

**Fishery Data Series No. 02-08**

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**A Survey of Lingcod in Resurrection Bay and the  
Chiswell Islands, Gulf of Alaska, 1998**

by

**Michael L. Bethe**

and

**Scott C. Meyer**

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May 2002

Alaska Department of Fish and Game

Division of Sport Fish



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<b>Weights and measures (metric)</b>		<b>General</b>		<b>Mathematics, statistics, fisheries</b>	
centimeter	cm	All commonly accepted abbreviations.	e.g., Mr., Mrs., a.m., p.m., etc.	alternate hypothesis	H <sub>A</sub>
deciliter	dL	All commonly accepted professional titles.	e.g., Dr., Ph.D., R.N., etc.	base of natural logarithm	e
gram	g	and	&	catch per unit effort	CPUE
hectare	ha	at	@	coefficient of variation	CV
kilogram	kg	Compass directions:		common test statistics	F, t, $\chi^2$ , etc.
kilometer	km			confidence interval	C.I.
liter	L			correlation coefficient	R (multiple)
meter	m	east	E	correlation coefficient	r (simple)
metric ton	mt	north	N	covariance	cov
milliliter	ml	south	S	degree (angular or temperature)	°
millimeter	mm	west	W	degrees of freedom	df
		Copyright	©	divided by	÷ or / (in equations)
<b>Weights and measures (English)</b>		Corporate suffixes:		equals	=
cubic feet per second	ft <sup>3</sup> /s	Company	Co.	expected value	E
foot	ft	Corporation	Corp.	fork length	FL
gallon	gal	Incorporated	Inc.	greater than	>
inch	in	Limited	Ltd.	greater than or equal to	≥
mile	mi	et alii (and other people)	et al.	harvest per unit effort	HPUE
ounce	oz	et cetera (and so forth)	etc.	less than	<
pound	lb	exempli gratia (for example)	e.g.,	less than or equal to	≤
quart	qt	id est (that is)	i.e.,	logarithm (natural)	ln
yard	yd	latitude or longitude	lat. or long.	logarithm (base 10)	log
Spell out acre and ton.		monetary symbols (U.S.)	\$, ¢	logarithm (specify base)	log <sub>2</sub> , etc.
		months (tables and figures): first three letters	Jan, ..., Dec	mid-eye-to-fork	MEF
<b>Time and temperature</b>		number (before a number)	# (e.g., #10)	minute (angular)	'
day	d	pounds (after a number)	# (e.g., 10#)	multiplied by	x
degrees Celsius	°C	registered trademark	®	not significant	NS
degrees Fahrenheit	°F	trademark	™	null hypothesis	H <sub>0</sub>
hour (spell out for 24-hour clock)	h	United States (adjective)	U.S.	percent	%
minute	min	United States of America (noun)	USA	probability	P
second	s	U.S. state and District of Columbia abbreviations	use two-letter abbreviations (e.g., AK, DC)	probability of a type I error (rejection of the null hypothesis when true)	α
Spell out year, month, and week.				probability of a type II error (acceptance of the null hypothesis when false)	β
<b>Physics and chemistry</b>				second (angular)	"
all atomic symbols				standard deviation	SD
alternating current	AC			standard error	SE
ampere	A			standard length	SL
calorie	cal			total length	TL
direct current	DC			variance	Var
hertz	Hz				
horsepower	hp				
hydrogen ion activity	pH				
parts per million	ppm				
parts per thousand	ppt, ‰				
volts	V				
watts	W				

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**A SURVEY OF LINGCOD IN RESURRECTION BAY AND THE  
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by  
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## ABSTRACT

The purpose of this study was to assess changes in lingcod *Ophiodon elongatus* length and sex composition in Resurrection Bay and the Chiswell Islands, Alaska since a prior survey in 1993-1994. Sampling was conducted at 101 sites in Resurrection Bay and 87 sites in the Chiswell Islands, resulting in catches of 20 and 218 lingcod, respectively. In addition to collecting length and sex data, lingcod were tagged and released. Detailed effort data were also recorded to establish a baseline for comparing relative abundance in future years.

Very low catches of lingcod in Resurrection Bay during the 1998 study suggest continued low levels of abundance and support extended closure of the fishery in that study area. In the Chiswell Islands, significant differences in the sex and length distributions were detected between the two periods, suggesting that some level of recruitment has taken place. However, absolute abundance of lingcod is still unknown.

Key words: lingcod, *Ophiodon elongatus*, Gulf of Alaska, Resurrection Bay, Chiswell Islands, recruitment, biological composition, spatial, temporal, catch distribution.

## INTRODUCTION

The recreational harvest of lingcod *Ophiodon elongatus* landed at the port of Seward, Alaska increased from about 2,000 fish in 1987 to more than 9,000 fish in 1992 (Meyer and Stock *In prep*). During that time, the proportion of the Seward area lingcod harvest comprising young (<7 years) and small (<75 cm total length) fish declined precipitously. This was accompanied by anecdotal reports of declining lingcod catch rates in Resurrection Bay and a general tendency within the sport fishing fleet to range farther from the port of Seward to maintain quality lingcod fishing. Based on these trends of increasing harvest, declining recruitment, and outward moving fleet, the Alaska Department of Fish and Game (ADF&G) concluded that existing harvest trends were not sustainable and proposed more restrictive regulations in the northern Gulf of Alaska (Vincent-Lang and Bechtol 1992).

In response to these proposals, the Alaska Board of Fisheries implemented regulations for commercial and recreational fisheries in 1993 that were designed to protect Resurrection Bay lingcod and provide for increased recruitment in nearby waters. At the time, these regulations constituted the most restrictive fishery regulations for lingcod within the state and reflected a conservative management strategy necessary for this highly vulnerable marine species. These regulation changes, which are still in effect, were as follows:

1. Resurrection Bay north of a line between Cape Resurrection and Cape Aialik was closed to recreational and commercial harvest year-round;
2. The recreational bag and possession limit in all other waters between Cape Puget and Gore Point was reduced from 2 lingcod daily, 4 in possession to 1 lingcod daily, 1 in possession;
3. A closed season of January 1 through June 30 was established throughout the central Gulf of Alaska to protect nest-guarding males; and
4. A minimum size limit of 35 inches for recreational and commercial harvest was established in most waters to allow fish the opportunity to spawn at least twice before being harvested. In addition, sport-caught lingcod may be landed only by hand or net.

The length, sex, and age composition of the Seward area lingcod harvest has been estimated annually by ADF&G, Sport Fish Division since 1987. This project is a component of an ongoing catch monitoring and harvest assessment program for recreational halibut and groundfish

harvests throughout the central Gulf of Alaska. With implementation of the minimum size limit in 1993, estimates of age, length, and sex composition from the sport harvest were no longer comparable to the historical time series of data (Vincent-Lang 1995). Fishery-independent sampling was therefore initiated in 1993-1994 to estimate length and sex composition in Resurrection Bay and the Chiswell Islands area. Estimates from the 1993-1994 surveys were consistent with the earlier time series of recreational harvest data suggesting that detectable levels of recruitment had yet to occur by 1994.

As with many other marine species, lingcod recruitment can be highly variable from year to year. Salmon and halibut anglers have reported catching and releasing significant numbers of juvenile lingcod in Resurrection Bay in recent years, but some anglers and guides fishing for lingcod outside Resurrection Bay have reported a decline in abundance of adult fish. Therefore, the principal goal of this study was to assess the magnitude and nature of changes in the stock composition of lingcod in Resurrection Bay and the Chiswell Islands area since 1994.

Specific study objectives were to:

1. Estimate the relative length and sex composition of lingcod in Resurrection Bay and in the Chiswell Islands, and
2. For each area, test the hypotheses that there were no significant differences in length or sex composition between lingcod captured during the 1993-1994 survey and lingcod captured during 1998.

This report summarizes results from the 1998 survey, provides the necessary background for reviewing the effectiveness of current management strategies, and makes recommendations for future studies and regulatory changes.

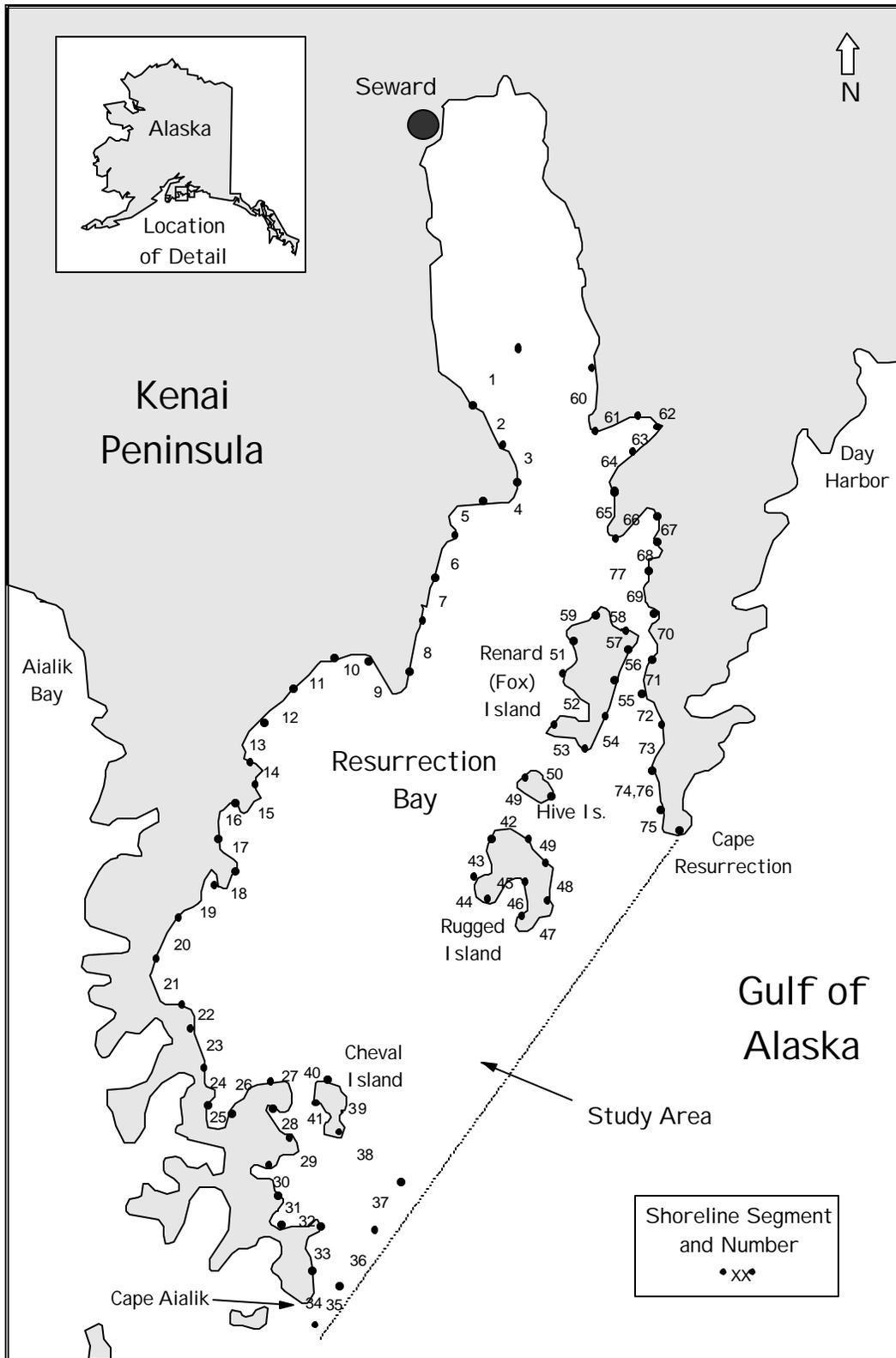
## **METHODS**

During 1998, a lingcod survey was conducted in Resurrection Bay inside a line from Cape Aialik to Cape Resurrection (Figure 1) and in the Chiswell Islands area (Figure 2). All fishing was conducted from a leased 43-foot Delta charter vessel. Sampling began on August 8 and ended on October 2, 1998. To ensure comparability with earlier studies, sampling in Resurrection Bay and the Chiswell Islands was conducted in the same general areas sampled during 1993 and 1994 (Vincent-Lang 1995).

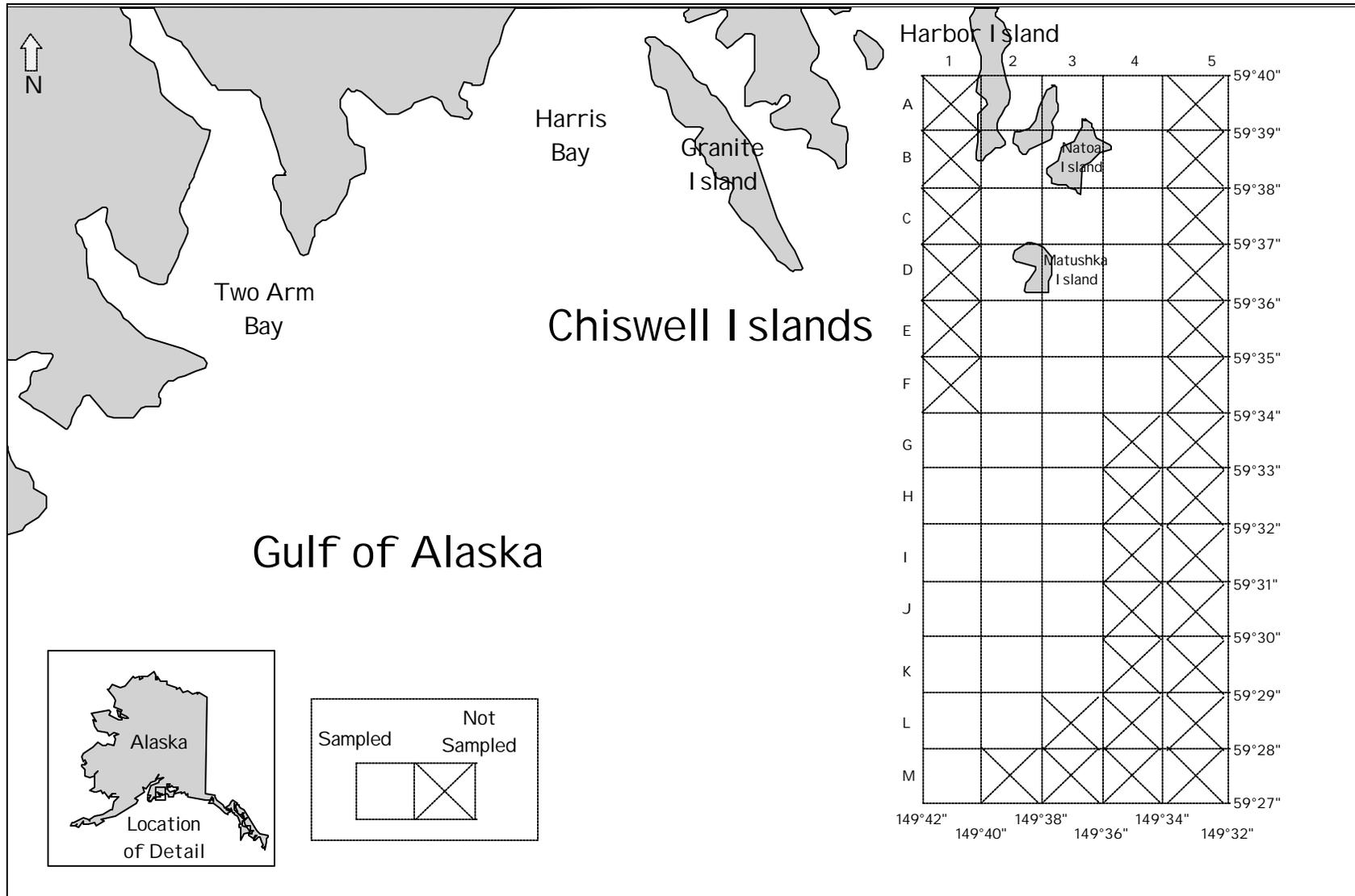
In the Resurrection Bay study area, shoreline areas containing suitable lingcod habitat were divided into 76 shoreline locations of approximately 1 nautical mile in length (Figure 1, Appendix A1). From these 76 locations, 46 sample locations were selected at random. Within each sample location, fishing was conducted at a minimum of two sites.

