An Examination of Recapture Rates of Lingcod as a Potential Source of Bias in Recreational Catch Per Unit Effort (CPUE) Indices

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AN EXAMINATION OF RECAPTURE RATES OF LINGCOD AS A POTENTIAL SOURCE OF BIAS IN RECREATIONAL CATCH PER UNIT EFFORT (CPUE) INDICES

by

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Catch per unit effort (CPUE) data collected from the creel survey program have been used to index lingcod abundance in the Strait of Georgia. Typically, catch per unit effort has been summarized as released lingcod per unit effort or retained lingcod per unit effort. An observed increase in these indices has been interpreted to reflect an increase in the abundance of lingcod, particularly juvenile fish. However, it has been noted that caution should be used when applying recreational fishery CPUE data as indices of abundance. Increased directed effort, coupled with size and daily limits which mean that a higher proportion of lingcod are released than kept, create the potential for a recapture bias in estimates of released lingcod per unit effort indices. High survival rates after release along with low movement rates could mean that lingcod captured at a specific locale and released are recaptured often. This recapture bias would inflate CPUE estimates and limit the ability of such indices to accurately reflect changes in lingcod abundance. We investigated the recapture rate of lingcod typically released in the recreational fishery that was being conducted prior to 2002 (fish < 65 cm) in order to examine the 'bias' in the released CPUE indices due to the recapture of sublegal sized fish. With the involvement of volunteer recreational fishers, we caught 298 lingcod and tagged 295 lingcod at Entrance Island, British Columbia, at the end of July 2003. One month later, we returned to Entrance Island and caught an additional 104 lingcod, 98 of which were tagged. One tagged lingcod was recaptured during the tagging period and two tagged lingcod were recaptured in the recapture period. The resulting recapture rate estimates range from 0.7-1.3% but may be biased by several factors such as lingcod mortality, tag loss, and movement of lingcod away from the area; however, if these sources of error are accounted for, the recapture rate only increased to 3%. The recapture rate may have been increased with greater effort in the second sampling period or by sampling a larger area. Nonetheless, it appears from this study that the released CPUE for lingcod from the recreational fishery is not overly biased due to the recapture of lingcod. These results are only applicable to areas with a similar lingcod abundance to Entrance Island. Other sources of bias associated with CPUE indices are not addressed in this study.

RÉSUMÉ

King, J.R., and D.R. Haggarty. 2004. An examination of recapture rates of Lingcod as a potential source of bias in recreational catch per unit effort (CPUE) indices. Can. Manuscr.Rep. Fish, Aquat. Sci. 2670: 23 p.

Les données sur les captures par unité d'effort (CPUE) recueillies dans le cadre du programme d'enquête sur la pêche sportive ont été utilisées pour calculer des indices d'abondance de la morue-lingue dans le détroit de Georgia. En général, les CPUE comprennent les morues-lingues remises à l'eau ou conservées par unité d'effort. Une hausse de ces indices a été interprétée comme étant un signe d'une augmentation de l'abondance de la morue-lingue, particulièrement de juvéniles. Il a cependant été noté qu'il faut faire preuve de prudence lorsque des données sur les captures récréatives par unité d'effort sont utilisées comme indices d'abondance. Un effort dirigé accru combiné à des limites de taille et quotidiennes font en sorte qu'une plus grande proportion de morues-lingues sont remises à l'eau que conservées, ce qui signifie qu'il y a une possibilité de biais lié à la recapture dans les estimations des indices des CPUE. Les taux de survie élevés après la remise à l'eau combinés aux faibles taux de déplacement pourraient signifier que les morues-lingues remises à l'eau dans une niche particulière sont souvent recapturées. Ce biais lié à la recapture ferait gonfler les estimations des CPUE et limiterait la capacité de tels indices à représenter avec exactitude les changements dans l'abondance de la morue-lingue. Nous avons étudié le taux de recapture de morues-lingues remises à l'eau dans le cadre de la pêche récréative pratiquée avant 2002 (poissons de moins de 65 cm) afin d'examiner le biais des indices des CPUE lié à la recapture de poissons d'une longueur inférieure à la longueur permise. Avec l'aide de pêcheurs récréatifs bénévoles, nous avons capturé 298 morue-lingues et marqué 295 morues-lingues à l'île Entrance (C.-B.) à la fin du mois de juillet 2003. Un mois plus tard, nous sommes retournés à cette île et avons capturé 104 morues-lingues supplémentaires et avons marqué 98 morue-lingues. Seuls deux poissons marqués ont été recapturés durant la période de recapture. Le taux de recapture de 0.7-1.3 % ainsi obtenu peut être biaisé par plusieurs facteurs, comme la mortalité de la morue-lingue, la perte de marques et les déplacements des poissons vers l'extérieur de la région. Si ces sources d'erreur sont prises en compte, le taux de recapture n'est cependant que de 3 %. Ce taux aurait pu être plus élevé si l'effort avait été supérieur au cours de la deuxième période d'échantillonnage ou si la zone d'échantillonnage avait été plus grande. Il semble néanmoins que les indices des CPUE de la pêche récréative ne sont pas très biaisés par la recapture de morues-lingues dans les zones où l'abondance de cette espèce est semblable à celle à l'île Entrance. D'autres sources de biais des indices des CPUE ne sont pas abordées dans cette étude.

INTRODUCTION

Lingcod (*Ophiodon elongatus*) populations in the Strait of Georgia have been severely depressed for several decades (Richards and Hand 1989; King 2001). As such, the commercial fishery has been closed since 1990 and the recreational fishery has been subject to regulations. Prior to 2002, regulations to protect lingcod included an eight month winter non-retention period to protect nest guarding males, the non-retention of fish less than 65 cm, and reduced daily (1 per day) and annual catch limits (10 per year). In 2002, the recreational fishery was closed for the retention of lingcod as an additional measure to protect this stock (King and Surry 2000).

Catch per unit effort (CPUE) data collected from the Strait of Georgia creel survey program have been used to index lingcod abundance (Haist 1995; King and Surry 2000; King 2001). Typically, catch per unit effort has been summarized as released lingcod per unit effort or retained lingcod per unit effort. Effort has been expressed as total fishing time, total directed or non-directed fishing time or boat trips. Released lingcod per unit of effort estimates were higher for 2000-2001 than they had been throughout the 1990's. Information collected in 1999 and 2000, on the size of released lingcod indicates that 95% of these fish are less than 65 cm, and presumably juveniles (King 2001). The increase in these indices has been interpreted to reflect an increase in the abundance of lingcod, particularly juvenile fish. However, it has been noted that caution should be used when applying recreational fishery CPUE data as indices of abundance (English 2003). Changes in fishery management, fisher behaviour and abundance of other species are all factors that can affect CPUE estimates yet do not reflect lingcod abundance (English 2003). For instance, when preferred target species (such as coho and chinook salmon) are low in abundance, or fishing regulations limit access to these species, anglers are more likely to focus on alternate species such as lingcod. Abundance of coho salmon in the Strait of Georgia declined from 1994 to 1997 and a closure of the coho fishery occurred in 1998. Increased directed effort for lingcod during this time would be expected as a result of reduced catch success for coho salmon (English 2003).

