— Walleye Pollock —

Theragra chalcogramma

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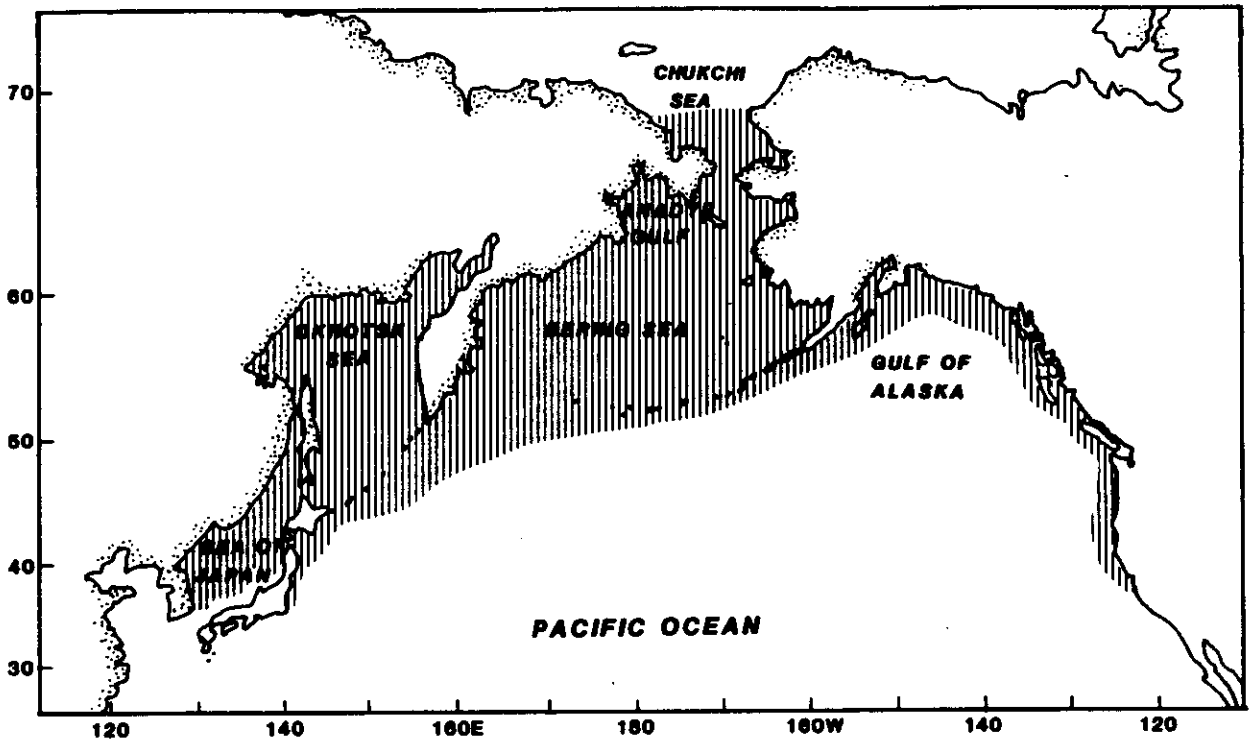
Walleye Pollock Life History and Habitat Requirements
Southwest and Southcentral Alaska



Map 1. Range of walleye pollock (Bakkala et al. 1983)

I. NAME
   A. Common Name: Walleye pollock
   B. Scientific Name: Theragra chalcogramma

II. RANGE
   A. Worldwide
      Pollock are distributed from central California through the Bering Sea to St. Lawrence Island and on the Asian coast to Kamchatka, the Okhotsk Sea, and the Southern Sea of Japan (Hart 1973).
   B. Regional Distribution Summary
      To supplement the distribution information presented in the text, a series of bluelined reference maps has been prepared for each region. Most of the maps in this series are at 1:250,000 scale, but some are at 1:1,000,000 scale. These maps are available for

review in ADF&G offices of the region or may be purchased from the contract vendor responsible for their reproduction. In addition, a set of colored 1:1,000,000-scale index maps of selected fish and wildlife species has been prepared and may be found in the Atlas that accompanies each regional guide.

1. Southwest. In the western Gulf of Alaska, the Sanak area had the highest mean catch per unit effort, followed by the Chirikof and Kodiak areas, during the National Marine Fisheries Service (NMFS) survey of 1973-76 (Ronholt et al. 1977). (For more detailed narrative information, see volume 1 of the Alaska Habitat Management Guide for the Southwest Region.)
2. Southcentral. Walleye pollock had the highest relative apparent abundance of any species in the Gulf of Alaska from Cape Spencer to Unimak Pass during the NMFS survey of 1973-76 (ibid.). In May-August 1975, a NMFS study team found the highest concentrations of pollock in the northeastern Gulf of Alaska to be near Cape Cleare at the southern end of Montaque Island (ibid.). More detailed information is presented in the pollock Distribution and Abundance narrative found in volume 2 of this publication. (For more detailed narrative information, see volume 2 of the Alaska Habitat Management Guide for the Southcentral Region.)

