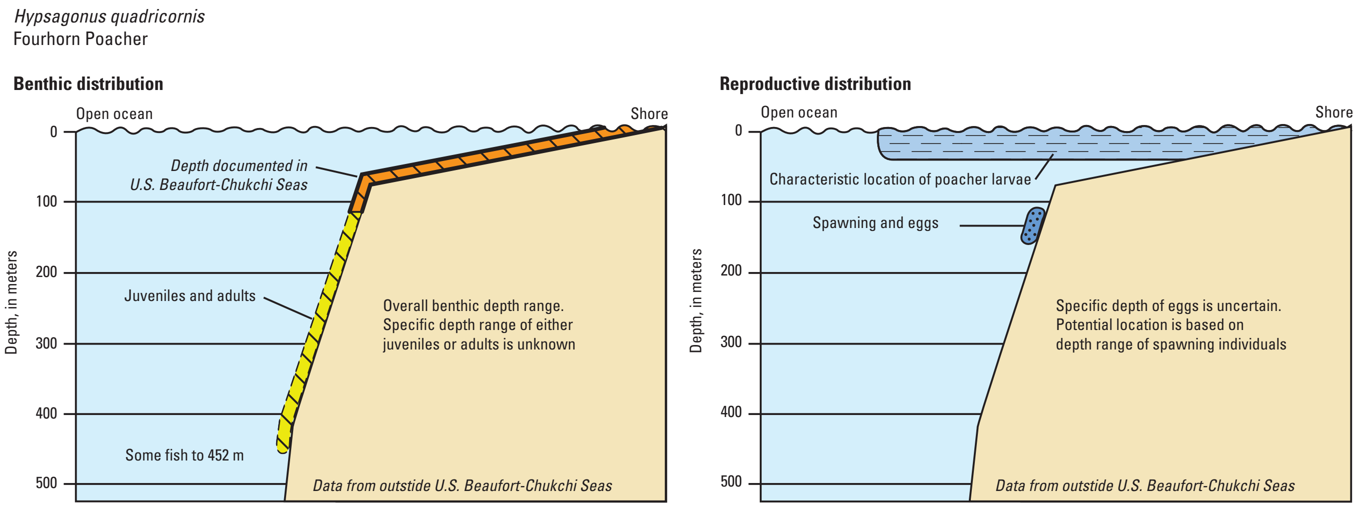


Base modified from USGS and other digital data. U.S.-Russia Maritime Boundary follows the EEZ/200-mile limit line, western edge. Coordinate reference system: projection, Lambert Azimuthal Equal Area; latitude of origin, 75.0°; horizontal datum, North American Datum of 1983.

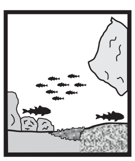
0 50 100 200 MILES
0 50 100 200 KILOMETERS

Geographic distribution of Fourhorn Poacher (*Hypsagonus quadricornis*) within Arctic Outer Continental Shelf Planning Areas [8] based on review of published literature and specimens from historical and recent collections [3, 4].

Depth Range: From intertidal zone to 452 m [1], but most abundant at less than 200 m [1, 5, 9, 10]. *Occurs at depths less than 110 m in northern Bering Sea and U.S. Chukchi Sea* [4]. In the Pacific Ocean off the northern Kuril Islands, spawning occurs at depths of 110–150 m [10]. Depth range of juveniles is unknown. Depth range of larvae is unknown. In general, poacher larvae are abundant in near-surface waters, over continental shelf and upper slope [11–13].

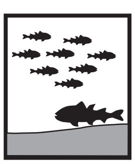


Benthic and reproductive distribution of Fourhorn Poacher (*Hypsagonus quadricornis*).



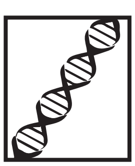
Habitats and Life History

Eggs—Size: 1.5–3.1 mm [10]. Time to hatching: Unknown. Habitat: Demersal and adhesive [2].
Larvae—Size at hatching: 6.4 mm [14]. Size at juvenile transformation: 14 mm [14]. Days to juvenile transformation: Unknown. Habitat: Pelagic [2]. In general, poacher larvae are abundant in near-surface waters, over continental shelf and shallow slope waters [11–13].
Juveniles—Age and size: Unknown. Habitat: Demersal and live over both high and low relief sea floors [2, 7, 10, 15].
Adults—Age and size at first maturity: Off the Kuril Islands, most fish mature by 3 years at 6.5 to 7.5 cm TL, although some males may mature a year earlier [10]. Males and females grow to same length and have similar life spans [10]. Maximum age: At least 7 years old. Maximum size: 12.0 cm TL [10]. Habitat: Demersal and live over both high and low relief sea floors [2, 7, 10, 15].
Substrate—On silty, rocky sand, gravel, and pebble bottoms [1, 4].
Physical/chemical—Temperature: -1.2 °C [4] to 10 °C**.** Salinity: Marine (or occasionally estuarine [7, 15].



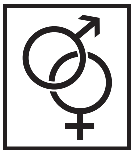
Behavior

Diel—Unidentified poacher larvae have migrated into slightly deeper waters at night in southeastern Alaska [12].
Seasonal—Off Kamchatka, found in relatively shallow waters during summer; winters deeper on the edge of the continental shelf [5].
Reproductive—Unknown.
Schooling—Unlikely. Other poacher species are solitary [16, 17].
Feeding—Can use pectoral fins to lift up rocks and shells to look for prey [14].



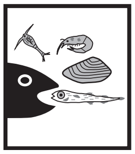
Populations or Stocks

There have been no studies.



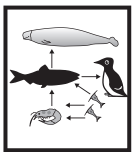
Reproduction

Mode—Separate sexes, oviparous. Fertilization is external [2].
Spawning season—Poorly known. Spawning occurs at least during July and August [10].
Fecundity—Poorly known. 57–921 eggs, spawned in a single batch [10].



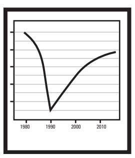
Food and Feeding

Food items—In general, poachers feed on crustaceans and polychaetes [2]. Off the Kuril Islands, polychaetes, gammarid, and caprellid amphipods are the most important foods. However, in fishes over 10 cm (4.0 in.) long, shrimps, limpets, and small fishes (mainly sculpins) are of increasing importance [10]. Food habits of larvae are unknown.
Trophic level—3.19 (standard error: 0.37) [18].



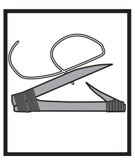
Biological Interactions

Predators—Cannibalism has not been reported. Predators include Pacific Cod and Whiteblotched Skates [19, 20].
Competitors—Presumably other zoobenthos feeders such as Arctic Cod, Walleye Pollock, other poachers, eelpouts, and sculpins.



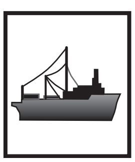
Resilience

High, minimum population doubling time: less than 15 months (Preliminary *K* or Fecundity) [18].



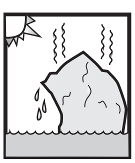
Traditional and Cultural Importance

None reported.



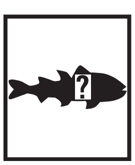
Commercial Fisheries

Currently, Fourhorn Poacher are not commercially harvested.



Potential Effects of Climate Change

Fourhorn Poacher are found primarily in the southeastern Chukchi Sea. Warming, associated with climate change, could increase this species abundance in conjunction with a range extension to the north. Potential effects include changes in competition with other marine fishes that feed on small benthic organisms, including Arctic Cod, Walleye Pollock, other poachers, flatfishes, and sculpins.



Areas for Future Research [B]

Little is known about the ecology and life history of this species in the Chukchi Sea. 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.

References Cited

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., avaliable from U.S. Department of Commerce, Springfield, Virginia] [15]

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

Sheiko, B.A., and Mecklenburg, C.W., 2004, Family Agonidae Swainson 1839—Poachers: California Academy of Sciences Annotated Checklists of Fishes no. 30, 27 p. [2]

Tokranov, A.M., 1987b, Species composition and distribution of sea poachers (Pisces, Agonidae) in nearshore waters of Kamchatka: Zoologicheskii Zhurnal, v. 66, p. 385–392. [5]

Tokranov, A.M., and Orlov, A.M., 2004, Some aspects of the biology of the northern four-horned poacher *Hypsagonus quadricornis* (Agonidae) in Pacific waters off the northern Kuril Islands: Journal of Ichthyology, v. 44, no. 7, p. 508–514. [10]

Bibliography

1. Mecklenburg, C.W., Mecklenburg, T.A., and Thorsteinson, L.K., 2002, Fishes of Alaska: Bethesda, Maryland, American Fisheries Society, 1,116 p.
2. Sheiko, B.A., and Mecklenburg, C.W., 2004, Family Agonidae Swainson 1839—Poachers: California Academy of Sciences Annotated Checklists of Fishes no. 30, 27 p.
3. 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.
4. Mecklenburg, C.W., Mecklenburg, T.A., Sheiko, B.A., and Steinke, D., 2016, Pacific Arctic marine fishes: Akureyri, Iceland, Conservation of Arctic Flora and Fauna, Monitoring Series Report No. 23, 406 p., accessed May 10, 2016, at http://caff.is/monitoring-series/370-pacific-arcticmarine-fishes.
5. Tokranov, A.M., 1987b, Species composition and distribution of sea poachers (Pisces, Agonidae) in nearshore waters of Kamchatka: Zoologicheskii Zhurnal, v. 66, p. 385–392.
6. Dragoo, D.E., 2006, Seabird, fish, marine mammals and oceanography coordinated investigations (SMMOCI) near Bluff, Norton Sound, Alaska, July 2002: U.S. Fish and Wildlife Service Report AMNWR 06/03, 35 p.
7. Abookire, A.A., Piatt, J.F., and Robards, M.D., 2000, Nearshore fish distributions in an Alaska estuary in relation to stratification, temperature and salinity: Estuarine, Coastal and Shelf Science, v. 51, no. 1, p. 45–59.
8. Minerals Management Service, 2008, Beaufort Sea and Chukchi Sea planning areas—Oil and Gas Lease Sales 209, 212, 217, and 221: U.S. Department of the Interior, Minerals Management Service Alaska OCS Region, OCS EIS/EA, MMS 2008-0055, 538 p.
9. Clemens, W.G., and Wilby, G.V., 1946, Fishes of the Pacific Coast of Canada: Fisheries Research Board of Canada Bulletin 68, 368 p.
10. Tokranov, A.M., and Orlov, A.M., 2004, Some aspects of the biology of the northern four-horned poacher *Hypsagonus quadricornis* (Agonidae) in Pacific waters off the northern Kuril Islands: Journal of Ichthyology, v. 44, no. 7, p. 508–514.
11. Boehlert, G.W., Gadomski, D.M., and Mundy, B.C., 1985, Vertical distribution of ichthyoplankton off the Oregon coast in spring and summer months: Fishery Bulletin, v. 83, no. 4, p. 611–621.
12. Haldorson, L., Pritchett, M., Sterritt, D., and Watts, J., 1993, Abundance patterns of marine fish larvae during spring in a southeastern Alaskan bay: Fishery Bulletin, v. 91, no. 1, p. 36–44.

13. Ambrose, D.A., Carter, R.L., and Manion, S.M., 2006, Ichthyoplankton and station data for surface (manta) and oblique (bongo) plankton tows for California Cooperative Oceanic Fisheries Investigations survey cruises in 2005: U.S. Department of Commerce, National Oceanic and Atmospheric Administration, NOAA Technical Memorandum NOAA-TM-NMFS-SWFSC-392, 125 p.

14. Love, M.S., 2011, Certainly more than you wanted to know about the fishes of the Pacific Coast: Santa Barbara, California, Really Big Press, 649 p.

15. 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.]

16. Busby, M.S., Mier, K.L., and Brodeur, R.D., 2005, Habitat associations of demersal fishes and crabs in the Pribilof Islands region of the Bering Sea: Fisheries Research, v. 75, nos. 1–3, p. 15–28.

17. Love, M.S., University of California-Santa Barbara, pers. obs., 2009.

18. Froese, R., and Pauly, D., eds., 2012, FishBase—Global information system on fishes: FishBase database, accessed July 8, 2012, at http://www.fishbase.org.

19. Hunter, M.A., 1979, Food resource partitioning among demersal fishes in the vicinity of Kodiak Island, Alaska: Seattle, University of Washington, Master's thesis, 120 p.

20. Yang, M.-S., 2003, Food habits of the important groundfishes in the Aleutian Islands in 1994 and 1997: National Marine Fisheries Service, AFSC Processed Report 2003-07, 233 p.

Atlantic Poacher (*Leptagonus decagonus*)

(Bloch & Schneider, 1801)

Family Agonidae

Atlantic Poacher (*Leptagonus decagonus*), 150 mm TL, off northeastern Sakhalin Island, Russia, Sea of Okhotsk, 2003. Photograph by B.A. Sheiko, Russian Academy of Sciences.

