Factors Influencing the Abundance and Distribution of Lingcod Egg Masses in the Nearshore Waters Adjacent to the West Coast of Vancouver Island During January 17 – March 15, 1979

J. R. King, G. A. McFarlane, R. J. Beamish, and C. J. Low

Fisheries and Oceans Canada
Science Branch, Pacific Region
Pacific Biological Station
Nanaimo, British Columbia
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ABSTRACT

King, J.R., McFarlane, G.A., Beamish, R.J., and Low, C.J. 2004. Factors influencing the abundance and distribution of lingcod egg masses in the nearshore waters adjacent to the west coast of Vancouver Island during January 17 – March 15, 1979. Can. Tech. Rep. Fish. Aquat. Sci. 2557: v + 13 p.

A dive survey was conducted in January to March of 1979 in the Clayoquot Sound and Sydney Inlet region of the west coast of Vancouver Island. Unfortunately the results of the survey were not published but, given the recent interest in factors affecting lingcod population dynamics, we report the results in this document. The survey results provide a useful historical perspective of the distribution of lingcod spawning sites in the area. The number of egg masses observed were related to the number of crevices available for egg deposition. The survey region was divided into three classifications of relative water movement: exposed outer coast sites which had the most active water movement; semi-exposed sites which had less active water movement; and unexposed inner coast sites. Unfortunately interaction between number of crevices available and egg masses present made it difficult to statistically test for differences in egg mass density with relative water movement. However, in a limited number of dives in the exposed outer coast areas and unexposed inner coast area for which the crevice densities were similar, there were generally more egg masses found in the areas with active water movement.

RÉSUMÉ

King, J.R., McFarlane, G.A., Beamish, R.J., and Low, C.J. 2004. Factors influencing the abundance and distribution of lingcod egg masses in the nearshore waters adjacent to the west coast of Vancouver Island during January 17 – March 15, 1979. Can. Tech. Rep. Fish. Aquat. Sci. 2557: v + 13 p.

Un relevé en plongée à été effectué entre les mois de janvier et mars 1979 dans la région de Clayoquot Sound et de l'inlet Sydney de la côte Ouest de l'île de Vancouver. Les résultats de ce relevé n'avaient malheureusement pas été publiés, mais compte tenu de l'intérêt récent portés aux facteurs susceptibles d'affecter la dynamique démographique des morues lingues, nous en faisant état dans le présent document. Les résultats du relevé nous offrent une perspective historique utile pour ce qui est de la distribution des sites de fraie des morues lingues dans la région. Nous avons relié le nombre de grappes d'œufs au nombre de crevasses propices à les accueillir. La région couverte par le relevé a été divisée en trois classes suivant la force des courants : les sites au large exposés à de forts courants, les sites semi-exposés où les courants étaient moindres et les sites abrités du littoral. Malheureusement, le nombre de grappes d'œufs étant lié à la densité de crevasses disponibles, il nous a été difficile d'étudier statistiquement comment varier la densité des grappes d'œufs avec les courants. Un nombre limité de plongées dans les zones exposées du large et dans les zones abritées pour lesquelles la densité de crevasses était semblable nous a cependant permis d'observer que les masses d'œufs étaient généralement plus importantes dans les zones exposées, où les courants étaient plus forts.

INTRODUCTION

An initial study into lingcod (*Ophiodon elongates*) nesting behaviour (Low and Beamish, 1978) identified the availability of rocky crevice space and the presence of relatively strong current velocity in nearshore habitats as factors important to successful lingcod spawning in the Strait of Georgia. Generally, the abundance of egg masses were positively correlated to these two factors. In January to March, 1979, a second study was conducted in exposed outer waters off the west coast of Vancouver Island and adjacent semi-exposed and sheltered waters between Tofino and Sydney Inlets. The purpose of this study was to identify factors influencing the abundance and distribution of lingcod egg masses in a spawning stock separate from the Strait of Georgia lingcod stock. In addition, since at the time of the survey not much was known on lingcod spawning, the intent of the study was to also locate and describe lingcod spawning habitat on the west coast of Vancouver Island. In this paper we report on the results of the survey conducted off the west coast of Vancouver Island in 1979. The results of the 1979 survey remained unpublished, but given the recent interest in factors affect lingcod population dynamics we felt that it was important to publish them. Unfortunately survey records are incomplete and therefore the interpretation of results are limited.

METHODS

The survey area included both exposed outer coastal areas and inside waters (inlets, channels and inner islands) in the Sydney Inlet and Clayoquot Sound region of the west coast of Vancouver Island (Figure 1). Dive sites that were expected to provide rocky nearshore habitat and considerable water movement were selected from hydrographic charts. These sites were of limited accessibility since wave action and surge made these sites difficult to get to and sometimes dangerous to dive at. Areas of likely low spawning potential, namely those areas of minimal rocky crevice space and, or reduced water movement were also selected in order to provide a range of habitat types. Sites were surveyed by SCUBA divers.

