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Surveys for gray whales, *Eschrichtius robustus*, near Cape Caution, British Columbia, Summer 2003

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Executive Summary

The Coastal Ecosystems Research Foundation conducted several surveys for gray whales on the southern Central Coast of British Columbia during the summer of 2003. Three surveys were conducted in CERF's usual study area near Cape Caution, and three along the west coast of Calvert Island. Additional shorter surveys were also conducted of the Rivers Inlet / Smith Sound region north of Cape Caution.

A total of 50 animals were identified from the pigmentation on their flanks. Twelve of these were new to the area in 2003. All but three were photographed. The animals not photographed (due to a camera malfunction) were identified visually by an experienced observer. Twelve animals were identified in the Cape Caution area by Cascadia Research, only one of which had not also been identified by CERF crews.

A shift in habitat use was observed. Animals were observed regularly feeding off the west coast of Calvert Island for the first time since CERF began its research in the area in 1994. Also for the first time since 1994, no animals were observed feeding off Allison Harbour in June and July. They returned to North Bay and Allison Harbour in August. Overall, the home range size of individual animals increased from about 4 nautical miles in 2002 to about ten in 2003.

Introduction

Background

The California gray whale is the first of the great whales to have recovered sufficiently from overharvesting in the early part of the 20th century to be removed from the endangered species list. The eastern North Pacific population was estimated at 26,000 animals in 1999 (Rugh *et al.* 1999), a level considered to be about equal to or possibly greater than the historical population size (Henderson 1984).

Most of these animals migrate annually from feeding grounds in the Bering & Chukchi Seas to breeding grounds off the west coast of Baja California, Mexico. Their route takes them along the Pacific coast of North America, usually very near shore, rather than directly across the Pacific (Pike 1962). Several groups do not however complete the migration, choosing to spend their summers in the waters of the Pacific Northwest, patchily distributed between northern California and southeastern Alaska (Darling 1984, Calambokidis *et al.* 1991, Megill & Randall 2000, Heath & Megill 2002, Calambokidis *et al.* 2002, Megill *et al.* 2003, Calambokidis 2003). The research reported here has focused on one of these groups which summers near Cape Caution, on the southern Central Coast of British Columbia (Figure 1). It is still unknown whether all of the animals belonging to this so-called *Southern Feeding Aggregation* participate in the migration, or whether they remain on the feeding grounds all year. To date, only two individuals have been identified photographically at both ends of the migration (Megill *et al.* 2003).

On these so-called tertiary feeding grounds (Kim & Oliver 1989) gray whales feed primarily on planktonic prey, especially mysids (Murison *et al.* 1984, Dunham 1999, Stelle & Megill 1999, Stelle *et al.* in review), though crab larvae, ghost shrimp and amphipods are also consumed where available (Dunham & Duffus 2001, 2002). In the waters near Cape Caution, previous research has documented mysids to be the primary prey of gray whales during July & August (Stelle & Megill 1999, Stelle 2001).

The best current estimate for the size of the southern resident population is 273-280 whales (Calambokidis 2003), a number which must be taken as a minimum estimate, since the distribution of the southern feeding aggregation remains unknown. Indeed, Calambokidis (2003) reports four matches between Kodiak, AK, and the Pacific Northwest (including Cape Caution), indicating that the northern limit extends well beyond Cape Caution, despite the absence of observations on the north coast of BC (Megill *et al.* 2003).

Specific objectives for 2003

1. Conduct three boat surveys for gray whales where each survey covers the coastal waters around Cape Caution extending from Allison Harbour to Rivers Inlet. A survey will be conducted in each month from July to September with each survey separated by at least two weeks.
2. Obtain identification photographs of all gray whales encountered during the surveys. Match the photographs to those taken in previous years in this area and provide the photographs to Cascadia Research Collective for matching to their photographic catalogue.

Methods

Vessels

Observations were made from the *R/V Stardust*, a 38' converted gillnetter, cruising at 6.5 knots with a crew of 6 to 8, and the *M/V Rubber Duck*, a 16' inflatable, cruising at 12knots with a crew of 2. Both vessels were equipped with GPS units. On the *Stardust*, the GPS was interfaced through a laptop computer to digital charts of the coast. Crew aboard the *Stardust* rotated every hour or so through two observation posts on the roof and one on the stern, taking rest breaks between each shift. The *Rubber Duck* was used primarily for a separate study of the diving behaviour of gray whales, but participated regularly in the photo-identification study, particularly when the *Stardust* was in a different part of the study area.