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

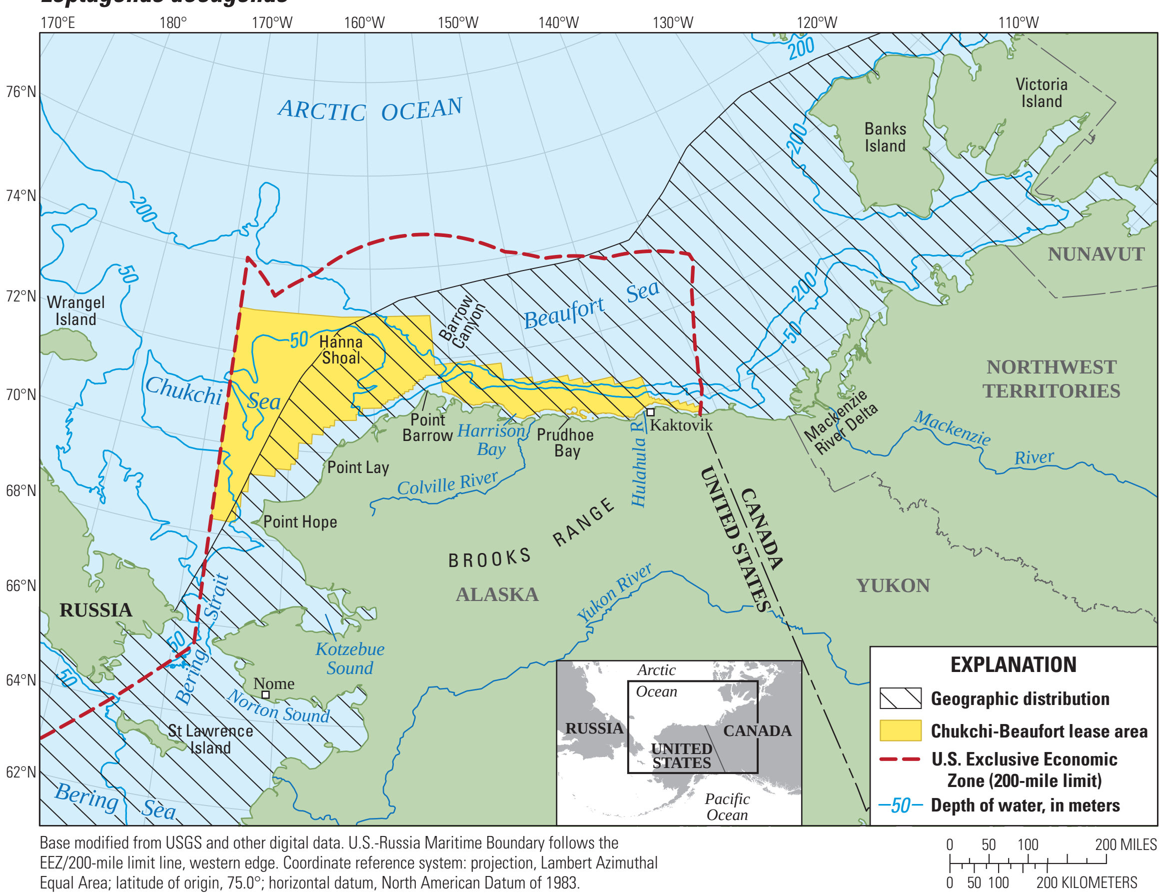
Ecological Role: Current information about occurrence is limited in the U.S. Chukchi and Beaufort Seas. The Atlantic Poacher is unlikely to represent a significant prey resource to higher-level organisms or role in regional food webs.

Physical Description/Attributes: A yellowish gray fish with vague grayish brown bands and patches. Pectoral and caudal fins are brownish black toward tips. For species diagnostic characteristics, see *Fishes of Alaska* (Mecklenburg and others, 2002, p. 537) [1]. Swim bladder: Absent [2]. Antifreeze glycoproteins in blood serum: Unknown.

Range: *U.S. Chukchi and Beaufort Seas* [1, 3]. Elsewhere in Alaska, south to Bristol Bay in Bering Sea. Worldwide, nearly circumpolar from Laptev Sea east to western North Atlantic; in Atlantic Ocean to Newfoundland; and in Pacific Ocean there is an isolated population in Sea of Okhotsk [1, 4, 5].

Relative Abundance: *Uncommon in U.S. Chukchi and Beaufort Seas* [1, 3]. Elsewhere, common at least in western Barents Sea [8] and rare around much of Greenland [9].

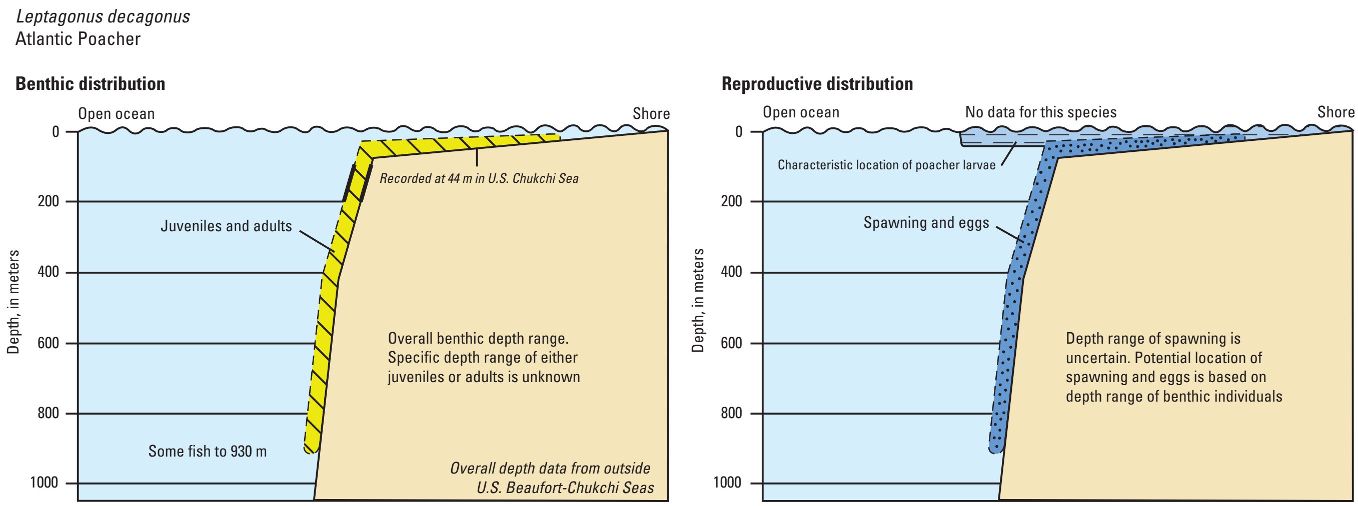
Atlantic Poacher
Leptagonus decagonus



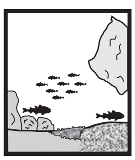
Base modified from USGS and other digital data. U.S.-Russia Maritime Boundary follows the EEZ/200-mile limit line, western edge. Coordinate reference system: projection, Lambert Azimuthal Equal Area; latitude of origin, 75.0°; horizontal datum, North American Datum of 1983.

Geographic distribution of Atlantic Poacher (*Leptagonus decagonus*) within Arctic Outer Continental Shelf Planning Areas [6] based on review of published literature and specimens from historical and recent collections [1, 3, 7].

Depth Range: Overall range is 24–930 m, but usually between 100–200 m [1, 3]. *Documented in U.S. Chukchi Sea at 44–59 m* [1, 5]. Depth range of juveniles is unknown. Depth range of larvae is unknown. In general, abundant in near-surface waters, over continental shelf and shallow slope waters [10–12].

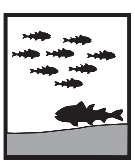


Benthic and reproductive distribution of Atlantic Poacher (*Leptagonus decagonus*).



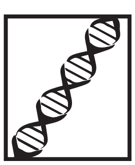
Habitats and Life History

Eggs—Size: 1.5–2.0 mm [13]. Time to hatching: Unknown. Habitat: Demersal and adhesive (probably on sand and mud) [2].
Larvae—Size at hatching: Unknown. Size at juvenile transformation: About 28 mm TL [14]. Days to juvenile transformation: 2–3 months for poachers in general [2]. Habitat: Pelagic [2], although distance from shore and depth in water column are unknown for this species, in general poacher larvae are abundant in near-surface waters, over continental shelf and shallow slope waters [10–12].
Juveniles—Age and size: Unknown. Habitat: Demersal [1, 5].
Adults—Age and size at first maturity: Unknown. Maximum age: Unknown. Maximum size: 22.6 cm TL [1, 15]. Habitat: Demersal [1, 5].
Substrate—Both juveniles and adults live on sand and mud [1, 5].
Physical/chemical—Temperature: Documented -1.7–7.4 °C [5, 13–15]. Salinity: Mainly marine but occasionally found at 27.4 ppt [1, 5]. *In U.S. Chukchi Sea, recorded at 32.58 psu* [5].



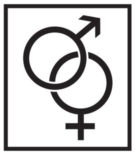
Behavior

Diel—Unidentified poacher larvae migrated into slightly deeper waters at night in southeastern Alaska [11].
Seasonal—Unknown.
Reproductive—Unknown.
Schooling—Unlikely. Other poacher species are solitary [16, 17].
Feeding—Unknown.
Feeding Behavior—Unknown.

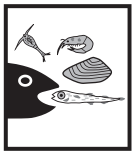


Populations or Stocks

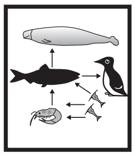
There have been no studies.



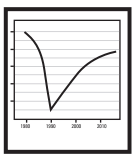
Reproduction
Mode—Separate sexes, oviparous. Fertilization is external [2].
Spawning season—Poorly known. At least from May to July [13].
Fecundity—Poorly known. 480–1,750 eggs [13].



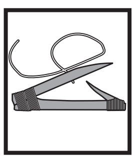
Food and Feeding
Food items—Food habits of larvae are unknown. Adults and juveniles feed on water column crustaceans (such as, copepods), benthic crustaceans, and polychaetes [13].
Trophic level—3.21 standard error 0.36. Based on food items [18].



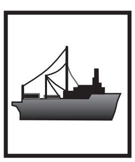
Biological Interactions
Predators—Cannibalism has not been reported and is unlikely. Predators are poorly known. In the Canadian Arctic, they are occasionally eaten by bearded seals [19].
Competitors—Presumably other zoobenthic feeders such as Arctic Cod, Walleye Pollock, other poachers, eelpouts, flatfish, and sculpins.



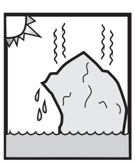
Resilience
Medium, minimum population doubling time: 1.4–4.4 years (Fecundity = 1,088) [18].



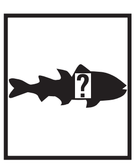
Traditional and Cultural Importance
None reported.



Commercial Fisheries
Currently, Atlantic Poacher are not commercially harvested.



Potential Effects of Climate Change
This species is widely distributed in the Chukchi and Beaufort Seas, as well as southward to the eastern Bering Sea and eastward to the North Atlantic. Climate effects will likely result in changes in abundance and competition with other marine fishes.



Areas for Future Research [B]
Little is known about the ecology and life history 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.