Preliminary SCUBA observations of the survey area indicated that lingcod egg masses were not highly abundant. Conventional SCUBA survey methods that employ a transect line of known length (and therefore limited length) were considered to be ineffective because they would not cover enough distance to adequately estimate the number of lingcod egg masses present. For each site, divers attempted to swim in a straight line and with the current if one was present. When a boat attendant was available, the divers would enter the water at the starting point of the dive, and would be picked at the end point of the dive. This type of dive was considered to have only one leg. When a boat attendant was not available, the boat was anchored and the dive consisted of an outward leg and a return leg made at different depths, and was considered to be two different dives. For each dive the distance swam was estimated using distance between landmarks on shore. In addition, the time down and air consumption were recorded. Vertical and horizontal visibilities at depth were estimated, and vertical visibility (m) was estimated by secchi disk depth measured on the surface. In general, secchi depth was considered to be well correlated with bottom visibility. However, in only a few instances, where secchi depth was not representative of bottom visibility (such as on silty bottom), visibility at depth was estimated by a 10 point system. The area surveyed during each dive was quantified as the distance swam multiplied by two thirds of the secchi depth.

The number of egg masses present was recorded during each dive. The median depth of the dive, the number of crevices and relative water movement were estimated for each dive. Sites were divided into three classifications of relative water movement: exposed outer coast sites which had the most active water movement; semi-exposed sites which had less active water movement; and unexposed inner coast sites which had the least active water movement (i.e. tidal currents only). When egg masses were present, the depth of the crevice which contained the egg mass was noted. The species and number of organisms preying on egg masses and the presence and abundance of other fish and invertebrates were recorded.

RESULTS

Sites were surveyed from January 17 to March 15, 1979. An estimated area of 4.0×10^5 m^2 was surveyed in a total of 127 dives. Observations for each dive location are provided in Appendix Table 1. In total, 40 dives were completed in exposed outer coastal locations; 17 dives were completed in semi-exposed coastal locations; and 70 dives were completed in unexposed inner coastal locations (Table 1). There were 292 egg masses observed. Approximately 70 % of the egg masses observed were found in the exposed outer coast area where crevices were also abundant (Table 1).

SPATIAL DISTRIBUTION OF EGG MASSES

The distribution of egg masses was highly clumped. For example, 85% of the 99 egg masses observed in the exposed outer coast sites of the study area were found in 8 of the 40 dives completed in these waters, even though spawning habitat was seemingly abundant in the other dive locations. Most notable was dive location number 79 located off Rafael Point near Sydney Inlet (Appendix Table 1; Figure 1), where 28 egg masses were observed in an estimated area of 3000 m^2 (estimated egg mass density: $9.33/10^3$ m^2). All of these egg masses were located in horizontal crevices in highly excavated soft strata. The substrate appeared to be composed of shale or slate. Conversely, dive locations 23 and 81, located within the same general area of Sydney Inlet (Figure 1), had egg mass densities of only 1.36 (per 10^3 m^2) and 1.43 (per 10^3 m^2) respectively. Surprise Reef (dive location 113), Nob Rock (dive location 114) and McKay Reef (dive location 115) all located on the exposed coast south of Vargas Island (Figure 1), had a total of 5, 10 and 17 egg masses respectively. Each of these areas consisted of a steeply rising reef originating from a relatively flat floor at a depth of 24 m. At the base of each reef, an accumulation of large boulders provided an abundance of suitable crevices for lingcod egg mass deposition. The surge even at 24 m, on relatively calm days, provided extreme water movement. These reefs were surveyed up to a height of about 15-18 m below water level, where the violent nature of the surge made diving dangerous. In contrast, areas of similar substrate at Lennard Island (Dive location 44), Blunden Island (dive location 52) and Tonquin Island (dive location 1) had few or no egg masses (Figure 1; Appendix Table 1). In these areas the boulder field was at a depth of no more than 11 m, and the lack of nests may reflect the intensity of the surge in the shallow regions.

Hayden Passage (dive locations 30, 86 and 89) was the most productive area in the unexposed inner coast region (Appendix Table 1; Figure 1). Other unexposed inner coast areas with high egg mass densities were Clifford Point (dive location 8), Dixon Point (dive location 63), Starling Point (dive location 67) and Shelter Inlet (dive location 88). In these areas there was considerable current and an abundance of organisms indicative of substantial water movement: the tube worm (*Dodecacaria fewski*), the giant barnacle (*Balanus nubilus*), the red sea urchin (*Strongylocentrotus franciscanus*) and the rock scallop (*Hinnites giganteus*).