III. PHYSICAL HABITAT REQUIREMENTS

Walleye pollock are schooling fish, found on or near the sea bottom as well as at mid water and near-surface depths, although most catches are found between 50 and 300 m (Alton and Deriso 1982, Rogers et al. 1980). Juvenile (age 0) pollock in their first months of life are found above the thermocline (depth at which temperature rapidly decreases) in the Bering Sea (Traynor 1983). Traynor (1983) also observed that age 0 pollock avoid depths where water temperature is less than approximately 2.5 to 3.0°C. Age 0 pollock begin to settle to the bottom in the fall months, after which they mainly occupy semidemersal waters (Bakkala 1983).

Concentrations of adult walleye pollock in the Bering Sea are usually found in water temperatures between 2 and 4°C (Serobaba 1970).

IV. NUTRITIONAL REQUIREMENTS

A. Preferred Foods

In the Bering Sea, euphausiids are the most important food for pollock under 400 mm (Smith et al. 1978). Fish make an important contribution to the diet of adult Bering Sea pollock, making up 70% of stomach contents by volume in a study done by Smith et al. (1978). Pollock larvae (4.8 to 17.7 mm standard length) from the Bering Sea consume mainly copepod nauplii and eggs and adult copepods (especially Oithona similis) (Clarke 1978). Copepods are, however, consumed only by small (less than 200 mm) pollock (Smith et al. 1978, Bailey and Dunn 1979).

Studies in the Bering Sea have shown that small (young of the year and one-year-old) pollock comprise at least 44% by weight of the total stomach contents of adult pollock (Dwyer et al. 1983. Takahashi and Yamaguchi 1972).

In the Southeastern Gulf of Alaska, Clausen (1983) found that small (less than 250 mm) walleye pollock ate mostly planktonic crustaceans, particularly euphausiids, mysids, and copepods, while large pollock (larger than 349 mm) generally ate larger prey, such as shrimp and fish. Cannibalism was observed in only 1% of the stomachs; however, few pollock greater than 450 mm were examined.

B. Feeding Locations

Pollock feed mainly in the shallow (90 to 140 m) waters of the outer continental shelf, where tidal mixing occurs in the spring (Serobaba 1970, Salveson and Alton 1976, Chang 1974). Juveniles follow a diel vertical movement, rising to feed on zooplankton near the surface at night (Serobaba 1970, Kobayashi 1963).

C. Feeding Behavior

In the Bering Sea, pollock feeding activity is concentrated in the summer months (June - August). Pollock feed very little or not at all during the spawning period (April - mid May) (Chang 1974).

V. REPRODUCTIVE CHARACTERISTICS

A. Reproductive Habitat

Pollock spawn in shallow (90 to 200 m) waters of the outer continental shelf (Smith 1981). There is also evidence that pollock spawn in oceanic areas off the continental shelf. Oceanic spawning has been reported over waters 640 m deep south of Seward, Alaska, and in the Aleutian basin (Blackburn, pers. comm.). Some spawning may also occur under the sea ice (Kanamaru et al. 1979). Spawning in the Bering Sea occurs at temperatures of 1 to 3°C (Serobaba 1968). In Asian waters, variability in time of spawning is believed to be an adaptation to periods when water temperatures are favorable for production of abundant supplies of the initial food of the larvae and for larval growth (Kamaba 1977, Nakatani and Maeda 1983, Hamai et al. 1971). Temperature at time of spawning is, however, apparently not as important for the Shelikof Strait spawning population. Pollock consistently return to Shelikof Strait to spawn, though the temperature varies from 3.5 to 6.5°C (Blackburn, pers. comm.; NMFS 1983).

B. Reproductive Seasonality

In the Bering Sea, spawning begins in late February. Fish in the southeastern Bering Sea spawn first. Most spawning occurs from late March to mid June, with a peak in May (Serobaba 1968). In the western Gulf of Alaska, Hughes and Hirschhorn (1979) found that more than 85% of pollock adults had spawned prior to their earliest sampling in May, indicating that most spawning occurred in March and April.

C. Reproductive Behavior

Spawning and prespawning fish move high in the water column, forming dense schools (Takakura 1954, Serobaba 1974). Eggs are

planktonic and are found primarily within 30 m of the surface (Serobaba 1967, 1974).