Increased directed effort, coupled with size and daily limits which mean that a higher proportion of lingcod are released than kept, create the potential for a recapture bias in estimates of released lingcod per unit effort indices (King *et al.* 2003; English 2003). The capture and release mortality for lingcod has been estimated to be less than 5% (Albin and Karpov 1998). Lingcod are relatively sedentary, remaining associated with a specific locale. The high rate of survival after release along with their resident nature could mean that lingcod captured at a specific locale and released are recaptured often. This recapture bias would inflate CPUE estimates and limit the ability of such indices to accurately reflect changes in lingcod abundance. The rate of recaptures could also increase over time with changes in such factors as non-retention of lingcod (which would increase the lingcod available for recapture), and anglers returning to specific locations with lingcod success and increases in lingcod abundance. If the magnitude of recapture rates is large, then the inflation bias to CPUE indices may be significant enough to actually conceal declines in lingcod abundance or could lead to the conclusion that lingcod abundance is increasing when it is not (King *et al.* 2003; English 2003).

This study was undertaken to investigate the recapture rate of lingcod typically released in the recreational fishery that was being conducted prior to 2002 (fish < 65 cm) in order to examine the 'bias' in the released CPUE indices due to recapture of sublegal sized fish. Recapture rate will be estimated as the proportion of tagged lingcod in the total catch of lingcod during the second sampling period (outlined below).

METHODS

Representatives of the recreational fishing community selected Entrance Island, northeast of Gabriola Island, as the study site location. This site was deemed suitable due to its central location accessible from both Nanaimo and Silva Bay, and for previously observed high lingcod catches. Fishing took place anywhere around Entrance Island within a 45 m (150 feet) depth contour. Although lingcod are found in deeper water, this represents common depths recreational fishers target.

For maximum angler participation, two periods corresponding to long-weekends were selected for the tagging and recapture periods (the August long weekend and Labour Day weekend respectively). Mid to late summer is a time period when many of the sport catches of lingcod occur and therefore might reflect the time when most releases are reported in the fishery. The month between sampling periods was deemed sufficient to allow fish to recover from tagging and resume feeding behaviour.

Anglers fished at Entrance Island using typical recreational fishing gear and bait. Anglers suggested barb-less tri-hook lures were appropriate gear to target lingcod under 65 cm at depths less than 45 m (150 feet). Gibbs/Nortac, a British Columbian fishing gear manufacturing company, generously donated numerous Gibbs Minnow® tri-hook lures (40 and 60 g weight) for use by the anglers in this study (Use of product names does not represent endorsement of the product by Fisheries & Oceans Canada). Fishers could alternatively use other lures or bait of their choice provided the bait targeted lingcod under 65 cm. The fork length of all captured lingcod was measured and each fish was tagged with a yellow Floy spaghetti tag. All tags were inserted below the first dorsal fin by an employee of Fisheries and Oceans Canada or, in a few cases, by an experienced volunteer.

The date, general location around Entrance Island, depth fished, amount of time spent fishing (effort), bait used, fish length, tag number, and fish release condition were recorded. Additional comments such as unusual hooking locations and other remarks about the fish were recorded as well other species caught and the recapture of previously tagged fish.

The recapture rate was calculated as a proportion of tagged fish recovered in the second sampling period to the total fish tagged in the first sampling period. Catch-per-unit of effort was compared between sampling periods, locations, depth, time of day, and fishing crew. A length frequency distribution was computed and length was compared between depths, and bait type.

RESULTS

Twenty-three volunteers took part in the project, many of whom also donated the use of their boat. A total of 260.23 effort hours were spent fishing over ten days; 172.18 hours in the first sampling (tagging) period and 88.05 hours in the second sampling (recapture) period. The first period took place on July 29, 31, and August 1-5. The second period consisted of only three days, August 30, and September 5 and 8, due to weather and volunteer availability.

A total of 400 lingcod were caught and landed, 297 in the first sampling period and 103 in the second sampling period (Table 1). Note that the total lingcod caught in Table 1 includes two recaptures (i.e. 400+2=402). Only 393 of the 400 landed fish were tagged, (295 in the first sampling period and 98 in the second sampling period) as 5 lingcod were deemed too small and 2 were in poor condition. Only 3 tagged fish were recovered, 2 of which were landed. One lingcod was recaptured during the tagging period (first sampling period) after only 152 lingcod had been tagged: fish tag number 95 (forklength=65 cm) was tagged on August 3 and recaptured on the following day, August 4. Two lingcod were recaptured during the second sampling period. Fish tag number 127 (forklength=53 cm) was tagged on August 4 and recaptured on September 5. The second recaptured tagged lingcod was not landed, so the tag number is unknown. This fish was known to be tagged because the tag was clearly visible while it was at the surface.

Of the 393 tagged lingcod, 78% were released in good condition. Good condition was defined as "swam away immediately with no obvious injuries". A further 15 % were still considered to be in good condition despite having been dropped or the presence of minor cuts, abrasions or damaged fins, for a total of 93% in good condition. Only 7% were considered to be in poor condition at time of release (Table 2).

Several other species were also caught in addition to lingcod, including kelp greenling (*Hexagrammos decagrammus*), copper rockfish (*Sebastes caurinus*), quillback rockfish (*Sebastes maliger*), spiny dogfish (*Squalus acanthias*) and cabezon (*Scorpaenichthys marmoratus*). All catch information by fishing event is presented in Table 1.

BIOLOGICAL INFORMATION

The mean length of all lingcod caught in this study was 56.4 cm (Tables 2 and 3). The length of one fish caught was not recorded. A significant difference in the length of fish caught was observed between the first and second sampling periods. Larger fish were caught in the second sampling period (Table 3). A length frequency histogram (Figure 1) of all fish caught shows that most fish caught in the study fell within the desired size range (< 65 cm). Fish < 65 cm were the desired size range because the objective of this study was to investigate the recapture rate of lingcod typically released in the recreational fishery that was being conducted prior to 2002 (i.e. fish < 65 cm) in order to examine the recapture of sublegal sized fish 'bias' in the released CPUE indices. In this study, some fish greater than 65 cm were also caught, particularly with certain bait types. The median length of fish varied significantly with respect to the type of bait used (Figure 2). All bait types used effectively targeted the <65 size

category with the exception of kelp greenling (mean length=76.2, median=72.0, SD=9.4). The 12 lingcod caught with kelp greenling and tagged during the first sampling period were excluded from the analysis since they fall outside of the objectives of the study, leaving 283 (i.e. 295-12) tagged fish during this sampling period for analysis (Table 3). Frozen herring caught slightly larger fish, however, the mean length caught was still below 65 cm (mean=63.0, median=59.7, SD=8.9). The 60 g Gibbs Minnow lures provided for the study effectively targeted the correct size of lingcod; however, the 40 g Gibbs Minnow lures was rarely used and caught only 2 fish.

The lingcod length did not vary significantly with respect to the depth however it did vary significantly by location (Table 3). Slightly larger lingcod were caught on the western and southern sides of Entrance Island (S, W, SW, and NW) (Table 3).

CATCH PER UNIT OF EFFORT (CPUE)

Lingcod Catch Per Unit of Effort (CPUE) was calculated for a total of 101 fishing events. Effort was defined as the total time a crew fished at a particular location around Entrance Island on a given day multiplied by the number of rods fishing. Mean lingcod CPUE for both sampling periods combined was 1.7 fish caught per fishing hour. Mean CPUE was significantly higher during the first sampling period (2.1 fish per hour) than during the second sampling period (1.2 fish per hour) (Table 4).

CPUE also varied among crews of fishers and with respect to time of day; however, unequal sample sizes make differences difficult to interpret. We found no difference in catch rates among locations around Entrance Island.