Crevices which contained nests were generally large, usually with an opening of at least 20 cm, a length of at least 1 m and a depth of at least 30 cm. When guarding males were present, the male was most often in a nearby crevice. Usually the guarding male was docile, and could be easily approached. Occasionally males fled the general area immediately after being spotted by a diver.

GUARDIAN MALES

Less than 30% of the 132 egg masses observed were guarded by males. At Rafael Point (dive location 79), the highest egg mass density was observed (Appendix Table 1) only 1 egg mass of the 28 observed had a guardian male. It is unknown if any guardian males might have fled the egg mass location in advance of being noticed by divers. Egg masses were observed for a short time, so it is difficult to draw conclusions relating to guardian male absence.

STATISTICAL ANALYSES OF EGG MASS DENSITIES

Kruskal-Wallis one-way ANOVA for differences in median egg mass density by relative water movement suggests that there were significant differences between median egg mass densities ($F=5.02$; $df=2$; $p=0.009$) . However, pairwise comparison of mean ranks suggests no distinct groupings. While the highest egg mass densities were observed in the exposed outer coast sites, so many of the dives completed did not have any egg masses observed so the median egg mass density for all three water movement categories were zero (Figure 2). Approximately 60% of the dive sites in the exposed outer coast area sites had no egg masses; 75% of the semi-exposed coastal area sites had no egg masses; and 81% of the unexposed inner coastal area sites had no egg masses observed.

In order to deal with the bias introduced by several observations with zero lingcod egg masses, we analysed the data after dive sites with no lingcod egg masses were removed. ANOVA indicates that there are significant differences in median egg mass densities

(F=5.41; df=2; p<0.001). Comparison of mean ranks using critical z-values determined that median egg mass density in the exposed outer coast sites (n=16) was significantly higher than in the unexposed inner coast sites (n=14).

Since only 4 dive sites in the semi-exposed coastal areas had lingcod egg masses, we focused on contrasting the exposed outer coast sites to the unexposed inner coast sites for factor interaction between water movement and crevice availability. It is important to note that the median number of crevices per area was significantly (p<0.001) higher at the exposed outer coast sites than at the unexposed inner coast sites (Median test: chi-square=14.58) so it is difficult to ascertain if the higher egg mass densities observed there were due to high water movement or availability of crevices. ANCOVA with water movement as a treatment factor (exposed and unexposed) and number of crevices per area as a co-variate indicated that there was a significant (p<0.001) interaction between egg mass density and crevice density (F=9.89; df=28). Overall the number of egg masses observed (per area) increased with number of crevices present (per area) (Figure 3) and this linear regression was significant (R^2=0.50; p<0.001). Given the underlying relationship between crevice density and egg mass density, ANCOVA suggested that the higher median egg mass density for the exposed outer coast sites were attributable to the higher median crevice densities observed at those dive locations.

There were, however, a limited number of dive locations in the exposed outer coast sites and the unexposed inner coast sites that had similar crevice densities and may provide some indication of the influence of water movement on the abundance of egg masses. There were two dive sites in the exposed outer coast area (Surprise Reef, dive location 113; Barney Rock, dive location 81) and three dive sites in the unexposed inner coast area (Hayden Pass, dive locations 30 and 86; MacKay Island, dive location 85) that had similar low crevice densities (Figure 3). Similar moderate crevices densities were observed at two exposed outer coast sites (Offshore Shoal, dive location 23; Shot Island, dive location 11) and at an unexposed inner coast site (Dunlap Island, dive location 99) (Figure 3).
For these limited comparisons, when crevice densities are similar, there were generally higher egg mass densities observed in the exposed outer coast areas (Figure 3).

DISCUSSION

This was the only known lingcod egg mass survey conducted in the Clayoquot Sound and Sydney Inlet areas, and the extensive number of dives conducted, which cover a wide geographic area, is an invaluable set of data. These data can be used as historical reference points for the spatial distribution of spawning lingcod. Additionally, the underwater observations made by divers and reported in the results section should be useful to researchers planning lingcod spawning surveys.

It is not surprising that the number of egg masses observed in a specific location were related to the number of crevices available, i.e. suitable habitat for egg mass deposition. Unfortunately since this was the first survey in the area and habitat at specific dive sites was unknown, sites selected did not optimize comparison between areas of different water movement but similar crevice availability. Our ANCOVA suggests that higher number of egg masses observed in the area with relatively higher water movement (exposed outer coast sites) was likely a reflection of a higher number of crevices in that area. However, for the limited number of dive locations with similar crevice densities between the different water movement areas, there was some indication that there were more egg masses in the exposed outer coast areas compared to the unexposed inner coast areas.