D. Age at Sexual Maturity
Pollock begin to recruit to the spawning population at age two, but age classes four and five contribute most to potential reproduction of the population (Smith 1981, Chang 1974).

E. Fecundity
Estimates of individual female fecundity are difficult to achieve because ovaries of female pollock contain oocyte populations composed of two or three size classes. The percent of each size class released during spawning is uncertain (Smith 1981, Foucher and Beamish 1977). Serobaba (1971) found fecundities of 37,000 to 312,000 eggs per female in fish of lengths of 40 to 80 cm in the Bering Sea. Thompson (1981) found fecundities of 199,000 to 996,600 for lengths of 32 to 49 cm off the Pacific coast of Canada.

F. Frequency of Breeding
Pollock breed yearly.

G. Incubation Period
Length of incubation is dependent upon temperature. Incubation time from fertilization to 50% hatching is 10 days at 10°C but up to 27.4 days at 2°C (Hamai et al. 1971). Newly hatched larvae are 3.5 to 4.4 mm in length and apparently float upside-down at the water surface (Gobunova 1954). The yolk sac is absorbed at about 7.0 to 7.5 mm (22 days at 2°C) (Yusa 1954, Hamai et al. 1971).

VI. MOVEMENTS ASSOCIATED WITH LIFE FUNCTIONS

A. Timing of Movements and Use of Areas
In the Bering Sea, winter concentrations have been found between Unimak Island and the Pribilof Islands, with some concentrations east of the Pribilofs (Salveson and Alton 1976) and northwest of the Pribilofs along the continental slope (Japan Fishery Agency 1974). Summer feeding concentrations in the Bering Sea are found north of the Pribilofs and to the west and northwest of St. Matthew Island.
A major spawning concentration of pollock is found in the spring in Shelikof Strait (Alton and Deriso 1982). This concentration disperses before summer, and it is not known where that population resides at other times of the year (ibid.).

B. Migration Routes
In the Bering Sea, pollock follow a circular pattern of migration, moving inshore to the shallow (90 to 140 m) waters of the continental shelf to breed and feed in the spring (March), and moving to warmer, deeper areas of the shelf (160 to 300 m) in the winter months (December-February) (Chang 1974). Hughes (1974) noted a similar movement of pollock in the Gulf of Alaska.

VII. FACTORS INFLUENCING POPULATIONS

A. Natural

Water temperature affects the length of incubation, rate of growth, and survival of juvenile pollock (Hamai et al. 1971).

Pollock are a major prey item for several animals, including fur seals (Salveson and Alton 1976), seabirds (Hunt 1981), and other fish.

Estimates have indicated that in the eastern Bering Sea marine mammals consume about 1.13 million tons of pollock annually, an amount approximating the commercial pollock catch in that region (Laevastu and Larkins 1981). In Southeast Alaska, juvenile walleye pollock are one of the most common foods of troll-caught Pacific salmon (Oncorhynchus spp.) (Wing 1977).

In the Bering sea, juvenile pollock have been identified as a major prey item of adult pollock. Because of this, cannibalism may have an important effect on the dynamics of the population (Laevastu and Favorite 1981, Smith 1981, Takahashi and Yamaguchi 1972).

Cooney et al. (1979) suggested that weather conditions at the time of first feeding of larval pollock may be very important for their survival. Conditions resulting in a reduction of water surface turbulence allow plankton to become concentrated and may lead to an increased feeding efficiency (and therefore increased survival) of the pollock larvae.

B. Human-related

A summary of possible impacts from human-related activities includes the following:

- Alteration of preferred water temperatures, pH, dissolved oxygen, and chemical composition
- Introduction of water soluble substances
- Increase in suspended organic or mineral material
- Reduction in food supply
- Human harvest
- Seismic shock waves

(See the Impacts of Land and Water Use volume of this series for additional impacts information.)

VIII. LEGAL STATUS

Pollock within the 200-mi limit are managed by the North Pacific Fishery Management Council (NPFMC) within their groundfish fishery management plan. More details of management status can be found in the pollock Human Use section of this document.

IX. LIMITATIONS OF INFORMATION

There are large gaps in the available pollock life history information; more information is available, however, for Bering Sea stocks than for those in the Gulf of Alaska.

Interactions between pollock and other species, particularly marine mammals, need to be studied (Smith 1981). A better understanding of movements of pollock stocks and interchange between stocks is also important (ibid.). Density-dependent mechanisms (such as the effect of

spawning population size on age-class abundance) need to be examined in more detail to help determine the optimal population size (ibid.).

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