

## Inconnu and Glacier Lanternfish

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### Inconnu (*Stenodus leucichthys*)

(Güldenstadt, 1772)

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#### Family Salmonidae

**Colloquial Name:** Iñupiat—*Siigruaq* [1]. Most often called sheefish in Alaska.

**Ecological Role:** Rarely enters marine waters and thus is not of ecological importance in the U.S. Chukchi and Beaufort Seas. Common in coastal lagoons in Kotzebue Sound, this fish is a major predator of pelagic species, such as Pacific Herring and possibly juvenile salmon. Inconnu is an important subsistence species in western Alaska including the southeastern Chukchi Sea.

**Physical Description/Attributes:** Body not much compressed; and colored green, blue, or brown dorsally and silvery white ventrally. For specific diagnostic characteristics, see *Fishes of Alaska* (Mecklenburg and others, 2002, p. 181) [2]. Swim bladder: Present [3]. Antifreeze glycoproteins in blood serum: Unknown.

**Range:** Northward to Kobuk River [2] and probably Noatak River drainages of U.S. Chukchi Sea [4]. Elsewhere in Alaska, this fish has been found as far south as Kuskokwim River [2]. Worldwide, Inconnu are found from Firth to Anderson Rivers, Canada [5], and in Caspian, Siberian, and White Sea drainages, south to Kamchatka, Russia [2]. Reported in nearshore semi-saline waters of Canadian Beaufort Sea to at least as far west as Herschel Island and Nunaluk Lagoon, Yukon Territory; most numerous just west of Mackenzie River, Northwest Territory [6].



Inconnu (*Stenodus leucichthys*). Photograph by R.J. Brown, U.S. Fish and Wildlife Service.

**Relative Abundance:** Common in the Kobuk River. Despite earlier reports of scattered fish in the Meade and Colville Rivers, there have been no recent reports of fish from any North Slope drainage [2].

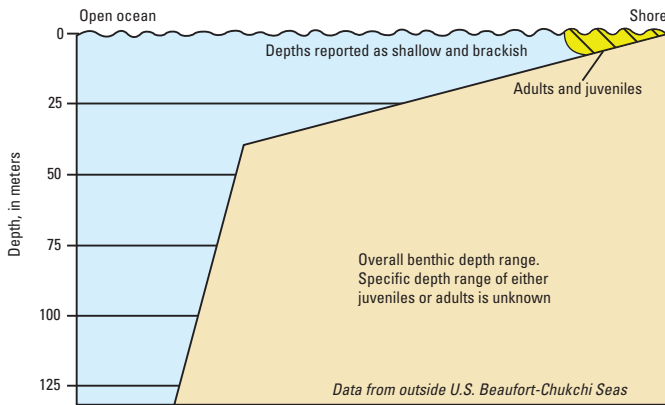


Geographic distribution of Inconnu (*Stenodus leucichthys*), in brackish nearshore and delta waters within Arctic Outer Continental Shelf planning areas [7] based on review of published literature and specimens from historical and recent collections [2, 8].

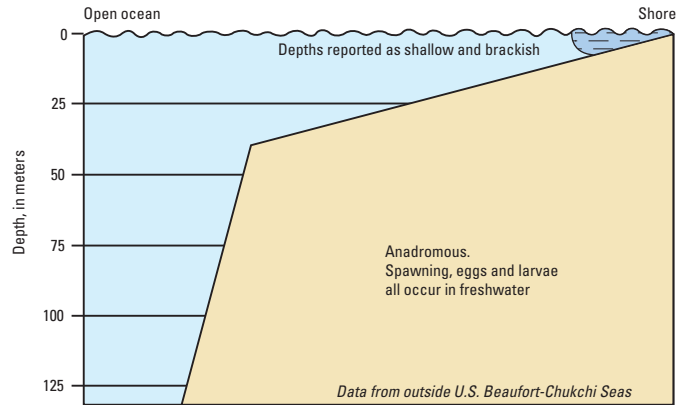
**Depth Range:** Shallow waters in rivers and brackish, near-shore coastal systems [9].

