Lingcod Fishery and Fishery Monitoring in Southeast Alaska

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ABSTRACT: Lingcod *Ophiodon elongatus* have recently become an important commercial fish species in Southeast Alaska. The fishery began in 1987 and occurs along the outer coast of northern Southeast Alaska. Dinglebar gear is the primary gear used in the directed fishery. Lingcod are also caught incidentally in significant amounts in the longline and salmon troll fisheries. The Alaska Department of Fish and Game has monitored the fishery through dockside samples, skipper interviews, and onboard observer trips since 1988. Catch per unit effort is lowest during the summer months. Average length of lingcod caught in the directed dinglebar fishery from 1988–1992 was 81 cm, and lingcod caught in the longline fisheries while targeting other species averaged 91 cm. The largest male lingcod sampled from the directed fishery was 95 cm and the largest female was 127 cm. Male lingcod are caught at a higher rate than females from March through May. Peak spawning occurs in February. Size at which >50% of the female lingcod sampled were mature was 83 cm. Lingcod may shrink up to 8 cm when held in slush-ice.

INTRODUCTION

Lingcod *Ophiodon elongatus*, largest member of the greenling family, Hexagrammidae, inhabit rocky areas at depths from intertidal to 425 m but are most common at depths <185 m (Alverson 1960). They occur from Baja, California, to the Shumagin Islands in Alaska, the center of abundance occurring off the coast of British Columbia (Cass et al. 1990). Noted for their large size and fine flavor, they have a long history of exploitation as both a sport and commercial species in California, Oregon, Washington, and British Columbia and are currently the target of a growing sport fishery in southcentral Alaska (Vincent-Lang 1991).

In British Columbia the lingcod commercial harvest, which primarily uses bottom trawls, peaked at 5,000 tonnes in 1985 (Cass et al. 1990); the majority of the harvest occurs along the outer coast of Vancouver Island and Queen Charlotte Sound. Handlines were the primary gear used in the Strait of Georgia where catches peaked at 3,000 tonnes in the 1940s and steadily declined to a low of 277 tonnes in 1985. Managers closed the fishery completely in 1990.

Prior to 1987 most lingcod in Southeast Alaska were landed incidentally in fisheries targeting other species, but since 1987, lingcod have become increasingly important as a commercial fish species. Commercial harvests have increased from 224 tonnes in 1987 to 363 tonnes in 1991, largely because of the development of effort associated with the directed fishery. The distribution of lingcod within Southeast Alaska has not been determined, but catch records indicate that most of the directed fishing activity has occurred along the outer coast. Compared to outside waters, there is a relatively small incidental harvest of lingcod in longline fisheries targeting other species in internal waters, suggesting low abundance. This may be due to the major straits and inlets in the internal waters of Southeast Alaska being predominately >185 m with a sedimentary bottom, characteristics not typical of lingcod habitat.

In 1988 the Alaska Department of Fish and Game (ADF&G) began a 3-part monitoring program of the lingcod fishery that includes dockside sampling for length frequency, skipper interviews, and onboard observations. This paper summarizes the data collected through 1992 and discusses future research and data collection needs.

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FISHERIES FOR LINGCOD

Directed Fishery

Most vessels participating in the directed fishery for lingcod are salmon trollers <13 m in length that use dinglebar gear trolled at slow speeds. Salmon trollers are easily adapted to this fishery. Dinglebar gear is configured as a single horizontal spread of up to 13 lead-headed jigs extending from an attachment about 1 m above a 1- to 3-m steel bar weighing 13.6–34 kg (Figure 1). The troll wire is run directly into the water off a block and, unlike troll gear, is not tagged to a trolling pole. This allows the fisher to keep a hand on the wire and feel if the gear is hitting bottom or if fish are biting. For this reason a person can effectively fish only 1 line. Other gear types used to target lingcod include mechanical jigging machines and hand jigging.

The primary port of landing, Sitka, received 91% of the total Southeast Alaska directed fishery catch between 1987 and 1991. Fishing occurs throughout the year; the greatest poundage is landed during the summer months (Figure 2). Fishers target rocky areas or reefs at depths ranging from 9 to 90 m. A typical trip for an ice-boat is 2–3 d, some lasting as long as 5 d; freezer vessels make longer trips. Lingcod caught in the directed fishery are typically headed and gutted (western cut) on board and sold to market as a fresh product.

The catch of lingcod in the directed fishery has increased from 72 tonnes, round weight, in 1987 to 225 tonnes in 1991 (Figure 3); the number of vessels reporting landings rose from 33 in 1987 to 62 in 1992. In the fall of 1990, because of the rapid growth of the fishery and a lack of information on stock size, the Alaska Board of Fisheries implemented a directed fishery guideline harvest range of 136–227 tonnes for the Southeast Alaska Region. This guideline harvest range was based on the 1990 harvest of 150 tonnes. In 1991 the directed fishery for lingcod was closed for the first time because the upper end of the harvest guideline had been reached.