Photo-identification

Animals were photographed using 35mm SLR cameras with 100-300mm zoom lenses and Fuji 400 ASA colour print film. Animals were approached to within 100', parallel to their direction of travel, to obtain photographs of their flanks, and followed at about 100' to photograph their flukes. Visual identifications were also made when possible by comparing pigmentation patterns & scars on the animals to a photographic catalogue carried on board the research vessel. Although prone to error, these visual identifications were useful during the analysis stage as a starting point, and crucial in the later part of the season, when a camera malfunction (jammed shutter) prevented the film from being exposed. Once developed, photographs were digitised using a Hewlett-Packard Photosmart Scanner and custom-written software, then compared to an on-line catalogue (Megill & Randall 2001). Photographs & identifications have been provided to the Cascadia Research Collective (Olympia WA) for comparison with their catalogue.

Sighting locations were recorded with reference to local landmarks (distance & bearing), or more infrequently (when landmarks were too far away, or when the whales were immediately next to the boat), by recording the position of the boat as given by the onboard GPS unit. Other data recorded included the movements, dive times and blow rates of individual whales, as well as any unusual behaviour.

Results

Effort

CERF crews, students and volunteers were on the water actively looking for and photoidentifying gray whales for a total of 227 hours over 31 days during the 2003 field research season, which began the 17th of June, and ended on the 22nd of August. The season had to be cut shorter than in previous years, since all of the authors were required to return to classes and teaching after Labour Day. Effort was divided between

short behavioural surveys of the waters close to the vessels' base at Duncanby Landing, and longer surveys of the Cape Caution area, and of the west coast of Calvert Island.

Cape Caution surveys

Three surveys of the Cape Caution area were conducted at bi-weekly intervals over the course of the summer. Surveys covered the whole of CERF's traditional study area between Allison Harbour, in Queen Charlotte Strait, and Duncanby Landing, in Rivers Inlet. Additional effort was also focussed on the west coast of Calvert Island, an area not previously observed by CERF crews to be used by gray whales, but which was in continuous use during the summer of 2003. Hours on the water and numbers of whales observed are summarised in Table 1.

The study area was divided into zones as shown in Figure 1. Zone boundaries (Table 2) were set arbitrarily at obvious, significant landmarks. The zones were used for two purposes: one, to quantify the effort by the survey crew in the different regions of the study area, and two, as a means of localising sightings of relatively mobile whales. In general, the whales did not cross more than one zone boundary, and most often remained completely within a single zone, during the time it took to get a complete set of photographs. Because of the whales' mobility during photographing sessions, locations of gray whale sightings are given throughout this report as zone references. Locations given in this way are precise to within approximately +/- 2 nautical miles for southern zones, and +/- 5 nautical miles for northern zones. The +/- 2 mile precision is representative of most animals' behaviour during photo shoots.

Additional shorter surveys were conducted as well, with effort focussed primarily on the northern end of the study area, between Hoop Bay and Kelp Head, close to our base at Duncanby Landing, where the largest aggregations of whales were to be found.

Identification of individuals

A total of 307 gray whale encounters occurred over the course of the summer (an encounter defined as a given whale photographed somewhere, by one or other of the vessels, on a given day). 49 individual animals were identified in 263 of these encounters, either by photo-identification, or after the camera malfunction, by visual identification (Table 3). In the remaining 37 encounters, individuals were not identified visually either because the encounter was too brief, or because the whale was not known to the photographer. Lesser-known and boat-shy whales will therefore be under-represented in the latter half of the season (after the 26th of July). The largest number of missed identifications in any one day was 6 on the 4th of August (average 2 or 3 per big survey day). We do not believe, therefore, that we missed very many animals during the time we were surveying. It is certainly possible that CG065, identified on the 8th of August by John Calambokidis (pers comm), was present later in the season, as its pigmentation was not immediately familiar to the field crew.

Of the 50 individual gray whales identified in the Cape Caution/Calvert Island area during the summer of 2003, 36 have been identified and catalogued by Cascadia Research from previous years' observations elsewhere in the Pacific Northwest (Table 3). Comparisons between the CRC and CERF catalogues continues, and additional matches may still be reported. Of particular interest among the individuals identified in the Cape Caution/Calvert Island region were CG007 (CRC 238) and CG009 (CRC 323), both seen in previous years in Mexico (Megill et al. 2003).