*Stenodus leucichthys*  
Inconnu

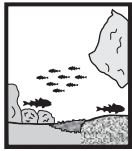
**Benthic distribution**



**Reproductive distribution**



Benthic and reproductive distribution of Inconnu (*Stenodus leucichthys*).



**Habitats and Life History**

Amphidromous.

**Eggs**—Size: 2.5–2.7 mm [5, 10–13]. Time to hatching: 6–9 months. Habitat: Benthic, buried in gravel in freshwater rivers [5, 10, 14].

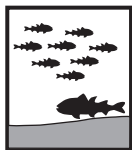
**Larvae**—Size at hatching: 11.0–11.3 mm [15]. Size at juvenile transformation: 7.0 cm [15]. Days to juvenile transformation: Unknown. Habitat: Newly hatched larvae are carried down river to nursery and overwintering areas in river deltas, estuaries, or lower reaches of watersheds [11].

**Juveniles**—Age and size: 0–7 years and about 70 cm average [5, 10, 14]. Habitat: Fresh and brackish water [5, 10, 14].

**Adults**—Age and size at first maturity: Males mature at 4–11 years (70–85 cm) [10, 11, 14] and females at 6–14 years (75–90 cm) [10, 14]; most fish mature at 8–12 years [16]. On average, males mature when younger and smaller than females [5]. Maximum age: At least 41 years [17]. Older studies using scales to age fish rather than otoliths underestimated fish ages beginning at about 10 years [18]. Females grow larger than males, live longer, and tend to reach maturity later [9–11, 14]. Growth rates, life spans, and size and age at maturity vary between watersheds and between populations within watersheds [11, 19]. For instance, fish in Kobuk and Selawik Rivers live longer and grow larger than those in Yukon and Kuskokwim systems; however, Kobuk and Selawik fish grow slower [14]. Maximum size: 140 cm [2]. Habitat: Large and slow moving rivers and estuaries. Entire life is spent within or adjacent to their home rivers [5, 11, 16].

**Substrate**—Coarse gravel and cobble mixed with sand for spawning [10, 11, 16].

**Physical/chemical**—Temperature: Spawning occurs at least between 0–7 °C [5, 13]. Salinity: Primarily freshwater, but some in brackish waters to about 20 parts per thousand [5, 20].



### Behavior

**Diel**—Unknown.

**Seasonal**—Many watersheds contain a relatively small resident freshwater population that migrate within a river system and a larger amphidromous population that may or may not enter estuarine waters in a given year [5, 10]. For example, Mackenzie River sea-going inconnu spend their first 1–2 years in freshwater and then tend to move annually into brackish and more marine coastal waters. Among these stocks, some regularly migrated to sea throughout their lives, whereas others made only occasional estuarine migrations or sea migrations followed by extended periods in freshwater or in estuaries [9]. In some rivers, resident and amphidromous forms do not share feeding, overwintering, or spawning grounds [20, 21]. Overwintering areas vary with watershed. Fish in Kobuk and Selawik Rivers overwinter in brackish waters of Hotham Inlet and Selawik Lake. Fish in the lower Yukon and Kuskokwim Rivers spend winter in those rivers' deltas [11], whereas Mackenzie River fish winter both in the delta and nearshore coastal waters of Canadian Beaufort Sea [9]. Slightly before or at about ice break-up time, adults and some juveniles begin to leave overwintering grounds [14, 22], although in some areas (for example, Selawik Lake) juveniles remain on nursery grounds throughout the year [10]. Individuals that will spawn in autumn migrate with other fish to feeding grounds during summer, but do not feed, instead they continue on to spawning grounds [5, 14]. Feeding (non-spawning) fish migrate back to overwintering grounds during August and September [5, 10, 16].