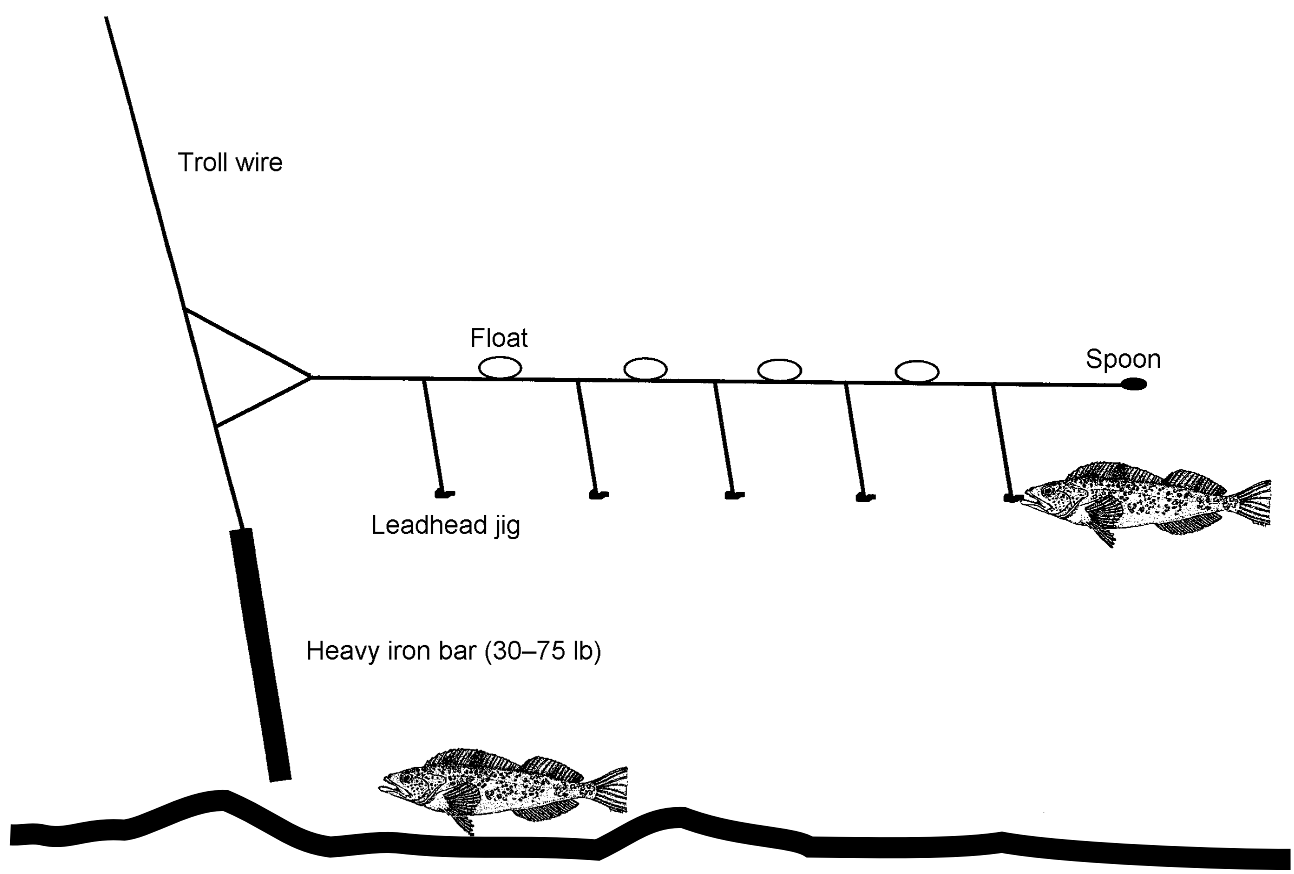

Figure 1. Diagram of dinglebar gear used to fish for lingcod in Southeast Alaska.

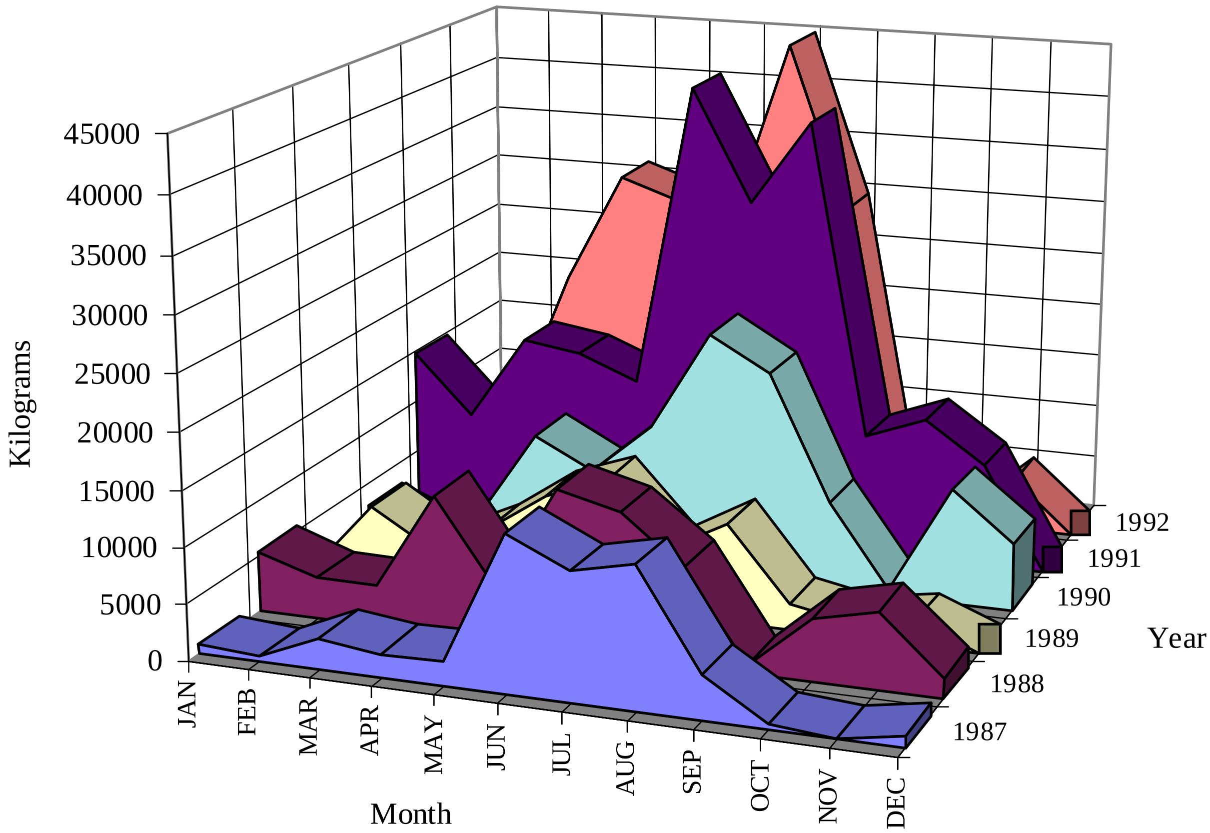

Figure 2. Lingcod landings by month and year in Southeast Alaska from the directed fishery.

Dinglebar gear is highly selective for lingcod: The predominate bycatch, yelloweye rockfish *Sebastes ruberrimus*, composes an average of only 3% of the total weight of the landings, and other rockfish species combined make up <1%. The average exvessel price for the dinglebar lingcod catch in 1992 was $1.39/kg ($0.63/lb) dressed weight, and the total exvessel value was approximately $206,000.

Incidental Fishery

Lingcod are landed incidentally in longline fisheries targeting rockfish and halibut. The landed incidental catch has increased dramatically over the past decade in response to rapid growth in the domestic groundfish fisheries and improved lingcod markets. The incidental catch increased from 9 tonnes in 1982 to nearly 160 tonnes in 1992. The average exvessel price paid for dressed lingcod in the longline fishery was $0.81/kg ($0.37/lb) in 1992, and the total exvessel value was approximately $130,000. Because the longline fishery produces a lower quality product than the directed fishery, the per-unit price is lower. Also, most groundfish species landed incidentally in the halibut fishery traditionally receive a lower price because markets become flooded with fresh fish.

In the nearshore demersal shelf rockfish (DSR) fishery, lingcod can account for up to 50% of a landing. The greatest incidental harvests of lingcod in the DSR fishery occur during the fall and winter (Figure 4). This is probably due to prespawning aggregations of lingcod during the fall and winter in areas fished for rockfish. Lingcod are also landed in significant amounts in the salmon troll fishery. In 1992 approximately 44 tonnes were landed by salmon trollers. The 1992 average exvessel price paid for troll-caught lingcod was $0.95/kg ($0.43/lb) dressed weight, and the total value was approximately $30,000.