References Cited

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., avaliable from U.S. Department of Commerce, Springfield, Virginia] [13]

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., Stein, D.L., Sheiko, B.A., Chernova, N.V., Mecklenburg, T.A., and Holladay, B.A., 2007, Russian–American long-term census of the Arctic—Benthic fishes trawled in the Chukchi Sea and Bering Strait, August 2004: Northwestern Naturalist, v. 88, no. 3, p. 168–187. [5]

Scott, W.B., and Scott, M.G., 1988, Atlantic fishes of Canada: Toronto, University of Toronto Press, 730 p. [15]

Sheiko, B.A., and Mecklenburg, C.W., 2004, Family Agonidae Swainson 1839—Poachers: California Academy of Sciences Annotated Checklists of Fishes no. 30, 27 p. [2]

Bibliography

1. Mecklenburg, C.W., Mecklenburg, T.A., and Thorsteinson, L.K., 2002, Fishes of Alaska: Bethesda, Maryland, American Fisheries Society, 1,116 p.
2. Sheiko, B.A., and Mecklenburg, C.W., 2004, Family Agonidae Swainson 1839—Poachers: California Academy of Sciences Annotated Checklists of Fishes no. 30, 27 p.
3. 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.
4. Stewart, D.B., Ratynski, R.A., Bernier, L.M.J., and Ramsey, D.J., 1993, A fishery development strategy for the Canadian Beaufort Sea-Amundsen Gulf area: Canadian Technical Report Fisheries and Aquatic Sciences 1910, 135 p.
5. Mecklenburg, C.W., Stein, D.L., Sheiko, B.A., Chernova, N.V., Mecklenburg, T.A., and Holladay, B.A., 2007, Russian–American long-term census of the Arctic—Benthic fishes trawled in the Chukchi Sea and Bering Strait, August 2004: Northwestern Naturalist, v. 88, no. 3, p. 168–187.
6. Minerals Management Service, 2008, Beaufort Sea and Chukchi Sea planning areas—Oil and Gas Lease Sales 209, 212, 217, and 221: U.S. Department of the Interior, Minerals Management Service Alaska OCS Region, OCS EIS/EA, MMS 2008-0055, 538 p.
7. Mecklenburg, C.W., Mecklenburg, T.A., Sheiko, B.A., and Steinke, D., 2016, Pacific Arctic marine fishes: Akureyri, Iceland, Conservation of Arctic Flora and Fauna, Monitoring Series Report No. 23, 406 p., accessed May 10, 2016, at http://caff.is/monitoring-series/370-pacific-arcticmarine-fishes.
8. Byrkjedal, I., and Høines, Å., 2007, Distribution of demersal fish in the south-western Barents Sea: Polar Research, v. 26, no. 2, p. 135–151.
9. Rätz, H.-J., 1999, Structures and changes of the demersal fish assemblage off Greenland, 1982–96: Northwest Atlantic Fisheries Organization Science Council Studies, v. 32, p. 1–15.
10. Boehlert, G.W., Gadomski, D.M., and Mundy, B.C., 1985, Vertical distribution of ichthyoplankton off the Oregon coast in spring and summer months: Fishery Bulletin, v. 83, no. 4, p. 611–621.
11. Haldorson, L., Pritchett, M., Sterritt, D., and Watts, J., 1993, Abundance patterns of marine fish larvae during spring in a southeastern Alaskan bay: Fishery Bulletin, v. 91, no. 1, p. 36–44.
12. Ambrose, D.A., Carter, R.L., and Manion, S.M., 2006, Ichthyoplankton and station data for surface (manta) and oblique (bongo) plankton tows for California Cooperative Oceanic Fisheries Investigations survey cruises in 2005: U.S. Department of Commerce, National Oceanic and Atmospheric Administration, NOAA Technical Memorandum NOAA-TM-NMFS-SWFSC-392, 125 p.

13. 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.]

14. Wienerroither, R., Johannesen, E., Langøy, H., Børve Eriksen, K., de Lange Wenneck, T., Høines, Å., Bjelland, O., Aglen, A., Prokhorova, T., Murashko, P., Prozorkevich, D., Konstantin, Byrkjedal, I., Langhelle Drevetnyak, and G., Smirnov, O., 2011, Atlas of the Barents Sea fishes: IMR/PINRO Joint Report Series 1-2011, ISSN 1502-8828, 274 p.

15. Scott, W.B., and Scott, M.G., 1988, Atlantic fishes of Canada: Toronto, University of Toronto Press, 730 p.

16. Busby, M.S., Mier, K.L., and Brodeur, R.D., 2005, Habitat associations of demersal fishes and crabs in the Pribilof Islands region of the Bering Sea: Fisheries Research, v. 75, nos. 1–3, p. 15–28.

17. Love, M.S., University of California-Santa Barbara, pers. obs., 2009.

18. Froese, R., and Pauly, D., eds., 2012, FishBase—Global information system on fishes: FishBase database, accessed July 8, 2012, at http://www.fishbase.org.

19. Finley, K.J., and Evans, C.R., 1983, Summer diet of the bearded seal (*Erignathus barbatus*) in the Canadian High Arctic: Arctic, v. 36, no. 1, p. 82–89.

Bering Poacher (*Occella dodecaedron*)

(Tilesius, 1813)

Family Agonidae

Bering Poacher (*Occella dodecaedron*), 107 mm TL, Norton Sound, Bering Sea, 2002. Photograph by C.W. Mecklenburg, Point Stephens Research.

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.*

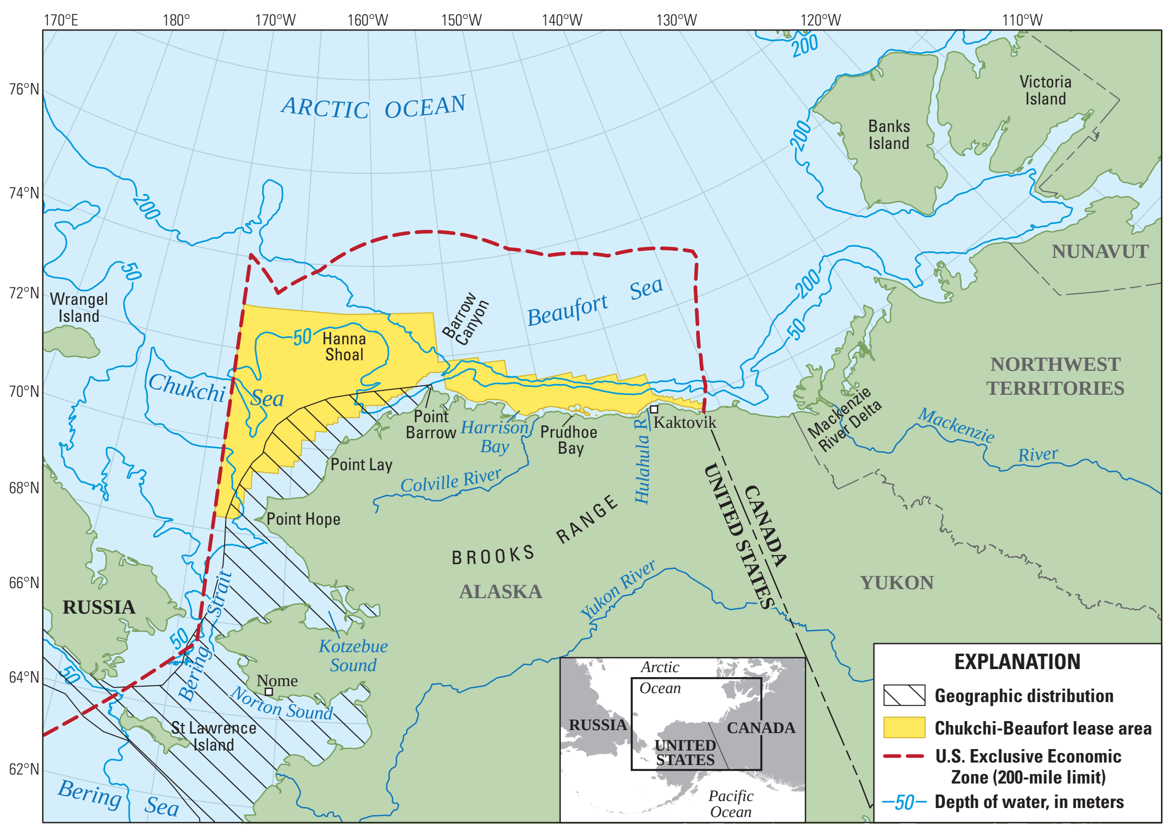
Ecological Role: Current information about this species occurrence in the U.S. Chukchi and Beaufort Seas is very limited. The Bering Poacher is unlikely to represent a significant prey resource to other fish or higher trophic level organisms.

Physical Description/Attributes: Brownish olive on the back and sides, and light tan or ivory white on the underside. Males have orange pectoral fins and those of females are translucent; pelvic fin membranes in males are black and in females are white [1]. For specific diagnostic characteristics, see *Fishes of Alaska* (Mecklenburg and others, 2002, p. 536) [2]. Swim bladder: Absent [3]. Antifreeze glycoproteins in blood serum: Unknown.

Range: *Eastern Chukchi Sea* [4]. Elsewhere in Alaska, from Port Clarence (northeastern Bering Sea near Bering Strait) [4] to western Gulf of Alaska [2]. Worldwide, Sea of Japan northward from Peter the Great Bay, Sea of Okhotsk, and Kuril Islands to Pacific Ocean off Kamchatka Peninsula, Russia, and western Bering Sea at Gulf of Anadyr [2].

Relative Abundance: *Rare in U.S. Chukchi Sea* [2, 4, 6, 7]. Elsewhere in Alaska, common in southeastern [8, 9] but rare in northern Bering Sea [4]. There appears to be a northward shift in the southeastern Bering Sea [10].Worldwide, common at least in Sea of Japan [11] and around Kamchatka Peninsula, Russia [12].

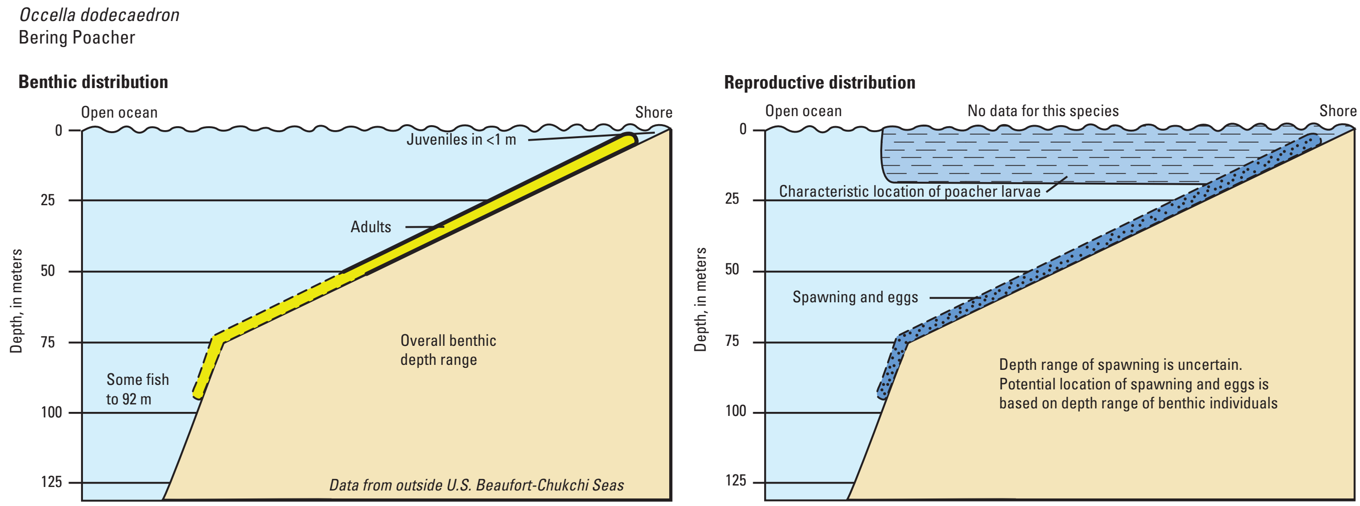
Bering Poacher
Occella dodecaedron



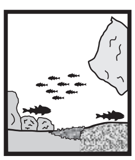
Base modified from USGS and other digital data. U.S.-Russia Maritime Boundary follows the EEZ/200-mile limit line, western edge. Coordinate reference system: projection, Lambert Azimuthal Equal Area; latitude of origin, 75.0°; horizontal datum, North American Datum of 1983.

Geographic distribution of Bering Poacher (*Occella dodecaedron*) within Arctic Outer Continental Shelf Planning Areas [5] based on review of published literature and specimens from historical and recent collections [4, 6].

Depth Range: Overall range is 5–92 m, mainly less than 50 m [12–14]. A record from 375 m [13] is likely in error. Juveniles may live in less than 1 m [15]. Depth range of larvae unknown. In general, poacher larvae are abundant in near-surface waters, over continental shelf and shallow slope waters [16–18].



Benthic and reproductive distribution of Bering Poacher (*Occella dodecaedron*).



Habitats and Life History

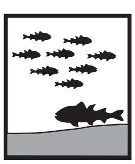
Eggs—Size: Unknown. Time to hatching: Unknown. Habitat: Benthic and adhesive (probably on sand and mud) [3].

Larvae—Size at hatching: Unknown. Size at juvenile transformation: Unknown. Days to juvenile transformation: 2–3 months [3]. Habitat: Pelagic, although distance from shore and depth in water column are unknown for this species, in general, poacher larvae are abundant in near-surface waters, over continental shelf and shallow slope waters [16–18].

Juveniles—Age and size: Unknown. Habitat: Benthic [3, 19].

Adults—Age and size at first maturity: Unknown. Maximum age: At least 9 years. Females are larger at age than males [1]. Maximum size: As long as 23 cm TL [20]. Habitat: Benthic [3, 19]. Substrate: Both juveniles and adults live on sand and mud [21].