In more recent egg mass surveys conducted in the Strait of Georgia, factors such as gradually sloping or flat bottoms with barren areas or a lack of coverage by large flora (e.g. *Agarum* spp.) appeared to be important habitat features that characterized preferred lingcod spawning habitat in addition to (King and Beaith, 2001; King and Winchell, 2002). These features suggest that lingcod require areas with rocky crevices for egg deposition, but prefer open spaces with improved visibility for spawning behaviour or for effective nest guarding. Perhaps open spaces provide sufficient current flow for egg development. Though not considered in this study, selection of spawning habitat may also be related to optimizing larval dispersion. Any future research surveys on habitat requirements for lingcod spawning should be a factorial design to allow for comparison of factors across controls and account for interaction effects.

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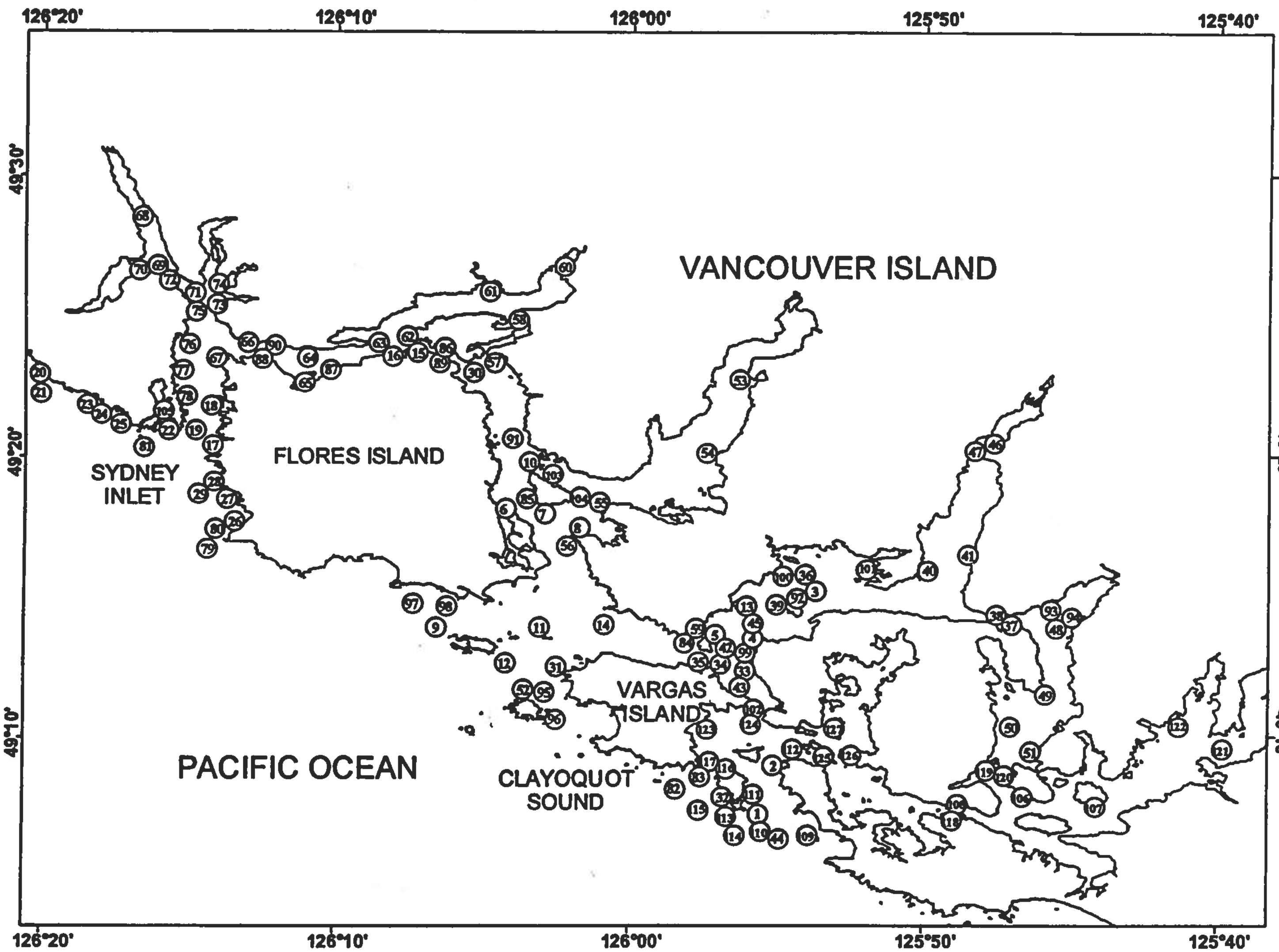

Figure 1. Dive site locations in lingcod egg mass survey area, west coast Vancouver Island, British Columbia, January 17-March 15, 1979. Dive site location numbers correspond to those in Appendix Table 1.