Management and Regulations

The Alaska Board of Fisheries has adopted 3 regulations for management and conservation of the lingcod resource in Southeast Alaska. In 1989 a minimum size limit of 69 cm (27 in) for commercially caught lingcod was adopted that was intended to allow 50% of the female lingcod to reach maturity before they become available for harvest. In 1991 a closure of waters inside

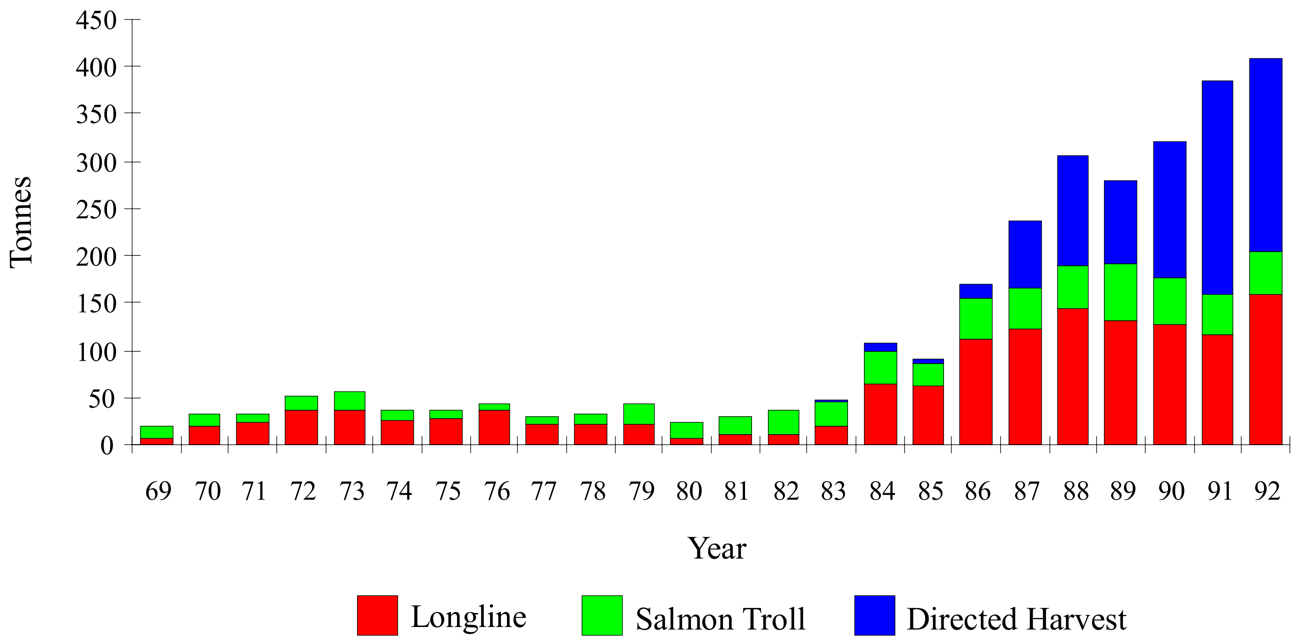

Figure 3. Annual total harvest of lingcod in incidental and directed fisheries in Southeast Alaska, 1969–1992.

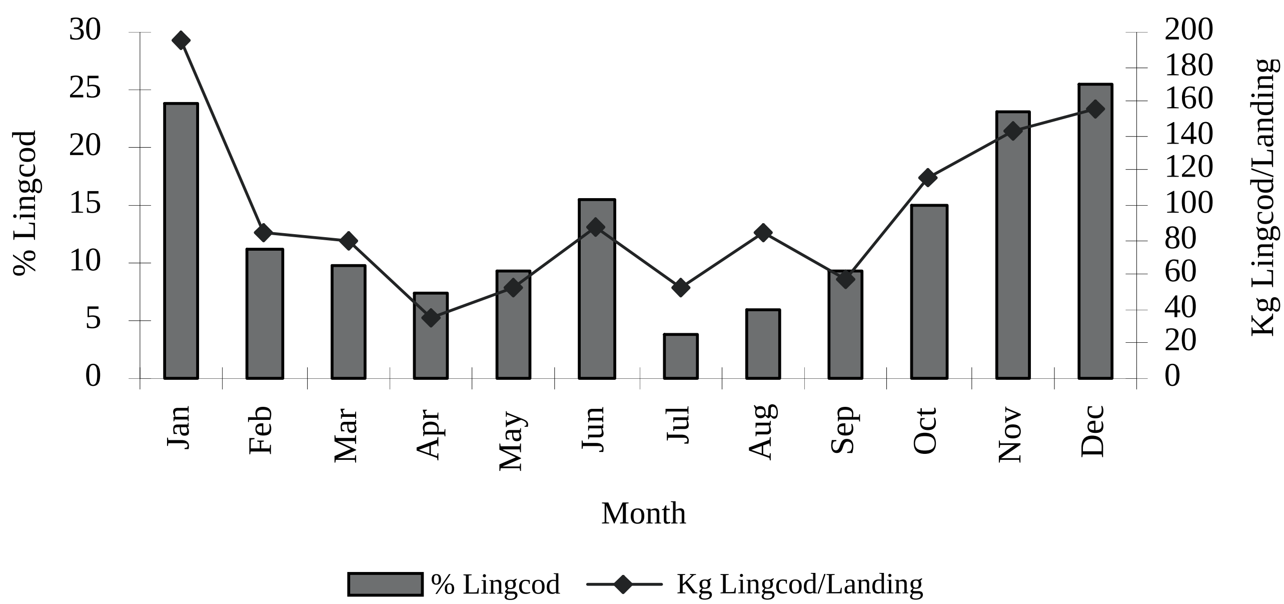

Figure 4. Average (1987–1992) kilograms/landing and average proportion of total catch of lingcod incidentally caught in longline fishery for rockfish by month.

the surfline (a point-to-point boundary along the outer coast extending from the southern border of the Alaskan panhandle north to Cape Spencer) was effected from January 1 through May 31 to protect lingcod during the spawning and nest-guarding season. Also adopted in 1991 was a guideline harvest limit for the directed fishery in the Southeast District of 136–227 tonnes, which controls total harvest in lieu of more definitive information on stock size.

METHODS

The 1988–1992 port sampling program included skipper interviews and examination of length frequency of landed catches. Skipper interviews were conducted to gather information on specific areas fished, depths fished, number of days fished, number of hours fished, number of hooks (jigs) fished, approximate sex ratio of the catch, number of lingcod caught, number released, and incidental catch of other species.

Biological sampling of landed catches was limited to length data because most lingcod are dressed at sea. Because most lingcod are landed with the head removed, an alternative to total length measurement was needed. Head-on lingcod landings were sporadic, and samples were taken only during the months of February to May. No headed samples were taken in 1990; consequently, only headless fish were used for looking at trends in length distribution. I sampled 274 lingcod during onboard observer trips to derive a conversion from the headless measurement to total length. Head-on lingcod were measured for total length. The head was then removed, and the fish was measured again from the apex of the cleithral arch to the end of the tail, a length chosen because it is a quick and reliable measurement. An aluminum cylinder 2 cm in diameter and 4 cm high was attached to a measuring board upright at the zero end of the measuring stick; the fish was laid on the board with the apex of the cleithral arch held against the cylinder.

No adjustments for shrinkage were made for the dockside length frequency samples. However, following adoption of the 69-cm total length or 56-cm dorsal length (from the insertion of the dorsal fin) size limit, fishers began to observe that lingcod were shrinking substantially when held in an iced hold. Lingcod measuring 69–71 cm total length when caught were <56 cm dorsal length at the dock. To examine this problem, I measured total length and dorsal length of lingcod as they were brought on board a commercial vessel. A numbered tag was attached to each measured fish so that individual lingcod could be identified after retention in a slush-iced hold. The dorsal lengths were remeasured 16–24 h later at the dock.