Physical/chemical—Temperature: -1.5–15 °C [6, 12, 22]. In southeastern Bering Sea, mainly 2.2–5.5 °C [22]. Salinity: All life stages live in marine waters [12, 22] and occasionally estuaries [6].



Behavior

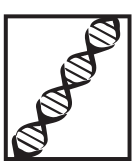
Diel—Unidentified poacher larvae have migrated into slightly deeper waters at night in southeastern Alaska [17].

Seasonal—Off Kamchatka Peninsula, Russia, found in relatively shallow waters during the summer; during winters found deeper on the edge of the continental shelf [12].

Reproductive—Unknown for this family [3].

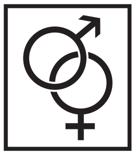
Schooling—Unlikely. Other poacher species are solitary [19, 23].

Feeding—Unknown.

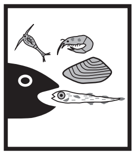


Populations or Stocks

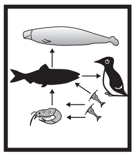
There have been no studies.



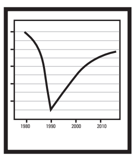
Reproduction
Mode—Separate sexes, oviparous. Fertilization is external [3].
Spawning season—Poorly known. Spawning occurs in the spring [1, 21].
Fecundity—400–4,575 eggs [1, 21].



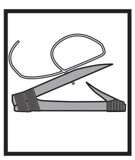
Food and Feeding
Food items—In eastern Bering Sea, off Kamchatka Peninsula, Russia, and in Sea of Japan, small epibenthic crustaceans (for example, mysids, amphipods, isopods, and shrimps) and polychaetes [1, 20, 24]. Food habits of larvae are unknown.
Trophic level—4.0 [10].



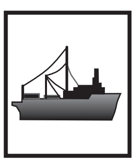
Biological Interactions
Predators—Pacific Cod and Plain Sculpin in eastern Bering Sea and off Kamchatka Peninsula, Russia. Cannibalism has not been reported and is unlikely [25, 26].
Competitors—Presumably a wide range of other zoobenthic feeders such as Arctic Cod, Walleye Pollock, other poachers, eelpouts, and sculpins.



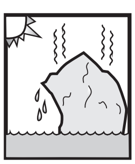
Resilience
Medium, minimum population doubling time: 1.4–4.4 years (Preliminary *K* or Fecundity) [27].



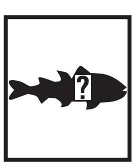
Traditional and Cultural Importance
None reported.



Commercial Fisheries
Currently, Bering Poacher are not commercially harvested.



Potential Effects of Climate Change
Bering Poacher is a Boreal Pacific species [4] and may be expected to expand its distribution northward and become more abundant in the Chukchi Sea as the climate continues to warm. It already appears to be moving northward in the eastern Bering Sea, perhaps in response to warming water temperatures [10]. This may increase competition with other fishes that feed on small benthic organisms, including Arctic Cod, Walleye Pollock, other poachers, and sculpins.



Areas for Future Research [B]
Little is known about the biology and 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.

References Cited

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.] [21]

Mecklenburg, C.W., Mecklenburg, T.A., and Thorsteinson, L.K., 2002, Fishes of Alaska: Bethesda, Maryland, American Fisheries Society, 1,116 p. [2]

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. [4]

Sheiko, B.A., and Mecklenburg, C.W., 2004, Family Agonidae Swainson 1839—Poachers: California Academy of Sciences Annotated Checklists of Fishes no. 30, 27 p. [3]

Smith, R.L., and Gillispie, J.G., 1988, Notes on the biology of the Bering Poacher, *Occella dodecaedron* (Tilesius), and the Sturgeon Poacher, *Agonus acipenserinus Tilesius* in the southeast Bering Sea: Copeia, v. 1988, no. 2, p. 454–460. [1]

Tokranov, A.M., 1987b, Species composition and distribution of sea poachers (Pisces, Agonidae) in nearshore waters of Kamchatka: Zoologicheskii Zhurnal, v. 66, p. 385–392. [12]

Bibliography

1. Smith, R.L., and Gillispie, J.G., 1988, Notes on the biology of the Bering Poacher, *Occella dodecaedron* (Tilesius), and the Sturgeon Poacher, *Agonus acipenserinus Tilesius* in the southeast Bering Sea: Copeia, v. 1988, no. 2, p. 454–460.

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

3. Sheiko, B.A., and Mecklenburg, C.W., 2004, Family Agonidae Swainson 1839—Poachers: California Academy of Sciences Annotated Checklists of Fishes no. 30, 27 p.

4. 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.

5. Minerals Management Service, 2008, Beaufort Sea and Chukchi Sea planning areas—Oil and Gas Lease Sales 209, 212, 217, and 221: U.S. Department of the Interior, Minerals Management Service Alaska OCS Region, OCS EIS/EA, MMS 2008-0055, 538 p.

6. Mecklenburg, C.W., Mecklenburg, T.A., Sheiko, B.A., and Steinke, D., 2016, Pacific Arctic marine fishes: Akureyri, Iceland, Conservation of Arctic Flora and Fauna, Monitoring Series Report No. 23, 406 p., accessed May 10, 2016, at http://caff.is/monitoring-series/370-pacific-arcticmarine-fishes.

7. Barber, W.E., Smith, R.L., Vallarino, M., and Meyer, R.M., 1997, Demersal fish assemblages of the northeastern Chukchi Sea, Alaska: Fishery Bulletin, v. 95, no. 2, p. 195–209.

8. Acuna, E.I., Goddard, P., and Kotwicki, S., 2003, 2002 bottom trawl survey of the eastern Bering Sea continental shelf: National Marine Fisheries Service, Alaska Fisheries Science Center, Processed Report 2003-01.

9. Hoff, G.R., 2006, Biodiversity as an index of regime shift in the eastern Bering Sea: Fishery Bulletin, v. 104, no. 2, p. 226–237.

10. Mueter, F.J., and Litzow, M.A., 2008, Sea ice retreat alters the biogeography of the Bering Sea continental shelf: Ecological Applications, v. 18, no. 2, p. 309–320.

11. Kolpakov, N.V., 2005, Diversity and seasonal dynamics of ichthyocenosis of the Circumlittoral of Russkaya Bight (Northern Primor's): Journal of Ichthyology, v. 45, no. 9, p. 744–753.

12. Tokranov, A.M., 1987b, Species composition and distribution of sea poachers (Pisces, Agonidae) in nearshore waters of Kamchatka: Zoologicheskii Zhurnal, v. 66, p. 385–392.

13. Allen, M.J., and Smith, G.B., 1988, Atlas and zoogeography of common fishes in the Bering Sea and northeastern Pacific: National Oceanic and Atmospheric Administration Technical Report NMFS 66, 151 p.

14. Fedorov, V.V., 2000, Species composition, distribution and habitation depths of the northern Kuril Islands fish and fish like species, *in* Koteneva, B.N., ed., Commercial and biological studies of fishes in the Pacific waters of the Kuril Islands and adjacent areas of the Okhotsk and Bering Seas in 1992–1998: Moscow, VNIRO Publishing, collected papers, p. 7–41. [In Russian.]

15. Love, M.S., Mecklenburg, C.W., Mecklenburg, T.A., and Thorsteinson, L.K., 2005, Resource inventory of marine and estuarine fishes of the West Coast and Alaska—A checklist of North Pacific and Arctic Ocean species from Baja California to the Alaska-Yukon border: Seattle, Washington, U.S. Department of the Interior, U.S. Geological Survey, Biological Resources Division, OCS Study MMS 2005-030 and USGS/NBII 2005-001, 276 p.

16. Boehlert, G.W., Gadomski, D.M., and Mundy, B.C., 1985, Vertical distribution of ichthyoplankton off the Oregon coast in spring and summer months: Fishery Bulletin, v. 83, no. 4, p. 611–621.

17. Haldorson, L., Pritchett, M., Sterritt, D., and Watts, J., 1993, Abundance patterns of marine fish larvae during spring in a southeastern Alaskan bay: Fishery Bulletin, v. 91, no. 1, p. 36–44.

18. Ambrose, D.A., Carter, R.L., and Manion, S.M., 2006, Ichthyoplankton and station data for surface (manta) and oblique (bongo) plankton tows for California Cooperative Oceanic Fisheries Investigations survey cruises in 2005: U.S. Department of Commerce, National Oceanic and Atmospheric Administration, NOAA Technical Memorandum NOAA-TM-NMFS-SWFSC-392, 125 p.

19. Busby, M.S., Mier, K.L., and Brodeur, R.D., 2005, Habitat associations of demersal fishes and crabs in the Pribilof Islands region of the Bering Sea: Fisheries Research, v. 75, nos. 1–3, p. 15–28.

20. Tokranov, A.M.,1992, Dietary characteristics of sea poachers (Agonidae) in the coastal waters of Kamchatka: Journal of Ichthyology, v. 32, no. 9, p. 85–94.

21. 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., avaliable from U.S. Department of Commerce, Springfield, Virginia]

22. Mueter, F.J., University of Alaska-Fairbanks, written commun., 2010.

23. Love, M.S., University of California-Santa Barbara, pers. obs., 2009.

24. Dolganova, N.T., Kolpakov, N.V., and Chuchukalo, V.I., 2006, Feeding habits and trophic relations of fish in coastal waters off northern Primorye: Izvestiya TINRO, v. 144, p. 140–179.

25. Tokranov, A.M., 1987a, Feeding of giant sculpin *Myoxocephalus polyacanthocephalus* Pallas and plain sculpin *M. jaok* (Cuvier) (Cottidae) in coastal waters of Kamchatka: Journal of Ichthyology, v. 27, p. 104–114.

26. Lang, G.M., Livingston, P.A., and Dodd, K., 2005, Groundfish food habits and predation on commercially important prey species in the eastern Bering Sea from 1997 through 2001: U.S. Department of Commerce, National Oceanic and Atmospheric Administration, NOAA Technical Memorandum NMFS-AFSC-158, 249 p.

27. Froese, R., and Pauly, D., eds., 2012, FishBase—Global information system on fishes: FishBase database, accessed July 8, 2012, at http://www.fishbase.org.

Tubenose Poacher (*Pallasina barbata*)

(Steindachner, 1876)

Family Agonidae

Tubenose Poacher (*Pallasina barbata*), 138 mm TL, eastern Chukchi Sea, 2007. Photograph by C.W. Mecklenburg, Point Stephens Research.

Note on taxonomy: *The eastern Pacific form is treated by Russian authors as a separate species,* Pallasina aix *(Starks, 1896), although other taxonomists have given evidence for it being the same as* P. barbata [1].

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

Ecological Role: Largely unknown. Current information about the occurrence of this fish in the U.S. Chukchi and Beaufort Seas is limited. The Tubenose Poacher is unlikely to represent a significant prey resource for many higher level organisms.

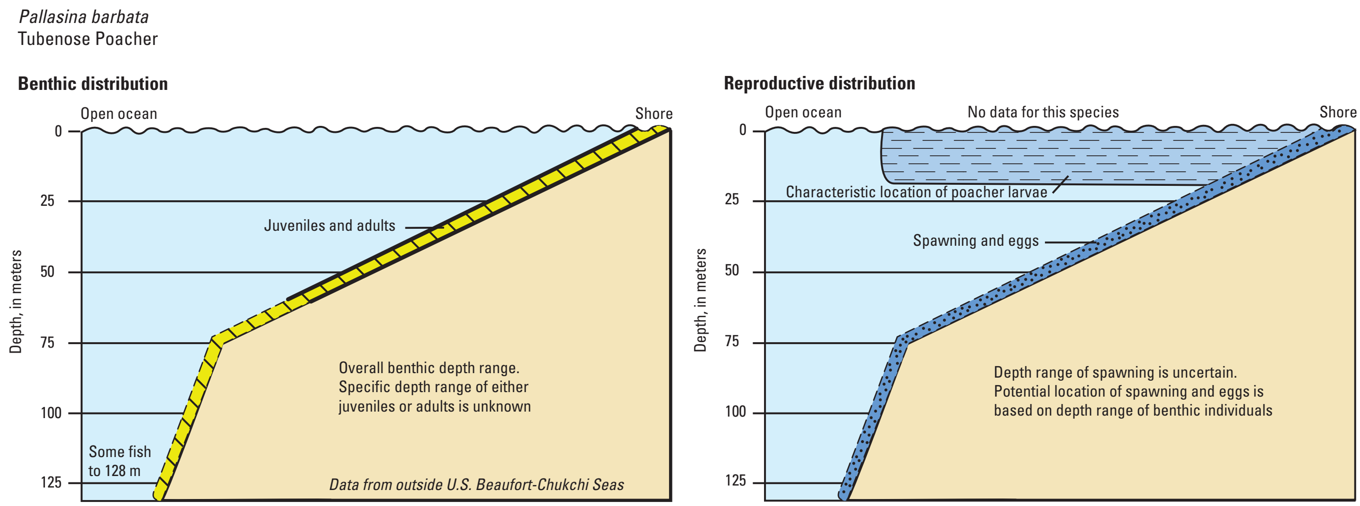
Physical Description/Attributes: An elongate, slender fish with gray to brownish back and sides and white underside. For specific diagnostic characteristics, see *Fishes of Alaska*, (Mecklenburg and others, 2002, p. 533) [1]. Swim bladder: Absent [2]. Antifreeze glycoproteins in blood serum: Unknown.