RECAPTURE RATE

Using the ratio of the number of lingcod recaptured in the second sampling period (2) to the number of lingcod tagged in the first sampling period that met the objectives of the study (283), the non-standardized recapture rate is approximatley 0.7 %. However, if all recapture lingcod are included, the non-standardized recapture rate of tagged lingcod is approximately 1.3% (i.e. 2 recaptured lingcod of 283 lingcod tagged during the first sampling period plus 1 recapture of 152 lingcod tagged before August 4).

DISCUSSION

This was a pilot study conducted in a small area, but due to the very low tag recapture rate observed it appears that the released CPUE of lingcod in Strait of Georgia Creel Survey is not overestimated for sites with similar lingcod abundance to Entrance Island. These results may not be applicable to sites with lower lingcod abundance and therefore of conditions in the Strait of Georgia at large. Low tag returns may have also been influenced by other factors including tag shedding, lingcod mortality due to capture and tagging, movement patterns of

tagged lingcod, and insufficient effort in the recapture period. It is important to note, that this study did not address other sources of bias inherent in the Strait of Georgia Creel survey discussed in English (2003) including changes in the abundance of other species, the influence of fishing regulations, local and regional changes in fishing patterns or the quantity of fishing effort.

Smith, McFarlane et al. (1990) calculated a tag shedding rate of 0.14 for a tagging study of lingcod in the Strait of Georgia. Though we did not measure a tag loss rate, we assume tags were lost at a rate comparable to this previous study as the same tags and tagging procedure was employed and all tags were applied by experienced taggers. Thus, 14 % of the tags may have been lost during this study.

The death of tagged individuals can also influence tag recaptures. Lingcod have been found to have relatively low mortality rates from hook and line capture. Albin and Karpov (1998) calculated a mortality rate of 4.3 % for lingcod due to capture injuries and approximately 7% for capture injuries plus stress. This mortality rate is probably reflective of the mortality rates observed due to capture by hook and line here since lingcod of similar sizes and similar depths were studied. Fish in our study also had the additional stress of the tagging; therefore, overall mortality rates may be slightly higher. Most lingcod were deemed to be in good condition at the time of release. We did observe a lower CPUE in the second sampling period, which may be attributed to mortality of previously caught lingcod. Tagged lingcod may have also experienced greater predation rates than untagged lingcod. Entrance Island is a seal haul-out so predation rates of small lingcod may be high.

Another factor that may have influenced tag recaptures is the movement of lingcod away from Entrance Island. We do not believe that flight response to tagging is a limiting factor, since the whole reef of Entrance Island was fished daily and we planned an interval of a month between fishing periods to allow the resumption of normal behaviour. Within the month interval, lingcod could have undergone their usual seasonal depth migration. Lingcod are considered to be non-migratory fish that remain close to the reef/rocky area to which they recruit. Most lingcod are thought to remain within 10 km of their home area, though juvenile fish are thought to disperse over a wider range than adults (Cass, Beamish et al. 1990). Smith et al. (1990) calculated a daily dispersal rate of 1,040 m/day for female lingcod and 400-600 m/day for male lingcod. In a study in the San Juan Islands, Matthews and LaRiviere (1987) reported a higher proportion of fish that showed migratory behaviour than other studies. Of the fish recaptured, roughly 50% were caught greater than 8.1 km away from the initial capture site, while 50% were found within 8.1 km (Matthews and Lariviere 1987). Despite the relatively small home range and movement rates that have been reported in these studies, the geographic area sampled in this study, which was less than 10 km^2, may have been too limited, particularly since we targeted young lingcod. Matthews (1992) found that male lingcod tagged with acoustic tags off of Gabriola Island showed high site fidelity and homing behaviour after having been displaced. However, her study was conducted in April, at the conclusion of the spawning season, when male lingcod may be expected to show more site fidelity than at other times of year (Matthews 1992). Lingcod undergo seasonal depth distribution changes, by occupying deeper depths as the summer months progress. In a tagging study in Washington State, Jagielo (1995) observed a loss of tagged fish from

nearshore areas in the summer and a recovery of many fish in deeper waters. The timing of our study may have also contributed to the low recapture rates since male lingcod may undertake an offshore migration in the summer (Jagielo 1995). We were confined in our selection of August and September as the period of sampling due to the availability of volunteer sports fishers and due to windy weather typical of the months of June and July. In addition, the period of our study coincides with typical recreational fishing effort.

Unfortunately, the timeline and effort involved in this study did not allow for an expansion of the spatial range (particularly by depth) sampled in the second time period. In fact, less effort was expended in the recovery period than in the initial tagging period (88 versus 172 hours). Fewer volunteers and staff were available during the second period and unfavourable weather conditions limited our sampling days.

This small study investigated the recapture rate of released lingcod and possible biases to the released CPUE index. The non-standardized recapture rate of previously caught lingcod is approximately 0.7-1.3% (Table 5). However, the number of lingcod tagged should be adjusted to account for the sources of mortality, tag loss and migration outlined above. As an overly conservative approach, we assumed that the 7% of tagged fish released in poor condition subsequently died; that an additional mortality rate due to capture and stress was as high as 7%; that the tag loss rate was 14%; and that the highest migration of tagged fish out of the study area was 50% (Table 5). We have selected the higher rates for sources of mortality, tag loss and migration in order to provide the upper range of recapture rate. Using the adjusted number of tagged lingcod available for recapture, the recapture rate increases to approximately 3%. This is still a very low rate of recapture. It appears that for the lingcod abundance level at Entrance Island, recaptures are relatively infrequent. This study could have been improved by increased effort and an expanded area (particularly deeper habitat) fished in the tag recapture sampling period. However, volunteer availability limited increased effort and recreational fishing gear may not be suitable for sampling depths greater than 150 feet. This study could also be improved by sampling at additional sites with varying lingcod abundances (particularly low abundance areas) and perhaps at different times of the year to allow for a wider application of results.

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Table 1. Catch data by fishing event at Entrance Island. Period 1=July 29-Aug. 5, 2003; period 2=Aug. 30-Sept. 8, 2003.