In the Chiswell Islands study area, the area shallower than about 50 fathoms was divided into 65 equal-sized sampling locations of approximately 1 square nautical mile each (Figure 2, Appendix B1). From this sampling grid, 29 locations were removed because they did not appear to offer suitable lingcod habitat. In each of the remaining 36 locations, fishing was conducted at a minimum of two sites.

In both study areas, fishing sites were selected using an acoustic sounder to locate concentrations of fish or likely underwater habitat. An exhaustive search for all suitable habitat areas was not conducted at each sample location; rather nautical charts were used to concentrate search efforts.



**Figure 1.-Study area for lingcod of Resurrection Bay, showing study boundary and numbered shoreline segments, 1998.**



**Figure 2.-Survey area for lingcod of Chiswell Islands, showing sampling grid, 1998.**

Rather than randomly selecting fishing sites, likely habitat areas were targeted because:

1. Lingcod are known to aggregate near rocky areas and steep gravel slopes (Wilby 1937; Shaw and Hassler 1989);
2. It increased the cost-effectiveness of the survey; and
3. We desired catch rates from the survey to be comparable to catch rates estimated from the sport fishery.

Lingcod catch per unit effort (CPUE) can reasonably be expected to exhibit hyperstability, or the tendency to remain high as abundance decreases (Hilborn and Walters 1992), because lingcod distribution is patchy and linked to habitat. If CPUE is only measured after fish are located, it could be a biased index of abundance. Measures of CPUE should also take into account time spent searching for habitat or concentrations of fish. Therefore, search time and fishing time were recorded to the nearest minute for each fishing site. Search time was defined as the duration of time expended searching for rocky areas or aggregations of lingcod within a location. Fishing time was defined as the duration of time expended actively fishing at a given site within a location.

For each fishing site, lingcod habitat was classified by the presence or absence of detectable rock outcroppings, distance to the nearest shoreline, and substrate. Shoreline areas were defined as 0-50 ft from shore; nearshore areas were >50 ft to 300 ft from shore; and offshore areas were >300 ft from shore. Substrate was classified as rocky, hard, soft, mixed, or unknown, and was determined subjectively while bouncing the fishing jig on the bottom.

Lingcod were captured with hook-and-line gear using lead head style "scampi" jigs. Terminal gear was consistent with types used in 1993-1994 by Vincent-Lang (1995). At least three rods with at least one jig each were fished for 15 minutes at each fishing site. To augment overall sample sizes, fishing time was occasionally extended at sites where significant aggregations of lingcod or promising habitat were found. To ensure comparability of catch and effort data between fishing sites, data from extended fishing events were recorded separately.

For each fishing site, the date, latitude, longitude, depth range fished (fathoms), apparent echo size of schooled fish (if any), and total catch by species were recorded. Fishing and search times were recorded as defined above. Injuries, mortalities, and apparent causes were noted. All captured lingcod were examined for external marks and measured for total length to the nearest 0.5 cm. Sex was determined through the presence (male) or absence (female) of anal papilla. Lingcod were released at, or as near as possible to, the original location of capture. No fish were intentionally killed, with the exception of two juvenile lingcod taken for age analysis.

Released lingcod were tagged with one of three tag types. Most were tagged with individually numbered wire-core spaghetti tags inserted through the soft tissue of the preopercle and twisted to secure. A small number of fish were tagged with individually numbered Floy FT-4 cinch tags. In addition, a modified technique for applying Peterson disk tags to the opercle of lingcod was evaluated. This technique consisted of inserting either post or snap automotive door panel clips through a hole punched in the opercle and then securing the Peterson disk, drilled to 3/16 in, to the protruding end of the clip. Tagged fish were also given a caudal fin punch to identify recaptures during the duration of the survey. Tagging efforts were subordinate to this study and will be used over the long term to help define migratory patterns and define stock units.

A Garmin Model 45 portable GPS receiver was used to fix geographic locations and record vessel tracks. The GPS receiver was interfaced with a laptop computer to record the track of the vessel at each fishing site. Latitude and longitude were automatically recorded every 15 seconds. Drift track data were archived for future surveys using Marine Map software (Version 3.0, Jeppeson Marine). Survey tracks and exact locations of capture sites are confidential data under Alaska statute and are not reported here.

Length and sex composition (Objective 1) were estimated using standard techniques for estimating proportions. The proportion of lingcod in each length or sex class  $j$  and its variance were estimated by (Cochran 1977):

$$\hat{p}_j = \frac{n_j}{n}, \text{ and} \tag{1}$$

$$\text{Var}(\hat{p}_j) = \frac{\hat{p}_j(1 - \hat{p}_j)}{n - 1}, \tag{2}$$

where:

- $n_j$  = the number of lingcod in length or sex class  $j$ , and
- $n$  = the total number of lingcod sampled for length or sex.

Differences in length composition between years were tested with the Kolmogorov-Smirnov (KS) two-sample test (Sokal and Rohlf 1981). The chi-square contingency test was used to test differences in sex composition between years and area of capture.

Mean CPUE for fishing or fishing and searching combined were expressed as the mean of CPUE for each fishing site  $i$ :

$$\text{Mean CPUE} = \frac{1}{n_i} \sum_i \frac{c_i}{f_i}, \tag{3}$$

where:

- $n_i$  = the number of fishing sites,
- $c_i$  = the number of lingcod caught at site  $i$ , and
- $f_i$  = the man-hours of effort fishing or searching for site  $i$ .

CPUE data collected during 1998 were added to the historic database to allow future quantitative assessment of relative abundance.

Although not an original study objective, length composition, sex composition, and catch rates were summarized as a function of distance from shore because the data indicated gross differences in catch rates between shoreline and offshore areas and between nearshore and offshore areas in the Chiswell Islands. This information may be useful in designing future surveys.

## RESULTS

During 1998, 75.6 man-hours were spent searching for suitable lingcod habitat in 82 sampling locations, and 187.1 man-hours of directed lingcod fishing effort were expended at 188 fishing sites in Resurrection Bay and the Chiswell Islands (Table 1). This resulted in a total catch of 238 lingcod.

**Table 1.-Catch, effort and CPUE by structure type, Resurrection Bay and the Chiswell Islands, 1998.**

Distance from Shore	Sites (n)	Man-Hours of Searching Effort	Man-Hours of Fishing Effort	Man-Hours of Combined Effort	Catch of Lingcod	Mean Fishing CPUE		Mean Combined CPUE <sup>a</sup>	
						Estimate	SE	Estimate	SE
<b><u>Resurrection Bay</u></b>									
Shoreline	40	17.4	30.1	47.5	12	0.40	0.128	0.29	0.093
Nearshore	48	15.2	36.9	52.1	5	0.15	0.077	0.11	0.057
Offshore	13	4.4	11.0	15.4	3	0.25	0.140	0.18	0.097
Total	101	37.0	78.0	115.0	20	0.26	0.066	0.19	0.048
<b><u>Chiswell Islands</u></b>									
Shoreline	12	4.6	12.2	16.8	20	1.52	0.552	1.16	0.424
Nearshore	15	8.9	22.9	31.8	25	1.03	0.206	0.75	1.807
Offshore	46	19.9	63.4	83.3	173	2.97	0.322	2.05	0.212
No Rock Outcropping	14	5.2	10.6	15.8	0	0.00	0.000	0.00	0.000
Total	87	38.6	109.1	147.7	218	1.96	0.225	1.37	0.153
<b><u>Study Areas Combined</u></b>	188	75.6	187.1	262.7	238	1.05	0.126	0.74	0.087

<sup>a</sup> Combined CPUE calculated using search and fishing effort.

## RESURRECTION BAY STUDY AREA

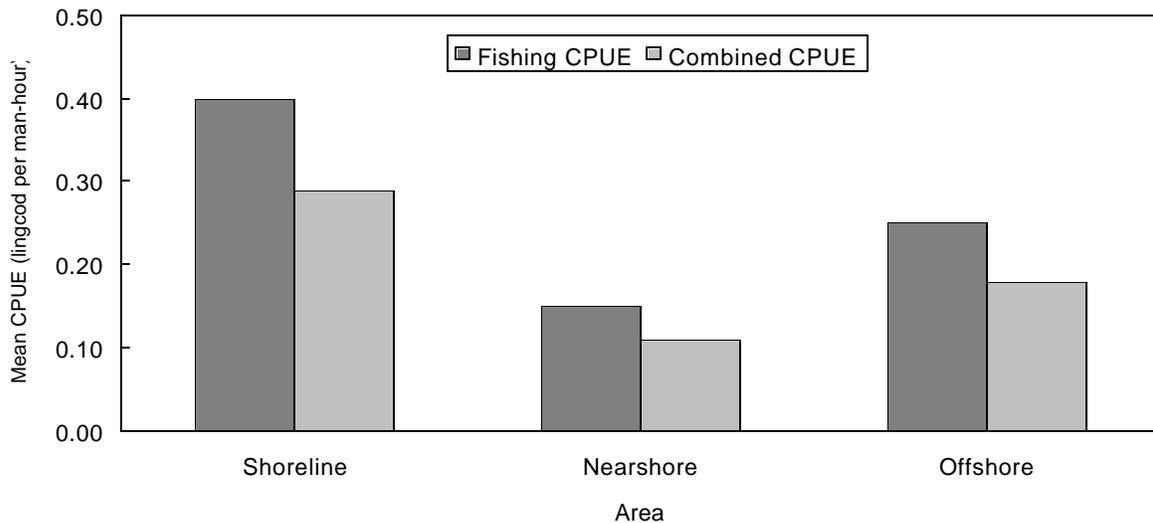
In Resurrection Bay, sampling occurred from August 26 through October 2, 1998. Total fishing effort was 78.0 man-hours, with a total of 101 fishing sites and 46 sample locations surveyed (Table 1). All effort occurred around rocky outcroppings, and all fish were caught over rocky substrate (Table 2). More effort (searching and fishing combined) was expended nearshore than along the shoreline and offshore (Table 1), but mean fishing CPUE and overall CPUE (including search time) were highest at shoreline sites (Figure 3). Lingcod were captured in only 16 of the 101 sites sampled (Appendix A2). The majority of the catch (60%) came from rocky shoreline areas (Table 2). Total catch in Resurrection Bay was 20 lingcod, and mean CPUE was 0.26 (SE = 0.066) lingcod per man-hour (Table 1).

**Table 2.-Lingcod catch, by distance from shore and substrate, for Resurrection Bay and Chiswell Islands, 1993-1994 and 1998.**

Distance from Shore	No. Caught by Substrate					Prop.	Length (cm)			Weight (kg)		
	Hard	Mixed	Rocky	Unknown	Total		Mean	n	SE	Mean	n	SE
<b>Resurrection Bay-1998</b>												
Shoreline	0	0	12	0	12	0.60	82.0	12	2.1	6.3	12	1.8
Nearshore	0	0	5	0	5	0.25	76.5	5	13.4	8.4	4	2.8
Offshore	0	0	3	0	3	0.15	96.8	3	6.9	10.3	3	2.9
Area Total	0	0	20	0	20	1.00	82.8	20	3.7	7.4	19	0.8
<b>Chiswell Islands-1998</b>												
Shoreline	0	0	20	0	20	0.09	88.3	20	2.0	8.1	20	0.6
Nearshore	0	1	24	0	25	0.11	93.2	25	2.5	9.2	25	0.9
Offshore	1	6	166	0	173	0.79	100.0	173	0.9	11.4	120	0.4
No Rock Outcropping	0	0	0	0	0	0.00	0.0	0	0.0	0.0	0	0.0
Area Total	1	7	210	0	218	1.00	98.2	218	0.8	10.7	165	1.0
<b>Areas Combined-1998</b>												
Grand Total	1	7	230	0	238	1.00	100.1	238	3.2	10.3	184	0.3
<b>Resurrection Bay-1993-1994</b>												
All	na	na	na	23	23	1.00	89.2	23	3.1	na	na	na
<b>Chiswell Islands-1993-1994</b>												
Nearshore	na	na	na	24	24	0.08	97.1	23	2.2	10.8	9	1.5
Offshore	na	na	na	272	272	0.92	105.1	271	0.9	11.1	90	0.5
Area Total	na	na	na	296	296	1.00	104.3	296	0.8	11.0	100	0.4
<b>Areas Combined-1993-1994</b>												
Grand Total	na	na	na	319	319	1.00	103.3	319	0.8	na	na	na

Notes: na = not available.

All fishing was conducted around rocky outcroppings, except as noted for the Chiswell Islands in 1998.



**Figure 3.-Mean fishing CPUE (lingcod per man-hour) and mean combined fishing and search CPUE for lingcod in Resurrection Bay as a function of proximity to shore, 1998.**

The mean length of sampled lingcod was 82.8 cm (SE = 3.7) and the mean weight was 7.4 kg (SE = 0.8; Table 2). Sixty-five percent of the fish were smaller than the minimum size limit of 88.9 cm for the sport and commercial fisheries. The sex composition was five female (26%) and 14 male (74%), with one unknown (Table 3). There was no significant difference in sex composition between this survey and the earlier survey ( $\chi^2 = 1.33$ ,  $df = 1$ ,  $P = 0.25$ ). There was also no significant change in the length distribution of either males or females between the two surveys (KS test; for females  $D = 0.40$ ,  $P = 0.76$ ; for males  $D = 0.26$ ,  $P = 0.66$ ; Figure 4).