Range: *U.S. Chukchi Sea as far northward to Point Barrow, Alaska* [3]. Elsewhere in Alaska, along coast southward from Bering Strait [1]. Worldwide, from Sea of Japan off Korea, to Sea of Okhotsk, and Pacific Ocean off Kuril Islands south to Bodega Bay, central California [1, 4–8].

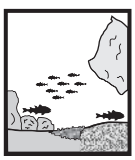
Relative Abundance: *Rare in U.S. Chukchi Sea* [3, 10, 11]. Elsewhere in Alaska, common in Bering Sea from Norton Sound southwards [10]. Worldwide, common in Pacific Ocean from Sea of Japan and Sea of Okhotsk, and southwards to Puget Sound [4–8].

Geographic distribution of Tubenose Poacher (*Pallasina barbata*) within Arctic Outer Continental Shelf Planning Areas [9] based on review of published literature and specimens from historical and recent collections [1, 3, 10].

Depth Range: Intertidal zone, including tide pools, to 128 m [10]. Most abundant in shallow nearshore waters down to 60 m [4, 8, 10, 12–14]. Depth range of juveniles is unknown. Depth range of larvae is unknown. In general, poacher larvae are abundant in near-surface waters, over continental shelf and upper slope [15–17]. Overall spawning depth is unknown but has been observed in shallow, nearshore waters [12, 13].



Benthic and reproductive distribution of Tubenose Poacher (*Pallasina barbata*).



Habitats and Life History

Eggs—Size: Unknown. Time to hatching: Unknown, though larvae have been caught in Barkley Sound, British Columbia, in April [18]. Habitat: Benthic and adhesive (probably on sand and mud) [2].

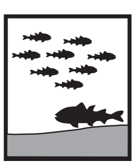
Larvae—Size at hatching: Unknown. Size at juvenile transformation: 2–3 cm TL [4, 18, 19]. Days to juvenile transformation: 2–3 months [2]. Habitat: Pelagic, although distance from shore and depth in water column are unknown for this species, in general poacher larvae are abundant in near-surface waters, over continental shelf and shallow slope waters [15–17].

Juveniles—Age: Unknown. Size: 2–3 cm TL [4, 18, 19] to 9 cm TL [13]. Habitat: Demersal and shallow (often intertidal) [4, 10, 18, 19].

Adults—Age and size at first maturity: Age unknown. May mature at about 9 cm TL [13]. Maximum age: At least 5 years [20]. Maximum size: 20.8 cm TL [1]. Habitat: Benthic and shallow (often intertidal) [1, 4, 10, 18, 19]. Generally, a structure-oriented fish [12, 21]. Common in eelgrass beds, although they also inhabit kelp stands, rocky outcrops, and shell hash sea floors [8, 11–13].

Substrate—Shell hash, sand and gravel bottoms [1, 11].

Physical/chemical—Temperature: Documented off Kamchatka Peninsula, Russia, at 0–12 °C [14], and in Bering Strait at 10.5 °C [11]. Salinity: Marine and estuarine [14], found at 30.62 salinity units in U.S. Bering Strait [11].



Behavior

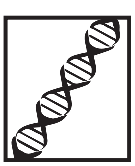
Diel—Unidentified poacher larvae migrated into slightly deeper waters at night in southeastern Alaska [16].

Seasonal—Off Kamchatka Peninsula, Russia, found in relatively shallow waters during summer and during winter in deeper waters on the edge of continental shelf [14].

Reproductive—During summer months, adults move into shallow waters to spawn [12, 13].

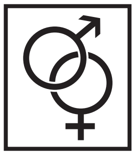
Schooling—Unlikely. Other poacher species are solitary [22, 23].

Feeding—Unknown.

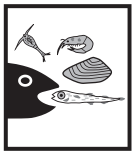


Populations or Stocks

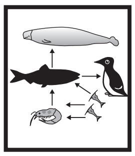
There have been no studies.



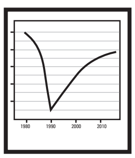
Reproduction
Mode—Separate sexes, oviparous. Fertilization is external [2].
Spawning season—Spawning occurs during the summer [12, 13].
Fecundity—Unknown.



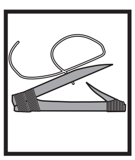
Food and Feeding
Food items—Small benthic and epibenthic crustaceans dominate the diet. Mysids are important, as are euphausiids, caprellid amphipods, and copepods. Polychaetes and shrimps also are consumed [5, 12, 13, 20, 24]. Food habits of larvae are unknown.
Trophic level—3.23 (standard error 0.41) [25].



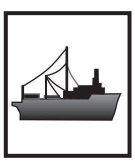
Biological Interactions
Predators—Cannibalism has not been reported. Off Kamchatka Peninsula, this species is eaten by great sculpin [26].
Competitors—Presumably a wide range of other zoobenthic feeders such as Arctic Cod, Walleye Pollock, other poachers, eelpouts, and sculpins.



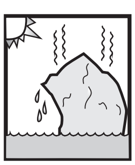
Resilience
Medium, minimum population doubling time: 1.4–4.4 years (Preliminary *K* or Fecundity) [25].



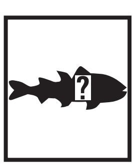
Traditional and Cultural Importance
None reported.



Commercial Fisheries
Currently, Tubenose Poacher are not commercially harvested.



Potential Effects of Climate Change
The expected result of climate warming would be an increased abundance of this species in the Chukchi Sea. An eventually expansion of range into the Beaufort Sea also would be expected. These changes would result in increased interactions and competition with other fishes that feed on small benthic organisms. Major competitors would potentially include: Arctic Cod, Walleye Pollock, other poachers, and sculpins.



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.

References Cited

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., avaliable from U.S. Department of Commerce, Springfield, Virginia] [12]

Marliave, J.B., 1975, The behavioral transformation from the planktonic larval stage of some marine fishes reared in the laboratory: Vancouver, University of British Columbia, Ph.D. dissertation. [18]

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

Sheiko, B.A., and Mecklenburg, C.W., 2004, Family Agonidae Swainson 1839—Poachers: California Academy of Sciences Annotated Checklists of Fishes no. 30, 27 p. [2]

Tack, S.L., 1970, The summer distribution and standing stock of the fishes of Izembek Lagoon, Alaska: Fairbanks, University of Alaska, Master's thesis. [13]

Tokranov, A.M., 1987b, Species composition and distribution of sea poachers (Pisces, Agonidae) in nearshore waters of Kamchatka: Zoologicheskii Zhurnal, v. 66, p. 385–392. [14]

Bibliography

1. Mecklenburg, C.W., Mecklenburg, T.A., and Thorsteinson, L.K., 2002, Fishes of Alaska: Bethesda, Maryland, American Fisheries Society, 1,116 p.
2. Sheiko, B.A., and Mecklenburg, C.W., 2004, Family Agonidae Swainson 1839—Poachers: California Academy of Sciences Annotated Checklists of Fishes no. 30, 27 p.
3. Mecklenburg, C.W., Mecklenburg, T.A., Sheiko, B.A., and Steinke, D., 2016, Pacific Arctic marine fishes: Akureyri, Iceland, Conservation of Arctic Flora and Fauna, Monitoring Series Report No. 23, 406 p., accessed May 10, 2016, at http://caff.is/monitoring-series/370-pacific-arcticmarine-fishes.
4. Barton, L.H., 1978, Finfish resource surveys in Norton Sound and Kotzebue Sound: Alaska Department of Fish and Game, Commercial Fisheries Division, p. 75–313.
5. Cross, J.N., Fresh, K., Miller, B.S., Simenstad, C.A., Steinfort, S.N., and Fegley, J.C., 1978, Nearshore fish and invertebrates assemblages along the Strait of Juan de Fuca including food habits of the common inshore fishes: U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Environmental Research Laboratories, NOAA Technical Memorandum ERL MESA-32.
6. Sokolovskaya, T.G., Sokolovskii, A.S., and Sobolevskii, E.I., 1998, A list of fishes of Peter the Great Bay (the Sea of Japan): Journal of Ichthyology, v. 38, no. 1, p. 1–11.
7. Chereshnev, I., Nazarkin, M.V., Skopets, M.B., Pitruk, D., Shestakov, A.V., Yabe, M., and others, 2001, Annotated list of fish-like vertebrates and fish in Tauisk Bay (northern part of the Sea of Okhotsk), *in* Andreev, A.V., and Bergmann, H.H., eds., Biodiversity and ecological status along the northern coast of the Sea of Okhotsk—A collection of study reports: Dalnauka Vladivostok, Russia, Institute of Biological Problems of the North, p. 64–86.
8. Johnson, S.W., Neff, A.D., and Thedinga, J.F., 2005, An atlas on the distribution and habitat of common fishes in shallow nearshore waters of southeastern Alaska: Alaska Fisheries Science Center, Technical Memorandum NMFS-AFSC-157, 98 p.
9. Minerals Management Service, 2008, Beaufort Sea and Chukchi Sea planning areas—Oil and Gas Lease Sales 209, 212, 217, and 221: U.S. Department of the Interior, Minerals Management Service Alaska OCS Region, OCS EIS/EA, MMS 2008-0055, 538 p.

10. 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.

11. Mecklenburg, C.W., Stein, D.L., Sheiko, B.A., Chernova, N.V., Mecklenburg, T.A., and Holladay, B.A., 2007, Russian–American long-term census of the Arctic—Benthic fishes trawled in the Chukchi Sea and Bering Strait, August 2004: Northwestern Naturalist, v. 88, no. 3, p. 168–187.

12. 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., avaliable from U.S. Department of Commerce, Springfield, Virginia]

13. Tack, S.L., 1970, The summer distribution and standing stock of the fishes of Izembek Lagoon, Alaska: Fairbanks, University of Alaska, Master's thesis.

14. Tokranov, A.M., 1987b, Species composition and distribution of sea poachers (Pisces, Agonidae) in nearshore waters of Kamchatka: Zoologicheskii Zhurnal, v. 66, p. 385–392.

15. Boehlert, G.W., Gadomski, D.M., and Mundy, B.C., 1985, Vertical distribution of ichthyoplankton off the Oregon coast in spring and summer months: Fishery Bulletin, v. 83, no. 4, p. 611–621.

16. Haldorson, L., Pritchett, M., Sterritt, D., and Watts, J., 1993, Abundance patterns of marine fish larvae during spring in a southeastern Alaskan bay: Fishery Bulletin, v. 91, no. 1, p. 36–44.

17. Ambrose, D.A., Carter, R.L., and Manion, S.M., 2006, Ichthyoplankton and station data for surface (manta) and oblique (bongo) plankton tows for California Cooperative Oceanic Fisheries Investigations survey cruises in 2005: U.S. Department of Commerce, National Oceanic and Atmospheric Administration, NOAA Technical Memorandum NOAA-TM-NMFS-SWFSC-392, 125 p.

18. Marliave, J.B., 1975, The behavioral transformation from the planktonic larval stage of some marine fishes reared in the laboratory: Vancouver, University of British Columbia, Ph.D. dissertation.

19. Harris, C.K., and Hartt, A.C., 1977, Assessment of pelagic and nearshore fish in three bays on the east and south coasts of Kodiak Island, Alaska: Seattle, University of Washington, Fisheries Research Institute, FRI-UW-7719.

20. Tokranov, A.M., 1992, Dietary characteristics of sea poachers (Agonidae) in the coastal waters of Kamchatka: Journal of Ichthyology v. 32, no. 9, p. 85–94.

21. Abookire, A.A., Piatt, J.F., and Robards, M.D., 2000, Nearshore fish distributions in an Alaska estuary in relation to stratification, temperature and salinity: Estuarine, Coastal and Shelf Science, v. 51, no. 1, p. 45–59.

22. Busby, M.S., Mier, K.L., and Brodeur, R.D., 2005, Habitat associations of demersal fishes and crabs in the Pribilof Islands region of the Bering Sea: Fisheries Research, v. 75, nos. 1–3, p. 15–28.