Fishing Event	Date	Crew	Period	Location	Start Time	No. Rods	Effort	CPUE	Lingcod	Juv Lingcod	Kelp Greenling	Copper RF	Quillback RF	Spiny Dogfish	Cabezon	Yelloweye RF	Coho	Black RF	China RF	Tiger RF
1	Jul-29	1	1	SW	8:26	4	19:48	0.8	14	0	0	9	1	0	0	0	0	0	0	0
2	Jul-31	2	1	SE	9:00	4	4:56	2.4	8	1	6	2	0	0	0	0	0	0	0	0
3	Jul-31	2	1	E	10:20	3	1:30	7.3	9	0	0	4	0	0	0	0	0	0	0	0
4	Jul-31	2	1	NE	11:00	3	2:09	3.3	7	0	3	2	0	0	0	0	0	0	0	0
5	Jul-31	2	1	NEW	16:22	3	3:36	4.2	12	0	0	3	0	0	0	1	0	0	0	0
6	Jul-31	2	1	E	17:37	3	0:51	2.4	1	0	0	7	0	1	0	0	0	0	0	0
7	Jul-31	2	1	NW	17:55	3	2:18	4.8	9	0	1	3	0	0	0	0	0	0	0	0
8	Jul-31	2	1	E	18:48	3	1:21	3.7	5	0	0	0	0	0	0	0	0	0	0	0
9	Jul-31	3	1	W	16:30	1	3:00	2.3	7	0	1	0	3	0	0	0	0	0	0	0
10	Aug-01	2	1	NEW	8:40	3	2:06	3.8	6	0	0	5	0	0	0	0	0	0	0	0
11	Aug-01	2	1	W	9:25	3	4:24	1.8	7	0	3	3	0	0	0	0	0	0	0	0
12	Aug-01	2	1	NW	10:56	3	4:36	3.9	18	0	3	5	0	0	0	0	0	0	0	0
13	Aug-01	2	1	W	12:30	3	1:30	1.3	2	0	1	2	0	0	0	0	0	0	0	0
14	Aug-01	2	1	N	13:51	3	2:18	5.2	11	0	0	0	0	0	1	0	0	0	0	0
15	Aug-01	2	1	NE	14:40	3	1:42	2.4	4	0	1	2	0	1	0	0	0	0	0	0
16	Aug-01	2	1	NE	15:22	3	2:39	4.9	9	0	5	1	0	0	0	0	0	0	0	0
17	Aug-01	2	1	W	16:20	3	0:30	4.0	2	0	0	0	0	0	0	0	0	0	0	0
18	Aug-02	4	1	SE	10:30	3	6:15	1.1	7	0	6	3	0	0	0	0	0	0	0	0
19	Aug-02	4	1	N	12:45	4	5:40	0.7	4	0	3	1	0	0	0	0	0	0	0	0
20	Aug-02	4	1	SW	14:12	3	0:54	1.1	1	0	1	0	0	0	0	0	0	0	0	0
21	Aug-02	4	1	SE	14:47	3	1:39	1.2	2	0	0	0	0	0	0	0	0	0	0	0
22	Aug-02	4	1	SW	15:25	4	3:44	0.5	2	0	2	0	0	0	0	0	1	0	0	0
23	Aug-02	4	1	NW	16:40	4	7:28	0.4	3	0	0	3	0	1	0	0	1	0	0	0
24	Aug-03	5	1	S	8:36	4	1:08	0.0	0	0	0	0	0	0	0	0	0	0	0	0
25	Aug-03	5	1	N	8:56	4	5:16	0.4	2	0	6	6	2	8	0	0	0	0	0	0

(Table 1 continued)

Fishing Event	Date	Crew	Period	Location	Start Time	No. Rods	Effort	CPUE	Lingcod	Juv Lingcod	Kelp Greenling	Copper RF	Quillback RF	Spiny Dogfish	Cabezon	Yelloweye RF	Coho	Black RF	China RF	Tiger RF
26	Aug-03	5	1	NW	10:20	4	9:40	1.8	17	0	0	0	0	0	1	0	0	0	0	0
27	Aug-03	5	1	NE	12:50	4	7:36	1.4	11	0	0	0	0	0	0	0	0	0	0	0
28	Aug-03	5	1	W	14:45	4	2:20	5.6	13	0	0	0	0	0	0	0	0	0	0	0
29	Aug-03	6	1	S	13:32	1	1:38	1.2	2	0	5	0	0	0	0	0	0	0	0	0
30	Aug-03	6	1	N	15:15	1	4:15	2.8	12	0	10	10	0	11	0	0	0	0	0	0
31	Aug-04	5	1	N	8:45	4	5:00	4.0	17	0	0	1	1	1	1	0	0	0	0	0
32	Aug-04	6	1	N	9:00	1	4:30	0.4	2	0	3	3	0	1	0	0	0	0	0	0
33	Aug-04	5	1	W	10:05	4	2:28	2.0	5	0	0	1	0	0	0	0	0	0	0	0
34	Aug-04	5	1	NE	10:47	4	2:52	0.0	0	0	0	3	0	0	0	0	0	0	0	0
35	Aug-04	5	1	SE	13:52	3	1:33	1.9	3	0	3	1	0	0	0	0	0	0	0	0
36	Aug-04	5	1	W	14:30	3	5:00	1.6	8	0	1	4	0	0	2	0	0	0	0	0
37	Aug-04	5	1	N	16:15	3	0:42	1.4	1	0	1	0	0	0	0	0	0	1	0	1
38	Aug-04	5	1	W	16:35	2	0:58	2.1	2	0	0	0	0	0	0	0	0	0	0	0
39	Aug-04	5	1	N	17:06	3	0:33	1.8	1	0	0	0	0	0	0	0	0	0	0	0
40	Aug-04	5	1	E	17:19	3	1:18	8.5	11	0	1	7	0	0	0	0	0	0	0	0
41	Aug-05	5	1	S	7:50	4	1:20	0.8	1	0	5	4	4	0	0	0	0	0	0	0
42	Aug-05	5	1	NW	8:11	4	0:36	1.7	1	0	6	3	4	0	0	0	0	0	0	0
43	Aug-05	5	1	NE	8:24	4	1:04	2.8	2	1	12	1	6	0	2	0	0	0	0	0
44	Aug-05	5	1	E	8:43	4	0:48	1.3	1	0	3	1	3	0	0	0	0	0	0	0
45	Aug-05	5	1	SE	8:56	4	2:56	1.7	5	0	0	0	0	0	0	0	0	0	0	0
46	Aug-05	5	1	E	9:44	4	0:24	0.0	0	0	0	0	0	0	0	0	0	0	0	0
47	Aug-05	5	1	SE	9:52	4	0:20	0.0	0	0	0	0	0	0	0	0	0	0	0	0
48	Aug-05	5	1	NW	9:59	4	4:24	1.6	7	0	0	0	0	0	0	0	0	0	0	0
49	Aug-05	5	1	NE	11:11	4	3:12	1.9	6	0	0	0	0	0	0	0	0	0	0	0
50	Aug-05	5	1	NW	12:07	4	1:56	1.0	2	0	0	0	0	0	0	0	0	0	0	0
51	Aug-05	5	1	NE	12:39	4	2:28	1.6	4	0	0	0	0	0	0	0	0	0	0	0
52	Aug-05	5	1	E	13:17	4	2:52	1.4	4	0	0	0	0	0	0	0	0	0	0	0
53	Aug-05	5	1	NE	14:03	4	0:04	0.0	0	0	0	0	0	0	0	0	0	0	0	0

(Table 1 continued)

Fishing Event	Date	Crew	Period	Location	Start Time	No. Rods	Effort	CPUE	Lingcod	Juv Lingcod	Kelp Greenling	Copper RF	Quillback RF	Spiny Dogfish	Cabezon	Yelloweye RF	Coho	Black RF	China RF	Tiger RF
54	Aug-05	5	1	NW	14:08	4	1:48	1.1	2	0	0	0	0	0	0	0	0	0	0	0
55	Aug-05	5	1	NW	15:45	3	1:39	1.2	2	0	1	2	0	0	0	0	1	0	0	0
56	Aug-05	5	1	SE	16:19	3	1:45	1.1	2	0	4	0	4	1	0	0	0	0	0	0
57	Aug-05	5	1	NW	16:56	3	1:12	0.8	1	0	0	0	0	0	0	0	0	0	0	0
58	Aug-05	5	1	SE	17:26	3	1:42	2.9	5	0	0	0	0	0	0	0	0	0	0	0
59	Aug-30	5	2	SW	8:36	3	2:15	2.2	4	0	0	0	0	0	0	0	0	0	0	0
60	Aug-30	5	2	NE	9:22	3	4:39	2.2	10	0	2	2	1	0	2	0	0	0	0	0
61	Aug-30	5	2	SE	10:56	3	1:27	2.8	4	0	1	0	1	0	0	0	0	2	0	0
62	Aug-30	5	2	SW	11:28	3	1:57	2.1	3	0	0	5	2	0	0	0	0	0	0	0
63	Aug-30	5	2	NW	12:09	3	0:51	0.0	0	0	0	0	0	0	0	0	0	0	0	0
64	Aug-30	5	2	SW	12:28	3	4:03	2.7	11	0	0	0	0	0	0	0	0	0	0	0
65	Aug-30	5	2	NW	13:51	3	0:48	2.5	1	0	0	0	0	0	0	0	0	0	0	0
66	Aug-30	5	2	W	14:08	3	0:48	0.0	0	0	1	0	1	0	0	0	0	0	0	0
67	Aug-30	5	2	W	14:29	3	1:54	0.5	0	0	0	0	0	0	0	0	0	0	0	0
68	Aug-30	5	2	E	15:12	3	0:54	2.2	2	0	0	0	3	0	0	0	0	0	0	0
69	Aug-30	5	2	NE	15:34	3	0:57	1.1	1	0	0	0	0	0	0	0	0	0	0	0
70	Aug-30	5	2	SW	15:57	3	0:51	2.4	1	0	1	1	1	0	0	0	0	0	0	0
71	Aug-30	2	2	N	8:31	3	1:06	0.0	0	0	4	2	0	0	0	0	0	0	0	0
72	Aug-30	2	2	E	8:57	3	0:21	0.0	0	0	1	0	0	0	0	0	0	0	0	0
73	Aug-30	2	2	NE	9:07	3	1:36	1.9	3	0	4	0	0	0	0	0	0	0	0	0
74	Aug-30	2	2	SW	9:42	3	0:54	0.0	0	0	2	0	0	0	0	0	0	0	0	0
75	Aug-30	2	2	S	10:07	3	0:57	1.1	0	1	0	0	0	0	0	0	0	0	0	0
76	Aug-30	2	2	NE	10:31	3	1:00	0.0	0	0	2	0	1	0	0	0	0	0	0	0