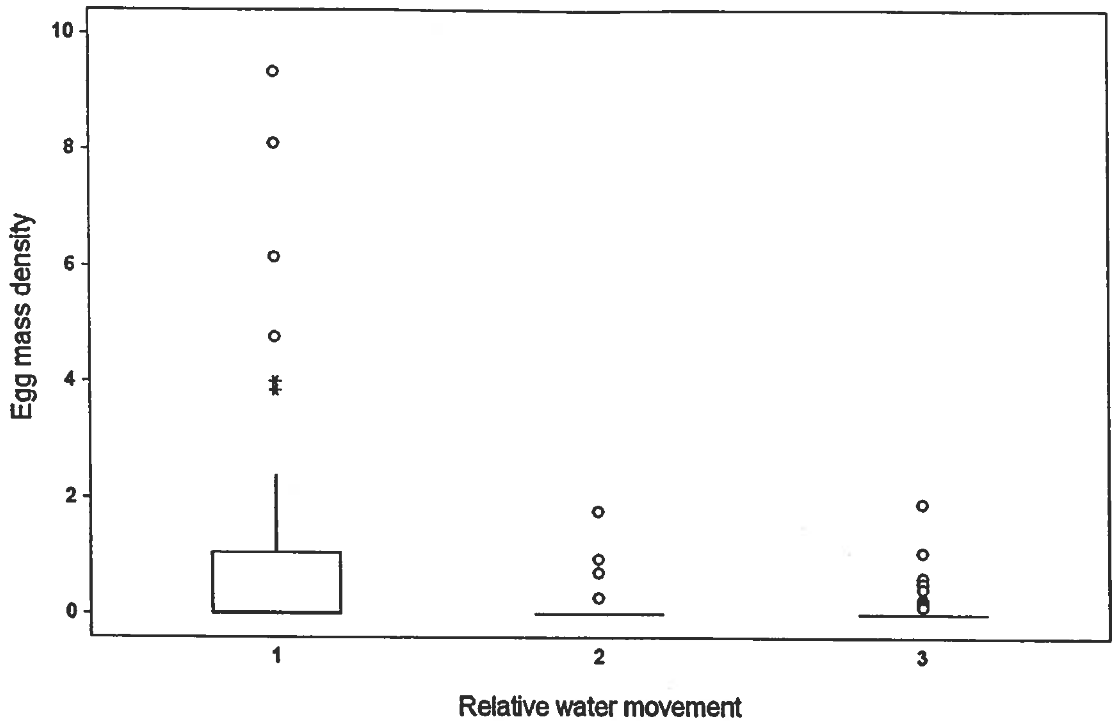

Figure 2. Box and whisker plots of egg mass density per dive by relative water movement categories: 1=exposed outer coast sites; 2=semi-exposed sites; 3=unexposed inner coast sites. Boxes correspond to 25 and 75 percentile; whiskers correspond to non-outlier ranges. Median values for each category are zero.