**Reproductive**—Spawn in their natal rivers. Spawning migrations may be long; as much as 1,800 km on the Mackenzie River [23], 1,500 km on the Yukon River [4], and 2,400 km on Siberian rivers [5]. Arrive on spawning grounds as early as 1–2 months before spawning in early autumn [5, 14, 24]. In the Selawik and Kobuk Rivers, spawning occurs in late afternoon and evening between at least 1500 and 1800 hours (local), perhaps peaking between 1545 and 2200 hours (local) [5, 10, 14]. Spawning sites are in relatively small and restricted areas, although these may change with time [5]. Inconnu are broadcast spawners in shallow and fast moving waters over coarse gravel and cobble mixed with sand [10, 11, 16]. Females release eggs at the surface and males release sperm just below the surface and rarely come to the surface [5, 11]. A female emits eggs in a series of discrete spawning spurts, returning to the bottom between each episode [5]. Eggs fall to the riverbed and are slightly adhesive to gravel and cobble [11]. Eggs are deposited in autumn and reportedly hatch around time of ice break-up in early spring [12, 16]. Some populations spawn annually [17]. However, in other populations, most individuals do not spawn annually; however, males are more likely to spawn in sequential years [16, 25, 26]. Although many migrate downstream immediately after spawning (arriving in October), others remain on spawning grounds for some length of time (as late as January) [5, 10, 16].

**Schooling**—Forms schools [5, 10, 14].

**Feeding**—Migrating juveniles and non-spawning adults travel to feeding areas. In western Alaska, foraging areas tend to be in lower reaches of rivers, upstream of overwintering grounds [22], but also include the brackish waters of Kotzebue Sound (for Kobuk and Selawik River fish) [5] and the Beaufort Sea (for Mackenzie River fish) [20]. Does not feed during spawning migrations (about 1–4 months) [14].



### Populations or Stocks

Two distinct spawning locations have been identified, one in the upper Kobuk River and one on the refuge in the upper Selawik River. In cooperation with the Native Village of Kotzebue and Alaska Department of Fish and Game, genetic mixed stock analysis is ongoing to understand the proportion of the winter inconnu harvest that comes from each of the two spawning populations.



### Reproduction

**Mode**—Gonochoristic, oviparous, iteroparous with external fertilization [5, 10, 11].

**Spawning season**—Autumn, primarily September and October [9, 16, 27].

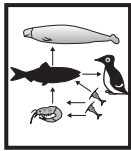
**Fecundity**—26,000–455,000 eggs [5, 10–12, 17].



### Food and Feeding

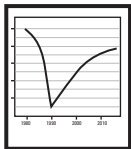
**Food items**—Plankton and insects for juveniles. For fish 2 years and older, food is primarily fishes (for example, whitefishes, Arctic Lamprey, Pacific Herring, and salmon) and secondarily on small invertebrates such as isopods, mysids, and insects [5, 6, 11].

**Trophic level**—4.15 (standard error 0.75) [28].

**Biological Interactions**

**Predators**—Unknown, although grayling, whitefish, and char consume newly spawned eggs [10].

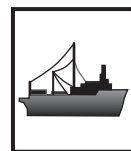
**Competitors**—Likely omnivores such as various whitefish species, char, and grayling.

**Resilience**

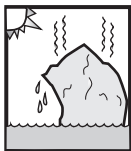
Low, minimum population doubling time: 4.5–14 years ( $K=0.05-0.10$ ;  $t_m=9-12$ ;  $t_{max}=22$ ; Fecundity=80,000) [28].

**Traditional and Cultural Importance**

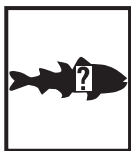
Inconnu are an important subsistence species for humans and dogs. In many watersheds, they are usually taken around the time of spawning, but in the Selawik-Kobuk river system a large fishery operates during winter in the Hotham Inlet area [4, 9, 10]. Many fish are taken by gill nets; however, seines and hook and line also account for large numbers. The fish are eaten fresh, dried, or aged and frozen, and the fat-riddled large intestines are boiled for the oil [27].