(Table 1 continued)

Fishing Event	Date	Crew	Period	Location	Start Time	No. Rods	Effort	CPUE	Lingcod	Juv Lingcod	Kelp Greenling	Copper RF	Quillback RF	Spiny Dogfish	Cabezon	Yelloweye RF	Coho	Black RF	China RF	Tiger RF
77	Aug-30	2	2	NE	10:55	3	4:00	1.3	4	0	2	0	4	0	0	0	0	0	0	0
78	Aug-30	2	2	SW	12:27	3	2:06	1.0	2	0	7	0	1	0	0	0	0	0	0	0
79	Aug-30	2	2	E	13:14	3	2:12	3.2	7	0	2	2	3	0	0	0	0	0	0	0
80	Aug-30	2	2	NE	13:59	4	3:08	0.0	0	0	0	1	1	0	2	0	0	0	0	0
81	Aug-30	2	2	SW	14:46	4	1:16	0.8	1	0	2	0	0	0	0	0	0	0	0	0
82	Aug-30	2	2	S	15:09	4	4:04	1.0	4	0	6	1	3	0	0	0	0	0	0	0
83	Aug-30	5	2	E	16:15	3	3:15	2.5	8	0	0	0	0	0	0	0	0	0	0	0
84	Aug-30	5	2	W	17:20	3	0:30	8.0	4	0	0	0	0	0	0	0	0	0	0	0
85	Aug-31	5	2		8:00	3	2:30	0.0	0	0	2	0	0	0	0	0	0	0	0	0
86	Sep-05	2	2	N	8:17	3	3:54	1.5	5	0	7	2	1	0	0	0	0	0	0	0
87	Sep-05	2	2	E	9:39	3	2:45	1.5	4	0	0	4	0	0	0	2	0	0	0	0
88	Sep-05	2	2	NW	10:36	3	4:06	2.9	11	0	7	1	0	0	0	0	0	0	0	0
89	Sep-05	2	2	E	12:01	3	1:09	0.9	0	0	0	0	0	0	0	0	0	0	0	0
90	Sep-05	2	2	W	13:06	3	1:39	0.6	1	0	2	0	0	0	0	0	0	0	2	0
91	Sep-05	2	2	SE	13:43	3	0:21	0.0	0	0	0	0	0	0	0	0	0	0	0	0
92	Sep-05	2	2	NE	13:53	3	2:06	1.4	3	0	3	0	0	0	2	0	0	0	0	0
93	Sep-05	2	2	E	14:40	3	1:57	0.0	0	0	4	6	0	0	1	0	0	0	0	0
94	Sep-05	2	2	N	15:19	3	0:33	0.0	0	0	1	0	0	0	0	0	0	0	0	0
95	Sep-05	2	2	W	15:33	3	0:51	1.2	1	0	0	0	0	0	0	0	0	0	0	0
96	Sep-08	1	2	N	8:34	3	9:03	0.2	0	1	6	5	0	0	0	0	0	0	0	0
97	Sep-08	1	2	W	12:24	4	1:00	1.0	0	1	1	0	1	0	0	0	0	0	0	0
98	Sep-08	1	2	N	12:39	4	3:04	0.3	1	0	0	0	0	0	0	0	0	0	0	0
99	Sep-08	1	2	E	13:25	4	0:48	0.0	0	0	1	0	0	0	0	0	0	0	0	0
100	Sep-08	1	2	N	13:39	4	3:56	0.5	2	0	0	4	1	0	0	0	0	0	0	0
101	Sep-08	1	2	S	14:45	4	0:32	0.0	0	0	1	0	0	0	0	0	0	0	0	0
Total		101							397	5	169	138	53	25	14	3	3	3	2	1

Table 2: Bait type used for capture, depth of capture (feet), fork length (cm) and release condition for individual tagged lingcod by fishing event. Fishing event corresponds to list in Table 1. Bait type codes are: 1=minnow trihook lure (40 gram weight); 2=minnow trihook lure (60 gram weight); 3=frozen herring; 4=trihook lure (unknown weight); 5=unihook lure (unknown weight); 6=rubber unihook lure; 7=live greenling; 8=buzz bomb; 9=netted at surface. Release condition codes are: G=good condition, immediately swam away; P=poor condition; B=bleeding; D=dropped on deck; C=cuts, fresh wounds; N=scrape or abrasions; F=damaged fins.

Fishing Event	Bait Type	Depth (feet)	Tag No.	Length (cm)	Release Condition
1	2	150	451	61.2	G
1	2	75	452	43.0	G
1	2	60	453	50.9	G/C
1	2	75	454	42.5	G
1	2	75	456	45.5	G
1	2	75	457	45.8	G/D
1	2	60	458	44.6	G/D
1	2	75	459	49.5	G
1	2	90	460	42.9	G
1	2	65	461	44.5	G
1	2	75	462	46.8	G
1	2	75	463	47.2	G
1	2	60	464	63.1	G
1	2	55	465	44.1	G
2	4	60	467	45.0	G/D
2	4	60	468	49.0	G/C
2	4	60	469	42.4	G
2	4	72	470	46.1	G/D
2	4	75	471	45.1	G
2	4	75	472	61.1	G
2	4	100	473	46.3	G/D
2	4	100	474	39.2	D
3	4	70	475	64.9	G/D
3	4	80	476	49.8	G/D
3	4	70	477	58.8	G/D
3	4	70	478	54.8	G/D
3	4	42	480	58.0	G
3	4	42	481	51.4	G/D
3	4	42	482	49.9	G/D
3	4	70	499	50.8	G
3	4	70	500	54.5	G/D
4	4	130	483	51.4	G/D
4	4	100	484	51.8	G/D/C
4	4	100	485	41.0	G
4	2	100	488	44.5	G
5	2	61	163	54.4	D/G
5	2	58	164	58.4	G
5	2	58	168	55.0	D/G
5	2	62	169	41.8	G
5	2	80	170	61.7	G
6	2	60	171	65.4	G
7	2	75	127	53.6	G
7	2	55	128	49.6	G/D
7	2	53	129	53.5	G
7	2	65	130	65.0	G
7	2	59	132	54.5	G
7	2	68	134	41.2	G
7	2	68	135	61.8	G
7	2	75	172	76.5	G
7	2	62	175	44.5	G
8	2	30	136	46.0	G
8	2	30	137	55.0	G
8	2	30	138	50.0	G
8	2	40	139	51.0	G
8	2	49	140	43.5	G
9	2	45	176	42.0	G
9	2	40	177	55.0	G
9	2	51	178	61.0	G
9	4	60	179	68.0	G
9	2	75	180	66.0	G
9	2	45	181	55.0	G
9	2	60	182	63.0	G
10	2	60	141	46.5	G
10	2	50	142	48.8	G
10	2	50	143	48.0	G
10	2	65	144	42.0	G
10	2	50	145	53.4	G/D
10	4	70	146	52.1	G
11	4	60	147	55.8	D/B/P
11	4	40	148	60.0	B/G

