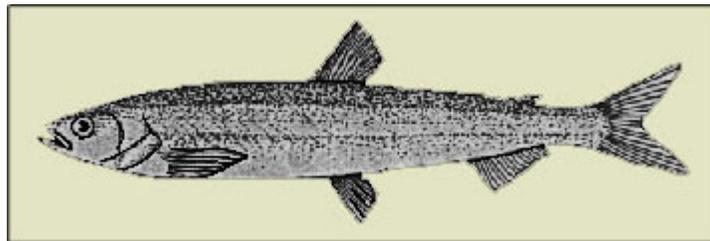


**Potential Winter Spawning of Surf Smelt  
(*Hypomesus pretiosus*) in the Outer Harbour of  
Burrard Inlet, British Columbia**



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# **Potential Winter Spawning of Surf Smelt (*Hypomesus pretiosus*) in the Outer Harbour of Burrard Inlet, British Columbia**

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2004

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## Summary

In British Columbia surf smelt (*Hypomesus pretiosus*) are being managed for a commercial and sport fishery during their traditional May through September spawning months. Management concerns for this species have increased since the Washington Department of Fish and Wildlife found three distinct stocks spawning either year round, fall-winter, or summer. Our objective was to sample the outer Burrard Inlet to determine if there are populations of reproductively mature adult surf smelt utilizing Spanish Banks and Second Beach during the January to April spawning period. Surf smelt were collected by gillnetting from January 7, 2005 to March 30, 2005 and assessed for sexual maturity in the lab at BCIT. Our team gillnetted for a total of 11.5 hours, and a total of seven surf smelt and two pacific herring were caught. Although we did find two female surf smelt with signs of fertility, the quantity of eggs does not reflect that of a ripe, ready to spawn female. Possible explanations for these observations are that (1) the eggs are left over from a previous spawn and have not been re-absorbed, or (2) the eggs are beginning to form in preparation for the summer spawning period. In general, we did not catch a sufficient number of surf smelt and, therefore, did not have enough data to conclude whether or not surf smelt are spawning during this January to April season.

## **Acknowledgements**

We would like to thank Tom Saare, Assistant Instructor for the Fish, Wildlife and Recreation program at BCIT, for suggesting this research project. Fortunately, a faint memory from a conversation he had with Sandie Hollock-Kenyon, a DFO Community Advisor, in the summer of 2004 triggered this project about a relatively under researched fish. We appreciate Sandie Hollick-Kenyon giving us the opportunity to research surf smelts and possibly confirming results found in Washington and Oregon State. We would also like to thank her for all the papers and contacts she provided for us. One of those contacts, Dr. Colin Levings (DFO Biologist) generously took the time to explain current methodologies used to capture adult surf smelts and collect deposited eggs. We also appreciated a copy of an unpublished research paper that he was currently completing. Many thanks are to be given to Robert Gunn for logistical support and providing equipment. Thanks should also be extended to Rick Chester for the orthophotos he obtained for us.

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## 1.0 Introduction

Surf smelt (*Hypomesus pretiosus*) are small, silvery, pelagic schooling fish belonging to the family Osmeridae. Surf smelt are distributed throughout nearshore marine waters from Chignik Lagoon, Alaska to Long Beach, California but little is known about their distribution along British Columbia coastline (Therriault *et al.*, 2002). Commercial fisheries for surf smelt have existed since the mid-1800s but peaked in 1904 with more than 240 tonnes harvested from British Columbia (Therriault and Hay, 2003). In the early 1960s, there was a shift in this fishery to a smaller commercial harvest and a larger recreational harvest. The commercial, recreational and aboriginal fisheries all coincide with surf smelt spawning period between the months of May and September (Therriault *et al.*, 2002). Unfortunately, both the recreational and aboriginal fisheries do not require reporting of catch so there is uncertainty regarding the actual harvest of surf smelt (IFMP, 2003). However, interest in this recreational fishery continues to grow and poses questions as to the sustainability of this fishery. There is growing concern regarding the unmonitored recreational harvest of surf smelt in British Columbia and the potential for over harvesting (Therriault and Hay, 2003). There have been no studies to determine if surf smelt are spawning during more than one season in British Columbia. In addition, spawning beaches in British Columbia have only just begun to be identified (Levings, pers. com., 2004). The Department of Fisheries and Oceans current knowledge of surf smelt spawning is from dated research. Surf smelt in British Columbia are thought to only spawn from May to September (Hollick-Kenyon, pers. com., 2004, Therriault *et al.*, 2002).