**Commercial Fisheries**

Currently, inconnu are not commercially harvested. A small barter and trade fishery exists in the Kotzebue area and in Great Slave Lake [9, 25] and Inconnu are popular with recreational anglers, particularly on the Kobuk River [5].

**Potential Effects of Climate Change**

Unknown. Generally, Durand and others (2011) [60] predict that, at least for anadromous fishes in subarctic rivers, shifts in biology will be effected by spring ice break-up and resultant peak flows and surrounding permafrost processes: both of which affect the supply of nutrients and (or) sediment to the watershed of climate change on spring break-up intensity. Climate change and its effects on the spawning recruitment of inconnu in the Selawik River are being studied in cooperative research between U.S. Fish and Wildlife Service and U.S. Geological Survey.

**Areas for Future Research [A]**

Research needs include: movements and migrations, behavior of larval and juveniles in response to environmental variables, and enumeration of predator-prey relationships in coastal waters. Catch and subsistence use patterns should continue to be monitored.

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**Glacier Lanternfish (*Benthosema glaciale*)**

(Reinhardt, 1837)

**Family Myctophidae**

**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:** Rarely observed in the U.S. Chukchi Sea. The role of the species in regional food webs is minimal.

**Physical Description/Attributes:** Small, silvery fish with compressed body, blunt head, large eyes, and numerous round photophores in a specific pattern. For specific diagnostic characteristics, see *Fishes of Alaska* (Mecklenburg and others, 2002, p. 249) [1]. Swim bladder: Present [2]. Antifreeze glycoproteins in blood serum: Unknown.

**Range:** U.S. Chukchi Sea [1, 3]. Elsewhere, from Baffin Bay and northwest Greenland, east to Svalbard Islands, Norway; Barents Sea; and Kara Sea [3].

**Relative Abundance:** Rare, one record from U.S. Chukchi Sea near Point Barrow, Alaska [1, 3]. Elsewhere, common in Barents Sea [6].



Glacier Lanternfish (*Benthosema glaciale*). Photograph by Rudolf Svensen, <http://www.uwp.no>.



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.

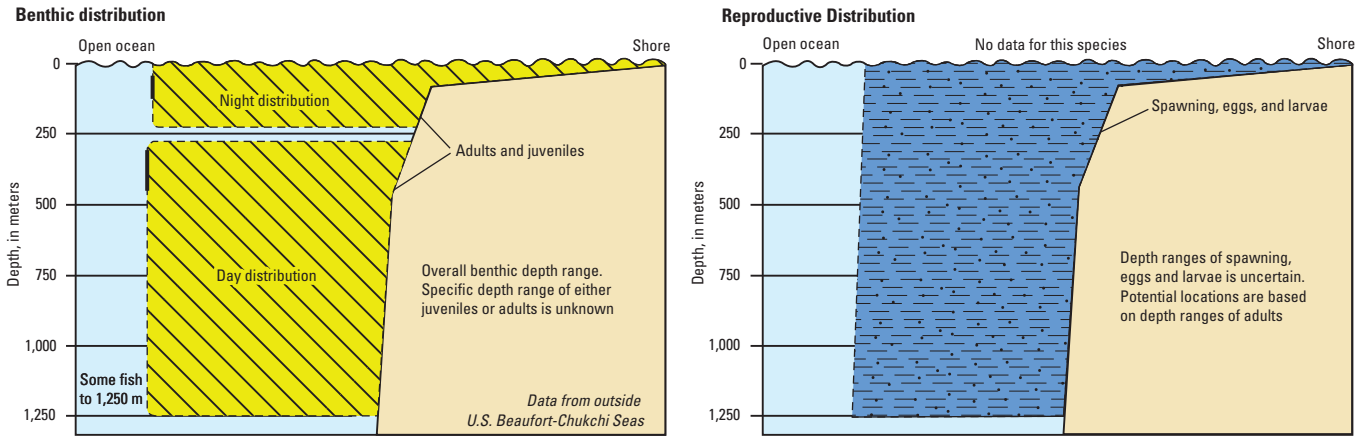
0 50 100 200 MILES  
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Geographic distribution of Glacier Lanternfish (*Benthosema glaciale*), within Arctic Outer Continental Shelf planning areas [4] based on review of published literature and specimens from historical and recent collections [1, 3, 5].