An onboard observer program was implemented in the fall of 1988 to collect sex ratio and maturity information. Nine observer trips were made between November 1988 and March 1992. All fish brought on board were sampled for length, sex, and stage of maturity. Depth and location of the catch site were also noted for each fish sampled.

Gonadal maturity stages for female and male lingcod were based on definitions developed and used by the Washington Department of Fisheries.

Females:

Immature: Small, translucent pink or reddish multiveined ovaries with no distinguishable eggs present.

Maturing: Ovaries swollen with an orange, opaque egg mass; ovarian wall not necessarily thickened.

Mature: Ovaries swollen with a large, pale, sticky egg mass; ovarian walls are thickened.

Spent: Thick-walled ovaries empty and flaccid; may be bloodshot; may contain residual eggs.

Transitional: Ovaries are thick-walled and firming in early stage, progressing to a thinner-walled, multiveined condition similar to advanced immature ovaries; egg rows should be distinguishable.

Males:

Immature: Testes very small and thin; clear to transparent red.

Transitional: Moderate-sized testes which are firm and compact; color brownish to mottled white; flowing sperm is not present.

Ripe: Testes moderate to large, softening and white; flowing sperm should be detectable by pressure and cross section.

RESULTS

Catch Per Unit Effort

Between 1988 and 1992, 118 skipper interviews were conducted in Sitka, representing about 10% of the total number of landings in Southeast Alaska during

Table 1. Summary of data collected from skipper interviews.

	Minimum	Maximum	Average	Sample Size
Hours/trip	2	84	29	104
Days/trip	1	7	3	109
Depth (m)	9	90	49	118
Hooks fished	4	13	10	104
Sublegal/hour[1]	0	4.8	1.4	65
Kg/hour	5	162	44	103

[1] Refers to lingcod released at sea that were below the 69-cm minimum size limit.

that period. Vessels fished an average of 29 h per trip and had an average catch of 44 kg/h (Table 1). Average depth fished was 49 m.

Catch per unit effort (CPUE) showed a weak trend of increase from 57 kg/h in 1989 to 67 kg/h in 1992 (Figure 5). Kilograms per landing from fish ticket (sales receipts given to fishermen by processors) data indicated a similar trend. A seasonal trend in CPUE was evident: Lower catch rates occurred during the summer months (Figure 6).

Distribution Of Fishing Effort

Most fishing occurred in outer coastal waters, primarily in the Central Southeast Outside (CSEO) and the Northern Southeast Outside (NSEO) management areas of Southeast Alaska (Figure 7; Table 2), and 67% of the total directed harvest between 1987 and 1991 occurred within 55 km of Sitka. Based on fish ticket information, the 1992 first-quarter harvest of lingcod reported from a statistical area (#355702) near Sitka was only 8 tonnes, down from a harvest of 28 tonnes reported during the same period in 1991. Concurrently, the harvest of lingcod from an adjacent statistical area (#355703) was 27 tonnes, a 3-fold increase from the same period in 1991. This information, in conjunction with concern of depletion expressed by lingcod fishers, was used to justify an emergency order closing coastal waters between 56°50' 00" N. latitude and 57°20'15" N. latitude to the retention of lingcod by commercial vessels for the remainder of 1992.

Most lingcod are sold as a fresh product that is flown to market by jet aircraft. This may contribute to the lack of fishing effort in the outer coastal areas of southern Southeast Alaska because those areas are isolated from jet service.

Size Distribution

All of the 55 fish sampled for shrinkage shrunk 2–8 cm. The average shrinkage rate was 6% of dorsal length before icing (Figure 8). There does not appear to be a relationship between the length of fish and rate of shrinkage: The rate of shrinkage was highly variable at any given length.

Between 1988 and 1992 a total of 2,894 commercially caught lingcod from 48 landings were measured with the head off and 1,006 lingcod from 13 landings with the head on. The range of mean headless lengths from 48 sampled landings was 54–73 cm. Relative frequency distributions of length data from headless samples show no substantial annual changes between

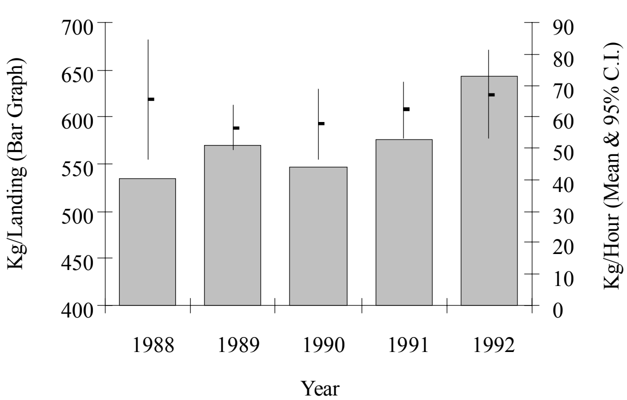

Figure 5. Annual mean catch per unit effort in the directed fishery for lingcod in Southeast Alaska, 1988–1992, expressed as kilograms (round) per hour with 95% confidence limits (dockside interviews) and expressed as kilograms (round)/landing (fish ticket data).

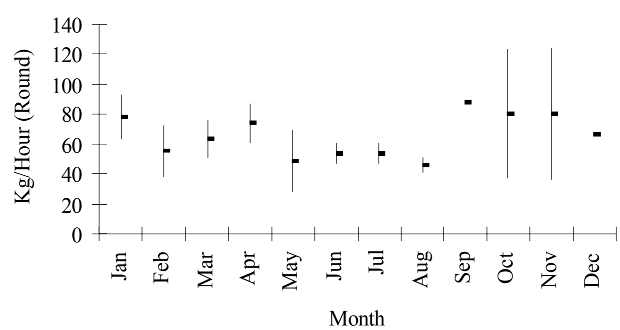

Figure 6. Mean (1988–1992) catch per unit effort in the directed fishery for lingcod expressed as kilograms (round)/hour with 95% confidence limits in Southeast Alaska. Only 1 trip sampled in September and December.

Table 2. Annual directed lingcod landings (tonnes) by management area in Southeast Alaska, 1987–1992.