The Department of Fisheries and Oceans main concern is the lack of research on coastal British Columbian surf smelt makes it challenging to determine any problems associated with the management of the current fishery (IFMP, 2003). In Washington State, surf smelt have been found to belong to specific stocks based on their use of geographically distinct spawning grounds and the temporal use of those grounds. Under their current management strategy, surf smelt have been allocated to one of three spawning groups; year round, fall-winter, and summer spawners (WDFW, 1997). This causes some

concern because there is little variance in oceanographic conditions between British Columbia and Washington State.

Surf smelts have specific spawning habitat requirements such as substrate size and tidal elevation. The ideal substrate for surf smelt spawning is coarse sand or pea gravel (1-7mm diameter) and they spawn on the rising tide, approximately 1 – 2 meters below the high tide mark (Levings, pers. com., 2004, DFO, 2002). Several males will line up with a single ripe female to spawn; their bodies vibrate in unison resulting in a simultaneous release of eggs and milt. The female will deposit only a fraction of her eggs and will repeat spawn throughout the season (Levy, 1985). The eggs of surf smelts are adhesive and will rupture once fertilization occurs turning the outer membrane inside out creating an anchor or pedestal. This pedestal along with their adhesiveness allows them to attach to the substrate subsequently resulting in their burial from repeat wave action. Incubation times range from 8.5 days (optimal temperatures around 17.6°C) to greater than 90 days (undesirable conditions; cool temperatures) (Middaugh *et al.*, 1987). This life history of surf smelts makes them very susceptible to shoreline and intertidal disruption through development, pollution and recreational activities. Currently, the City of Vancouver rakes many popular recreational beaches in order to groom the sand for aesthetic reasons and to keep them free of garbage and debris (Hollick-Kenyon, pers. com., 2004). This practice could potentially affect the development of surf smelt embryos and cause an increase in mortality.

The life history of surf smelt after they hatch is not well understood. They have been observed schooling in estuaries and river mouths, in particular that of the Fraser River. Tidal marsh plants and eelgrass (*Zostera marina*) are therefore believed to be an important ecosystem component for surf smelt juveniles (Levy, 1985). Eelgrass is a blooming underwater grass that builds up in the spring and summer, and then decays in the fall and winter. Eelgrass plays an important role in marine ecosystems, providing essential rearing habitat and supporting a large number of grazing crustaceans both essential to salmoniformes such as surf smelts (Fisheries and Oceans, 2005).