### **CHISWELL ISLANDS STUDY AREA**

During 1998, sampling occurred between August 8 and October 3 in the Chiswell Islands. A total of 87 fishing sites from 36 sample locations were surveyed (Table 1). Total fishing effort in the Chiswell Islands was 109.1 man-hours, resulting in a total catch of 218 lingcod (Table 1) at 27 different locations (Appendix B2). Mean fishing CPUE was 1.96 (SE = 0.225) lingcod per man-hour (Table 1).

More searching and fishing effort was expended in offshore than nearshore or shoreline waters (Table 1). Fourteen sites in seven locations were sampled in areas without rocky outcroppings, with 10.6 man-hours of fishing effort (Table 1). The majority of the total catch in the Chiswell Islands came from offshore (79%), distantly followed by nearshore (12%), then shoreline (9%); nearly all lingcod were caught over rocky substrate (Table 2).

Mean fishing CPUE and overall CPUE (including search time) were greatest offshore (Figure 5). Mean fishing CPUE was nearly 2.4 times greater offshore (2.97 lingcod per man-hour) than for nearshore and shoreline areas combined (1.25 lingcod per man-hour). The difference in sex ratio

**Table 3.-Sex composition of lingcod captured in Resurrection Bay and the Chiswell Islands during 1993-1994 and 1998.**

	Females		Males		Total	
	Number	Proportion	Number	Proportion	Number	Proportion
<b>Resurrection Bay (All Sites)</b>						
<b>All Sites - By Year</b>						
1993-1994	10	0.43	13	0.57	23	1.00
1998	5	0.26	14	0.74	19 <sup>a</sup>	1.00
Total	15		27		42	
<b>Chiswell Islands</b>						
<b>All Sites - By Year</b>						
1993-1994	196	0.66	100	0.34	296	1.00
1998	118	0.54	99	0.46	217	1.00
Total	314		199		513	
<b>1998 - By Site<sup>b</sup></b>						
Shoreline	4	0.20	16	0.80	20	1.00
Nearshore	13	0.52	12	0.48	25	1.00
Offshore	101	0.59	71	0.41	172	1.00
Total	118	0.54	99	0.46	217	

<sup>a</sup> Does not include one lingcod of unknown sex.

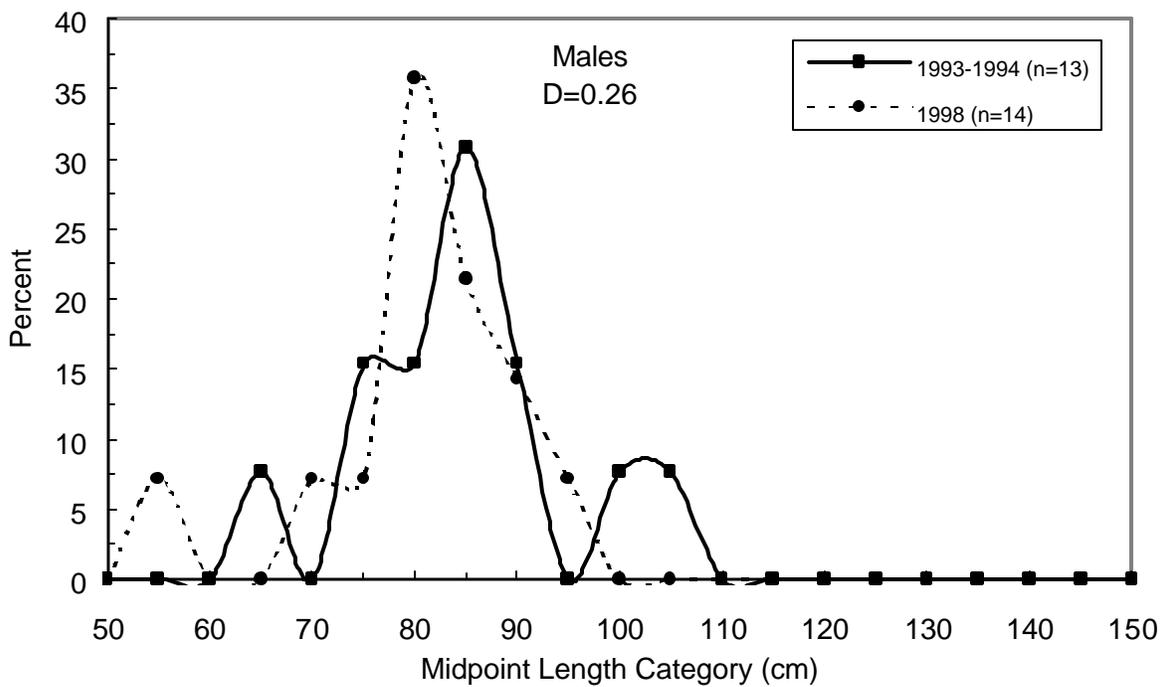
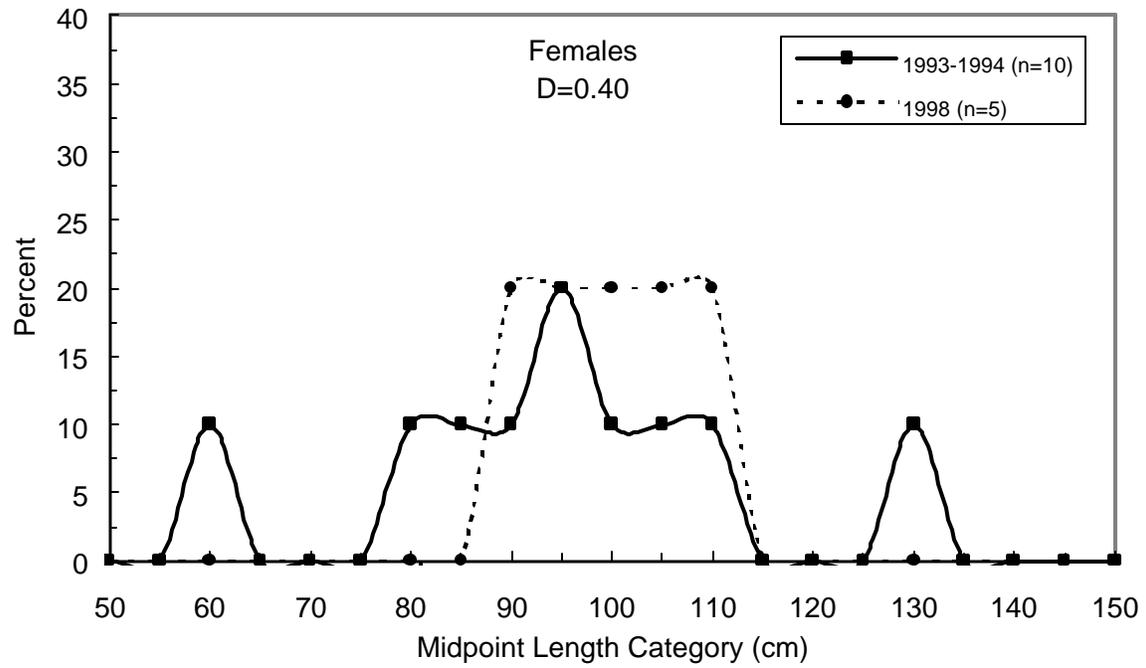
<sup>b</sup> Unable to discriminate between shoreline and nearshore areas in the 1993-1994 data.

between shoreline, nearshore, and offshore sites was significant ( $\chi^2 = 10.9$ ,  $df = 2$ ,  $P < 0.01$ ) with the highest proportion of females captured at offshore sites (Table 3).

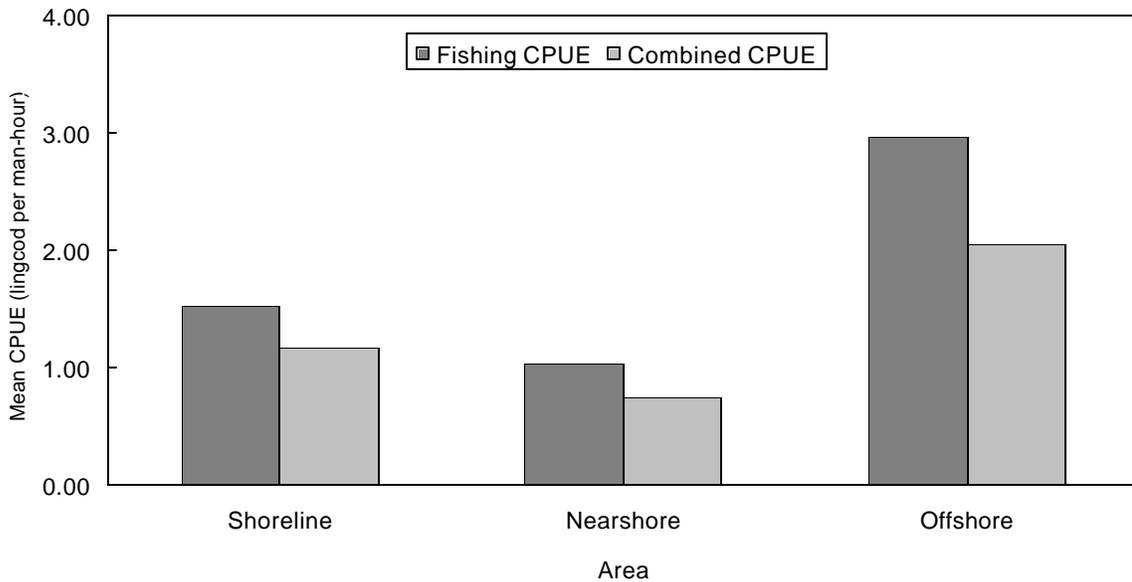
The mean length of captured lingcod was 98.2 cm (SE = 0.8) and mean weight was 10.7 kg (SE = 1.0; Table 2). Mean length and mean weight declined since the 1993-1994 survey. Twenty-two percent of the fish were smaller than the minimum size limit of 88.9 cm. The sex composition of captured lingcod among all areas was 118 females (54%) and 99 males (46%; Table 3). A significant difference in sex composition was found between the 1993-1994 and 1998 surveys ( $\chi^2 = 7.39$ ,  $df = 1$ ,  $P < 0.01$ ). The female percentage declined from 66% to 54%, while the male percentage increased from 34% to 46% (Table 3). There was also a significant change in the length composition of both female and male lingcod between the two surveys (KS test; for females  $D = 0.17$ ,  $P = 0.03$ ; for males  $D = 0.26$ ,  $P < 0.00$ ; Figure 6).

## TAGGING

During 1998, a total of 19 lingcod were tagged in Resurrection Bay (Appendix A3) and 205 lingcod were tagged in the Chiswell Islands (Appendix B3). In Resurrection Bay, all lingcod that were released were tagged with individually numbered spaghetti and Peterson disk tags. In the Chiswell Islands, 9 lingcod were tagged with only cinch tags, 45 were tagged with only



**Figure 4.-Length distribution of lingcod captured in Resurrection Bay, 1993-1994 and 1998.**



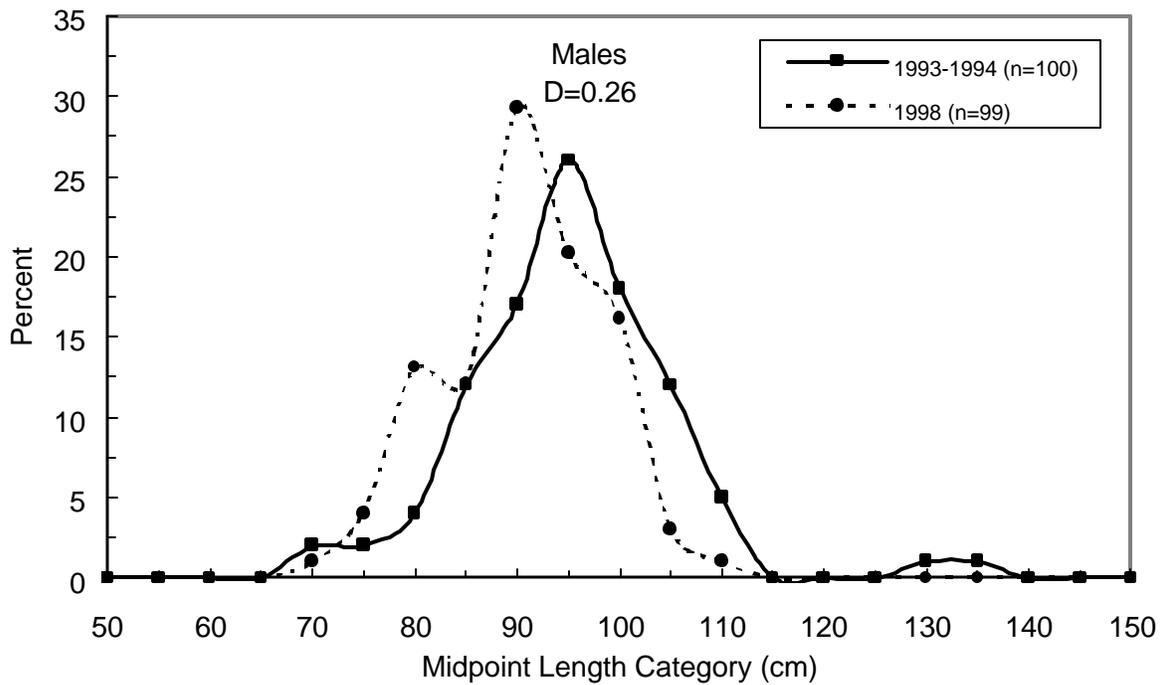
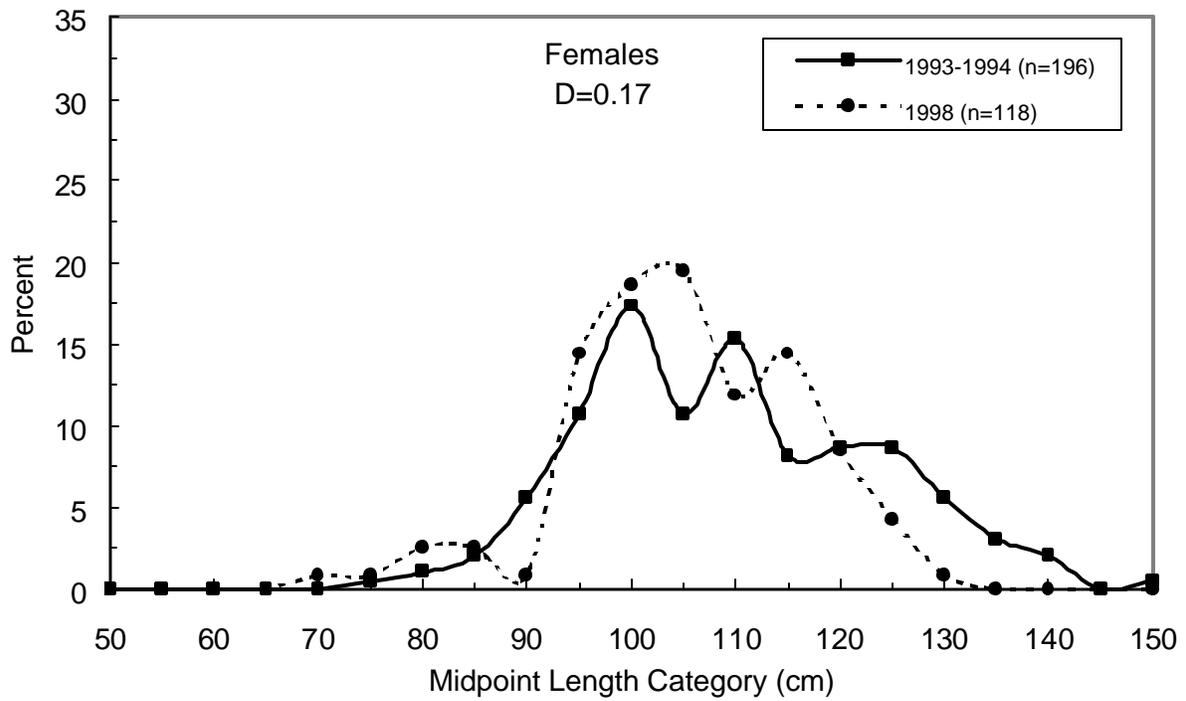
**Figure 5.-Mean fishing CPUE (lingcod per man-hour) and mean combined fishing and search CPUE for lingcod in the Chiswell Islands as a function of proximity to shore, 1998.**

Peterson disk tags, and 77 were tagged with both spaghetti and Peterson disk tags. No tagged or caudal fin-punched lingcod were recaptured during the survey.