Fishing Event	Bait Type	Depth (feet)	Tag No.	Length (cm)	Release Condition
4	2	80	489	45.6	G
4	2	80	491	41.4	G
4	2	80	496	49.0	G/C
5	2	80	151	71.0	P/B
5	2	55	152	53.9	G/C
5	2	129	153	65.5	P/D
5	2	128	154	62.0	B/P/C
5	2	45	155	44.2	G
5	2	55	159	58.4	G
5	2	60	160	65.7	G
12	4	30	836	52.5	G
12	2	55	838	44.7	G
12	2	55	839	51.9	G
12	2	55	840	53.0	G
12	4	60	841	58.5	D/B
12	2	56	842	47.6	D/G
12	4	41	843	46.0	D/G
12	4	51	844	43.5	D/G
12	4	51	845	43.5	D/G
12	4	50	846	59.0	D/G
12	2	50	847		G
12	4	50	848	56.8	D/G
12	2	58	849	52.4	B
13	4	50	101	80.9	
13	4	50	102	50.4	
14	2	40	103	52.8	G
14	4	40	104	46.1	G
14	4	65	105	52.8	G
14	2	65	106	59.4	G
14	2	40	107	48.0	G
14	4	42	108	47.3	G
14	4	35	109	49.1	G
14	4	44	110	50.2	G
14	2	60	111	46.5	G
14	4	60	112	50.8	G
14	2	60	113	54.5	C/N/P
15	4	65	114	49.0	D/G
15	4	53	115	46.1	G
15	4	68	116	60.0	G
15	4	54	117	40.6	G
16	2	60	1	57.6	G
16	4	40	118	47.7	G
16	4	65	119	55.8	G/D
11	4	60	149	58.4	G
11	4	50	827	55.8	B/P
11	2	47	828	56.5	G
11	2	42	829	65.0	G
11	2	40	830	51.5	G
12	4	53	831	53.0	G/D
12	2	73	832	55.0	G
12	2	73	833	51.5	G
12	2	40	834	52.0	D/G
12	2	30	835	47.5	G/D
18	4	30	11	43.1	G
18	2	80	12	48.6	G
18	4	60	13	53.4	G
19	4	20	14	42.8	G
19	4	85	15	49.9	G/D
19	5	50	16	59.4	G
19	4	17	17	59.9	G
20	4	55	19	63.1	G
21	4	50	23	67.6	G
21	4	50	25	42.6	G
22	2	50	51	47.2	P
22	4	55	52	68.1	B/P
23	4	45	53	51.8	G
23	5	28	55	59.4	G
23	4	57	56	54.6	G
25	7	35	57	71.0	G
25	6	70	58	48.1	G
26	7	52	59	69.0	G
26	2	81	60	51.5	G
26	6	65	61	73.0	G
26	6	70	62	56.5	G
26	6	20	63	62.0	G
26	6	90	64	62.8	G
26	6	110	65	46.8	P/B
26	6	38	66	68.4	G
26	2	35	67	68.6	G/C
26	2	100	68	89.0	G
26	2	100	69	73.5	G
26	2	30	70	56.0	G
26	2	25	71	51.4	G/C
26	4	55	72	45.3	G
26	4	55	73	43.3	G
27	4	112	75	56.7	G

Fishing Event	Bait Type	Depth (feet)	Tag No.	Length (cm)	Release Condition
16	2	65	120	44.6	D/G
16	2	35	121	43.0	D/G
16	4	35	122	57.3	G
16	2	44	123	41.4	G
16	4	55	124	45.9	G
16	2	50	125	45.7	G
17	2	46	2	54.7	G
17	2	75	3	65.3	G
18	4	67	5	43.2	G/D
18	2	75	8	43.7	P
18	5	140	9	52.8	G
18	4	90	10	56.8	G/D
28	4	38	89	76.1	G
28	7	35	90	82.9	G
28	7	35	91	70.0	G
28	4	52	92	49.5	B/P
28	7	45	93	88.8	G
28	7	46	94	77.5	G
28	7	47	95	65.0	G
28	4	50	96	69.6	G
28	7	65	97	86.0	G
28	7	65	98	70.1	G
28	7	89	99	67.0	G
29	2	35	326	53.8	G/D
30	4	30	327	44.6	G
30	4	70	328	62.5	G
30	2	60	329	47.8	G
30	2	50	330	53.8	G
30	2	65	331	55.9	G
30	2	45	332	65.3	G
30	2	60	333	59.4	P/B
30	2	55	334	53.5	G
31	4	48	26	58.5	G
31	3	65	28	80.5	G
31	4	64	30	50.4	P
31	6	65	31	48.7	G
31	6	60	32	58.4	G
31	6	55	34	70.0	G
31	4	50	35	62.8	G
31	3	55	38	63.0	P
31	6	55	39	59.4	P
31	3	50	40	59.8	G
31	6	50	41	61.5	G
27	4	60	76	49.4	P
27	2	100	77	49.2	G
27	2	50	79	55.0	G
27	2	60	80	49.2	P/C
27	2	81	81	54.9	G
27	4	60	82	37.8	P
27	4	62	83	34.1	G
27	2	62	84	52.4	G/F
27	4	67	85	64.9	G
27	7	110	86	73.0	G
28	6	48	87	45.0	G
28	7	60	88	93.5	G
35	2	50	313	60.0	G
35	6	50	315	48.8	G
36	6	40	316	56.5	G
36	6	80	318	63.5	G
36	6	80	321	71.5	G
36	6	50	322	76.3	G
36	6	30	376	68.0	G
36	6	41	379	75.0	G
36	6	75	380	65.8	G
36	6	75	381	49.0	G
37	4	34	382	49.8	G
38	6	45	383	42.5	G
38	6	36	384	72.4	G
39	2	57	385	47.7	G
40	6	60	386	48.0	G
40	6	58	388	56.9	G
40	6	69	389	46.4	G
40	6	69	390	44.2	G
40	6	60	391	46.3	G
40	6	50	394	45.0	G
40	6	50	396	52.5	G
40	6	50	397	52.0	G
40	6	50	398	54.5	G
40	6	50	399	63.4	G
40	6	50	400	55.3	G
41	6	40	183	47.5	G
42	4	60	184	68.0	G
43	5	30	185	50.5	G
43	4	40	186	49.0	G
44	6	30	187	44.5	G
45	6	40	188	47.5	G