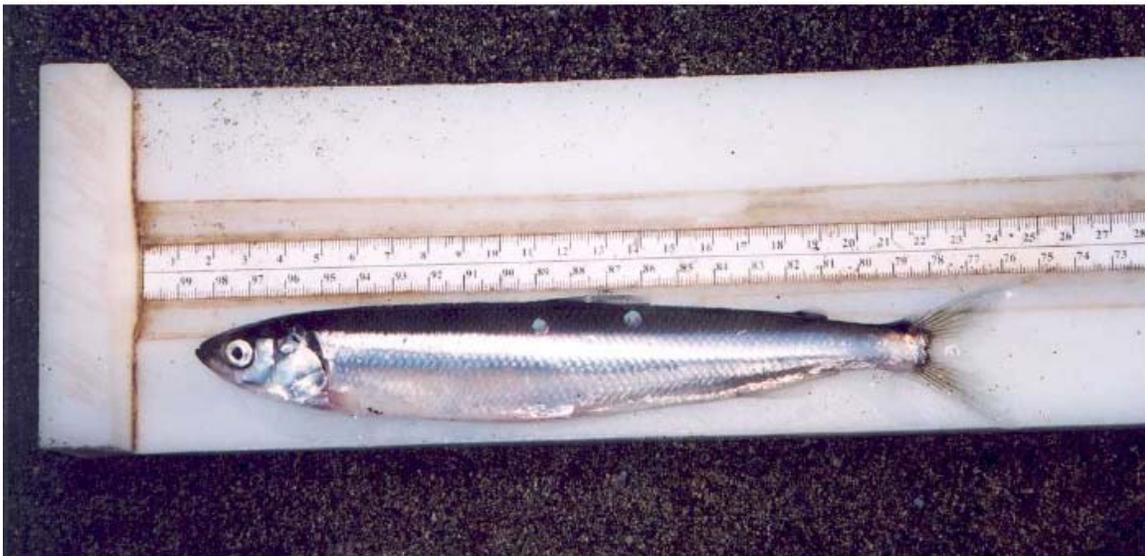
The three objectives of this study are:

1. To determine if surf smelt spawn from January to April within our study areas.
2. To identify surf smelt spawning habitats within the study area.
3. To map eel grass beds along the selected beaches to locate critical juvenile habitat.

## 2.0 Species Biology

Surf smelt are a schooling forage fish that reach up to 23 cm in length. Characteristics include a small mouth, a small curved adipose fin, an incomplete lateral line, tiny scales, and the insertion point of the pelvic fin beneath or behind the dorsal fin (Hart, 1978).

This fish has a green back with a silver or yellow band on its sides (Figure 1).



**Figure 1- Photograph of a surf smelt captured by gill net at Spanish Banks, Vancouver, British Columbia on January 19/05.**

Surf smelt are one of the few marine fish that spawn in the upper intertidal zone, which is believed to be an evolutionary adaptation of anadromous spawning (Martin and Swiderski, 2001). Surf smelt are repeat beach spawners with females depositing their eggs on beaches with a specific mixture of coarse sand to pea gravel (1-7 mm in diameter), usually at the head of bays or inlets. Females produce about 20,000 eggs (1.0 – 1.2 mm diameter) per season depending on size (Theirrault *et al.*, 2002). Spawning

events start a couple of hours before high tide with females leaving schools adjacent to the spawning beach and moving onshore. Several males pursue each female to the beach where eggs and milt are released. The fish then return to their school and the rising tide buries the eggs 2 – 15 cm beneath the sand, about one meter below the high tide mark (Levings, pers. com., 2004). Embryo development depends on temperature and spawning time but generally hatch after 11 days (Therriault *et al.*, 2002). Juvenile smelt rear in nearshore areas using vegetation such as eel grass beds for cover (Williams, 1989). Surf smelt reach sexual maturity in one to three years and can potentially live up to five years. The movements of juveniles and adult surf smelt during spawning seasons are generally unknown (Levy, 1985).

Surf smelt feed on a wide variety of zooplankton and zoobenthos including copepods, amphipods, crab larvae, shrimp, marine worms, combjellies, and a variety of larval fish (Therriault *et al.*, 2002). Surf smelt are also an important forage fish for other species such as salmon, seals, and seabirds and playing vital role in marine food webs (Therriault and Hay, 2003). The abundance of forage fish populations is extremely important for maintaining the health of other marine species including pacific salmon.

### **3.0 Fisheries Management**

Surf smelt are managed by the Department of Fisheries and Oceans by an Integrated Fisheries Management Plan (IFMP, 2003). There are three harvest sectors that have management plans recognized by the Department of Fisheries and Oceans (DFO): recreational, commercial and First Nations. To date, stock assessment for surf smelt is limited for British Columbia waters (IFMP, 2003) and there is very little regulation and enforcement of policies such as the completion of required harvest logs (Therriault *et al.*, 2002).