23. Love, M.S., University of California-Santa Barbara, pers. obs., 2009.

24. McConnaughey, T., and McRoy, C.P., 1979, ^{13}C label identifies eelgrass (*Zostera marina)* carbon in an Alaskan estuarine food web: Marine Biology, v. 53, no. 3, p. 263–269.

25. Froese, R., and Pauly, D., eds., 2012, FishBase—Global information system on fishes: FishBase database, accessed July 8, 2012, at http://www.fishbase.org.

26. Tokranov, A.M., 1987a, Feeding of giant sculpin *Myoxocephalus polyacanthocephalus* Pallas and plain sculpin *M. jaok* (Cuvier)(Cottidae) in coastal waters of Kamchatka: Journal of Ichthyology, v. 27, p. 104–114.

Veteran Poacher (*Podothecus veternus*)

Jordan & Starks, 1895

Family Agonidae

Veteran Poacher (*Podothecus veternus*), 172 mm TL, northeastern Bering Sea, 2006. Photograph by C.W. Mecklenburg, Point Stephens Research.

Note on taxonomy: *Because of historical confusion of* P. veternus *with* P. accipenserinus, *geographic and bathymetric ranges for the species are not well known* [1].

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

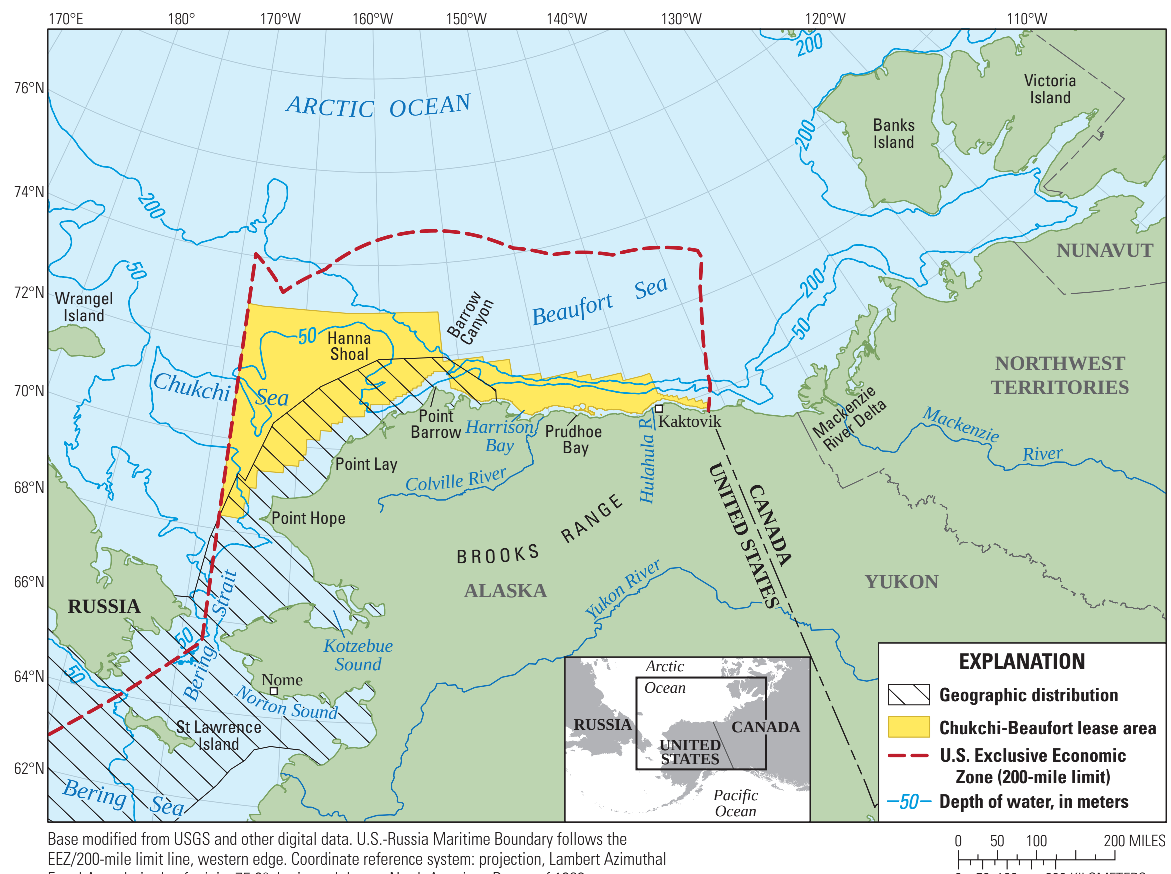
Ecological Role: Largely unknown. Current information about the occurrence of this fish is limited but the species is common in coastal waters near Point Barrow. Species information regarding the biology and ecology is not available. The veteran poacher is unlikely to represent a significant prey resource to higher-level organisms but may be locally and seasonally important.

Physical Description/Attributes: Brown back and sides marked by dark vertical bands, white on chest and belly. For specific diagnostic characteristics, see *Fishes of Alaska* (Meckenburg and others, 2002, p. 542) [1]. Swim bladder: Absent [2]. Antifreeze glycoproteins in blood serum: Unknown.

Range: *Eastern Chukchi Sea northward to 71°23'N, 160°15'W* [3] *eastward to western Beaufort Sea at Cooper Island* [4]. One unconfirmed record from the U.S. Beaufort Sea [3]. Elsewhere in Alaska, to eastern Bering Sea at Norton Sound and near St. Matthew Island. Worldwide, Seas of Okhotsk and Japan [1].

Relative Abundance: *Common in U.S. Chukchi Sea* [3]. Elsewhere in Alaska, common in northern Bering Sea, absent from southern Bering Sea [1]. Rare in Sea of Japan [7].

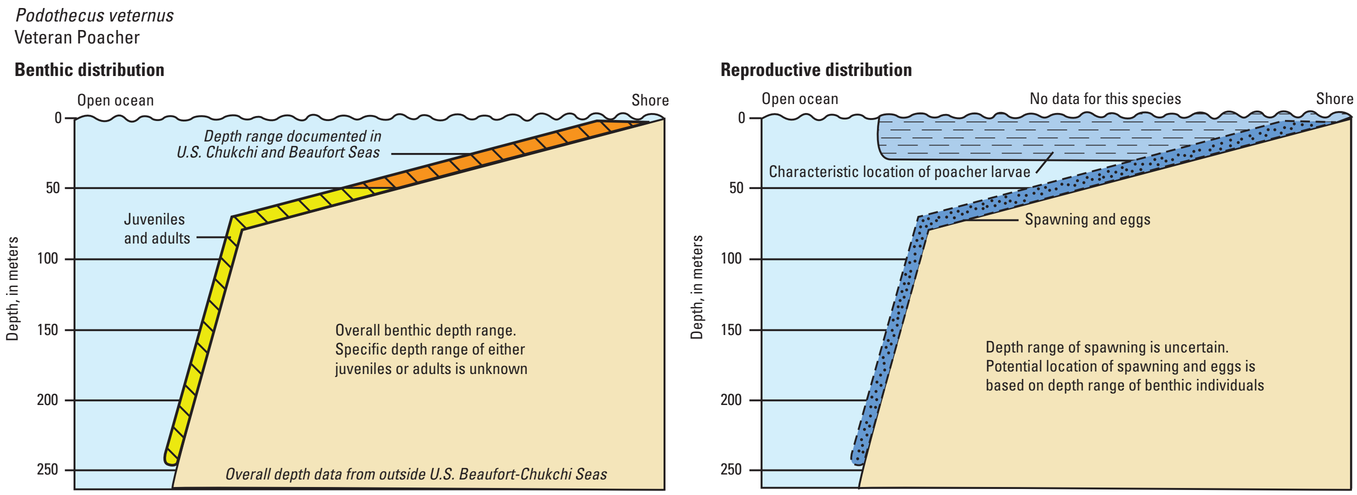
Veteran Poacher
Podothecus veternus



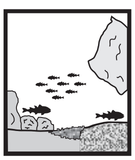
Base modified from USGS and other digital data. U.S.-Russia Maritime Boundary follows the EEZ/200-mile limit line, western edge. Coordinate reference system: projection, Lambert Azimuthal Equal Area; latitude of origin, 75.0°; horizontal datum, North American Datum of 1983.

Geographic distribution of Veteran Poacher (*Podothecus veternus*) within Arctic Outer Continental Shelf Planning Areas [5] based on review of published literature and specimens from historical and recent collections [3, 6].

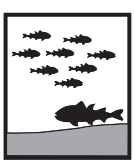
Depth Range: *Documented in U.S. Chukchi 41–48 m* [8]. Elsewhere, overall range is intertidal to 240 m [6]. Depth range of juveniles is unknown. Depth range of larvae is unknown. In general, poacher larvae are abundant in near-surface waters, over continental shelf and shallow slope waters [9–11].



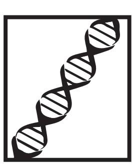
Benthic and reproductive distribution of Veteran Poacher (*Podothecus veternus*).



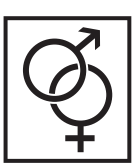
Habitats and Life History
Eggs—Size: Unknown. Time to hatching: Unknown. Habitat: Demersal and adhesive (probably on sand and mud) [2].
Larvae—Size at hatching: Unknown. Size at juvenile transformation: Unknown. Days to juvenile transformation: For poachers in general, 2–3 months [2]. Habitat: Pelagic. Although distance from shore and depth in water column are unknown for this species, in general poacher, larvae are abundant in near-surface waters, over continental shelf and shallow slope waters [9–11].
Juveniles—Age and size: Unknown. Habitat: Demersal [2].
Adults—Age and size at first maturity: Unknown. Maximum age: Unknown. Maximum size: 28.5 cm TL [1]. Habitat: Demersal [2].
Substrate—Shell hash and mud [8].
Physical/chemical—Temperature: -1.8–10.5 °C [8, 12] Salinity: All life stages live in marine waters [2].



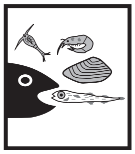
Behavior
Diel—Unidentified poacher larvae have migrated into slightly deeper waters at night in southeastern Alaska [10].
Seasonal—Unknown.
Reproductive—Unknown for this family [2].
Schooling—Unlikely. Other poacher species are solitary [13, 14].
Feeding—Unknown.



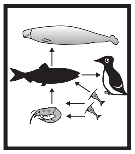
Populations or Stocks
There have been no studies.



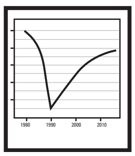
Reproduction
Mode—Separate sexes, oviparous. Fertilization is external [2].
Spawning season—Unknown.
Fecundity—Unknown.



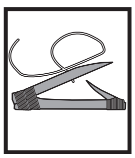
Food and Feeding
Food items—Unknown.
Trophic level—3.31 standard error 0.46. Based on size and trophics of closest relatives [15].



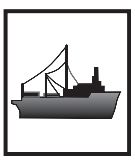
Biological Interactions
Predators—Unknown.
Competitors—Presumably other zoobenthic feeders such as Arctic Cod, Walleye Pollock, other poachers, eelpouts, and sculpins.



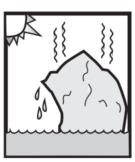
Resilience
Medium, minimum population doubling time: 1.4–4.4 years (Preliminary *K* or Fecundity) [15].



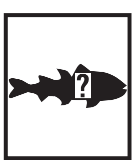
Traditional and Cultural Importance
None reported.



Commercial Fisheries
Currently, Veteran Poacher are not commercially harvested.



Potential Effects of Climate Change
Climate change would likely increase the abundance of this species in the study area. This may increase competition with other fishes that feed on small benthic organisms, including Arctic Cod, Walleye Pollock, other poachers, and sculpins.



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. The veteran poacher may be an important prey of migratory birds and mammals in the ice lead along northwest Alaska during spring.