Table 4 summarises the individual identification results for the 3 Cape Caution and 3 Calvert Island surveys. Note that several individuals seen in the Cape Caution/Calvert Island area would not have been reported if effort had been limited to the surveys only, since they were present in the area for less than the survey interval of two weeks (cf. Tables 3 & 4).

Site fidelity

Sighting histories for all individuals identified in 2003 are presented in Table 5. Of the 50 individuals identified, 38 had been seen in the Cape Caution area in previous years. More than half had been seen in more than four years, and 25% had been seen in more than 5 years (not necessarily consecutive). No animals were observed in all of the 10 years CERF has been working near Cape Caution. 27 of the whales identified in 2003 had been seen in the previous year, and an additional 6 were last seen in 2002. Three whales returned in 2003 after extended absences: CG013 returned after an 8 year absence, CG072 (CRC 143) after five years, and CG080 (CRC 93) after four. 2003 was also the first summer in which calves were seen at Cape Caution since observations began in 1994. One cow-calf pair (CG044 & CG106) remained in the area for the whole season, while a second pair (calf: CG112, mother not identified due to weather) were only present for two days in mid June.

Figure 1 shows the numbers of whales identified at Cape Caution in all years since 1996. The total of 51 individuals (50 identifications and one cow known but not identified) is tied with 1997 for the largest single year total since observations began. It is interesting to note the big jump in the number of sightings between 2002 and 2003. One possible explanation might be that the study area size has increased, but inspection of Table 6 shows that all but 4 of the animals would have eventually been identified even if no surveys of the Calvert Island shore had been undertaken. The increase is due in largest part to an influx of new animals – comparisons with other areas will tell if the individuals in question have already been identified as southern residents, or whether they represent immigration to the *Southern Feeding Aggregation*.

The home ranges of individual animals are shown in Table 6 as percentages of sightings in each zone. The first observation to be made from the table is that the animals seem to have preferred, defined home ranges within the study area. The size of these ranges was larger this year than last (~ 10 miles vs. ~4 miles), but the pattern is the same. To some extent, the herd seems to move north or south as a whole, and the order of encounters with individuals during a transect of the study area seems to remain constant. This was less general this year than in previous years, particularly as evidenced by the sudden displacement of several individuals usually regarded as “northern” animals to North Bay on the 4th of August. However, as a general trend, the animals seem to move as a herd, possibly following some tidal or current cue.

A second observation to be made from Tables 4 (bottom row) & 6 is that there are three classes of animals present in the Cape Caution area over the summer, termed residents, visitors, and transients. One group is present all summer (i.e. longer than 3 weeks), the second is present only for a day or two (transients), and the third is present for only a few weeks (visitors). Similar patterns have been observed every year in the area. A fourth class includes animals which visit the area for a day or two in the early part of the season, go away, then return later in the season to be residents. The pattern is probably indicative of home ranges with long tails – enlargements of the home range exhibited by CG011 or CG054 (Table 6). It will be interesting in future years as survey effort increases on the north coasts of Vancouver Island, to see how many of the Cape Caution transients turn out to be Cape Scott residents. At least two animals which were transients in 2003 (CG019 and CG028) were identified off the north coast of Vancouver Island this year – interestingly both of those animals have been residents at Cape Caution in previous years. There is a group of whales which are resident at Cape Caution almost every year (highlighted in dark blue in Table 5) – others join them from year to year, possibly rotating on longer time scales. Similar patterns have also been observed off Tofino (D. Duffus, pers. comm.).

Habitat use

The animals were found in similar habitat as in other years. Primarily in and around nearshore kelp beds, particularly near Kelp Head, Ruby Rocks, Hoop Reef, and North Bay in CERF's usual Cape Caution study area. There were fewer whales this year near Cape Caution, and more near Kelp Head, and for the first time since 1994, gray whales were regularly seen feeding in nearshore kelp beds on the west coast of Calvert Island, particularly near Herbert Pt, Stafford Pt, and Grief Bay. They were also regularly seen feeding on Fitzroy Rf, about 1.5 miles offshore, west of the southwest corner of Calvert Island. The habitat there was

in many ways similar to the Cluster Reefs in northern Smith Sound, but different in that it is exposed to the full brunt of Queen Charlotte Sound.

In the first half of the season, no whales were seen in the North Bay/Allison Harbour area, another first since 1994. The overall pattern was that the herd was shifted north by ten miles. Feeding was observed in the North Bay/Allison Harbour area in August, and the herd's overall habitat use pattern returned to one more similar to previous years, albeit with continued exploitation of the Calvert Island habitat by some whales.