Area	1987	1988	1989	1990	1991	1992
CSEO	36	62	76	115	170	112
NSEO	22	24	6	26	42	77
SSEO	9	18	3	0	0	4
SSEI	2	9	2	0	0	0
NSEI	0	2	3	1	8	5
EYAK	0	1	0	1	5	7

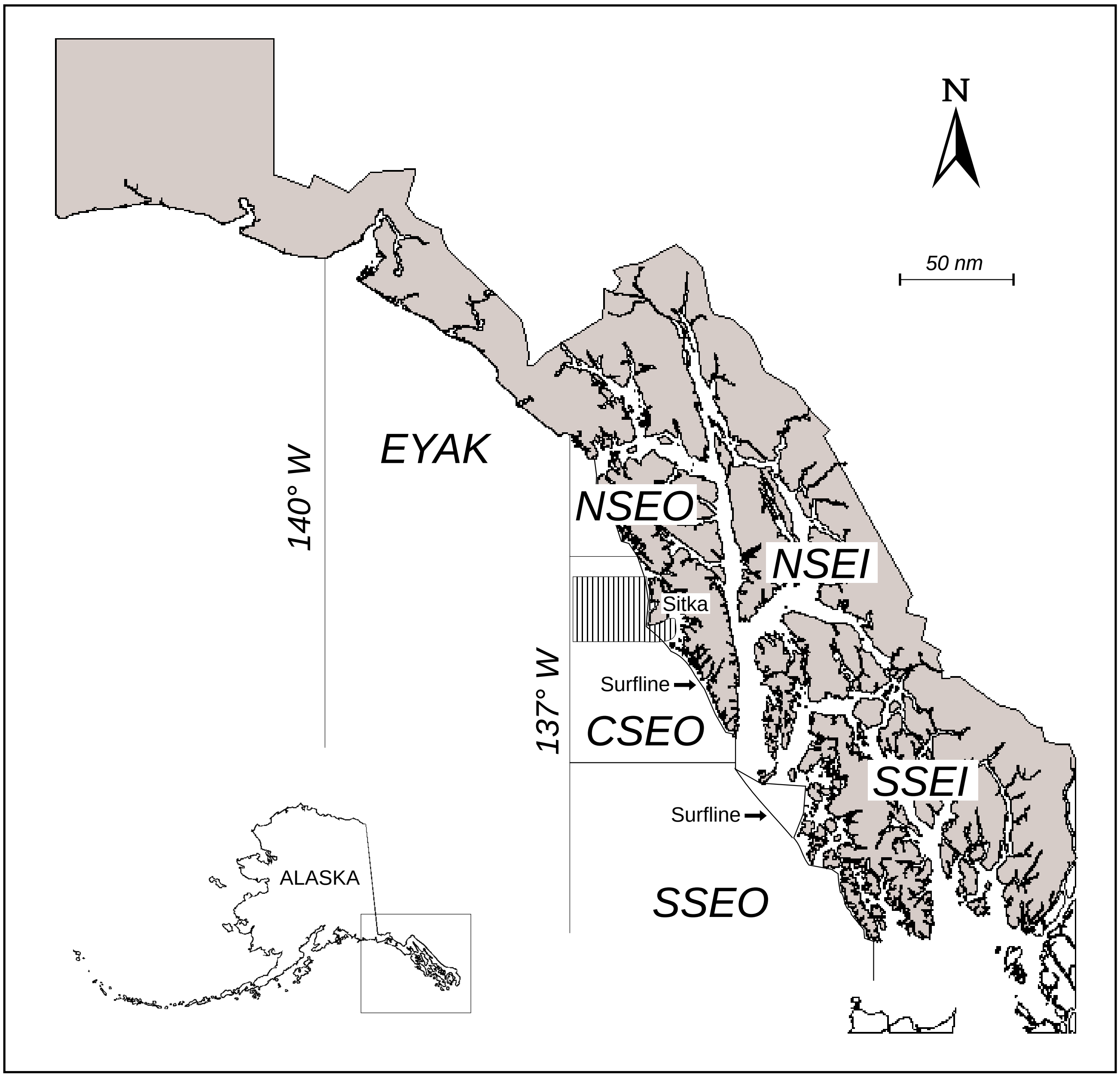

Figure 7. Southeast Alaska groundfish management areas showing the surfline and the area closed by emergency order in 1992 (shaded).

Table 3. Numbers of male and female lingcod and percent males by month; onboard observer data in Southeast Alaska, 1988–1992.

Month	Number of Females	Number of Males	Percent Males
October	79	98	55
November	209	125	37
December			
January	18	86	83
February	165	228	58
March	91	258	74
April	45	212	82
Total	607	1,007	62

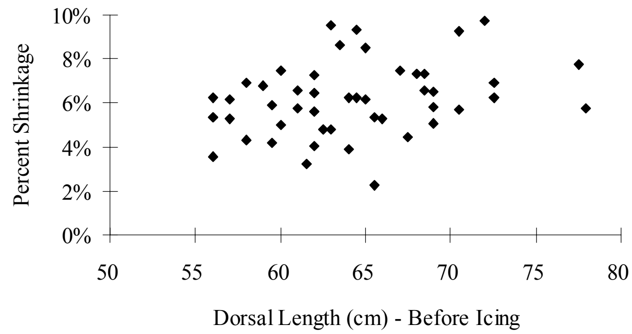

Figure 8. Dorsal length of Southeast Alaska lingcod before icing and percent shrinkage after being held in slush-ice for 16–24 h, 1990.

1988 and 1992, and means ranged from 62 to 63 cm (Figure 9). The relationship between headless length (X) to total length (Y) can be expressed by the following equation:

$$Y = 1.28348(X) + 0.215637; r^2 = 0.986.$$

There was an apparent seasonal change in mean length of the catch based on combined data from the years 1988–1992. Mean headless length of lingcod sampled during February to May was smaller than lingcod sampled from June to August (Figure 10). There was no apparent relationship between length and water depth ($r^2 = 0.145$); however, the small end of the size range was generally greater at increasing depths (Figure 11).

Females were larger in mean and maximum size than males. Total lengths for male lingcod sampled during observer trips ranged from 45 to 95 cm with a mean of 74 cm, and the total lengths for female lingcod ranged from 47 to 127 cm with a mean of 85 cm (Figure 12). Lingcod sampled from the longline fisheries were larger than lingcod sampled in the directed fishery (Figure 13); the mean total length, converted from headless length data, was 91 cm in the longline fishery versus 81 cm in the dinglebar fishery.

Sex Ratio

Male lingcod predominated the catch in the directed fishery from March through May (Table 3). During other times of the year, the sex ratio of individual catches was more mixed and variable, and some catches were predominated by females. Sex ratio plotted by depth from the observer data shows females predominating in deeper waters (Figure 14). The sex ratio of lingcod recorded during an observer trip on board a dinglebar vessel fishing 36 m in mid-January of 1992 was 86 males and 18 females. At the same time, a longliner targeting rockfish in 90 m of water in approximately the same location caught 1 male and 96 females.

Stage of Maturity and Spawn Timing

Stage of maturity was noted for 607 female and 1,007 male lingcod during the months of October, November, and January through April for the period

Table 4. Numbers of lingcod classified as mature or spent (females only), transitional or ripe (males only), and immature by month; onboard observer data from Southeast Alaska, 1988–1992.

	Female			Male		
Month	Mature[1]	Spent	Immature	Transitional	Ripe	Immature
October	76	0	3	90	0	0
November	182	0	27	104	1	0
December						
January	8	0	10	0	86	0
February	61	28	76	0	217	2
March	0	50	41	3	214	1
April	2	25	18	170	42	0

[1] Includes maturing, mature, and transitional stages.