Fishing Event	Bait Type	Depth (feet)	Tag No.	Length (cm)	Release Condition
31	6	44	45	58.0	P
31	4	35	100	48.6	G
31	6	55	301	63.5	G
31	6	55	302	68.7	G
31	3	60	303	67.8	G
31	6	60	304	57.5	G
32	2	67	335	52.4	G
32	2	48	336	47.4	G
33	4	66	307	73.5	G
33	2	66	308	58.1	G
33	4	50	309	66.5	G
33	4	59	310	59.1	G
33	4	75	311	65.8	G
35	6	53	312	61.0	G
49	6	60	203	59.5	G/D
49	6	60	206	57.6	P
49	6	71	207	51.4	G
50	4	133	208	76.5	G
50	6	41	209	56.0	B/D/P
51	4	40	210	43.0	G
51	4	41	211	50.5	G
51	4	48	212	45.5	G
51	6	39	213	43.0	G
52	6	63	214	49.0	G/D
52	2	48	215	51.5	G/D
52	4	25	216	42.0	G
52	2	25	217	47.5	G
54	4	99	218	63.0	P
54	2	77	219	67.0	G
55	2	100	220	74.0	G
55	4	100	221	80.0	G
56	2	58	222	42.5	G
56	2	58	223	52.5	G
57	2	60	224	76.0	G
58	4	21	226	42.0	G
58	2	21	227	63.0	G
58	4	17	228	43.0	G
58	4	21	229	44.5	G
58	4	21	230	44.5	G
59	6	30	602	59.5	G
59	6	23	603	55.2	G
59	6	31	604	59.0	G
59	6	30	625	60.5	G
45	4	80	189	48.0	G
45	6	50	190	63.0	G
45	3	50	191	58.5	G
45	3	73	192	59.5	G/D
48	3	45	193	73.5	G
48	3	50	194	59.0	G/D
48	3	75	195	50.5	G
48	3	30	196	53.0	G
48	6	20	197	54.0	G
48	6	20	198	57.0	G
48	3	50	199	73.0	G
49	3	40	200	59.0	G
49	6	40	201	50.8	G
49	4	25	202	41.0	G
62	6	10	609	72.0	G
64	6	10	578	70.0	G
64	6	10	579	66.5	G
64	6	100	580	80.0	G
64	6	34	581	68.5	G
64	9	34	582	92.0	G
64	4	80	583	83.4	G
64	4	40	584	66.2	G
64	4	110	585	62.5	G
64	4	15	586	60.2	G
64	4	50	588	58.4	G
64	4	65	589	68.0	G
65	4	42	590	66.2	G
68	4	88	591	81.7	G
68	4	89	592	62.5	G
69	4	100	593	62.5	G
70	4	35	595	66.8	G
73	2	43	798	45.7	G/D
73	4	43	799	46.0	G/D
73	4	57	800	41.7	G/D
77	4	80	794	58.8	G
77	4	80	795	42.0	G
77	2	125	796	54.8	G
77	4	70	797	46.8	G
78	4	50	792	54.7	G
78	4	35	793	66.9	G
79	4	90	785	46.3	G
79	4	70	786	51.2	G
79	2	90	787	52.0	G/D

Fishing Event	Bait Type	Depth (feet)	Tag No.	Length (cm)	Release Condition
60	6	66	614	59.5	G
60	6	66	615	62.0	G
60	4	85	616	45.0	G
60	6	85	617	60.2	G
60	6	81	618	57.4	G
60	6	81	619	59.5	G
60	6	80	620	65.0	G
60	6	70	621	54.9	G
60	6	65	622	66.0	G
60	6	50	624	62.3	G
61	6	62	610	62.0	G
61	6	65	611	65.7	G
61	6	75	612	42.9	G
61	6	51	613	55.2	G
62	6	125	576	72.4	G
62	4	90	608	98.5	G
83	6	45	250	52.8	G
84	6	90	237	58.6	G
84	6	90	238	55.4	G
84	6	55	239	62.1	G
84	6	60	240	48.4	G
86	4	55	351	64.0	G
86	2	60	352	57.0	G
86	2	50	353	77.0	G
86	2	50	354	82.0	G
87	4	45	356	51.5	G/D
87	4	47	357	77.0	G
87	6	50	358	61.0	P/C
87	4	60	359	66.0	G/C
88	6	60	361	51.0	G
88	2	74	362	48.5	P/D
88	6	40	364	56.5	G
79	2	85	788	50.1	G
79	4	85	789	52.0	G
79	2	80	790	57.1	G
79	4	80	791	48.5	G
81	2	90	783	50.8	G
82	2	40	779	65.1	G
82	4	40	780	56.4	G
82	4	40	781	66.4	G/D
82	2	40	782	67.5	G
83	6	60	241	66.6	G
83	6	37	242	42.9	G
83	6	35	243	59.0	G
83	6	40	244	65.0	G
83	6	45	245	65.8	G
83	8	50	248	57.3	G
83	6	45	249	77.6	G
88	4	60	365	71.0	G
88	2	40	366	60.5	G
88	6	40	367	62.0	G
88	6	65	368	67.5	G
88	4	24	369	45.5	G
88	6	30	370	54.0	G
88	4	30	371	54.5	G
88	4	35	372	53.5	G/D
90	4	35	373	76.0	G
92	6	60	374	55.0	G
92	6	60	375	51.0	G
92	4	40	401	67.0	G
95	4	30	402	52.0	G
98	1	30	403	56.5	G/D
100	1	50	404	46.1	G
100	2	57	407	53.4	G

Table 3. Length statistics of lingcod caught, tagged and measured. Length is also shown by sampling period, depth, and location.

Group	N	Mean (cm) Length	Median (cm) Length	SD
All fish				
Pooled	398	56.2	54.9	10.8
Period 1	299	55.1	53.2	10.5
Period 2	99	59.5	59.5	11.0
Significance	U=1570, **p= > 0.001**			
*Tagged Fish**				
Pooled	380	55.8	54.7	9.7
Period 1	286	54.4	52.8	9.4
Period 2	94	60.1	59.5	10.3
Significance	U= 24.1, **p= > 0.001**			
*By Depth**				
0-50 feet	161	55.9	55.0	9.6
51-100 feet	195	55.1	53.9	9.6
101-150 feet	22	61.1	61.6	14.0
Significance	T=3.8, p= > 0.15			
*By Location**				
N	57	55.8	53.5	8.9
NE	68	52.1	51.4	8.2
E	56	54.5	52.0	8.9
SE	42	51.4	48.7	8.4
S	6	59.5	60.8	8.1
SW	36	59.3	59.9	12.9
W	43	60.9	60.0	9.7
NW	70	57.9	54.8	10.4
Significance	U= 36.3, **p= > 0.001**			

*Excluding fish caught on kelp greenling.

Table 4. Lingcod catch per unit of effort (CPUE) statistics by sampling period, time of day, fishing crew and location. Significant differences are in by bold print.