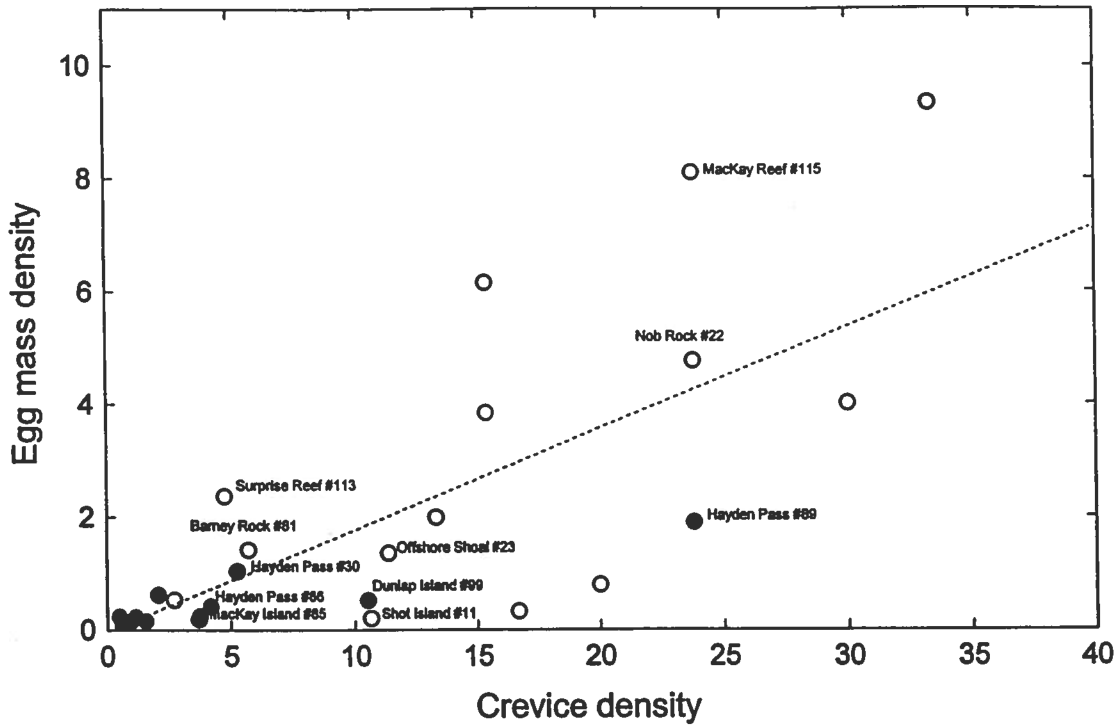

Figure 3. Relationship between number of crevices per area (10^3 m^2) and number of egg masses per area (10^3 m^2): y=0.18*x -0.02 (R^2=0.50; p<0.001). The number of egg masses observed is influenced by the number of crevices available to lingcod for habitat. The closed circles denote dive sites in the unexposed inner coastal area and the open circles denote the dive sites in the exposed outer coastal area. Selected dive sites are labeled by name and dive location identification number corresponding to Appendix Table 1. These selected dive sites illustrate that at similar crevice densities of approximately 5, 10 and 25 (crevices per area) the number of egg masses observed per area were generally higher at the exposed outer coast sites.

Table 1. Summary data for dives in the three areas: exposed outer coast sites (high water movement); semi-exposed sites (mid-range water movement); unexposed inner coast sites (low water movement). The number of dives completed in each of the three survey areas is indicated. For each survey area, the total area surveyed, the total number of egg masses and crevices observed are indicated. The percentage (%) of the number of dives completed in each survey during which no egg masses were observed is noted. Median egg mass and crevice densities were calculated using all dives (i.e. dives with zero egg mass values were included) and were calculated excluding dives in which no egg masses were observed (i.e. dives with zero egg mass values were excluded).

				Dives with zero values included			Dives with zero values excluded	
Number of dives	Total area surveyed (x 10^4 m^2)	Total number of egg masses	Total number of crevices	Median egg mass density (minimum; maximum)	Median crevice density (minimum; maximum)	Percentage of dives with no egg masses	Median egg mass density (minimum; maximum)	Median crevice density (minimum; maximum)
Exposed outer coast sites								
40	9.53	99	945	0.00 (0.00; 9.33)	7.46 (0.00; 62.50)	60	1.72 (0.21; 9.33)	16.03 (2.70; 33.33)
Semi-exposed sites								
17	4.74	169	551	0.00 (0.00; 1.76)	9.52 (0.00; 111.11)	75	0.83 (0.27; 1.76)	32.75 (3.13; 71.43)
Unexposed inner coast sites								
70	25.85	24	1241	0.00 (0.00; 1.90)	3.73 (0.00; 76.92)	81	0.25 (0.12; 1.90)	3.70 (0.49; 23.81)

Appendix Table 1. Dive location, date surveyed and dive location number (corresponding to location numbers in Figure 1). For each dive the number of crevices counted, the number of egg masses observed, and the number of guardian lingcod are indicated. The total area surveyed (thousands of m^2) were estimated by divers and used to calculate the number of egg masses observed per area.