## DISCUSSION

Current regulations were designed to afford additional protection for lingcod stocks, allow opportunity for recruitment, and in time, result in increased abundance. To assess whether or not current regulations promote recruitment of lingcod to the sport fishery, information on both abundance and changes in biological composition are needed. The current study provided some CPUE data that may be used for comparisons to future surveys as a relative measure of abundance, but estimates of absolute abundance are still not available.

Despite intensive sampling efforts in Resurrection Bay during 1998, only 20 lingcod were captured. Although two lingcod less than 75 cm were captured, poor catch rates suggest very low levels of abundance throughout the area. With no significant change detected in either length or sex composition between the two surveys, there is little to suggest that sufficient recruitment has taken place since 1993-1994 to affect the overall abundance of lingcod in this area. As a result, we recommend that commercial and recreational fishery closures for lingcod inside Resurrection Bay remain in place pending future assessments.



**Figure 6.-Length distribution of lingcod captured in the Chiswell Islands, 1993-1994 and 1998.**

In the Chiswell Islands, the presence of lingcod over a wide range of sizes, including fish under about 100 cm, indicates that some level of recruitment has occurred. Changes in length composition were also accompanied by a significant decrease in the proportion of females. Although lingcod catch rates from the Chiswell Islands were much greater than from Resurrection Bay, anecdotal information provided by local fishermen continues to indicate depressed abundance in the Chiswell Islands area. Although some recruitment has obviously occurred in the Chiswell Islands, the lack of a strong surge within any length category, combined with anecdotal indicators of continued low abundance, suggests that recruitment has not affected overall abundance appreciably to date.

In the Chiswell Islands, mean catch rates from offshore sites were nearly 2.4 times greater than from shoreline and nearshore combined during 1998. Although we do not have detailed effort information from 1993-1994 to quantify relative CPUE between years, current findings are consistent with the 1993-1994 survey in that they suggest a greater abundance of lingcod offshore. The higher proportion of males in shallow nearshore waters is typical of spring nest-guarding periods, but a general preference for shallower depths by males has been documented (Miller and Geibel 1973). Anglers in the Chiswell Islands often target shoreline and nearshore outcroppings because they afford protection from weather and prevailing sea conditions. The distribution of fishing effort by the fleet is probably a determining factor in the sex ratio of the harvest. Spatial segregation by sex should also be taken into account in future surveys where estimation of the sex ratio is an objective.

The Chiswell Islands portion of this survey encompassed only a very small portion of the waters open to fishing to the Seward recreational fleet. Because of that, no strong conclusions can be reached regarding changes in stock status. This survey does provide indication of changes in size composition since the 1993-1994 survey that warrant further consideration. Much of the information needed to develop an appropriate harvest strategy for lingcod is still lacking. We recommend continued surveys to evaluate changes in size and sex composition, estimate age and size at maturity, and develop a reliable index of changes in relative abundance.

## **RECOMMENDATIONS**

1. Resurrection Bay should remain closed to recreational and commercial lingcod fishing until sufficient numbers of lingcod are present to support a fishery.
2. Current bag and possession limits for lingcod should remain in effect outside of Resurrection Bay.
3. Reassess relative abundance and changes in biological composition, as they pertain to the effectiveness of regulatory strategies in promoting recruitment of lingcod stocks in Resurrection Bay and the Chiswell Islands at regular 3-5 year intervals.
4. Expand lingcod surveys into other areas with a long or developing history of commercial and recreational lingcod harvest, such as the entrances to Prince William Sound, to establish baseline measurements of CPUE and biological composition.
5. Refine and integrate characterizations of relative abundance and biological composition as a function of proximity to shore into future lingcod surveys.
6. Implement studies designed to assess length and age at maturity to evaluate the effectiveness of the current 35-inch minimum size limit for recreational and commercial fisheries.

7. In the absence of more reliable indicators of abundance, establish measurable management objectives based, in part, upon relative CPUE indices.

## ACKNOWLEDGEMENTS

We would like to thank all of the people who participated in the collection of the data, including Bruce Hedlund, Terry Lee, Chris Schmediscamp, Andy Hoffmann, Willy Dunne, Philip Cowan, and Charlie Stock. We would also like to thank Pat Hansen, Doug Vincent-Lang and Bob Clark for their careful review of this document and the attendant operational plan. We would like to thank Pat Hansen for her assistance in the statistical analysis of the data. Saree Timmons provided editorial assistance.

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**APPENDIX A. SUPPORTING DATA FOR RESURRECTION  
BAY**

**Appendix A1.-Latitude and longitude of boundary points in the Resurrection Bay study area, 1998.**

<u>Boundary Point</u>		
<u>Location</u>	<u>Latitude</u>	<u>Longitude</u>
<b>Western Shoreline</b>		
1	60.02.10	149.23.36
2	60.00.98	149.25.11
3	60.00.28	149.23.91
4	59.59.38	149.23.24
5	59.59.11	149.24.93
6	59.58.31	149.25.91
7	59.57.47	149.26.39
8	59.56.46	149.26.86
9	59.55.47	149.27.40
10	59.55.91	149.29.07
11	59.55.75	149.30.85
12	59.55.03	149.32.20
13	59.54.41	149.33.57
14	59.53.74	149.33.94
15	59.53.09	149.33.18
16	59.52.75	149.34.68
17	59.51.95	149.34.96
18	59.51.18	149.34.31
19	59.50.84	149.35.45
20	59.50.16	149.36.74
21	59.49.35	149.36.44
22	59.48.64	149.36.70
23	59.48.12	149.36.09
24	59.47.26	149.35.61
25	59.46.43	149.35.41
26	59.46.25	149.33.72
27	59.46.99	149.32.65
28	59.46.56	149.33.19
	59.45.68	149.32.49

<u>Boundary Point</u>		
<u>Location</u>	<u>Latitude</u>	<u>Longitude</u>
<b>Western Shoreline (continued)</b>		
29	59.45.68	149.32.49
30	59.45.29	149.33.53
31	59.44.72	149.32.49
32	59.43.88	149.32.10
33	59.43.89	149.31.32
34	59.42.92	149.31.51
35	59.41.94	149.31.29
36	59.42.89	149.30.51
37	59.43.94	149.29.52
38	59.44.86	149.28.21
	59.45.89	149.30.66

-continued-

## Appendix A1.-Page 2 of 2.

Boundary Point		
Location	Latitude	Longitude
<b><u>Cheval Island</u></b>		
	59 45 89	149 30 66
39	59.46.73	149.30.28
40	59 46 75	149 31 37
41	59 45 89	149 30 66
<b><u>Rugged Island</u></b>		
	59 52 10	149 23 02
42	59 51 97	149 24 20
43	59 51 21	149 24 11
44	59.50.70	149.29.00
45	59 51 08	149 22 88
46	59.50.39	149.22.83
47	59 50 48	149 22 09
48	59.51.46	149.21.92
<b><u>Hive Island</u></b>		
	59 52 79	149 21 77
49	59.53.28	149.22.77
50	59 52 79	149 21 77
<b><u>Renard (Fox) Island</u></b>		
	59 56 08	149 21 04
51	59.55.50	149.21.43
52	59 54 39	149 21 66
53	59 53 89	149 20 40
54	59 54 86	149 19 52
55	59 55 90	149 19 27
56	59 56 29	149 18 75
57	59 54 63	149 20 03
58	59.56.71	149.20.01
59	59 56 08	149 21 04

Boundary Point		
Location	Latitude	Longitude
<b><u>Eastern Shoreline</u></b>		
	60 01 79	149 20 17
60	60 00 83	149 20 07
61	60 00 72	149 19 03
62	60 00 76	149 17 28
63	60 00 08	149 18 46
64	59.59.30	149.19.50
65	59.58.31	149.19.24
66	59.58.68	149.17.71
67	59.57.89	149.17.26
68	59 57 66	149 18 03
69, 77 <sup>a</sup>	59 56 65	149 17 67
70	59 55 93	149 18 08
71	59 54 02	149 18 18
72	59 54 37	149 17 48
73	59.53.53	149.18.09
74, 76	59.52.61	149.17.23
75	59.52.14	149.16.72

<sup>a</sup> Location 77 is around Hat Island.

## Appendix A2.-Catch and effort of lingcod in Resurrection Bay, 1998.

Event	Date	Loc. <sup>a</sup>	Site	Latitude		Longitude		Search Time	Fishing Time	Number Rods	Man Hrs Fishing	Fishing Depth	Echo Size	Structure Type	Bottom Type	Lingcod	
				North	West	West	West									Catch	CPUE
1	8/26/98	25	1	59.46.19	149.34.11	4	15	3	0.75	25	None	Nearshore	Rocky	0	0.00		
2	8/26/98	25	2	59.46.24	149.35.51	9	15	3	0.75	11-15	None	Nearshore	Rocky	0	0.00		
3	8/26/98	24	1	59.46.80	149.35.12	6	15	3	0.75	11-15	None	Shoreline	Rocky	0	0.00		
4	8/26/98	24	2	59.46.88	149.35.41	3	15	3	0.75	8-15	None	Nearshore	Hard	0	0.00		
5	8/26/98	21	1	59.48.68	149.36.66	1	15	3	0.75	8-15	None	Shoreline	Rocky	0	0.00		
6	8/26/98	21	2	59.49.15	149.37.41	5	15	3	0.75	8.5	None	Nearshore	Hard	0	0.00		
7	8/26/98	19	1	59.50.38	149.35.87	6	15	3	0.75	5.5-10.5	None	Nearshore	Rocky	0	0.00		
8	8/26/98	19	2	59.50.32	149.35.14	2	15	3	0.75	24	None	Offshore	Hard	0	0.00		
9	8/26/98	18	1	59.50.92	149.34.48	9	15	3	0.75	6-20	None	Nearshore	Rocky	0	0.00		
10	8/26/98	18	2	59.50.91	149.34.37	6	15	3	0.75	6-22	None	Nearshore	Rocky	0	0.00		
11	8/26/98	16	1	59.52.15	149.34.58	8	15	3	0.75	10	None	Nearshore	Rocky	0	0.00		
12	8/26/98	16	2	59.52.38	149.34.77	7	15	3	0.75	9-12	None	Nearshore	Rocky	0	0.00		
13	8/27/98	15	1	59.52.66	149.33.41	5	15	3	0.75	6-10	None	Shoreline	Rocky	0	0.00		
14	8/27/98	15	2	59.52.62	149.33.43	3	16	3	0.80	9-18	None	Nearshore	Rocky	0	0.00		
15	8/27/98	15	3	59.52.86	149.33.99	8	15	3	0.75	8-16	None	Nearshore	Rocky	0	0.00		
16	8/27/98	15	4	59.52.96	149.32.89	6	15	3	0.75	16	None	Nearshore	Rocky	0	0.00		
17	8/27/98	15	5	59.53.04	149.32.95	2	16	3	0.80	15	None	Nearshore	Rocky	0	0.00		
18	8/27/98	13	1	59.53.93	149.33.58	4	15	3	0.75	16	None	Offshore	Hard	0	0.00		
19	8/27/98	13	2	59.54.33	149.33.35	6	15	3	0.75	6-18	None	Nearshore	Rocky	0	0.00		
20	8/27/98	12	1	59.54.36	149.32.57	4	15	3	0.75	15-43	None	Nearshore	Soft	0	0.00		
21	8/27/98	12	2	59.54.58	149.32.17	4	15	3	0.75	8-50	None	Nearshore	Hard	0	0.00		
22	9/16/98	40	1	59.46.80	149.30.30	4	15	3	0.75	10-25	None	Shoreline	Rocky	0	0.00		
23	9/16/98	40	2	59.46.99	149.30.85	9	15	3	0.75	18-24	Small	Shoreline	Rocky	0	0.00		
24	9/16/98	10	1	59.55.73	149.30.47	10	20	3	1.00	20-35	None	Nearshore	Hard	0	0.00		
25	9/16/98	10	2	59.55.69	149.29.42	6	15	3	0.75	16-25	None	Nearshore	Hard	0	0.00		
26	9/16/98	9	1	59.55.10	149.28.30	14	16	3	0.80	5-15	Small	Nearshore	Rocky	0	0.00		
27	9/16/98	9	2	59.54.96	149.27.92	7	16	3	0.80	10-18	None	Nearshore	Rocky	0	0.00		
28	9/16/98	8	1	59.55.69	149.27.18	11	16	3	0.80	8-15	None	Shoreline	Rocky	0	0.00		
29	9/16/98	8	2	59.56.35	149.26.87	5	15	3	0.75	8-15	None	Nearshore	Rocky	0	0.00		
30	9/16/98	7	1	59.57.12	149.26.48	6	15	3	0.75	8-32	None	Nearshore	Rocky	0	0.00		
31	9/16/98	7	2	59.57.38	149.26.51	5	15	3	0.75	6-10	None	Shoreline	Hard	0	0.00		
32	9/17/98	60	1	60.01.47	149.20.25	2	15	3	0.75	10-35	None	Shoreline	Hard	0	0.00		
33	9/17/98	60	2	60.01.19	149.20.23	4	15	3	0.75	6-36	None	Nearshore	Rocky	0	0.00		
34	9/17/98	62	1	60.00.71	149.18.35	3	15	4	1.00	32	Small	Nearshore	Soft	0	0.00		
35	9/17/98	62	2	60.00.76	149.17.44	5	15	4	1.00	1.4-5	None	Nearshore	Soft	0	0.00		
36	9/17/98	64	1	59.59.83	149.19.14	4	15	3	0.75	6	None	Shoreline	Rocky	0	0.00		
37	9/17/98	64	2	59.59.47	149.19.41	5	15	3	0.75	12-18	None	Shoreline	Rocky	0	0.00		
38	9/17/98	4	1	59.58.83	149.24.57	4	15	3	0.75	6-12	Medium	Offshore	Rocky	0	0.00		
39	9/17/98	4	2	59.59.15	149.23.11	55	15	3	0.75	5-10	None	Shoreline	Rocky	0	0.00		
40	9/18/98	2	1	60.00.77	149.24.19	15	15	3	0.75	32-47	None	Offshore	Soft	0	0.00		
41	9/18/98	2	2	60.00.74	149.23.68	13	16	3	0.80	44-50	None	Offshore	Mixed	0	0.00		
42	9/18/98	3	1	60.00.26	149.23.69	3	15	3	0.75	35	None	Nearshore	Soft	0	0.00		
43	9/18/98	3	2	59.59.68	149.23.22	6	10	3	0.50	9-12	None	Nearshore	Rocky	1	2.00		
44	9/18/98	49	1	59.52.37	149.21.79	6	15	3	0.75	35-40	None	Offshore	Rocky	1	1.33		
45	9/18/98	49	2	59.52.37	149.21.79	6	38	3	1.90	35-40	None	Offshore	Rocky	1	0.53		
46	9/18/98	52	1	59.55.09	149.21.25	6	15	3	0.75	15	None	Nearshore	Rocky	0	0.00		
47	9/18/98	52	2	59.55.36	149.21.45	2	15	3	0.75	3	None	Shoreline	Rocky	0	0.00		
48	9/18/98	51	1	59.55.62	149.21.44	1	15	3	0.75	12-25	None	Nearshore	Hard	0	0.00		
49	9/22/98	48	1	59.51.25	149.21.76	33	15	3	0.75	12-20	Small	Shoreline	Rocky	0	0.00		