We did not do any diving this year, but incidental observations of faeces indicated that the animals were feeding on mysids, as in previous years (Stelle et al. in review).

Discussion

This work is the continuation of a multi-year, ongoing study of the gray whales of Cape Caution, BC. CERF's catalogue now contains over one hundred different individuals identified in the Cape Caution area over the last ten summers. This represents a substantial portion of the estimated 270 animals in the *Southern Feeding Aggregation* (Calambokidis 2003).

As in previous years, a large group of animals was present in the Cape Caution area from mid July on. There was a substantial influx of animals in early August, as in previous years. The herd seemed to be divided into four groups. As in previous years, there was one group north of Smith Sound, a second in Hoop Bay, and a third south of Cape Caution. Differently from previous years, however, there was a fourth group feeding along the west coast of Calvert Island.

The west coast of Calvert Island was described as gray whale habitat by Darling (1984). However, several years' observation by CERF crews has until this year however never found gray whales in the area. Circumnavigations of Calvert Island began in 1998, at various times during the summer, and gray whales were never sighted. Reasons for the whales' avoidance of the area in previous years are not clear. It may be that the food resource at Cape Caution was less dense this year than in previous years, and unable to support the large herd, or it may be that the animals were "off-course" on their swim from Cape Scott across Queen Charlotte Sound in the spring, made landfall near Cape Calvert rather than Cape Caution, found mysids, and stayed.

Whales were regularly found feeding on Fitzroy Reef, about 1.5 miles west of Blackney Island, on the SW point of Calvert Island, suggesting that offshore rises, particularly ones hosting kelp beds, should also be labeled as gray whale habitat. One survey out to the Sea Otter group did not find whales, though extensive kelp beds were present.

The shift of gray whales north confirms that previously suspected gray whale feeding habitat off Calvert Island can indeed support summertime resident gray whales. The area was labelled as habitat based on its qualitative similarity to observed habitat in the Cape Caution area. This suggests that qualitatively similar areas further north along the coast, particularly off Aristazabal and Banks Islands, suspected in previous years to be gray whale habitat, should be labelled as potential habitat, and resurveyed when next possible.

Recommendations for Future Work

We make the following recommendations for future work:

1. Our research has continued to identify the Cape Caution area as significant gray whale feeding habitat. We recommend that surveys of the area continue to identify individuals, and recommend also that in future years, coverage be more regular, both to remove biases in the

- study of residence and home range, and to ensure that all individuals using the area are photographed.
2. The extension of the study area to include the west coast of Calvert Island should be made permanent, and regular circumnavigations of Calvert Island should be undertaken in future years.
 3. GIS analysis should be undertaken to determine what additional habitat in coastal BC is likely to harbour gray whales in the summer months.
 4. New surveys of the northern Central Coast and North Coast of BC should be undertaken, particularly in areas identified by the GIS work as likely gray whale habitat.
 5. New surveys of the northern coasts of Vancouver Island should be undertaken, as it is now clear that the Cape Caution animals travel regularly back and forth across Queen Charlotte Sound. It will be important in calculating energy requirements for these animals to know how much time they spend travelling through areas of no available prey.
 6. Work should resume on the ecology of gray whale prey in the Cape Caution area. Past experience using SCUBA teams proved to be expensive and highly time-consuming. We recommend therefore that mechanised means be used, either remotely operated or autonomous underwater vehicles.

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Tables

Table 1. Effort and sighting summary for the six transects conducted for the purposes of this contract. Survey time was defined as the time during daylight hours in reasonable (> 3 naut. mi.) visibility, that was spent looking for or photographing whales.

Date	Departure	Latitude Longitude	Route, <u>Arrival</u>	Survey Time (hrs)	Gray whales seen
<i>Cape Caution Area</i>					
15 Jul	Skull Cove	51 03.0 127 33.6	Cape Caution, Hoop Bay, Kelp Head, <u>Duncanby Landing</u>	10:52	13
4 Aug	Duncanby Landing	51 24.4 127 38.8	Kelp Head, Hoop Bay, Cape Caution, <u>Skull Cove</u>	8:31	24
21 Aug	Duncanby Landing	51 24.4 127 38.8	Kelp Head, Hoop Bay, Cape Caution, <u>Skull Cove</u>	8:30	14
<i>Calvert Island Area</i>					
12 Jul	Pruth Bay	51 39.3 128 07.0	Hakai Pass, Cape Calvert, <u>Duncanby Landing</u>	11:08	8
2 Aug	Duncanby Landing	51 24.4 127 38.8	Kelp Head, Cape Calvert <u>Fitzroy Reef</u>	3:41	2
2 Aug	Fitzroy Reef	51 30.0 128 08.0	Watch Rk, Pearl Rks, Ruby Rks, Kelp Head, Penrose Group, <u>Duncanby Landing</u>	7:30	3
20 Aug	Duncanby Landing	51 24.4 127 38.8	Fitzroy Reef	6:30	8

NB: Total gray whales seen may not match Table 4, since some individuals may not have been photographed, or photographs may have been of poor quality or lost due to the camera malfunction.