Recreational fishing for surf smelt has increased over the last decade, especially on the beaches of the Lower Mainland (Therriault and Hay, 2003). Sport fishers line the popular beaches of Burrard Inlet including, Kitsilano, Jericho, Wreck and Spanish Banks during the spawning season. The recreational fishery for smelt is regulated by the British

Columbia Sport Fishing Regulations (1996) under the Federal Fisheries Act. In order to sport fish for smelt, a Tidal Waters Sport Fishing License is required; daily, five and three day permits are also available at a lower cost. The daily harvest limit in all areas is 20kg with a possession limit of 40kg. Allowable fishing gear includes dipnets and gillnets to a maximum length of 7.5m and a mesh size of between 25mm and 50mm. The recreational fishery is open weekly from Friday through Sunday with an overall closure of the entire fishery from June 15<sup>th</sup> to August 15<sup>th</sup>.

There is a long history of First Nations use of the surf smelt fishery. It was believed to be utilized for food, ceremony and social purposes by many different groups. Currently the Patchedat First Nation on the west coast of Vancouver Island are still known to make use of this fishery and have applied to the Department of Fisheries and Oceans to commercially harvest the species (Therriault *et al.*, 2002). The First Nations fishing plan takes precedence over all other categories, with the commercial fishing plan having the lowest priority. The allowance of commercial fishing and recreational fishing may close if access for food, ceremonial and social needs is jeopardized for First Nation peoples. The Department of Fisheries and Oceans consult with the Aboriginal Fisheries Strategy and Aboriginal organizations when creating the IFMP, to negotiate First Nations access to the fishery. A communal license can be issued to the given Aboriginal organization for the purpose of fishing.

The commercial fishery for smelt is a modest and traditionally shore based activity. It requires either a Z8 smelt license or a category C, Schedule II Part II license. Licenses, which cost \$30, are valid from the date of purchase up to December 31<sup>st</sup> of that year.

Allowable gear includes:

- Seine nets to a maximum length of 90m and minimum mesh size of 19mm.
- Gill nets (permitted in selected areas only) to a maximum length of 275m with a minimum mesh size of 25mm up to a maximum size of 50mm.

Commercial fishermen must complete harvest log data on a daily basis and submit this information to the Department of Fisheries and Oceans so they can better monitor and manage the fishery. Harvest log data includes information such as license number, date of catch, area and location of catch, total catch (in weight), and the unit price and value if applicable. The harvest log also requires information such as the type of sale that the catch is for, i.e. dock sales, processor sales or personal bait. Fishermen must further submit a chart record of all the locations fished and the dates they were fished. The commercial fishery is open weekly between Monday and Thursday with an overall closure of the entire fishery from June 15<sup>th</sup> to August 15<sup>th</sup>.

With little monitoring done on recreational, commercial and First Nations catch sizes, it is not known what the impacts of the current management plans will have on surf smelt populations.

## **4.0 Study Area**

### **4.1 Burrard Inlet**

Spanish Banks West and Second Beach (Figure 2) were selected as the study sites. The Department of Fisheries and Oceans has assessed surf smelt spawning on Second Beach from May to August of 2004, along with nine other sites in Burrard Inlet. Second Beach was found to have the highest surf smelt egg counts in the upper tidal sands for all areas examined by and it was also chosen as a study site to provide additional data to Dr. Levings research (Levings, pers. com., 2004). Other study sites included Sandy Cove, Eagle Harbour, Radcliffe, Furry Creek, Prospect Point and Third Beach. Spanish Banks West was chosen because of its proximity to Wreck Beach, a known surf smelt spawning location, (Levings, pers. com., 2004) and its ideal coarse sand and pea gravel for spawning. These beaches are located in Burrard Inlet, a long waterway off the Pacific Ocean extending approximately 37km with an average width of 6.4km separating Vancouver to the south from North Vancouver to the north.