-continued-

## Appendix A2.-Page 2 of 2.

Event	Date	Loc. <sup>a</sup>	Site	Latitude	Longitude	Search Time	Fishing Time	Number Rods	Man Hrs Fishing	Fishing Depth	Echo Size	Structure Type	Bottom Type	Lingcod	
				North	West									Catch	CPUE
50	9/22/98	48	2	59.50.47	149.21.97	16	15	3	0.75	11-28	Small	Nearshore	Rocky	0	0.00
51	9/22/98	47	1	59.50.02	149.22.98	11	20	3	1.00	11-19	None	Nearshore	Rocky	0	0.00
52	9/22/98	47	2	59.50.16	149.23.38	2	15	3	0.75	33	None	Nearshore	Hard	0	0.00
53	9/22/98	46	1	59.50.43	149.22.68	7	15	3	0.75	5-10	None	Nearshore	Hard	0	0.00
54	9/22/98	45	1	59.51.12	149.22.98	25	15	3	0.75	6-12	None	Shoreline	Rocky	0	0.00
55	9/22/98	46	2	59.50.53	149.23.17	8	15	3	0.75	26	None	Offshore	Rocky	1	1.33
56	9/22/98	45	2	59.50.84	149.23.74	5	15	3	0.75	11-15	None	Shoreline	Rocky	0	0.00
57	9/22/98	43	1	59.51.40	149.24.38	1	15	3	0.75	38-50	None	Offshore	Soft	0	0.00
58	9/22/98	43	2	59.51.85	149.24.45	13	15	3	0.75	3-50	Small	Nearshore	Mixed	0	0.00
59	9/22/98	49	3	59.52.40	149.21.67	8	15	3	0.75	20-40	Small	Offshore	Rocky	0	0.00
60	9/23/98	65	1	59.58.86	149.19.35	24	15	3	0.75	9-15	None	Shoreline	Hard	0	0.00
61	9/23/98	65	2	59.58.38	149.19.58	2	15	3	0.75	10-42	None	Nearshore	Rocky	0	0.00
62	9/23/98	51	2	59.55.95	149.20.88	12	15	3	0.75	21-28	None	Shoreline	Hard	0	0.00
63	9/23/98	58	1	59.56.77	149.19.76	3	15	3	0.75	6-35	None	Nearshore	Mixed	0	0.00
64	9/23/98	58	2	59.56.22	149.19.09	11	15	3	0.75	10-21	None	Nearshore	Hard	0	0.00
65	9/23/98	70	1	59.56.30	149.18.25	7	15	3	0.75	12-35	None	Nearshore	Rocky	0	0.00
66	9/23/98	70	2	59.56.48	149.18.17	5	13	3	0.65	10-13	Small	Nearshore	Rocky	0	0.00
67	9/25/98	77	1	59.27.26	149.18.86	9	15	3	0.75	11-15	None	Shoreline	Rocky	0	0.00
68	9/25/98	77	2	59.57.32	149.18.40	6	15	3	0.75	6-14	None	Nearshore	Rocky	0	0.00
69	9/25/98	76	1	59.53.13	149.18.26	9	15	3	0.75	35	None	Offshore	Rocky	0	0.00
70	9/25/98	76	2	59.53.18	149.18.08	9	15	3	0.75	23-36	Small	Offshore	Rocky	0	0.00
71	9/25/98	49	4	59.52.68	149.21.86	6	15	3	0.75	12-17	None	Shoreline	Rocky	0	0.00
72	9/28/98	75	1	59.52.04	149.17.07	3	15	3	0.75	13-24	None	Nearshore	Rocky	2	2.67
73	9/28/98	75	2	59.52.04	149.16.93	11	15	3	0.75	12-28	Small	Shoreline	Rocky	2	2.67
74	9/28/98	75	3	59.52.01	149.16.77	4	15	3	0.75	9-24	None	Shoreline	Rocky	2	2.67
75	9/28/98	75	4	59.51.73	149.17.03	7	15	3	0.75	8-14	None	Shoreline	Rocky	1	1.33
76	10/1/98	75	5	59.52.04	149.16.93	8	15	3	0.75	14	None	Shoreline	Rocky	0	0.00
77	10/1/98	74	1	59.52.78	149.17.65	8	15	3	0.75	24-34	None	Nearshore	Mixed	0	0.00
78	10/1/98	74	2	59.53.46	149.18.09	7	15	3	0.75	11-24	None	Shoreline	Rocky	1	1.33
79	10/1/98	73	1	59.53.95	149.17.51	5	15	3	0.75	8-14	None	Shoreline	Rocky	0	0.00
80	10/1/98	73	2	59.54.28	149.17.64	6	15	3	0.75	9-14	Small	Nearshore	Rocky	1	1.33
81	10/1/98	56	1	59.55.39	149.19.32	13	15	3	0.75	8-12	None	Shoreline	Rocky	0	0.00
82	10/1/98	56	2	59.55.04	149.19.23	2	15	3	0.75	14-18	None	Shoreline	Rocky	0	0.00
83	10/1/98	37	1	59.44.46	149.28.29	8	15	3	0.75	14-25	None	Shoreline	Rocky	1	1.33
84	10/1/98	37	2	59.44.44	149.28.15	4	15	3	0.75	5-19	None	Shoreline	Rocky	0	0.00
85	10/1/98	37	3	59.44.39	149.27.93	12	15	3	0.75	13-21	None	Nearshore	Rocky	0	0.00
86	10/1/98	36	1	59.42.97	149.30.46	9	15	3	0.75	14	None	Shoreline	Rocky	0	0.00
87	10/1/98	36	2	59.42.94	149.30.38	7	15	3	0.75	28-32	Small	Nearshore	Rocky	0	0.00
88	10/1/98	34	1	59.42.07	149.31.44	1	15	3	0.75	6-15	None	Nearshore	Rocky	0	0.00
89	10/1/98	34	2	59.42.30	149.31.57	3	15	3	0.75	6-15	None	Shoreline	Rocky	0	0.00
90	10/1/98	32	1	59.44.09	149.30.55	7	15	3	0.75	24	None	Shoreline	Rocky	0	0.00
91	10/1/98	32	2	59.44.25	149.29.91	3	15	3	0.75	21-24	None	Offshore	Rocky	0	0.00
92	10/1/98	31	1	59.44.49	149.32.27	11	15	3	0.75	10-13	Small	Nearshore	Rocky	1	1.33
93	10/1/98	31	2	59.44.63	149.32.41	3	15	3	0.75	8-29	None	Shoreline	Rocky	0	0.00
94	10/2/98	41	1	59.46.62	149.31.38	8	15	3	0.75	12-20	None	Shoreline	Rocky	0	0.00
95	10/2/98	41	2	59.45.94	149.30.69	4	15	3	0.75	6-10	Small	Shoreline	Rocky	1	1.33
96	10/2/98	39	1	59.45.84	149.30.48	3	15	3	0.75	10-16	Small	Shoreline	Rocky	1	1.33
97	10/2/98	39	2	59.45.98	149.30.29	4	15	3	0.75	6-10	None	Shoreline	Rocky	2	2.67
98	10/2/98	27	1	59.46.36	149.32.02	6	15	3	0.75	11-14	None	Shoreline	Rocky	0	0.00
99	10/2/98	27	2	59.46.32	149.32.47	4	15	3	0.75	23-25	None	Nearshore	Rocky	0	0.00
100	10/2/98	29	1	59.45.50	149.32.05	1	15	3	0.75	8-15	Small	Shoreline	Rocky	0	0.00
101	10/2/98	29	2	59.45.08	149.32.96	7	15	3	0.75	6	Small	Shoreline	Rocky	1	1.33

<sup>a</sup> Location.

### Appendix A3.-Lingcod tagging data for Resurrection Bay, 1998.

Event	Length (cm)	Sex	Wt. (kg)	First Tag Type	First Tag Color	First Tag Number	Second Tag Type	Second Tag Color	Second Tag Number	Capture Latitude	Capture Longitude	Release Latitude	Release Longitude
44	108.0	F	15.5	Spaghetti	Orange	739	Peterson Disk	Orange	5720	59.52.37	149.21.79	59.52.37	149.21.79
45	98.0	F	10.0	Spaghetti	Orange	740	Peterson Disk	Orange	5721	59.52.37	149.21.79	59.52.37	149.21.79
55	84.3	M	5.5	Spaghetti	Orange	741	Peterson Disk	Orange	5722	59.50.53	149.23.17	59.50.53	149.23.17
72	91.5	F	8.5	Spaghetti	Orange	751	Peterson Disk	Orange	5731	59.52.04	149.17.07	59.52.04	149.17.07
72	55.5	M	1.5	Spaghetti	Orange	752	Peterson Disk	Orange	5732	59.52.04	149.17.07	59.52.04	149.17.07
73	80.5	M	5.0	Spaghetti	Orange	753	Peterson Disk	Orange	5733	59.52.04	149.16.93	59.52.04	149.16.93
73	79.0	M	4.7	Spaghetti	Orange	757	Peterson Disk	Orange	5737	59.52.04	149.16.93	59.52.04	149.16.93
74	73.5	M	4.0	Spaghetti	Orange	754	Peterson Disk	Orange	5734	59.52.01	149.16.77	59.52.01	149.16.77
74	67.5	M	2.5	Spaghetti	Orange	755	Peterson Disk	Orange	5735	59.52.01	149.16.77	59.52.01	149.16.77
75	80.5	M	6.5	Spaghetti	Orange	756	Peterson Disk	Orange	5736	59.51.73	149.17.03	59.51.73	149.17.03
78	84.5	M	7.0	Spaghetti	Orange	758	Peterson Disk	Orange	5738	59.53.46	149.18.09	59.53.46	149.18.09
80	106.5	F	15.0	Spaghetti	Orange	759	Peterson Disk	Orange	5739	59.54.28	149.17.64	59.54.28	149.17.64
83	95.5	M	10.0	Spaghetti	Orange	760	Peterson Disk	Orange	5740	59.44.46	149.28.29	59.44.46	149.28.29
92	94.0	F	8.5	Spaghetti	Orange	761	Peterson Disk	Orange	5741	59.44.49	149.32.27	59.44.49	149.32.27
95	81.5	M	6.0	Spaghetti	Orange	762	Peterson Disk	Orange	5742	59.45.94	149.30.69	59.45.94	149.30.69
96	82.5	M	6.0	Spaghetti	Orange	763	Peterson Disk	Orange	5743	59.45.84	149.30.48	59.45.84	149.30.48
97	81.5	M	7.5	Spaghetti	Orange	764	Peterson Disk	Orange	5744	59.45.98	149.30.29	59.45.98	149.30.29
97	89.5	M	8.5	Spaghetti	Orange	765	Peterson Disk	Orange	5745	59.45.98	149.30.29	59.45.98	149.30.29
101	88.0	M	8.0	Spaghetti	Orange	766	Peterson Disk	Orange	5746	59.45.08	149.32.96	59.45.08	149.32.96