Dive Location	Date	Dive location number	Number of crevices	Number of egg masses	Number of lingcod	Area surveyed (x 10^3 m^2)	Number of egg mass per area (x 10^3 m^2)
Exposed Outer Coast							
Tonquin Island	Jan-17	1	30	0	0	4.0	0.00
Tibbs Island	Jan-21	9	0	0	0	3.8	0.00
Shot Island	Jan-22	11	50	1	1	4.7	0.21
Lawrence Island	Jan-22	12	3	0	0	1.1	0.00
Monics Inlet	Jan-24	14	10	0	0	3.8	0.00
Sharp Point	Jan-26	17	30	0	1	5.6	0.00
Sharp Point	Jan-26	18	10	0	0	4.3	0.00
Sharp Point	Jan-26	19	20	0	2	3.8	0.00
Kantm Lake Outlet	Jan-27	20	5	0	1	0.5	0.00
Offshore Shoal	Jan-27	21	50	1	0	3.0	0.33
Hotsprings Cove	Jan-27	22	10	0	0	2.4	0.00
Offshore Shoal	Jan-28	23	50	6	3	4.4	1.36
Offshore Shoal	Jan-28	24	10	2	2	3.7	0.54
Offshore Shoal	Jan-28	25	3	0	0	1.6	0.00
Dagger Point	Jan-29	26	50	2	1	2.5	0.80
Dagger Point	Jan-29	27	50	0	0	1.6	0.00
Flores Island	Jan-30	28	50	2	2	2.5	0.80
Flores Island	Jan-30	29	50	2	0	2.5	0.80
Wikininnish Bay	Feb-02	32	3	0	0	2.6	0.00
Lennard Island	Feb-07	44	20	0	0	3.8	0.00
Brunden Island	Feb-10	52	40	0	0	5.4	0.00
North Sharp Point	Feb-19	78	50	0	0	0.8	0.00
Rafaiel Point	Feb-20	79	100	28	1	3.0	9.33
Rafaiel Point	Feb-20	80	15	0	0	1.8	0.00
Barney Rock	Feb-20	81	20	5	5	3.5	1.43
Wilf Rock	Feb-20	82	4	0	0	1.3	0.00
East Moser Point	Feb-22	83	0	0	0	1.4	0.00
Blunden Island	Feb-28	95	20	5	2	1.3	3.85
Blunden Island	Feb-28	96	20	0	0	1.3	0.00
Offshore Rock	Mar-01	97	20	8	3	1.3	6.15
Garrard Group	Mar-01	98	20	3	1	1.5	2.00
Hotsprings Cove	Mar-05	105	0	0	0	1.6	0.00
Frank Island	Mar-07	109	5	0	0	0.5	0.00
Lennard Island	Mar-08	110	15	2	0	0.5	4.00
Echachis Island	Mar-08	111	0	0	0	0.8	0.00
Surprise Reef	Mar-09	113	10	5	0	2.1	2.38
Nob Rock	Mar-09	114	50	10	5	2.1	4.76
McKay Reef	Mar-10	115	50	17	3	2.1	8.10

Dive Location	Date	Dive location number	Number of crevices	Number of egg masses	Number of lingcod	Area surveyed (x 10^3 m^2)	Number of egg mass per area (x 10^3 m^2)
Wikininnish Bay	Mar-10	116	0	0	0	0.5	0.00
Moser Point	Mar-10	117	2	0	0	0.3	0.00
Total		40	945	99.0	33.0	95.3	1.04
Semi-Exposed Coast							
Duffin Bay	Jan-17	2	0	0	0	5.4	0.00
Clifford Point	Jan-21	8	50	2	7	7.5	0.27
McKay Island	Feb-20	20	2	0	0	5.3	0.00
Clifford Point	Feb-11	56	50	0	1	8.9	0.00
Epper Island	Feb-13	59	20	0	0	1.4	0.00
Riley Cove	Feb-16	66	100	1	0	1.4	0.71
Starling Point	Feb-16	67	100	3	1	1.7	1.76
Adventure Point	Feb-18	71	20	0	0	2.1	0.00
Adventure Point	Feb-18	72	3	0	0	2.1	0.00
Young Bay	Feb-18	73	3	0	0	2.1	0.00
Young Bay	Feb-18	74	3	0	0	2.1	0.00
Young Bay	Feb-19	75	20	0	0	0.9	0.00
NW Starling Point	Feb-19	76	100	0	1	0.9	0.00
Starling Point	Feb-19	77	50	0	0	1.1	0.00
Shelter Inlet	Feb-24	88	10	3	2	3.2	0.94
Felice Island	Mar-08	112	15	0	0	0.8	0.00
Shindler Point	Mar-12	124	5	0	0	0.5	0.00
Total		17	551	9	12	47.4	0.22
Unexposed Inner Coast							
Welcome Island	Jan-18	3	20	0	0	8.0	0.00
Dunlap Island	Jan-18	4	10	1	0	6.4	0.16
Morfer Island	Jan-18	5	2	0	0	8.1	0.00
Matilda Pennisula	Jan-20	6	20	0	0	5.6	0.00
Ross Passage	Jan-22	10	15	1	9	4.0	0.25
Karaan Island	Jan-23	13	5	0	0	4.6	0.00
Hayden Pass	Jan-24	15	20	0	0	8.9	0.00
Hayden Pass	Jan-24	16	5	0	1	1.3	0.00
Hayden Pass	Jan-31	30	30	6	7	5.7	1.05
Hobbs Island	Jan-31	31	3	0	0	4.9	0.00
Maurus Channel	Feb-02	33	10	0	0	4.9	0.00
Engvik Rock	Feb-03	34	15	0	1	4.9	0.00
Morfete Island	Feb-03	35	15	0	0	7.4	0.00
Welcome Island	Feb-04	36	5	0	0	5.7	0.00
Matlsert Narrows	Feb-04	37	2	1	1	4.1	0.24
Matlsert Narrows	Feb-07	38	2	0	0	3.1	0.00
Saranac Island	Feb-04	39	15	0	0	3.7	0.00
Rant Point	Feb-05	40	5	1	1	4.3	0.23
Bedwell Sound	Feb-05	41	20	0	0	4.3	0.00
Dunlap Island	Feb-06	42	10	0	0	3.1	0.00
Rassler Point	Feb-06	43	10	0	0	2.5	0.00