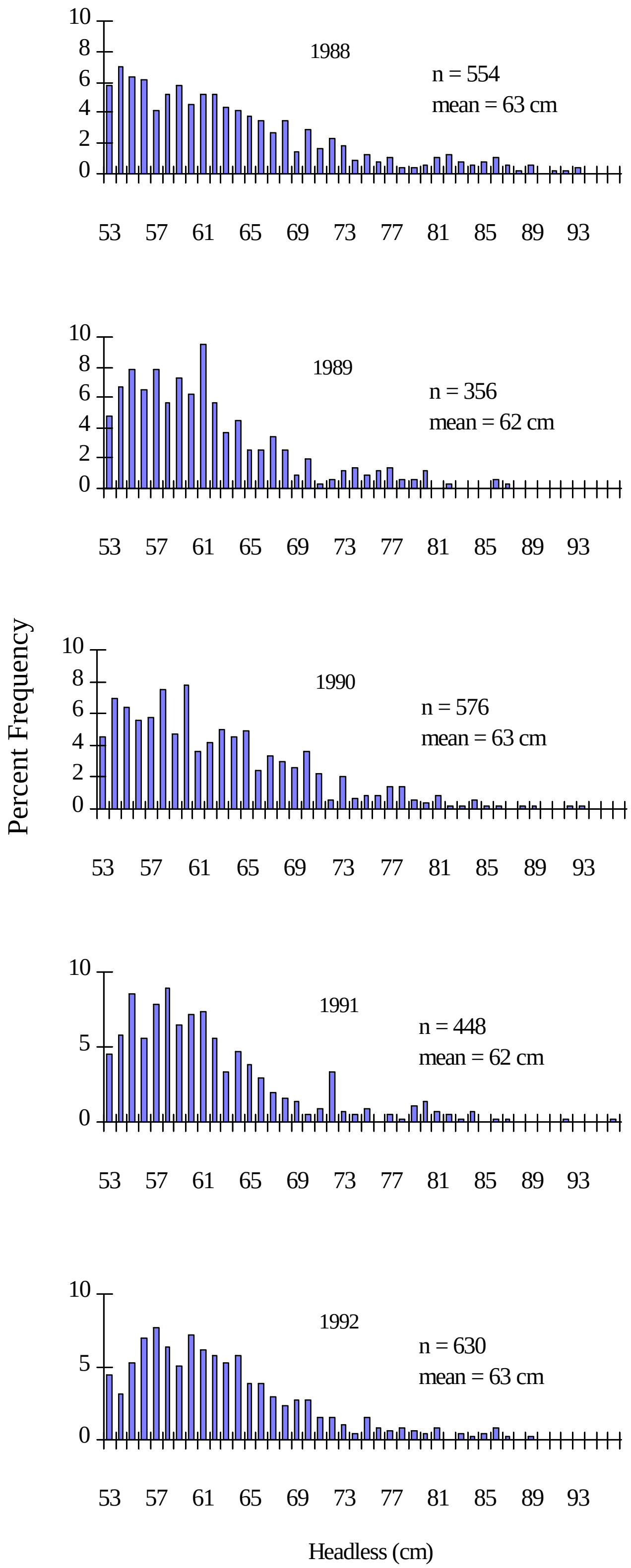

Figure 9. Relative length frequency by year of headless lingcod from dockside samples of the directed fishery in Southeast Alaska, 1988–1992.

Table 5. Number of female lingcod immature or mature by total length (cm) sampled during January–March in Southeast Alaska, 1989–1992.

Length (cm)	No. Immature	No. Mature
<76	42	2
76	8	0
77	10	1
78	11	0
79	6	3
80	10	5
81	13	4
82	14	6
83	5	7
84	5	10
85	3	7
86	7	7
87	3	13
88	3	14
89	8	11
90	1	18
91	2	11
92	3	9
93	2	10
94	0	11
>94	1	109

1988–1992 (Table 4). Based on the proportion of females with spent ovaries, spawning appears to peak during February. No ripe males were sampled in October, only 1 ripe male was sampled in November, but 99% of mature males sampled in January, February, and March were ripe.

Size At Maturity

Only samples collected during January through March were used to plot female lingcod length versus the number that were immature or mature (Table 5). We assumed that ovaries of fish collected during that period could be easily recognized as either mature or immature (fish that will not spawn during the year of observation) and that mature female lingcod spawn annually. The largest immature female was 99 cm and the smallest mature female was 68 cm. For these samples, 83 cm was the size at which >50% of the females were mature. Size at maturity for males was not examined because only 3 immature males (53, 58, and 61 cm) were sampled.

DISCUSSION

Length frequency is the only biological data routinely collected for monitoring lingcod stocks in Southeast Alaska, and most of this data is obtained

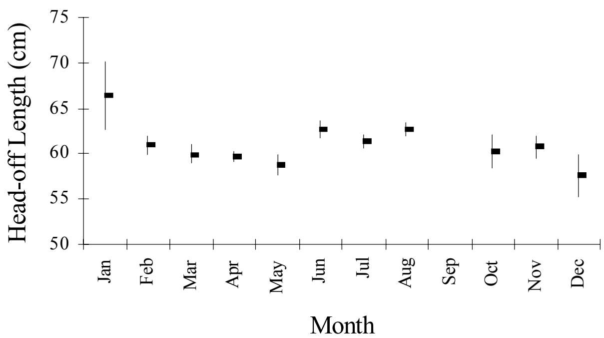

Figure 10. Mean (1988–1992) monthly lengths of headless lingcod and 95% confidence limits from the directed fishery in Southeast Alaska.

from lingcod with heads removed. It is apparent that the length distribution of lingcod are affected by factors such as season, depth, or area fished. Shrinkage of harvested fish over time adds another variable that is difficult to address. It is probable that many factors, such as length of time the fish are held, the type of icing used to hold the fish, and the size of the fish, can influence the rate of shrinkage. These variables may diminish the accuracy of estimating the actual size of fish; however, length data continues to be our most accessible and least expensive monitoring tool.

Sampling for age distribution on an annual basis provides information on stock structure, population trends, and recruitment. Studies have shown recruitment in lingcod populations to be highly variable. Bargmann (1985) suggested that successful lingcod spawning occurs every 6 to 7 years in Puget Sound, Washington, and Vincent-Lang (1991) reported that a single brood year supported the sport harvest out of Seward, Alaska, from 1986 through 1990.

Obtaining age samples from the commercial catch is difficult because removal of fin rays for aging requires cutting into the flesh and lowers the product's value. Also, because most lingcod are landed gutted with heads off, reliable size-at-age and size-by-sex data cannot be taken. Non-fishery sampling is needed to provide this data. Despite the lack of biological information, sampling the commercial catch for age data would facilitate monitoring changes in population age structure.