References Cited

Haldorson, L., Pritchett, M., Sterritt, D., and Watts, J., 1993, Abundance patterns of marine fish larvae during spring in a southeastern Alaskan bay: Fishery Bulletin, v. 91, no. 1, p. 36–44. [10]

Johnson, S.W., Thedinga, J.F., Neff, A.D., and Hoffman, C.A., 2010, Fish fauna in nearshore waters of a Barrier Island in the western Beaufort Sea, Alaska: U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Technical Memorandum, NMFSAFSC-210, 28 p. [4]

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]

Sheiko, B.A., and Mecklenburg, C.W., 2004, Family Agonidae Swainson 1839—Poachers: California Academy of Sciences Annotated Checklists of Fishes no. 30, 27 p. [2]

Bibliography

1. Mecklenburg, C.W., Mecklenburg, T.A., and Thorsteinson, L.K., 2002, Fishes of Alaska: Bethesda, Maryland, American Fisheries Society, 1,116 p.
2. Sheiko, B.A., and Mecklenburg, C.W., 2004, Family Agonidae Swainson 1839—Poachers: California Academy of Sciences Annotated Checklists of Fishes no. 30, 27 p.
3. 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.
4. Johnson, S.W., Thedinga, J.F., Neff, A.D., and Hoffman, C.A., 2010, Fish fauna in nearshore waters of a Barrier Island in the western Beaufort Sea, Alaska: U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Technical Memorandum, NMFSAFSC-210, 28 p. [4]
5. Minerals Management Service, 2008, Beaufort Sea and Chukchi Sea planning areas—Oil and Gas Lease Sales 209, 212, 217, and 221: U.S. Department of the Interior, Minerals Management Service Alaska OCS Region, OCS EIS/EA, MMS 2008-0055, 538 p.
6. Mecklenburg, C.W., Mecklenburg, T.A., Sheiko, B.A., and Steinke, D., 2016, Pacific Arctic marine fishes: Akureyri, Iceland, Conservation of Arctic Flora and Fauna, Monitoring Series Report No. 23, 406 p., accessed May 10, 2016, at http://caff.is/monitoring-series/370-pacific-arcticmarine-fishes.
7. Sokolovskaya, T.G., Sokolovskii, A.S., and Sobolevskii, E.I., 1998, A list of fishes of Peter the Great Bay (the Sea of Japan): Journal of Ichthyology, v. 38, no. 1, p. 1–11.
8. Mecklenburg, C.W., Stein, D.L., Sheiko, B.A., Chernova, N.V., Mecklenburg, T.A., and Holladay, B.A., 2007, Russian–American long-term census of the Arctic—Benthic fishes trawled in the Chukchi Sea and Bering Strait, August 2004: Northwestern Naturalist, v. 88, no. 3, p. 168–187.
9. Boehlert, G.W., Gadomski, D.M., and Mundy, B.C., 1985, Vertical distribution of ichthyoplankton off the Oregon coast in spring and summer months: Fishery Bulletin, v. 83, no. 4, p. 611–621.
10. Haldorson, L., Pritchett, M., Sterritt, D., and Watts, J., 1993, Abundance patterns of marine fish larvae during spring in a southeastern Alaskan bay: Fishery Bulletin, v. 91, no. 1, p. 36–44.
11. Ambrose, D.A., Carter, R.L., and Manion, S.M., 2006, Ichthyoplankton and station data for surface (manta) and oblique (bongo) plankton tows for California Cooperative Oceanic Fisheries Investigations survey cruises in 2005: U.S. Department of Commerce, National Oceanic and Atmospheric Administration, NOAA Technical Memorandum NOAA-TM-NMFS-SWFSC-392, 125 p.

12. Cui, X., Grebmeier, J.M., Cooper, L.W., Lovvorn, J.R., North, C.A., Seaver, W.L., and Kolts, J.M., 2009, Spatial distributions of groundfish in the northern Bering Sea in relation to environmental variation: Marine Ecology Progress Series, v. 393, p. 147–160.

13. Busby, M.S., Mier, K.L., and Brodeur, R.D., 2005, Habitat associations of demersal fishes and crabs in the Pribilof Islands region of the Bering Sea: Fisheries Research, v. 75, nos. 1–3, p. 15–28.

14. Love, M.S., University of California-Santa Barbara, pers. obs., 2009.

15. Froese, R., and Pauly, D., eds., 2012, FishBase—Global information system on fishes: FishBase database, accessed July 8, 2012, at http://www.fishbase.org.

Pimpled Lumpsucker (*Eumicrotremus andriashevi*)

Perminov, 1936

Family Cyclopteridae

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: A rare species that likely is of little ecological significance in the U.S. Chukchi Sea.

Physical Description/Attributes: Globose body with short tails and a disk on the underside, formed by modified pelvic fins, for clinging to rocks and other objects. Head and body covered in spiny tubercles. Color in life not reported. For specific diagnostic characteristics, see *Fishes of Alaska* (Mecklenburg and others, 2002, p. 568) [1]. Swim bladder: Absent [2]. Antifreeze glycoproteins in blood serum: Unknown.

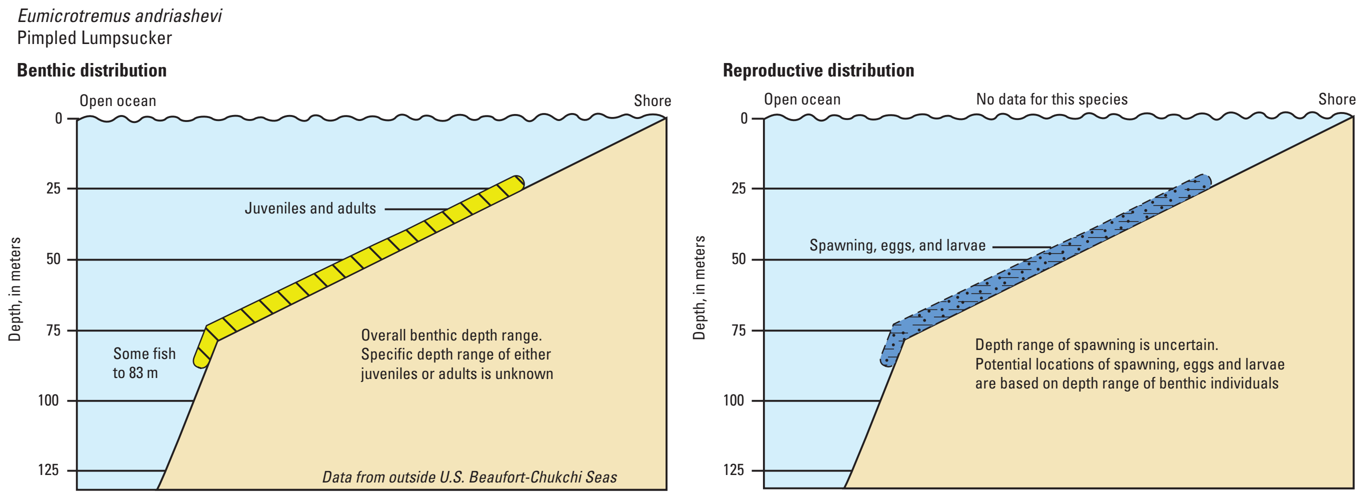
Pimpled Lumpsucker (*Eumicrotremus andriashevi*), 56 mm TL, Chukchi Sea, 1991 (preserved specimen, University of Alaska Museum of the North 4592). Photograph by C.W. Mecklenburg, Point Stephens Research.

Range: *U.S. Chukchi Sea*. Elsewhere in Alaska, eastern Bering Sea as far southward as St. Matthew Island. Worldwide, western Bering Sea southward to Karaginskiy Bay [3].

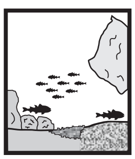
Relative Abundance: *Uncommon in U.S. Chukchi Sea* [1, 5, 6].

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

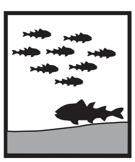
Depth Range: Benthic, at depths of 20–93 m [5]. Specific spawning depth unknown. In general, most lumpsuckers spawn in shallow coastal waters [2].



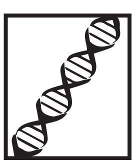
Benthic and reproductive distribution of Pimpled Lumpsucker (*Eumicrotremus andriashevi*).



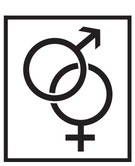
Habitats and Life History
Eggs—Size: Unknown. Time to hatching: Unknown. Habitat: Benthic [1, 2].
Larvae—Size at hatching: Unknown. Size at juvenile transformation: Unknown. Days to juvenile transformation: Unknown. Habitat: Likely benthic [2].
Juveniles—Age and size: Unknown. Habitat: Benthic [2].
Adults—Age and size at first maturity: Unknown. Maximum age: Unknown. Maximum size: As long as 9.7 cm TL [1]. Habitat: Benthic [1, 2].
Substrate—Mud, sand, and pebble bottoms [1].
Physical/chemical—Temperature: -1.6–2.8 °C [5]. Salinity: Unknown.



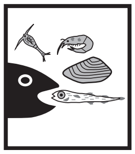
Behavior
Unknown for pimpled lumpsucker. All behavior given is for lumpsuckers in general.
Diel—Known to inflate their bodies by swallowing air or water in what is likely a defensive reaction.
Seasonal—Unknown.
Reproductive—After spawning male lumpsuckers guard the eggs [2].
Schooling—Unknown.
Feeding—Feeds on slow moving prey [2].



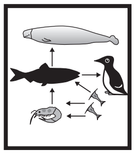
Populations or Stocks
There have been no studies.



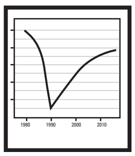
Reproduction
Mode—Oviparous.
Spawning season—Unknown.
Fecundity—Unknown.



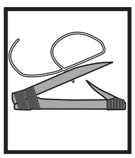
Food and Feeding
Food items—Unknown.
Trophic level—3.15 standard error 0.31 [7].



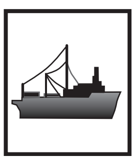
Biological Interactions
Predators—Unknown.
Competitors—Likely sculpins, poachers, and flatfishes.



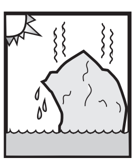
Resilience
Medium, minimum population doubling time: 1.4–4.4 years (assuming Fecundity <1,000) [7].



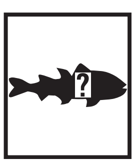
Traditional and Cultural Importance
None reported.



Commercial Fisheries
Currently, Pimpled Lumpsucker are not commercially harvested.



Potential Effects of Climate Change
Unknown.



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.

Bibliography

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

2. Mecklenburg, C.W., and Sheiko, B.A., 2003, Family Cyclopteridae Bonaparte 1831—Lumpsuckers: California Academy of Sciences Annotated Checklists of Fishes no. 6, 17 p.

3. 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.

4. Minerals Management Service, 2008, Beaufort Sea and Chukchi Sea planning areas—Oil and Gas Lease Sales 209, 212, 217, and 221: U.S. Department of the Interior, Minerals Management Service Alaska OCS Region, OCS EIS/EA, MMS 2008-0055, 538 p.

5. Mecklenburg, C.W., Mecklenburg, T.A., Sheiko, B.A., and Steinke, D., 2016, Pacific Arctic marine fishes: Akureyri, Iceland, Conservation of Arctic Flora and Fauna, Monitoring Series Report No. 23, 406 p., accessed May 10, 2016, at http://caff.is/monitoring-series/370-pacific-arcticmarine-fishes.

6. Barber, W.E., Smith, R.L., Vallarino, M., and Meyer, R.M., 1997, Demersal fish assemblages of the northeastern Chukchi Sea, Alaska: Fishery Bulletin, v. 95, no. 2, p. 195–209.

7. Froese, R., and Pauly, D., eds., 2012, FishBase—Global information system on fishes: FishBase database, accessed July 8, 2012, at http://www.fishbase.org.

Leatherfin Lumpsucker (*Eumicrotremus derjugini*)

Popov, 1926

Family Cyclopteridae

Leatherfin Lumpsucker (*Eumicrotremus derjugini*), 101 mm TL, Beaufort Sea, 2011. Photograph by C.W. Mecklenburg, Point Stephens Research.