Dive Location	Date	Dive location number	Number of crevices	Number of egg masses	Number of lingcod	Area surveyed (x 10^3 m^2)	Number of egg mass per area (x 10^3 m^2)
Bedwell Sound	Feb-07	45	5	0	0	3.4	0.00
Bedwell Sound	Feb-08	46	15	0	2	4.0	0.00
Bedwell Sound	Feb-08	47	10	0	1	4.0	0.00
Maltby Inlet	Feb-08	48	5	1	4	8.1	0.12
Plover Point	Feb-09	49	3	0	1	2.7	0.00
Darr Island	Feb-09	50	3	0	0	2.7	0.00
Gunner Inlet	Feb-09	51	20	0	2	5.4	0.00
Gibsons Cove	Feb-10	53	20	0	0	4.3	0.00
Binns Island	Feb-11	54	6	0	0	4.3	0.00
Banden Point	Feb-11	55	6	1	3	6.2	0.16
Sulphur Pass	Feb-11	57	10	0	3	5.4	0.00
Sulphur Pass	Feb-12	58	15	0	1	5.4	0.00
Belcher Point	Feb-15	61	15	0	0	2.4	0.00
Obstruction Island	Feb-15	62	4	0	0	2.4	0.00
Dixon Point	Feb-15	63	10	3	1	4.8	0.63
Clio Island	Feb-15	64	20	0	0	4.8	0.00
George Island	Feb-16	65	1	0	0	2.6	0.00
Stewardson Inlet	Feb-17	68	50	0	0	3.4	0.00
Driver Point	Feb-17	69	100	0	0	4.3	0.00
Darr Island	Feb-17	70	50	0	0	8.9	0.00
Epper Island	Feb-22	84	30	0	0	3.8	0.00
McKay Island	Feb-23	85	10	1	0	2.4	0.42
Hayden Pass	Feb-23	86	20	2	11	4.8	0.42
George Island	Feb-24	87	25	0	0	4.3	0.00
Hayden Pass	Feb-25	89	50	4	2	2.1	1.90
Shelter Inlet	Feb-25	90	0	0	0	2.4	0.00
North Matilda Bay	Feb-26	91	20	1	2	5.4	0.19
Saranac Island	Feb-26	92	0	0	0	0.1	0.00
North Maltby Inlet	Feb-27	93	10	0	1	3.2	0.00
Maltby Inlet	Feb-27	94	30	0	0	4.4	0.00
Dunlap Island	Mar-01	99	20	1	0	1.9	0.53
Rhodes Island	Mar-02	100	3	0	0	2.1	0.00
Mussel Rock	Mar-02	101	30	0	0	2.1	0.00
Rassier Point	Mar-03	102	10	0	0	0.9	0.00
Ross Passage	Mar-03	103	15	0	0	2.5	0.00
McKay Island	Mar-03	104	20	0	2	2.5	0.00
Hotsprings Cove	Mar-05	105	0	0	0	0.6	0.00
Baxter Island	Mar-07	106	5	0	0	0.5	0.00
Almond Island	Mar-07	107	100	0	0	1.3	0.00
Tsaper Narrows	Mar-08	108	20	0	0	2.8	0.00
Tsaper Narrows	Mar-11	118	50	0	0	1.1	0.00
Dawley Pass Island	Mar-11	119	5	0	0	1.3	0.00
Dawley Pass Island	Mar-11	120	6	0	0	2.1	0.00
Auseth Inlet	Mar-11	121	30	0	0	2.1	0.00
Rankin Rocks	Mar-11	122	30	0	0	1.3	0.00
South Rassier Point	Mar-12	123	30	0	0	1.1	0.00
Usatzes Point	Mar-13	125	30	0	0	1.1	0.00

Dive Location	Date	Dive location number	Number of crevices	Number of egg masses	Number of lingcod	Area surveyed (x 10^3 m^2)	Number of egg mass per area (x 10^3 m^2)
Morpheus Island	Mar-13	126	30	0	0	2.2	0.00
Lemmens Inlet	Mar-13	127	5	0	0	1.1	0.00
Total		70	1241	24	56	258.5	0.09