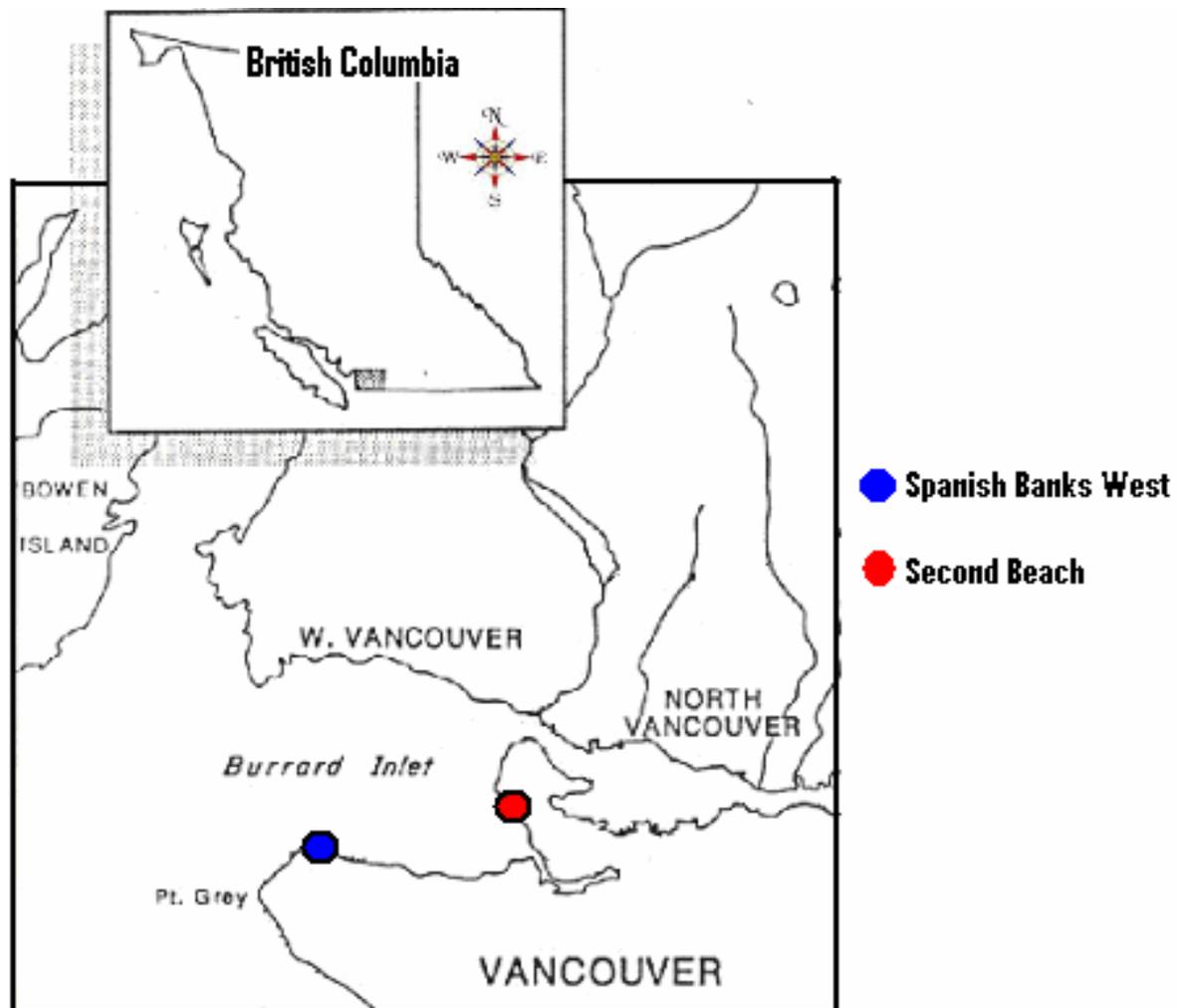


Figure 2 – Location of study areas in relation to Burrard Inlet, British Columbia. Source: [wlapwww.gov.bc.ca/.../burrard/burrard.html](http://wlapwww.gov.bc.ca/.../burrard/burrard.html) accessed December 2004.