**APPENDIX B. SUPPORTING DATA FOR THE CHISWELL  
ISLANDS**

**Appendix B1.-Latitude and longitude of boundary points in the Chiswell Islands study area, 1998.**

	Column 1	Column 2	Column 3	Column 4	Column 5	Column 6
Row A Latitude	59.40.00	59.40.00	59.40.00	59.40.00	59.40.00	59.40.00
Row A Longitude	149.42.00	149.40.00	149.38.00	149.36.00	149.34.00	149.32.00
Row B Latitude	59.39.00	59.39.00	59.39.00	59.39.00	59.39.00	59.39.00
Row B Longitude	149.42.00	149.40.00	149.38.00	149.36.00	149.34.00	149.32.00
Row C Latitude	59.38.00	59.38.00	59.38.00	59.38.00	59.38.00	59.38.00
Row C Longitude	149.42.00	149.40.00	149.38.00	149.36.00	149.34.00	149.32.00
Row D Latitude	59.37.00	59.37.00	59.37.00	59.37.00	59.37.00	59.37.00
Row D Longitude	149.42.00	149.40.00	149.38.00	149.36.00	149.34.00	149.32.00
Row E Latitude	59.36.00	59.36.00	59.36.00	59.36.00	59.36.00	59.36.00
Row E Longitude	149.42.00	149.40.00	149.38.00	149.36.00	149.34.00	149.32.00
Row F Latitude	59.35.00	59.35.00	59.35.00	59.35.00	59.35.00	59.35.00
Row F Longitude	149.42.00	149.40.00	149.38.00	149.36.00	149.34.00	149.32.00
Row G Latitude	59.34.00	59.34.00	59.34.00	59.34.00	59.34.00	59.34.00
Row G Longitude	149.42.00	149.40.00	149.38.00	149.36.00	149.34.00	149.32.00
Row H Latitude	59.33.00	59.33.00	59.33.00	59.33.00	59.33.00	59.33.00
Row H Longitude	149.42.00	149.40.00	149.38.00	149.36.00	149.34.00	149.32.00
Row I Latitude	59.32.00	59.32.00	59.32.00	59.32.00	59.32.00	59.32.00
Row I Longitude	149.42.00	149.40.00	149.38.00	149.36.00	149.34.00	149.32.00
Row J Latitude	59.31.00	59.31.00	59.31.00	59.31.00	59.31.00	59.31.00
Row J Longitude	149.42.00	149.40.00	149.38.00	149.36.00	149.34.00	149.32.00
Row K Latitude	59.30.00	59.30.00	59.30.00	59.30.00	59.30.00	59.30.00
Row K Longitude	149.42.00	149.40.00	149.38.00	149.36.00	149.34.00	149.32.00
Row L Latitude	59.29.00	59.29.00	59.29.00	59.29.00	59.29.00	59.29.00
Row L Longitude	149.42.00	149.40.00	149.38.00	149.36.00	149.34.00	149.32.00
Row M Latitude	59.28.00	59.28.00	59.28.00	59.28.00	59.28.00	59.28.00
Row M Longitude	149.42.00	149.40.00	149.38.00	149.36.00	149.34.00	149.32.00
Row N Latitude	59.27.00	59.27.00	59.27.00	59.27.00	59.27.00	59.27.00
Row N Longitude	149.42.00	149.40.00	149.38.00	149.36.00	149.34.00	149.32.00

## Appendix B2.-Chiswell Islands lingcod catch, by fishing event, location and site, 1998.

Event	Date	Location	Site	Latitude	Longitude	Search Time	Fishing Time	Number Rods	Man Hrs Fishing	Fishing Depth	Echo Size	Distance from Shore	Bottom Type	Lingcod		
				North	West									Catch	CPUE	
102	8/8/98	E3		1 59.35.98	149.37.90		75	160	3	8.00	8-30	None	Nearshore	Rocky	10	1.25
103	8/10/98	E2		1 59.35.98	149.39.22		0	20	4	1.33	11-15	None	Offshore	Rocky	2	1.50
104	8/10/98	E2		2 59.35.82	149.39.49		11	15	4	1.00	35	Medium	Offshore	Rocky	1	1.00
105	8/10/98	E3		2 59.35.70	149.37.72		4	15	4	1.00	15-30	Medium	Nearshore	Rocky	0	0.00
106	8/11/98	E3		3 59.35.49	149.37.76		23	21	4	1.40	6-28	Medium	Nearshore	Rocky	2	1.43
107	8/11/98	D3		1 59.36.17	149.37.61		4	17	4	1.13	13-20	Small	Shoreline	Rocky	2	1.76
108	8/11/98	D3		2 59.36.82	149.37.36		13	16	4	1.07	11-25	None	Nearshore	Rocky	3	2.81
109	8/11/98	C3		1 59.37.49	149.36.87		7	21	4	1.40	12-23	None	Offshore	Rocky	1	0.71
110	8/11/98	C3		2 59.37.90	149.36.15		5	17	4	1.13	6-15	Small	Shoreline	Rocky	6	5.29
111	8/11/98	C2		1 59.37.02	149.39.23		9	15	4	1.00	28-31	None	Offshore	Hard	1	1.00
112	8/11/98	C2		2 59.37.04	149.38.60		6	15	4	1.00	23-32	None	Offshore	Hard	0	0.00
113	8/11/98	D2		1 59.36.91	149.39.36		1	16	4	1.07	19-29	Small	Offshore	Rocky	0	0.00
114	8/11/98	D2		2 59.36.74	149.38.98		6	18	4	1.20	10-14	None	Shoreline	Rocky	6	5.00
115	8/11/98	E4		1 59.35.98	149.35.37		4	20	4	1.33	5-25	None	Nearshore	Rocky	0	0.00
116	8/11/98	E4		2 59.35.47	149.34.99		6	22	4	1.47	10-30	None	Shoreline	Rocky	1	0.68
117	8/11/98	E3		4 59.35.80	149.37.65		10	46	4	3.07	8-26	Medium	Offshore	Rocky	12	3.91
118	8/12/98	I2		1 59.31.53	149.38.17		4	20	4	1.33	10-30	Medium	Offshore	Rocky	3	2.25
119	8/12/98	I2		2 59.31.38	149.38.08		13	16	4	1.07	11-21	Medium	Offshore	Rocky	3	2.81
120	8/12/98	I3		1 59.31.10	149.37.14		13	17	4	1.13	6-18	None	Shoreline	Rocky	2	1.76
121	8/12/98	I3		2 59.31.50	149.37.59		10	20	4	1.33	20-30	Small	Offshore	Rocky	5	3.75
122	8/12/98	J2		1 59.30.26	149.38.32		5	16	4	1.07	20-40	Medium	Offshore	Rocky	5	4.69
123	8/12/98	J2		2 59.30.17	149.38.06		5	15	4	1.00	20-35	Small	Offshore	Rocky	5	5.00
124	8/12/98	MI		1 59.27.98	149.40.38		9	17	4	1.13	23	Small	Offshore	Rocky	9	7.94
125	8/13/98	A3		1 59.39.94	149.37.35		10	15	3	0.75	5-15	Small	Shoreline	Rocky	0	0.00
126	8/13/98	A3		2 59.39.29	149.36.04		3	15	3	0.75	10-18	None	Shoreline	Rocky	2	2.67
127	8/13/98	B3		1 59.38.95	149.37.38		1	16	3	0.80	3-18	Small	Shoreline	Rocky	0	0.00
128	8/13/98	B3		2 59.38.03	149.36.17		4	19	3	0.95	4-25	None	Shoreline	Rocky	1	1.05
129	8/13/98	B2		1 59.38.48	149.38.67		7	20	3	1.00	8	Small	Offshore	Rocky	0	0.00
130	8/13/98	B2		2 59.38.94	149.38.73		4	21	3	1.05	6-21	None	Shoreline	Rocky	0	0.00
131	8/13/98	A2		1 59.39.25	149.39.73		2	15	4	1.00	12	None	Nearshore	Mixed	1	1.00
132	8/13/98	A2		2 59.39.69	149.39.76		9	19	3	0.95	6-18	Small	Nearshore	Rocky	1	1.05
133	8/14/98	F2		1 59.34.32	149.38.20		11	16	3	0.80	40-42	None	None	Hard	0	0.00
134	8/14/98	F2		2 59.34.66	149.38.61		4	15	3	0.75	43	None	None	Hard	0	0.00
135	8/14/98	H2		1 59.32.48	149.39.05		10	18	3	0.90	15-25	None	Offshore	Rocky	2	2.22
136	8/14/98	H2		2 59.32.15	149.38.67		4	19	3	0.95	38	None	Offshore	Rocky	1	1.05
137	8/14/98	M1		2 59.27.98	149.40.39		4	15	3	0.75	25-30	Small	Offshore	Rocky	4	5.33
138	8/14/98	J3		1 59.30.81	149.37.30		3	17	3	0.85	29	None	Offshore	Rocky	1	1.18
139	8/14/98	J3		2 59.30.97	149.36.81		3	15	3	0.75	18-26	None	Offshore	Rocky	2	2.67
140	8/18/98	B3		3 59.38.16	149.36.61		10	15	3	0.75	7	Small	Nearshore	Rocky	1	1.33
141	8/18/98	D3		3 59.36.93	149.36.80		4	20	4	1.33	6-22	Small	Nearshore	Rocky	2	1.50
142	8/18/98	D4		1 59.36.73	149.35.93		9	17	4	1.13	3-8	Small	Shoreline	Rocky	0	0.00
143	8/18/98	D4		2 59.36.62	149.35.80		2	16	3	0.80	8-10	Small	Nearshore	Rocky	1	1.25
144	8/18/98	E3		5 59.35.64	149.37.61		9	20	4	1.33	8-22	None	Offshore	Rocky	2	1.50
145	8/19/98	I1		1 59.31.05	149.40.56		13	16	3	0.80	30-45	None	Offshore	Mixed	2	2.50
146	8/19/98	I1		2 59.31.05	149.40.51		5	15	3	0.75	25-40	Small	Offshore	Mixed	1	1.33
147	8/19/98	J1		1 59.30.12	149.41.15		16	15	3	0.75	48-50	None	None	Soft	0	0.00
148	8/19/98	J1		2 59.30.27	149.40.14		8	16	3	0.80	50	None	None	Soft	0	0.00
149	8/19/98	J3		3 59.30.37	149.37.96		10	20	3	1.00	18-40	Medium	Offshore	Rocky	7	7.00
150	8/19/98	K3		1 59.29.89	149.37.69		6	18	3	0.90	26	Small	Offshore	Rocky	4	4.44
151	8/19/98	K3		2 59.29.85	149.37.46		1	75	3	3.75	36	Medium	Offshore	Rocky	2	0.53
152	8/19/98	H3		1 59.32.99	149.36.75		10	17	3	0.85	27-35	Small	Offshore	Rocky	3	3.53
153	8/19/98	H3		2 59.32.89	149.36.91		5	17	3	0.85	28-40	None	Offshore	Mixed	2	2.35
154	8/19/98	G3		1 59.33.21	149.36.95		5	18	3	0.90	38	Small	Offshore	Rocky	2	2.22
155	8/19/98	G3		2 59.33.74	149.37.75		7	17	3	0.85	38-48	None	Offshore	Mixed	1	1.18

-continued-

## Appendix B2.-Page 2 of 2.

Event	Date	Location	Site	Latitude		Search Time	Fishing Time	Number Rods	Man Hrs Fishing	Fishing Depth	Echo Size	Distance from Shore	Bottom Type	Lingcod	
				North	West									Catch	CPUE
156	8/21/98	L1	1	59.28.10	149.40.70	9	15	3	0.75	20-31	Small	Offshore	Rocky	5	6.67
157	8/21/98	L1	2	59.28.10	149.40.61	9	16	3	0.80	35	Small	Offshore	Rocky	6	7.50
158	8/21/98	L2	1	59.28.62	149.38.55	10	15	3	0.75	49	None	None	Hard	0	0.00
159	8/21/98	L2	2	59.28.92	149.39.41	9	15	3	0.75	49	None	None	Hard	0	0.00
160	8/21/98	K1	1	59.29.72	149.41.03	3	16	3	0.80	49	None	None	Soft	0	0.00
161	8/21/98	K1	2	59.29.86	149.40.18	4	15	3	0.75	49	None	None	Soft	0	0.00
162	8/21/98	K2	1	59.29.54	149.38.25	11	15	3	0.75	49	None	None	Soft	0	0.00
163	8/21/98	K2	2	59.29.86	149.39.19	6	15	3	0.75	49	None	None	Soft	0	0.00
164	8/24/98	E3	6	59.35.56	149.37.63	13	15	4	1.00	8-30	None	Offshore	Rocky	1	1.00
165	8/24/98	G2	1	59.33.38	149.37.88	8	21	4	1.40	34	Small	Offshore	Rocky	8	5.71
166	8/25/98	A4	1	59.39.76	149.35.86	8	15	4	1.00	16-29	None	Offshore	Rocky	0	0.00
167	8/25/98	A4	2	59.39.39	149.35.63	9	11	4	0.73	11-15	None	Shoreline	Rocky	0	0.00
168	8/25/98	B4	1	59.38.75	149.35.62	3	17	4	1.13	10-30	Small	Nearshore	Rocky	0	0.00
169	8/25/98	B4	2	59.38.72	149.35.44	2	15	4	1.00	10-35	None	Nearshore	Rocky	2	2.00
170	8/25/98	B4	3	59.38.74	149.35.46	2	17	4	1.13	11-24	None	Nearshore	Rocky	1	0.88
171	8/25/98	C4	1	59.37.83	149.35.44	3	15	4	1.00	10-25	None	Nearshore	Rocky	1	1.00
172	8/25/98	C4	2	59.37.86	149.36.13	2	15	4	1.00	5-21	None	Nearshore	Rocky	0	0.00
173	9/15/98	F3	1	59.34.88	149.37.50	11	21	3	1.05	14-20	None	Offshore	Rocky	4	3.81
174	9/15/98	F3	2	59.34.14	149.37.60	11	15	3	0.75	25-29	None	Offshore	Rocky	2	2.67
175	9/15/98	G2	2	59.33.15	149.38.90	11	16	3	0.80	22	Small	Offshore	Rocky	5	6.25
176	9/15/98	G2	3	59.32.99	149.38.97	15	17	3	0.85	25-30	None	Offshore	Rocky	6	7.06
177	9/15/98	M1	3	59.27.89	149.40.38	8	17	3	0.85	10-35	Medium	Offshore	Rocky	4	4.71
178	9/15/98	M1	4	59.28.01	149.40.32	3	59	3	2.95	10-35	Medium	Offshore	Rocky	9	3.05
179	9/24/98	F4	1	59.34.86	149.34.23	10	15	3	0.75	29	Small	Offshore	Rocky	3	4.00
180	9/24/98	F4	2	59.34.88	149.34.01	7	16	3	0.80	38	Small	Offshore	Rocky	2	2.50
181	9/24/98	G1	1	59.33.82	149.40.45	8	15	3	0.75	43	None	None	Soft	0	0.00
182	9/24/98	G1	2	59.33.64	149.40.14	4	15	3	0.75	45	None	None	Hard	0	0.00
183	9/24/98	H1	1	59.32.58	149.41.23	2	13	3	0.65	45	None	None	Hard	0	0.00
184	9/24/98	H1	2	59.32.20	149.41.12	8	15	3	0.75	42	None	None	Mixed	0	0.00
185	9/24/98	F3	3	59.34.87	149.37.58	12	28	3	1.40	6-35	Small	Offshore	Rocky	3	2.14
186	10/2/98	F4	3	59.34.88	149.34.23	11	17	3	0.85	26-32	None	Offshore	Rocky	2	2.35
187	10/2/98	M1	5	59.27.91	149.40.91	5	251	3	12.55	10-35	Medium	Offshore	Rocky	29	2.31
188	10/3/98	F4	4	59.35.43	149.37.76	12	17	3	0.85	6-25	None	Offshore	Rocky	1	1.18