Table 2. Zone codes, names and geographical centre locations used in this report. The limits of the zones are shown in Figure 1. Whale sightings were recorded in the field with reference to nearby landmarks, or more rarely (i.e. if landmarks were too far away, or if the whale was within 100' of the boat) to readings from a GPS unit on the boat. Because whales tended to move quite a bit during the course of a day, we present pseudo-average positions here, citing only the zone centre locations. Locations given in this way are precise to within approximately +/- 2 nautical miles for southern zones, and +/- 5 nautical miles for northern zones. The +/- 2 mile precision is representative of most animals' behaviour during photo shoots. Gray whales were seen only along the shore or near islands, usually within 300m of the low-tide line, except in the Smith Sound zone, where they were also found in shallow water halfway from Table Island to the mainland. Zones in which gray whales were not seen by CERF crews in 2003 are greyed out.

Code	Zone Name	Centre Location	Southern Limit	Northern Limit
A	South Bay	51 01N 127 33W	Stevens Island	Emily Group
B	Burnett Bay	51 07N 127 41W	Lascelles Point	Wilkie Point
C	Cape Caution	51 09N 127 45W	Wilkie Point	Cape Caution
D ¹	Deserter Group			
E	Echo Is (Queen Charlotte Strait)		3.0mi NW Numas Island	Echo Island
F	Fitzhugh Sound		Addenbroke Island	Port John
G	Gwalgwalis	51 11N 127 47W	Cape Caution	Neck Ness
H	Hoop Bay	51 13N 127 48W	Neck Ness	Milthorp Point
I	Smith Inlet		Jones Cove / Millbrooke	
K	Kelp Head	51 20N 127 48W	1.0 mi S of Ruby Rocks	Cranstown Point
L ²	Goletas Channel		Port Hardy	Gordon Islands
M	Mayor Island	51 03 N 127 36 W	Bramham Point	McEwan Point
N	North Bay	51 02.5 N 127 34 W	Emily Group	Bramham Point
P	Morphy Bay	51 04.5 N 127 38 W	McEwan Point	Lascelles Point
Q	Queen Charlotte Sound			
R	Rivers Inlet		Sharbau Island	Oweekeno
S	Smith Sound	51 17 N 127 48 W	Milthorp Point	1.0mi S of Ruby Rocks
T	Tinson Group	51 00 N 127 32 W	Ann Island	Stevens Island
U ³	Upward Rk (SW Coast Calvert I)	51 25 N 128 01 W	Cape Calvert	Blackney Island
V	Shelter Bay		Jeanette Islands	Ann Island
W	West Coast Calvert Island	51 32 N 128 08 W	Blackney Island	Dublin Point
X	Hakai Pass & NW Coast Calvert I	51 39 N 128 10 W	Dublin Point	Hakai Pass
Y ³	Fitzhugh / Rivers	51 26 N 127 58 W	Cranstown Pt	Sharbau I / Addenbroke I
Z	Storm & Pine Islands			

¹ Deserter Group includes all islands, Ripple Pass & Gordon Channel, S of Pine to Echo Island

² Includes Hardy Bay and Beaver Harbour

³ Sorrow Islands & SE Shore of Calvert Island within 200m included in Zone U.

Table 5. Previous observations of whales photographed in 2003. "1" indicates at least one observation during the summer months. Blue highlighted animals have been identified as "residents" (more than 20 days sighted) in most years.