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

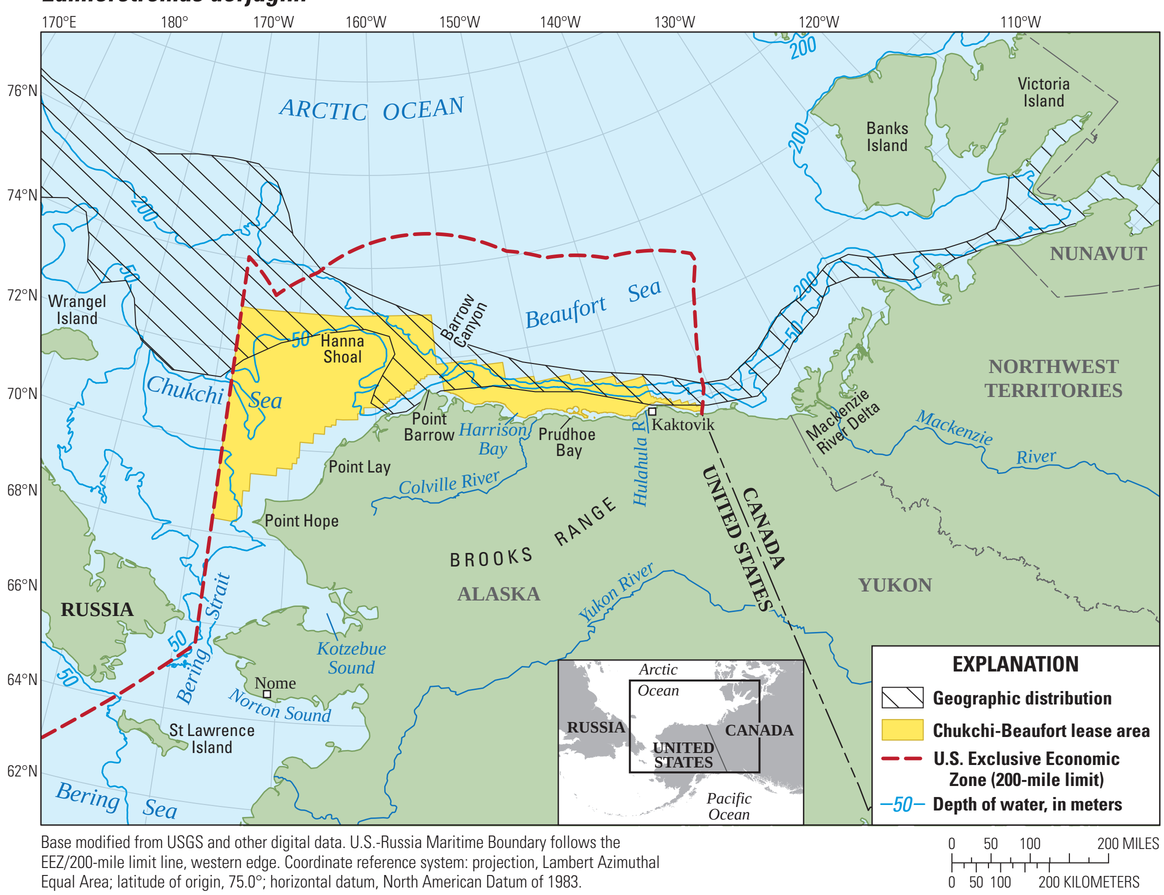
Ecological Role: An uncommon species in the U.S. Beaufort Sea. Its ecological significance is not known but believed to be of minor consequence.

Physical Description/Attributes: Globose body with short tail and an adhesive disk on the underside, formed by modified pelvic fins, for clinging to rocks and other objects. Head and body covered in spiny tubercles. Colored blackish brown on head, back, and sides fading to nearly white on belly. For specific diagnostic characteristics, see *Fishes of Alaska*, (Mecklenburg and others, 2002, p. 566) [1]. Swim bladder: Absent [2]. Antifreeze glycoproteins in blood serum: Unknown.

Range: *Eastern Chukchi Sea and Alaskan Beaufort Sea* [5]. Worldwide, circumpolar in Arctic seas; northward in Barents Sea to 81–82°N; isolated population in northern Sea of Okhotsk [3].

Relative Abundance: *Common in U.S. Beaufort Sea, not reported from U.S. Chukchi Sea* [1, 5]. Common off northwest and northeast Greenland [6].

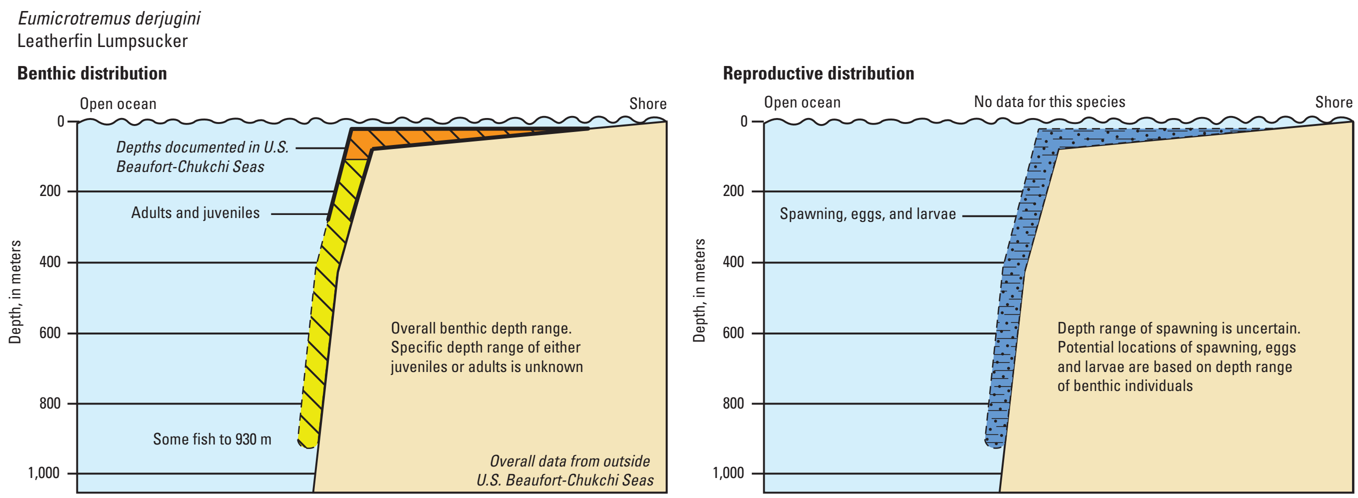
Leatherfin Lumpsucker
Eumicrotremus derjugini



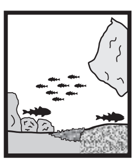
Base modified from USGS and other digital data. U.S.-Russia Maritime Boundary follows the EEZ/200-mile limit line, western edge. Coordinate reference system: projection, Lambert Azimuthal Equal Area; latitude of origin, 75.0°; horizontal datum, North American Datum of 1983.

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

Depth Range: 50–930 m, typically less than 275 m [1]. *Documented in U.S. Beaufort Sea from 50–110 m* [7]. *A juvenile was taken at 41 m in U.S. Beaufort Sea* [3]. Specific spawning depth unknown. In general, most lumpsuckers spawn in shallow coastal waters [2].

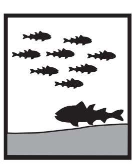


Benthic and reproductive distribution of Leatherfin Lumpsucker (*Eumicrotremus derjugini*).



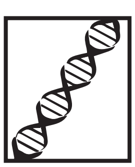
Habitats and Life History

Eggs—Size: 4.0–5.0 mm [8]. *Females can contain two size classes of eggs at one time* [7]. Time to hatching: Unknown. In Barents Sea, eggs laid in autumn hatch the following summer [9]. Habitat: Benthic [1, 2].
Larvae—Size at hatching: Unknown. Size at juvenile transformation: Unknown. Days to juvenile transformation: Unknown. Habitat: Unknown, likely benthic [2].
Juveniles—Age and size: Unknown. *One juvenile from U.S. Beaufort Sea was 10.1 mm SL, 14.2 mm TL* [3]. Habitat: Benthic [2]. In Barents Sea, they remain in coastal areas until about 1 year old and up to 3–4 cm [2, 9].
Adults—Age and size at first maturity: Unknown. *Over 6.5 cm TL for females in U.S. Beaufort Sea* [7]. Maximum age: Unknown. Maximum size: 12.7 cm TL [1]. Habitat: Benthic [2, 10, 11]. Substrate—Mud, gravel, stony bottoms [1, 10].
Physical/chemical—Temperature: Poorly documented; -2–0 °F [11]. Salinity: Marine [10].



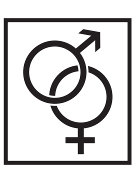
Behavior

Diel—*Unknown*. In general, lumpsuckers are known to inflate their bodies by swallowing air or water in what is likely a defensive reaction.
Seasonal—Unknown.
Reproductive—Unknown. In general, after spawning male lumpsuckers guard the eggs [2].
Schooling—Unknown.
Feeding—Feeds on slow moving prey [2].



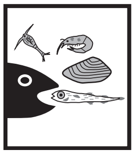
Populations or Stocks

There have been no studies.

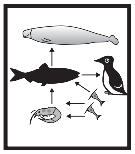


Reproduction

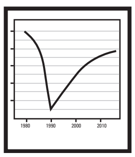
Mode—Oviparous.
Spawning season—Unknown. Autumn in Barents Sea [9]. Females taken off Russia during August and September contained large eggs [10].
Fecundity—Unknown.



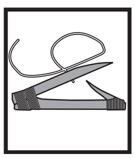
Food and Feeding
Food items—*In U.S. Beaufort Sea, primarily hyperiid amphipods and gammarid amphipods, mysids, and polychaetes* [7].
Trophic level—3.25 standard error 0.34 [12].



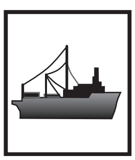
Biological Interactions
Predators—Thick-billed Murres in the Canadian Arctic [13].
Competitors—Likely sculpins, poachers, and flatfishes.



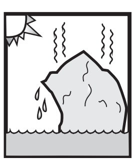
Resilience
High, minimum population doubling time is less than 15 months (Preliminary *K* or Fecundity) [12].



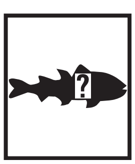
Traditional and Cultural Importance
None reported.



Commercial Fisheries
Currently, Leatherfin Lumpsucker are not commercially harvested.



Potential Effects of Climate Change
Unknown.



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.

References Cited

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.] [10]

Frost, K.J., and Lowry, L.F., 1983, Demersal fishes and invertebrates trawled in the northeastern Chukchi and western Beaufort Seas 1976–1977: U.S. Department of Commerce, National Oceanic and Atmospheric Administration, AA Technical Report NMFS-SSRF-764, 22 p. [7]

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]

Mecklenburg, C.W., and Sheiko, B.A., 2003, Family Cyclopteridae Bonaparte 1831—Lumpsuckers: California Academy of Sciences Annotated Checklists of Fishes no. 6, 17 p. [2]

Bibliography

1. Mecklenburg, C.W., Mecklenburg, T.A., and Thorsteinson, L.K., 2002, Fishes of Alaska: Bethesda, Maryland, American Fisheries Society, 1,116 p.
2. Mecklenburg, C.W., and Sheiko, B.A., 2003, Family Cyclopteridae Bonaparte 1831—Lumpsuckers: California Academy of Sciences Annotated Checklists of Fishes no. 6, 17 p.
3. 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.
4. Minerals Management Service, 2008, Beaufort Sea and Chukchi Sea planning areas—Oil and Gas Lease Sales 209, 212, 217, and 221: U.S. Department of the Interior, Minerals Management Service Alaska OCS Region, OCS EIS/EA, MMS 2008-0055, 538 p.
5. Mecklenburg, C.W., Mecklenburg, T.A., Sheiko, B.A., and Steinke, D., 2016, Pacific Arctic marine fishes: Akureyri, Iceland, Conservation of Arctic Flora and Fauna, Monitoring Series Report No. 23, 406 p., accessed May 10, 2016, at http://caff.is/monitoring-series/370-pacific-arcticmarine-fishes.
6. Møller, P.R., Nielsen, J.G., Knudsen, S.W., Poulsen, J.Y., Sünksen, K., and Jørgensen, O.A., 2010, A checklist of the fish fauna of Greenland waters: Zootaxa, v. 2378, p. 1–84.
7. Frost, K.J., and Lowry, L.F., 1983, Demersal fishes and invertebrates trawled in the northeastern Chukchi and western Beaufort Seas 1976–1977: U.S. Department of Commerce, National Oceanic and Atmospheric Administration, AA Technical Report NMFS-SSRF-764, 22 p.
8. Able, K.W., Markle, D.F., and Fahay, M.P., 1984, Cyclopteridae—Development, *in* Moser, H.G. and others, eds., Ontogeny and systematics of fishes: Lawrence, Kansas, Allen Press, American Society of Ichthyology and Herpetology Special Publication 1, p. 428–437.
9. Wienerroither, R., Johannesen, E., Langøy, H., Børve Eriksen, K., de Lange Wenneck, T., Høines, Å., Bjelland, O., Aglen, A., Prokhorova, T., Murashko, P., Prozorkevich, D., Konstantin, Byrkjedal, I., Langhelle Drevetnyak, and G., Smirnov, O., 2011, Atlas of the Barents Sea fishes: IMR/PINRO Joint Report Series 1-2011, ISSN 1502-8828, 274 p.
10. 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., avaliable from U.S. Department of Commerce, Springfield, Virginia]
11. Rose, G.A., 2005, On distributional responses of North Atlantic fish to climate change: ICES Journal of Marine Science, v. 62, no. 7, p. 1,360–1,374.
12. Froese, R., and Pauly, D., eds., 2012, FishBase—Global information system on fishes: FishBase database, accessed July 8, 2012, at http://www.fishbase.org.
13. Scott, W.B., and Scott, M.G., 1988, Atlantic fishes of Canada: Toronto, University of Toronto Press, 730 p.