### Appendix B3.-Lingcod tagging data for the Chiswell Islands, 1998.

Event	Length (cm)	Sex <sup>a</sup>	Wt. (kg)	First Tag Type	First Tag Color	First Tag Number	Second Tag Type	Second Tag Color	Second Tag Number	Capture Latitude	Capture Longitude	Release Latitude	Release Longitude
102	100.0	M	9.2	Cinch	Orange	2441	Cinch	Orange	2442	59.35.98	149.37.9	59.35.98	149.37.9
102	97.5	F	9.8	Cinch	Orange	2444	None			59.35.98	149.37.9	59.35.98	149.37.9
102	77.5	M	4.5	Cinch	Orange	2433	None			59.35.98	149.37.9	59.35.98	149.37.9
102	94.0	M	10.0	Cinch	Orange	2434	None			59.35.98	149.37.9	59.35.98	149.37.9
102	89.0	M	7.2	Cinch	Orange	2445	None			59.35.98	149.37.9	59.35.98	149.37.9
102	92.5	F	7.9	Cinch	Orange	2446	None			59.35.98	149.37.9	59.35.98	149.37.9
102	80.5	M	5.1	Cinch	Orange	2448	None			59.35.98	149.37.9	59.35.98	149.37.9
102	89.5	M	7.9	Cinch	Orange	2425	None			59.35.98	149.37.9	59.35.98	149.37.9
102	89.5	F	6.9	Cinch	Orange	2426	None			59.35.98	149.37.9	59.35.98	149.37.9
103	114.0	U	15.4	Spaghetti	Orange	600	None			59.35.98	149.39.2	59.35.98	149.39.2
103	98.5	M	10.4	Spaghetti	Orange	601	None			59.35.98	149.39.2	59.35.98	149.39.2
104	87.0	M	8.8	Spaghetti	Orange	602	None			59.35.82	149.39.4	59.35.82	149.39.4
106	99.0	F	10.1	Spaghetti	Orange	603	None			59.35.49	149.37.7	59.35.49	149.37.7
107	98.0	F	10.8	Spaghetti	Orange	610	None			59.36.17	149.37.6	59.36.17	149.37.6
107	81.5	M	5.8	Spaghetti	Orange	611	None			59.36.17	149.37.6	59.36.17	149.37.6
108	82.5	F	6.8	Spaghetti	Orange	619	None			59.36.82	149.37.3	59.36.82	149.37.3
108	104.0	F	12.8	Spaghetti	Orange	612	None			59.36.82	149.37.3	59.36.82	149.37.3
108	110.5	F	17.1	Spaghetti	Orange	613	None			59.36.82	149.37.3	59.36.82	149.37.3
109	109.0	M	9.2	Spaghetti	Orange	614	None			59.37.49	149.36.8	59.37.49	149.36.8
110	89.5	M	8.5	Spaghetti	Orange	615	None			59.37.90	149.36.1	59.37.90	149.36.1
110	92.0	M	8.7	Spaghetti	Orange	616	None			59.37.90	149.36.1	59.37.90	149.36.1
110	94.5	M	9.2	Spaghetti	Orange	617	None			59.37.90	149.36.1	59.37.90	149.36.1
110	85.5	M	7.5	Spaghetti	Orange	618	None			59.37.90	149.36.1	59.37.90	149.36.1
110	91.0	M	9.8	Spaghetti	Orange	577	None			59.37.90	149.36.1	59.37.90	149.36.1
110	81.0	M	7.2	Spaghetti	Orange	620	None			59.37.90	149.36.1	59.37.90	149.36.1
111	81.0	M	6.0	Spaghetti	Orange	621	None			59.37.02	149.39.2	59.37.02	149.39.2
114	93.5	M	9.2	Spaghetti	Orange	622	None			59.36.74	149.38.9	59.36.53	149.38.4
114	79.5	M	6.1	Spaghetti	Orange	623	None			59.36.74	149.38.9	59.36.53	149.38.4
114	82.0	M	6.1	Spaghetti	Orange	624	None			59.36.74	149.38.9	59.36.53	149.38.4
114	98.5	F	11.5	Spaghetti	Orange	625	None			59.36.74	149.38.9	59.36.53	149.38.4
114	84.5	M	7.4	Spaghetti	Orange	626	None			59.36.74	149.38.9	59.36.53	149.38.4
114	84.0	M	6.0	Spaghetti	Orange	627	None			59.36.74	149.38.9	59.36.53	149.38.4
116	89.0	M	7.8	Spaghetti	Orange	628	None			59.35.47	149.34.9	59.35.47	149.34.9
117	84.0	F	5.5	Spaghetti	Orange	629	None			59.35.80	149.37.6	59.36.04	149.37.6
117	87.5	M	6.4	Spaghetti	Orange	630	None			59.35.80	149.37.6	59.36.04	149.37.6
117	96.5	M	9.6	Spaghetti	Orange	631	None			59.35.80	149.37.6	59.36.04	149.37.6
117	115.5	F	16.4	Spaghetti	Orange	632	None			59.35.80	149.37.6	59.36.04	149.37.6
117	99.5	M	10.5	Spaghetti	Orange	633	None			59.35.80	149.37.6	59.36.04	149.37.6
117	100.5	M	11.2	Spaghetti	Orange	634	None			59.35.80	149.37.6	59.36.04	149.37.6
117	92.0	M	8.5	Spaghetti	Orange	635	None			59.35.80	149.37.6	59.36.04	149.37.6
117	99.0	M	11.5	Spaghetti	Orange	636	None			59.35.80	149.37.6	59.36.04	149.37.6
117	101.5	F	10.8	Spaghetti	Orange	637	None			59.35.80	149.37.6	59.36.04	149.37.6
117	116.0	F	15.5	Spaghetti	Orange	638	None			59.35.80	149.37.6	59.36.04	149.37.6
117	94.5	M	8.0	Spaghetti	Orange	639	None			59.35.80	149.37.6	59.36.04	149.37.6
117	91.5	M	9.0	Spaghetti	Orange	640	None			59.35.80	149.37.6	59.36.04	149.37.6
118	99.5	F	8.1	Spaghetti	Orange	641	None			59.31.53	149.38.1	59.31.53	149.38.1
118	94.0	M	8.2	Spaghetti	Orange	642	None			59.31.53	149.38.1	59.31.53	149.38.1
118	121.0	F	22.5	Spaghetti	Orange	643	None			59.31.53	149.38.1	59.31.53	149.38.1
119	80.0	M	4.3	Spaghetti	Orange	644	None			59.31.38	149.38.0	59.31.38	149.38.0
119	90.0	M	8.5	Spaghetti	Orange	645	None			59.31.38	149.38.0	59.31.38	149.38.0
119	116.5	F	14.0	Spaghetti	Orange	646	None			59.31.38	149.38.0	59.31.38	149.38.0

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**Appendix B3.-Page 2 of 4.**

Event	Length (cm)	Sex <sup>a</sup>	Wt. (kg)	First Tag Type	First Tag Color	First Tag Number	Second Tag Type	Second Tag Color	Second Tag Number	Capture Latitude	Capture Longitude	Release Latitude	Release Longitude
120	94.0	M	8.8	Spaghetti	Orange	647	None			59.31.10	149.37.1	59.31.10	149.37.1
120	89.0	M	8.3	Spaghetti	Orange	648	None			59.31.10	149.37.1	59.31.10	149.37.1
121	81.0	F	4.7	Spaghetti	Orange	649	None			59.31.50	149.37.5	59.31.50	149.37.5
121	97.0	F	8.1	Spaghetti	Orange	658	None			59.31.50	149.37.5	59.31.50	149.37.5
121	107.0	F	13.0	Spaghetti	Orange	659	None			59.31.50	149.37.5	59.31.50	149.37.5
121	111.0	F	13.5	Spaghetti	Orange	667	None			59.31.50	149.37.5	59.31.50	149.37.5
121	92.5	F	7.8	Spaghetti	Orange	668	None			59.31.50	149.37.5	59.31.50	149.37.5
122	102.5	F	11.2	Spaghetti	Orange	669	None			59.30.26	149.38.3	59.30.26	149.38.3
122	100.0	F	9.9	Spaghetti	Orange	679	None			59.30.26	149.38.3	59.30.26	149.38.3
122	87.5	M	7.0	Spaghetti	Orange	678	None			59.30.26	149.38.3	59.30.26	149.38.3
122	103.0	F	10.9	Spaghetti	Orange	683	None			59.30.26	149.38.3	59.30.26	149.38.3
122	87.5	M	7.2	Spaghetti	Orange	684	None			59.30.26	149.38.3	59.30.26	149.38.3
123	99.0	M	11.5	Spaghetti	Orange	685	None			59.30.17	149.38.0	59.30.17	149.38.0
123	94.5	F	10.3	Spaghetti	Orange	686	None			59.30.17	149.38.0	59.30.17	149.38.0
123	96.0	F	9.1	Spaghetti	Orange	687	None			59.30.17	149.38.0	59.30.17	149.38.0
123	93.0	F	8.1	Spaghetti	Orange	688	None			59.30.17	149.38.0	59.30.17	149.38.0
123	118.0	F	16.5	Spaghetti	Orange	692	None			59.30.17	149.38.0	59.30.17	149.38.0
124	96.5	M	10.8	Spaghetti	Orange	693	None			59.27.98	149.40.3	59.27.98	149.40.3
124	110.0	F	13.0	Spaghetti	Orange	694	None			59.27.98	149.40.3	59.27.98	149.40.3
124	98.5	F	8.9	Spaghetti	Orange	695	None			59.27.98	149.40.3	59.27.98	149.40.3
124	113.5	F	14.5	Spaghetti	Orange	696	None			59.27.98	149.40.3	59.27.98	149.40.3
124	93.0	M	8.5	Spaghetti	Orange	697	None			59.27.98	149.40.3	59.27.98	149.40.3
124	120.0	F	17.0	Spaghetti	Orange	698	None			59.27.98	149.40.3	59.27.98	149.40.3
124	105.5	F	12.5	Spaghetti	Orange	699	None			59.27.98	149.40.3	59.27.98	149.40.3
124	87.5	M	7.5	Spaghetti	Orange	700	None			59.27.98	149.40.3	59.27.98	149.40.3
124	103.0	F	12.2	Spaghetti	Orange	701	None			59.27.98	149.40.3	59.27.98	149.40.3
126	78.5	F	4.5	Spaghetti	Orange	850	None			59.39.29	149.36.0	59.39.29	149.36.0
126	70.0	M	3.5	Spaghetti	Orange	851	None			59.39.29	149.36.0	59.39.29	149.36.0
128	111.0	F	15.8	Spaghetti	Orange	852	None			59.38.03	149.36.1	59.38.18	149.36.3
131	104.0	F	12.0	Spaghetti	Orange	853	None			59.39.25	149.39.7	59.39.25	149.39.7
132	94.0	F	10.0	None			Peterson Disk	Orange	5535	59.39.69	149.39.7	59.39.69	149.39.7
135	96.5	F	9.5	Spaghetti	Orange	854	Peterson Disk	Orange	5536	59.32.48	149.39.0	59.32.48	149.39.0
135	122.5	F	19.0	Spaghetti	Orange	855	Peterson Disk	Orange	5537	59.32.48	149.39.0	59.32.48	149.39.0
136	81.5	M	5.2	Spaghetti	Orange	856	Peterson Disk	Orange	5538	59.32.15	149.38.6	59.32.15	149.38.6
137	113.0	F	13.5	Spaghetti	Orange	857	Peterson Disk	Orange	5539	59.27.98	149.40.3	59.27.98	149.40.3
137	88.5	M	6.5	Spaghetti	Orange	858	Peterson Disk	Orange	5540	59.27.98	149.40.3	59.27.98	149.40.3
137	86.3	M	6.5	Spaghetti	Orange	859	Peterson Disk	Orange	5541	59.27.98	149.40.3	59.27.98	149.40.3
137	101.0	F	10.5	Spaghetti	Orange	836	Peterson Disk	Orange	5542	59.27.98	149.40.3	59.27.98	149.40.3
138	92.0	M	8.1	Spaghetti	Orange	837	Peterson Disk	Orange	5543	59.30.81	149.37.3	59.30.81	149.37.3
139	88.0	M	7.5	Spaghetti	Orange	838	Peterson Disk	Orange	5544	59.30.97	149.36.8	59.30.97	149.36.8
139	88.4	M	7.0	Spaghetti	Orange	839	Peterson Disk	Orange	5545	59.30.97	149.36.8	59.30.97	149.36.8
140	86.0	M	5.1	Spaghetti	Orange	840	Peterson Disk	Orange	5546	59.38.16	149.36.6	59.38.16	149.36.6
141	92.5	M	7.5	Spaghetti	Orange	841	None			59.36.93	149.36.8	59.36.93	149.36.8
141	95.0	M	10.0	Spaghetti	Orange	842	Peterson Disk	Orange	5547	59.36.93	149.36.8	59.36.93	149.36.8
143	86.0	M	6.8	Spaghetti	Orange	843	Peterson Disk	Orange	5548	59.36.62	149.35.8	59.36.62	149.35.8
144	122.0	F	19.0	Spaghetti	Orange	844	Peterson Disk	Orange	5549	59.35.64	149.37.6	59.35.64	149.37.6
144	93.0	F	8.0	Spaghetti	Orange	845	Peterson Disk	Orange	5550	59.35.64	149.37.6	59.35.64	149.37.6
145	119.5	F	19.0	Spaghetti	Orange	846	Peterson Disk	Orange	5551	59.31.05	149.40.5	59.31.05	149.40.5
145	123.0	F	17.8	Spaghetti	Orange	847	Peterson Disk	Orange	5552	59.31.05	149.40.5	59.31.05	149.40.5
146	102.5	F	9.8	Spaghetti	Orange	845	Peterson Disk	Orange	5553	59.31.05	149.40.5	59.31.05	149.40.5
149	110.0	F	14.5	Spaghetti	Orange	807	Peterson Disk	Orange	5554	59.30.37	149.37.9	59.30.37	149.37.9
149	110.0	F	15.5	Spaghetti	Orange	808	Peterson Disk	Orange	5555	59.30.37	149.37.9	59.30.37	149.37.9
149	116.0	F	17.5	Spaghetti	Orange	809	Peterson Disk	Orange	5556	59.30.37	149.37.9	59.30.37	149.37.9
149	102.0	F	10.5	Spaghetti	Orange	810	Peterson Disk	Orange	5557	59.30.37	149.37.9	59.30.37	149.37.9

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Appendix B3.-Page 3 of 4.