CERF GwID	CRC ID	2002	2001	2000	1999	1998	1997	1996	1995	1994
CG003	-			1			1	1		1
CG004	229	1	1			1	1	1	1	1
CG005	79	1	1	1	1		1	1	1	1
CG006	138	1	1		1		1	1	1	1
CG007	238		1		1		1	1	1	1
CG009	323	1				1	1	1	1	
CG011	328	1	1	1		1	1	1	1	1
CG012	32	1			1	1		1	1	
CG013	-								1	
CG014	324	1		1	1	1	1	1	1	
CG015 ¹	244		1	1			1	1	1	
CG016	671	1				1			1	
CG019 ¹	144		1						1	
CG028 ¹	41	1	1	1	1		1			
CG030	761	1					1	1	1	
CG037	612	1	1	1			1	1		1
CG038	320	1	1			1	1	1		1
CG039	91		1	1		1	1	1		
CG040 ²	315		1	1	1	1	1	1		
CG041	314	1	1	1	1	1	1	1		
CG043	325	1	1			1	1			
CG044 ³	675	1						1		
CG049	762	1			1		1	1	1	
CG050	629	1	1					1		
CG054	237	1	1	1	1	1	1	1		
CG064	674	1				1	1			
CG065 ⁴	98	1					1			
CG072	143					1				
CG075 ¹	538	1	1			1				
CG077	594	1	1	1	1					
CG079	83	1	1		1					
CG080	93				1					
CG087	628	1	1	1						
CG088	651	1	1	1						
CG093	306		1							
CG100	141	1	1							
CG101	759	1								
CG104	673/760	1								
CG106 ³	-									
CG107	-									
CG108	601									
CG109	-									
CG110	-									
CG111	-									
CG112	-									
CG113	-									
CG114	-									
CG115	-									
CG116	-									
CG117	-									

Notes:

1. No photograph available, but identification 100% certain
2. No photograph available, identification uncertain
3. Cow (CG044) & Calf (CG106) pair.
4. Photographs provided by J. Calambokidis.

Summaries

# seasons seen	10	9	8	7	6	5	4	3	2	1
# whales	0	2	5	4	6	4	7	4	6	2

Years since last observation	1	2	3	4	5	6	7	8	9
# whales	28	6	1	1	1	0	0	1	0

Table 4a. Numbers of whales identified at Cape Caution.

Year	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Total IDs	14	31	33	51	27	21	25	43	43	50

Table 6. Sighting frequencies by zone, expressed as percentages of the total number of sightings of each individual whale. Animals seen less than three times are grayed out. Zone codes are given in Table 2, and described in Figure 1. Sightings are distributed throughout the summer (see Table 4). For almost all animals, most sightings were in three or more adjacent zones, indicating a home range size of about 10 miles. Individuals are arranged from top to bottom in the table roughly according to median zone.

CRC ID	CERF GwID	Total Obs	T	A	N	M	P	B	C	G	H	S	K	Y	U	W
674	CG064	1														100
	CG109	1														100
	CG111	1														100
538	CG075	1													100	
	CG107	3										33			67	
32	CG012	4											25		50	25
91	CG039	4											100			
628	CG087	4											100			
	CG110	1											100			
	CG112	2											100			
671	CG016	16								6	6	6	69		6	6
761	CG030	14										43	43		7	7
759	CG101	11									18	18	64			
229	CG004	8					12		12				63	12		
323	CG009	7			14					14	14		58			
314	CG041	8									13	25	63			
328	CG011	19		5	5						5	42	37		5	
320	CG038	13			8				8		8		77			
612	CG037	14			7				14	7	14	7	36		14	
675	CG044	14						7	14		21		57			
	CG106	14						7	14		21		57			
673/760	CG104	12								8	17	17	50		8	
325	CG043	6									33	16	50			
762	CG049	10									10	60	30			
237	CG054	12			8						8	67	16			
144	CG019	1										100				
	CG116	1										100				
601	CG108	3									67		33			
238	CG007	2									50	50				
141	CG100	3						33			33				33	
651	CG088	5			20			20			20				20	20
	CG013	1										100				
143	CG072	1										100				
83	CG079	1										100				
306	CG093	1										100				
93	CG080	3								33	67					
	CG003	2							50		50					
244	CG015	6			33						67					
315	CG040	4								75	25					
	CG114	3								100						
594	CG077	3							33	33	33					
79	CG005	9			22		11	11	11	11	22				11	
138	CG006	5		20				20	20		20	20				
629	CG050	2						50			50					
	CG115	1										100				
	CG117	1										100				
41	CG028	2						50	50							
	CG113	3						67	33							
324	CG014	7		28	28			14					28			

Figures

Figure 1. Map of the Central Coast of British Columbia, showing CERF's study area near Cape Caution and the usual transect routes (red & green curves) followed by the *R/V Stardust* through the area. Red capital letters are zone labels and blue lines denote zone boundaries described in Table 2. Light green line: 2 July, Dashed green: 4 Aug, Dark green: 20 Aug.