Interpretation of fishery performance data is difficult because changes in CPUE may not necessarily reflect changes in stock size. For example, fishers becoming more proficient at catching lingcod and the discovery of new fishing grounds as the fleet expands into new areas would have a positive effect on CPUE; inexperienced fishers entering the fishery would have a negative effect on CPUE. There is an apparent seasonal change in the catchability of lingcod, lower catch rates occurring during the summer months. Jagielo (1991a) reported a similar pattern with the nearshore hook-and-line fishery for lingcod off Neah Bay in Washington. He suggested that lingcod are concentrated in nearshore waters for reproductive purposes during the winter-spring period, then disperse over a wide area for feeding in the summer. The current port sampling program only examines a small portion

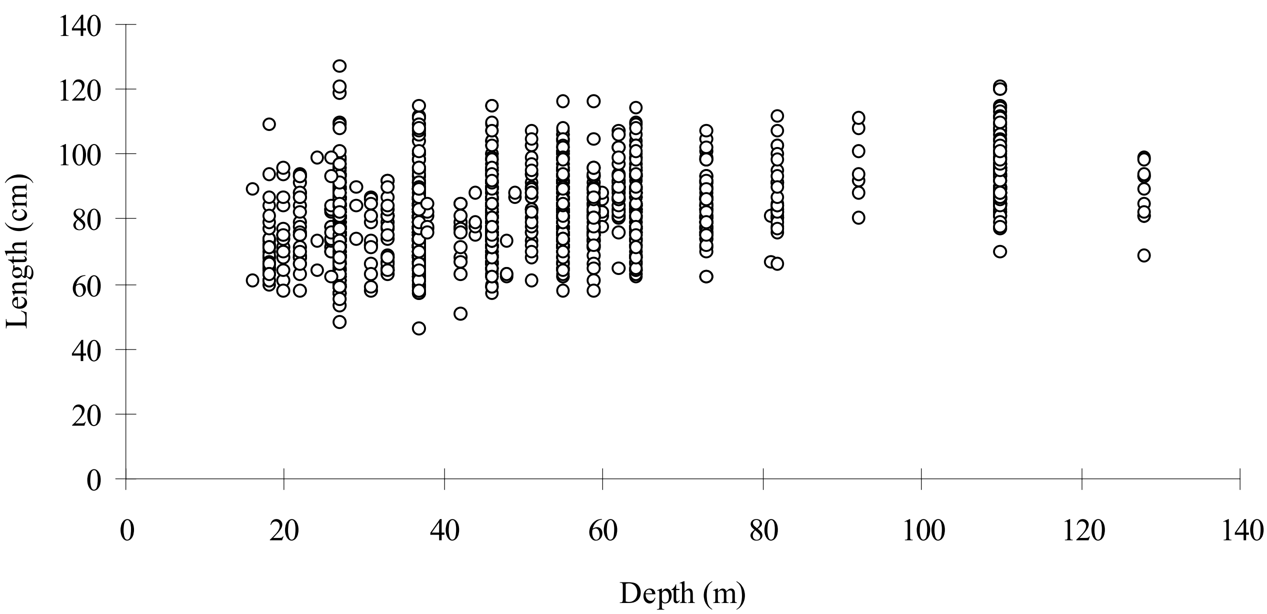

Figure 11. Total length versus capture depth of lingcod sampled during onboard observer trips in Southeast Alaska, 1988–1992.

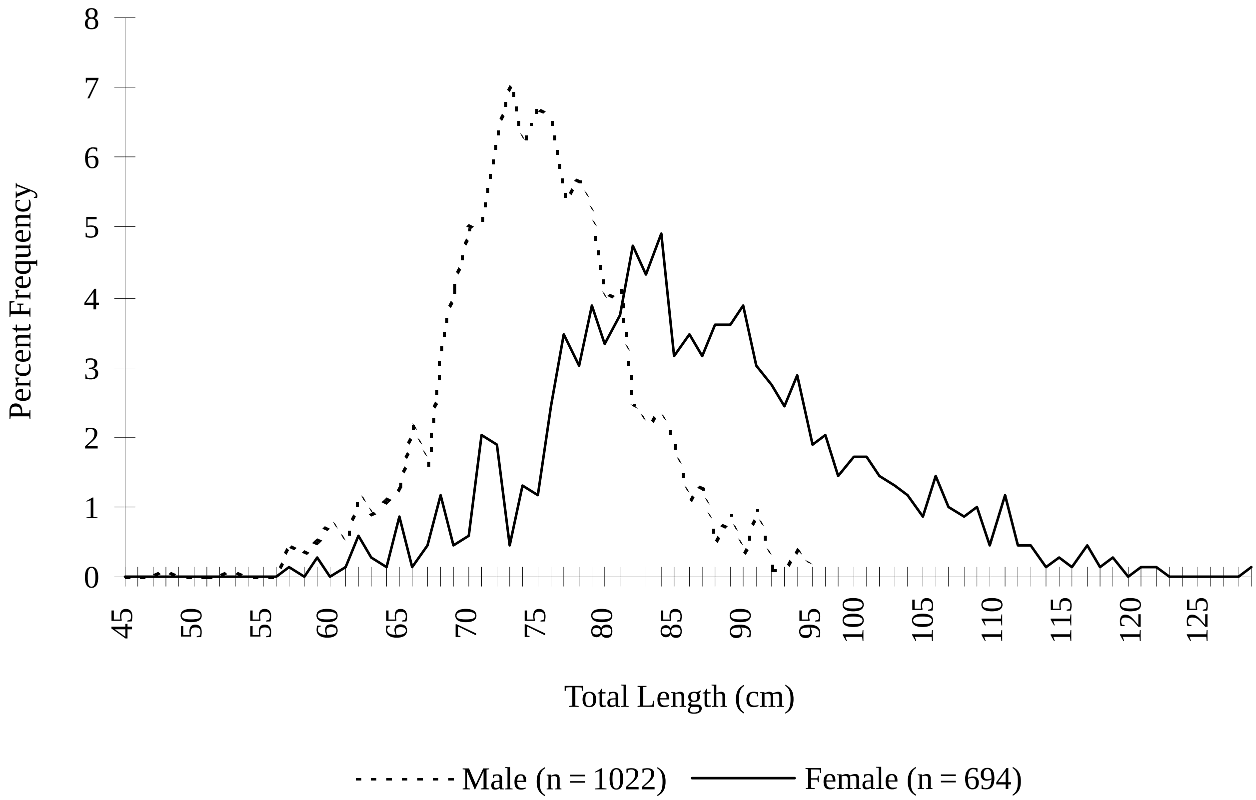

Figure 12. Relative length frequency distribution of lingcod by sex; sampled during onboard observer trips in Southeast Alaska, 1988–1992.