Event	Length (cm)	Sex <sup>a</sup>	Wt. (kg)	First Tag Type	First Tag Color	First Tag Number	Second Tag Type	Second Tag Color	Second Tag Number	Capture Latitude	Capture Longitude	Release Latitude	Release Longitude
149	99.0	F	11.0	Spaghetti	Orange	811	Peterson Disk	Orange	5558	59.30.37	149.37.9	59.30.37	149.37.9
149	96.5	M	10.3	Spaghetti	Orange	812	Peterson Disk	Orange	5559	59.30.37	149.37.9	59.30.37	149.37.9
149	110.0	F	18.0	Spaghetti	Orange	813	Peterson Disk	Orange	5560	59.30.37	149.37.9	59.30.37	149.37.9
150	106.0	F	11.5	Spaghetti	Orange	816	Peterson Disk	Orange	5563	59.29.89	149.37.6	59.29.89	149.37.6
150	101.5	F	11.0	Spaghetti	Orange	817	Peterson Disk	Orange	5564	59.29.89	149.37.6	59.29.89	149.37.6
150	109.0	F	15.0	Spaghetti	Orange	818	Peterson Disk	Orange	5565	59.29.89	149.37.6	59.29.89	149.37.6
150	94.0	M	9.0	Spaghetti	Orange	819	Peterson Disk	Orange	5566	59.29.89	149.37.6	59.29.89	149.37.6
151	103.0	F	11.1	Spaghetti	Orange	814	Peterson Disk	Orange	5561	59.29.85	149.37.4	59.29.85	149.37.4
151	111.0	F	14.5	Spaghetti	Orange	815	Peterson Disk	Orange	5562	59.29.85	149.37.4	59.29.85	149.37.4
152	100.0	M	11.1	Spaghetti	Orange	702	Peterson Disk	Orange	5567	59.32.99	149.36.7	59.32.99	149.36.7
152	108.5	F	14.5	Spaghetti	Orange	703	Peterson Disk	Orange	5568	59.32.99	149.36.7	59.32.99	149.36.7
152	89.0	M	8.5	Spaghetti	Orange	704	Peterson Disk	Orange	5569	59.32.99	149.36.7	59.32.99	149.36.7
153	114.0	F	15.2	Spaghetti	Orange	705	Peterson Disk	Orange	5570	59.32.89	149.36.9	59.32.89	149.36.9
153	108.5	F	10.5	Spaghetti	Orange	706	Peterson Disk	Orange	5571	59.32.89	149.36.9	59.32.89	149.36.9
154	104.0	F	10.5	Spaghetti	Orange	707	Peterson Disk	Orange	5572	59.33.21	149.36.9	59.33.21	149.36.9
154	85.0	M	7.0	Spaghetti	Orange	708	Peterson Disk	Orange	5573	59.33.21	149.36.9	59.33.21	149.36.9
156	93.0	M	8.5	Spaghetti	Orange	709	Peterson Disk	Orange	5574	59.28.10	149.40.7	59.28.10	149.40.7
156	102.0	F	11.0	Spaghetti	Orange	717	Peterson Disk	Orange	5575	59.28.10	149.40.7	59.28.10	149.40.7
156	115.5	F	18.5	Spaghetti	Orange	710	Peterson Disk	Orange	5576	59.28.10	149.40.7	59.28.10	149.40.7
156	95.5	F	9.0	Spaghetti	Orange	711	Peterson Disk	Orange	5577	59.28.10	149.40.7	59.28.10	149.40.7
156	94.0	M	9.0	Spaghetti	Orange	712	None			59.28.10	149.40.7	59.28.10	149.40.7
157	99.0	F	10.0	Spaghetti	Orange	713	Peterson Disk	Orange	5578	59.28.10	149.40.6	59.28.10	149.40.6
157	103.5	F	11.5	Spaghetti	Orange	714	Peterson Disk	Orange	5579	59.28.10	149.40.6	59.28.10	149.40.6
157	82.0	F	9.0	Spaghetti	Orange	715	Peterson Disk	Orange	5580	59.28.10	149.40.6	59.28.10	149.40.6
157	80.0	M	6.0	Spaghetti	Orange	716	Peterson Disk	Orange	5581	59.28.10	149.40.6	59.28.10	149.40.6
157	98.5	F	10.0	Spaghetti	Orange	718	Peterson Disk	Orange	5582	59.28.10	149.40.6	59.28.10	149.40.6
157	97.0	F	9.5	Spaghetti	Orange	719	Peterson Disk	Orange	5583	59.28.10	149.40.6	59.28.10	149.40.6
169	123.5	F	21.5	Spaghetti	Orange	721	Peterson Disk	Orange	5585	59.38.72	149.35.4	59.38.72	149.35.4
169	96.0	F	10.5	Spaghetti	Orange	722	Peterson Disk	Orange	5586	59.38.72	149.35.4	59.38.72	149.35.4
170	115.0	F	17.0	Spaghetti	Orange	720	Peterson Disk	Orange	5584	59.38.74	149.35.4	59.38.74	149.35.4
171	74.0	M	4.5	Spaghetti	Orange	723	Peterson Disk	Orange	5587	59.37.83	149.35.4	59.37.83	149.35.4
173	126.0	F	22.0	Spaghetti	Orange	605	Peterson Disk	Orange	5588	59.34.88	149.37.5	59.34.88	149.37.5
173	103.0	M	12.0	Spaghetti	Orange	606	Peterson Disk	Orange	5589	59.34.88	149.37.5	59.34.88	149.37.5
173	118.5	F	21.5	Spaghetti	Orange	607	Peterson Disk	Orange	5590	59.34.88	149.37.5	59.34.88	149.37.5
173	92.5	M	9.0	Spaghetti	Orange	608	Peterson Disk	Orange	5591	59.34.88	149.37.5	59.34.88	149.37.5
174	115.0	F	15.5	Spaghetti	Orange	609	Peterson Disk	Orange	5592	59.34.14	149.37.6	59.34.14	149.37.6
174	76.5	M	4.0	Spaghetti	Orange	724	Peterson Disk	Orange	5593	59.34.14	149.37.6	59.34.14	149.37.6
175	119.0	F	21.0	Spaghetti	Orange	725	Peterson Disk	Orange	5594	59.33.15	149.38.9	59.33.15	149.38.9
175	123.5	F	17.5	Spaghetti	Orange	726	Peterson Disk	Orange	5595	59.33.15	149.38.9	59.33.15	149.38.9
175	116.0	F	15.5	Spaghetti	Orange	727	Peterson Disk	Orange	5596	59.33.15	149.38.9	59.33.15	149.38.9
175	88.0	M	7.5	Spaghetti	Orange	728	Peterson Disk	Orange	5597	59.33.15	149.38.9	59.33.15	149.38.9
175	89.5	M	8.5	Spaghetti	Orange	729	Peterson Disk	Orange	5700	59.33.15	149.38.9	59.33.15	149.38.9
176	116.5	F	16.5	Spaghetti	Orange	730	Peterson Disk	Orange	5701	59.32.99	149.38.9	59.32.99	149.38.9
176	77.0	M	4.0	Spaghetti	Orange	731	Peterson Disk	Orange	5702	59.32.99	149.38.9	59.32.99	149.38.9
176	115.0	F	16.5	Spaghetti	Orange	732	Peterson Disk	Orange	5703	59.32.99	149.38.9	59.32.99	149.38.9
176	101.5	F	10.0	Spaghetti	Orange	733	Peterson Disk	Orange	5704	59.32.99	149.38.9	59.32.99	149.38.9
176	98.0	M	9.0	Spaghetti	Orange	737	Peterson Disk	Orange	5705	59.32.99	149.38.9	59.32.99	149.38.9
176	97.5	F	10.5	Spaghetti	Orange	738	Peterson Disk	Orange	5706	59.32.99	149.38.9	59.32.99	149.38.9
177	122.0	F		None			Peterson Disk	Orange	5707	59.27.89	149.40.3	59.27.89	149.40.3
177	99.0	M		None			Peterson Disk	Orange	5708	59.27.89	149.40.3	59.27.89	149.40.3
177	99.5	M		None			Peterson Disk	Orange	5709	59.27.89	149.40.3	59.27.89	149.40.3
177	97.5	F		None			Peterson Disk	Orange	5710	59.27.89	149.40.3	59.27.89	149.40.3
178	94.5	M		None			Peterson Disk	Orange	5711	59.28.01	149.40.3	59.28.01	149.40.3
178	95.0	F		None			Peterson Disk	Orange	5712	59.28.01	149.40.3	59.28.01	149.40.3
178	103.0	F		None			Peterson Disk	Orange	5713	59.28.01	149.40.3	59.28.01	149.40.3

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### Appendix B3.-Page 4 of 4.

Event	Length (cm)	Sex <sup>a</sup>	Wt. (kg)	First Tag Type	First Tag Color	First Tag Number	Second Tag Type	Second Tag Color	Second Tag Number	Capture Latitude	Capture Longitude	Release Latitude	Release Longitude
178	103.5	F		None			Peterson Disk	Orange	5714	59.28.01	149.40.3	59.28.01	149.40.3
178	105.0	F		None			Peterson Disk	Orange	5715	59.28.01	149.40.3	59.28.01	149.40.3
178	96.5	M		None			Peterson Disk	Orange	5716	59.28.01	149.40.3	59.28.01	149.40.3
178	100.0	F		None			Peterson Disk	Orange	5717	59.28.01	149.40.3	59.28.01	149.40.3
178	90.5	M		None			Peterson Disk	Orange	5718	59.28.01	149.40.3	59.28.01	149.40.3
178	74.5	F		None			Peterson Disk	Orange	5719	59.28.01	149.40.3	59.28.01	149.40.3
179	116.0	F	16.0	Spaghetti	Orange	742	Peterson Disk	Orange	5723	59.34.86	149.34.2	59.34.86	149.34.2
179	114.5	F	17.5	Spaghetti	Orange	743	Peterson Disk	Orange	5724	59.34.86	149.34.2	59.34.86	149.34.2
179	98.0	M	10.5	Spaghetti	Orange	744	Peterson Disk	Orange	5725	59.34.86	149.34.2	59.34.86	149.34.2
180	105.0	F	12.5	Spaghetti	Orange	745	Peterson Disk	Orange	5726	59.34.88	149.34.0	59.34.88	149.34.0
180	118.0	F	17.0	Spaghetti	Orange	746	Peterson Disk	Orange	5727	59.34.88	149.34.0	59.34.88	149.34.0
185	100.5	M	9.0	Spaghetti	Orange	748	Peterson Disk	Orange	5728	59.34.87	149.37.5	59.37.23	149.36.8
185	90.0	M	9.0	Spaghetti	Orange	749	Peterson Disk	Orange	5729	59.34.87	149.37.5	59.37.23	149.36.8
185	86.5	M	7.0	Spaghetti	Orange	750	Peterson Disk	Orange	5730	59.34.87	149.37.5	59.37.23	149.36.8
186	85.5	F		None			Peterson Disk	Orange	5747	59.34.88	149.34.2	59.34.88	149.34.2
186	92.5	F		None			Peterson Disk	Orange	5748	59.34.88	149.34.2	59.34.88	149.34.2
187	102.0	M		None			Peterson Disk	Orange	5749	59.27.91	149.40.9	59.27.91	149.40.9
187	87.5	M		None			Peterson Disk	Orange	5750	59.27.91	149.40.9	59.27.91	149.40.9
187	119.0	F		None			Peterson Disk	Orange	5751	59.27.91	149.40.9	59.27.91	149.40.9
187	128.0	F	22.0	None			Peterson Disk	Orange	5752	59.27.91	149.40.9	59.27.91	149.40.9
187	76.0	M		None			Peterson Disk	Orange	5753	59.27.91	149.40.9	59.27.91	149.40.9
187	104.0	F		None			Peterson Disk	Orange	5754	59.27.91	149.40.9	59.27.91	149.40.9
187	93.0	M		None			Peterson Disk	Orange	5755	59.27.91	149.40.9	59.27.91	149.40.9
187	84.0	M		None			Peterson Disk	Orange	5756	59.27.91	149.40.9	59.27.91	149.40.9
187	114.0	F		None			Peterson Disk	Orange	5757	59.27.91	149.40.9	59.27.91	149.40.9
187	108.0	F		None			Peterson Disk	Orange	5758	59.27.91	149.40.9	59.27.91	149.40.9
187	102.5	M		None			Peterson Disk	Orange	5759	59.27.91	149.40.9	59.27.91	149.40.9
187	103.0	F		None			Peterson Disk	Orange	5760	59.27.91	149.40.9	59.27.91	149.40.9
187	99.0	F		None			Peterson Disk	Orange	5761	59.27.91	149.40.9	59.27.91	149.40.9
187	98.0	M		None			Peterson Disk	Orange	5762	59.27.91	149.40.9	59.27.91	149.40.9
187	103.0	F		None			Peterson Disk	Orange	5763	59.27.91	149.40.9	59.27.91	149.40.9
187	81.0	M		None			Peterson Disk	Orange	5764	59.27.91	149.40.9	59.27.91	149.40.9
187	89.0	M		None			Peterson Disk	Orange	5765	59.27.91	149.40.9	59.27.91	149.40.9
187	95.0	F		None			Peterson Disk	Orange	5766	59.27.91	149.40.9	59.27.91	149.40.9
187	97.0	F		None			Peterson Disk	Orange	5767	59.27.91	149.40.9	59.27.91	149.40.9
187	88.0	M		None			Peterson Disk	Orange	5768	59.27.91	149.40.9	59.27.91	149.40.9
187	110.0	F		None			Peterson Disk	Orange	5769	59.27.91	149.40.9	59.27.91	149.40.9
187	78.0	M		None			Peterson Disk	Orange	5770	59.27.91	149.40.9	59.27.91	149.40.9
187	86.5	M		None			Peterson Disk	Orange	5771	59.27.91	149.40.9	59.27.91	149.40.9
187	102.5	M		None			Peterson Disk	Orange	5772	59.27.91	149.40.9	59.27.91	149.40.9
187	102.5	F		None			Peterson Disk	Orange	5773	59.27.91	149.40.9	59.27.91	149.40.9
187	106.0	F		None			Peterson Disk	Orange	5774	59.27.91	149.40.9	59.27.91	149.40.9
187	84.5	M		None			Peterson Disk	Orange	5775	59.27.91	149.40.9	59.27.91	149.40.9
187	94.0	F		None			Peterson Disk	Orange	5776	59.27.91	149.40.9	59.27.91	149.40.9
187	78.0	M		None			Peterson Disk	Orange	5799	59.27.91	149.40.9	59.27.91	149.40.9

<sup>a</sup> Male, female, unknown.