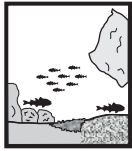


**Depth Range:** Near surface to 225 m at night [1], mainly 30–90 m [7]; descending to 275–1,456 m during day [1, 5], mainly 350–450 m [7].

*Benthoosema glaciale*  
Glacier Lanternfish



Benthic and reproductive distribution of Glacier Lanternfish (*Benthoosema glaciale*).



**Habitats and Life History**

**Eggs**—Size: 0.75–0.80 mm [8]. Time to hatching: Unknown. Habitat: Pelagic [9].

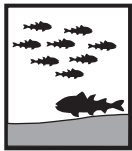
**Larvae**—Size at hatching: *Unknown*. 5 mm or less [8]. Size at juvenile transformation: 11–15 mm [8]. Days to juvenile transformation: Unknown. Habitat: Pelagic [9].

**Juveniles**—Age and size: Age unknown. 1.1–5.0 cm [6, 8]. Habitat: Epipelagic to mesopelagic [1].

**Adults**—Age and size at first maturity: 2–3 years and 4.5–5.0 cm [6]. Maximum age: 8 years in Barents Sea [6]. Maximum size: As long as 10.3 cm (reported as both TL and SL) [10], usually less than 7.0 cm [1]. Habitat: Epipelagic to mesopelagic, typically offshore [1].

**Substrate**—Unknown.

**Physical/chemical**—Temperature: Common between 4 and 16 °C in northwest Atlantic Ocean. Has been captured at temperatures of -0.1–21 °C [5]. Salinity: Marine [9].



**Behavior**

**Diel**—Mesopelagic by day, epipelagic by night [1].

**Seasonal**—Unknown.

**Reproductive**—Spawns pelagically [6].

**Schooling**—Forms schools [6].

**Feeding**—Filter feeder [6]. Feeds year-round, but activity is most intensive in spring and summer [11].



**Populations or Stocks**

There have been no studies.



**Reproduction**

**Mode**—Oviparous, separate sexes [9].

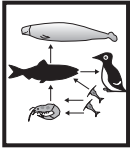
**Spawning season**—June–July in Barents Sea [6]. Early spring off Nova Scotia, Canada [8].

**Fecundity**—750–800 eggs [6].



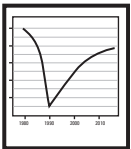
**Food and Feeding**

**Food items**—Mainly copepods and euphausiids [6, 7, 11].  
**Trophic level**—2.99 (standard error 0.29) [12].



**Biological Interactions**

**Predators**—Leach’s Storm-Petrels off Newfoundland, Canada [13]. For lanternfish in general, predators are squids, larger fishes, and marine mammals [1].  
**Competitors**—As one of the few mesopelagic species in the U.S. Chukchi Sea, Glacier Lanternfish probably have few fish competitors, especially at depth. Arctic Cod and Ice Cod co-occur with Glacier Lanternfish and may compete for zooplankton prey.



**Resilience**

Medium, minimum population doubling time: 1.4–4.4 years ( $K=0.20-0.45$ ;  $t_m=2-3$ ;  $t_{max}=8$ ; fecundity=700) [12].



**Traditional and Cultural Importance**

None reported.



**Commercial Fisheries**

Glacier Lanternfish are not currently harvested commercially.



**Potential Effects of Climate Change**

Unknown.



**Areas for Future Research [B]**

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

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