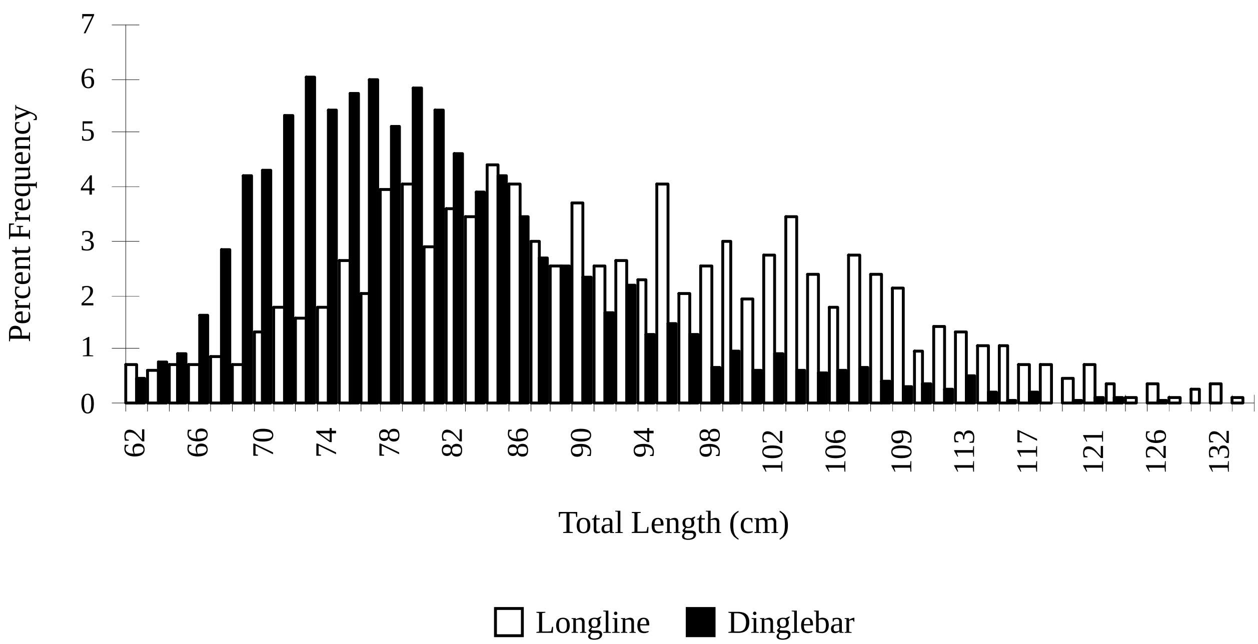

Figure 13. Relative length (headless measurements converted to total length) frequency distribution of lingcod sampled from the directed dinglebar fishery and the longline fishery for demersal shelf rockfish in Southeast Alaska, 1988–1992.

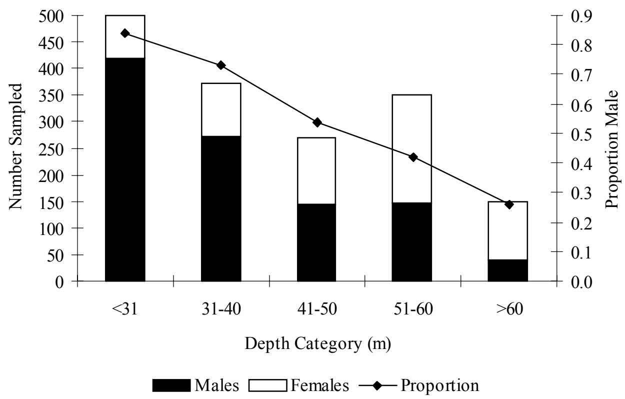

Figure 14. Sex ratio by depth category of lingcod sampled during onboard observer trips in Southeast Alaska, 1988–1992.

of the total effort, and that may not be representative of the total fishery CPUE. Although the fish ticket database provides catch per landing for the entire fishery, the amount of time spent fishing per trip can vary considerably, making this data unreliable as an indicator of abundance trends. To alleviate some of these problems, ADF&G has requested that a mandatory logbook program be implemented. This program would provide comprehensive effort information for evaluating catch trends.

Lingcod migration is an important life history characteristic that needs study because the effectiveness of time and area closures would be highly dependent on lingcod movements. For example, Jagielo (1990) reported that significant mixing occurred between the offshore and nearshore components of lingcod stocks off Neah Bay, Washington. He suggested that this had a replenishing effect and prevented local depletion of lingcod in the nearshore area. Smith et al. (1990) reported that movement of lingcod in the Strait of Georgia may result in concentrations of fishing effort, depleting lingcod populations over a broader region.

Harvesting lingcod during the nest-guarding season could increase egg mortality due to the removal of the guardian male (Low and Beamish 1978) and increase exploitation of male fish. The impact of harvesting a greater proportion of male lingcod has not been determined but may be an important management consideration. The winter-spring surfline closure attempts to address these concerns by partially closing many of the shallow nearshore nesting areas. However, most of the traditional fishing grounds are outside the surfline, and large areas of potential nesting habitat may remain open to fishing. A recent study in Southeast Alaska documented lingcod egg masses as deep as 67 m and observed nesting behavior by lingcod at greater depths (O'Connell 1993). Prior to this study, nesting had never been documented at depths >30 m (Low and Beamish 1978; LaRiviere 1981; Bargmann 1982).

Size-at-maturity data indicate that 50% of females are mature upon attaining a length of approximately 83 cm, whereas only 65–67 cm is reported for female lingcod along the coast of British Columbia (Richards et al. 1990). In British Columbia, minimum size limits have been set at the 50% female-maturity length; this allows a portion of the females to spawn at least once before being harvested. Prior to having any size-at-maturity data for lingcod in Southeast Alaska, the data from British Columbia was used for setting a minimum size limit of 69 cm in Southeast Alaska. If the size limit was increased to 83 cm, nearly 90% of the males and 40% of the females currently harvested in the dinglebar fishery would have been under minimum size. Because female lingcod grow faster and attain a larger size than males, a size limit of 83 cm would direct the harvest on predominately females and large males. From observer data, the sex composition of lingcod >82 cm was 80% females and 20% males. The tendency of female lingcod to reside in deeper waters than male lingcod has been well documented (Chatwin 1956; Forrester 1973; Miller and Geibal 1973; Cass et al. 1984) and is supported by my findings. It is therefore conceivable that fishers could fish the deeper waters targeting the larger females. Observer data also showed there were 182 (9%) immature female lingcod >68 cm out of 2,055 lingcod sampled. Whether the potential harvest of immature female lingcod under the current size limit would have a greater impact on the overall fecundity than would an 83-cm limit is unclear. Consequently, ADF&G is not recommending an increase of the minimum size limit at this time.

As with many marine fishery resources, obtaining an estimate of the biomass of the lingcod population is difficult. Jagielo (1991b) used a Multi-sample Single Recapture Model to estimate open-population survival rate, exploitation rate, fishing mortality, and abundance of lingcod at Neah Bay, Washington. His simulation results suggested that reasonably precise estimates of abundance and fishing mortality may be obtained when the results of multiple years of tagging data are coupled with auxiliary fishery information. However, it would be difficult to use this method to expand to a broader region unless habitat-specific density estimates were obtained and the available habitat in the region was known. O'Connell and Carlile (1993) used a submersible to obtain habitat-specific density estimates of yelloweye rockfish. The density of yelloweye rockfish was extrapolated to a broad region by estimating the area of rocky habitat based on nautical charts, NOS bathymetric data, and commercial longline logbook information. If similar work is continued for rockfish in the eastern Gulf of Alaska, it should include lingcod (V. O'Connell, ADF&G, Sitka, personal communication).

Inadequate knowledge of the biology of lingcod in Southeast Alaska combined with the rapid growth of the commercial fishery are cause for concern. A conservative approach is necessary until more information on the biology and size of the stock is available. The current harvest guideline for Southeast Alaska appears to be conservative. However, it is apparent that localized depletion has occurred in some areas, and continued use of emergency order closures to thwart localized depletions is warranted. Further monitoring and research are necessary to determine appropriate harvest levels, which should include managing harvests within smaller areas.

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