CPUE	N	Mean	Median	SD
All	101	1.7	1.4	1.7
Period 1	58	2.1	1.8	1.6
Period 2	43	1.2	1.0	1.4
Significance	U=8.87, **p=0.003**			
Time				
700	1	0.8	0.8	-
800	15	1.4	1.3	1.4
900	10	1.2	1.5	1.0
1000	11	2.2	1.8	2.1
1100	3	2.4	2.1	0.8
1200	11	1.1	1.0	0.7
1300	12	1.5	1.3	1.6
1400	12	1.2	1.0	1.6
1500	10	1.7	1.2	1.4
1600	9	2.1	2.1	1.3
1700	6	4.7	3.9	2.9
1800	1	3.7	3.7	-
Significance	T=20.6, **p=0.038**			
Crew				
1	7	0.4	0.3	0.4
2	37	2.0	1.5	1.8
3	1	2.3	2.3	-
4	6	0.8	0.9	0.3
5	47	1.8	1.6	1.8
6	3	1.5	1.2	1.2
Significance	T=11.2, **p=0.048**			
Location				
N	16	1.7	1.1	1.7
NE	16	1.6	1.5	1.3
E	15	2.3	1.5	2.6
SE	10	1.5	1.5	1.0
S	6	0.7	0.9	0.5
SW	10	1.3	1.0	0.9
W	14	2.3	1.7	2.1
NW	13	1.8	1.6	1.4
Significance	T=5.5 p=0.599			

Table 5: Estimate of recapture rate (percentage) of tagged lingcod. One lingcod was recaptured during the tagging period (first sampling period) after only 152 lingcod had been tagged. Two lingcod were recaptured during the second sampling period after all 286 lingcod had been tagged in the previous month. The number of tagged lingcod is adjusted to account for presumed mortality of fish released in poor condition, capture and stress mortality, tag loss due to shedding of tag and migration rate of tagged fish out of the study area.

	First Sampling Period			Second Sampling Period			
	Correction Factor	Adjusted number of tagged lingcod	Recapture rate (%)	Correction Factor	Adjusted number of tagged lingcod	Recapture rate (%)	Total Recapture rate (%)
Non-standardized		152	0.6		283	0.7	1.3
Standardized							
7% of fish released are in poor condition and presumed to die	7% of 152 = 11	141		7% of 283 = 20	266		
7% mortality rate due to capture and stress (Albin and Karpov 1998)	7% of 141 = 10	131		7% of 266 = 19	247		
14% tag loss rate due to shedding of tag (Smith and McFarlane 1990)	14% of 131 = 18	113		14% of 247 = 35	212		
50% migration rate of tagged fish out of study area (Matthews and Larivier 1987)	50% of 113 = 67	67	1.5	50% of 212 = 106	106	1.9	3.4

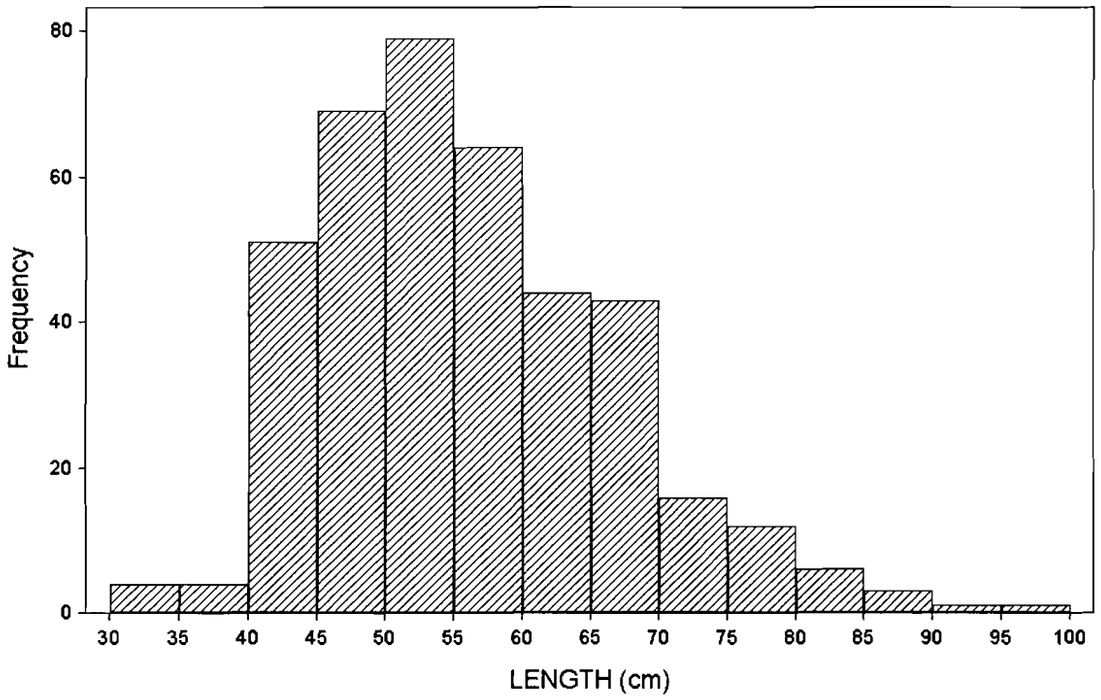

Figure 1. Length (cm) frequency histogram of all lingcod caught at Entrance Island from July 29-August 5, 2003 and August 30-September 8, 2003. N=397.

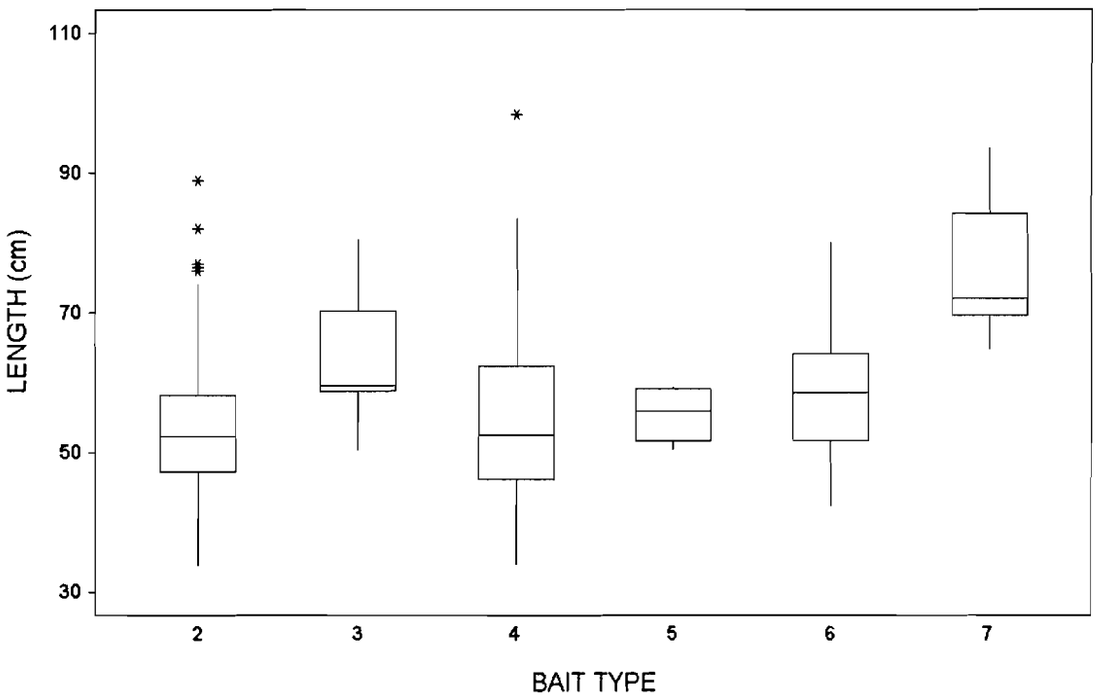

Figure 2. Boxplot of tagged lingcod lengths (cm) by bait type, where bait type codes are as follows: 1=Gibbs 40 (not shown due to too few cases, n=2); 2=Gibbs 60 (n=130); 3=Frozen herring (n=12); 4=Unknown–trihook lure (n=138); 5=Unknown–unihook lure (n=4); 6=Rubber fish with unihook lure (n=95); 7=Live greenling (n=12).

Appendix 1: Participants in Recapture Rate Project

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