#### 4.2 Second Beach

Second beach is located within the boundaries of the municipally operated Stanley Park (Figure 3). The beach is backed by the seawall which extends around Stanley Park protecting it from wave action and erosion. The Second Beach recreation area is sandy with many large logs. The substrate of the beach is mostly coarse sand which is ideal for surf smelt spawning. From observational knowledge of the area, human use is high on this beach year round with its peak in the warmer summer months. One hundred and fifty meters northwest of the beach sits a large outdoor children's pool and concession area (Figure 4). Southeast is the continuation of beach and seawall (Figure 4, 5 & 6) and to the south and west is Burrard Inlet and the Pacific Ocean (Figure 4). The beach is enclosed

on the east by the seawall which stands approximately one meter high and two meters wide.



**Figure 3 – Aerial photo of Stanley Park showing locality of Second Beach and study site in relation to the park. Yellow – Second Beach; Blue – study site boundary. Source: <http://www.seestanleypark.com/> accessed January 05 2005.**



**Figure 4 – View of Second Beach study site facing northwest towards the children's pool. Area at low tide showing potential spawning area. Source: <http://www.bearspace.info/h/tra/ca/bc/va/sea4.html> accessed April 04, 2005.**



**Figure 5 – View of Second Beach study site facing southeast from the seawall alongside the children's pool towards Downtown Vancouver. Source: <http://www.bearspage.info/h/tra/ca/bc/va/sea4.html> accessed April 04, 2005.**



**Figure 6 – View of Second Beach study site facing southeast towards Downtown Vancouver and large green playing field at low tide. Source: <http://www.bearspage.info/h/tra/ca/bc/va/sea4.html> accessed April 04, 2005.**

### 4.3 Spanish Banks

Spanish Banks was located approximately 100 meters west of an area known as Spanish Bank West (Figure 9). The foreshore area of Spanish Banks Beach was sandy with large logs, rocks and areas of coarse sands and gravels. The substrates of the high tide area were a combination of pea gravel (2mm) and coarse sand (1.0 – 2.0mm). The beach was shaded dominantly by alder (*Alnus rubra*), snowberry (*Symphoricarpus albus*) and black cottonwood (*Populus balsamifera*) which created a 25 meter buffer zone separating the foreshore area and the main road travelling to the University of British Columbia. A walking trail was located adjacent to the beach extending from Jericho Beach to Spanish Banks West and included vegetation buffer. Spanish Banks West was separated from our Spanish Banks site by large boulders constructed for wave interceptors, keeping the waters calmer and potentially safer for human use. Our selected site on Spanish Banks appeared to have relatively low human use because of the cover provided by the surrounding trees (unsuitable for sunbathers) and the rockier shoreline.



**Figure 7 – View of Spanish Banks study site facing east towards downtown Vancouver and English Bay January 26, 2005; High tide level: 3.6m.**

## 5.0 Methods and Materials

### 5.1 Field Methods

#### 5.1.1 Gillnet Sampling

Twenty-five to fifty millimeter (mesh size) gill nets were used to catch surf smelts. Each panel measured 7.5 meters in length and 2.4 meters in depth providing a total catch area of 54 square meters. Nets were set perpendicular to the shore using either an inflatable dingy or small row boat (Figure 10). One technician stayed on shore to securely anchor the nets while the other two rowed out to set them. Nets were set approximately 1-2 hours before high tide as this is when surf smelts are known to spawn (Martin and Swiderski, 2001). To limit mortalities, nets were checked at 30 minutes intervals. Because of the little success in January, beginning on February 02/05 gillnets were set lower in the water column to target deeper waters. This practice continued until the end of our study and showed slightly more success than previous efforts.



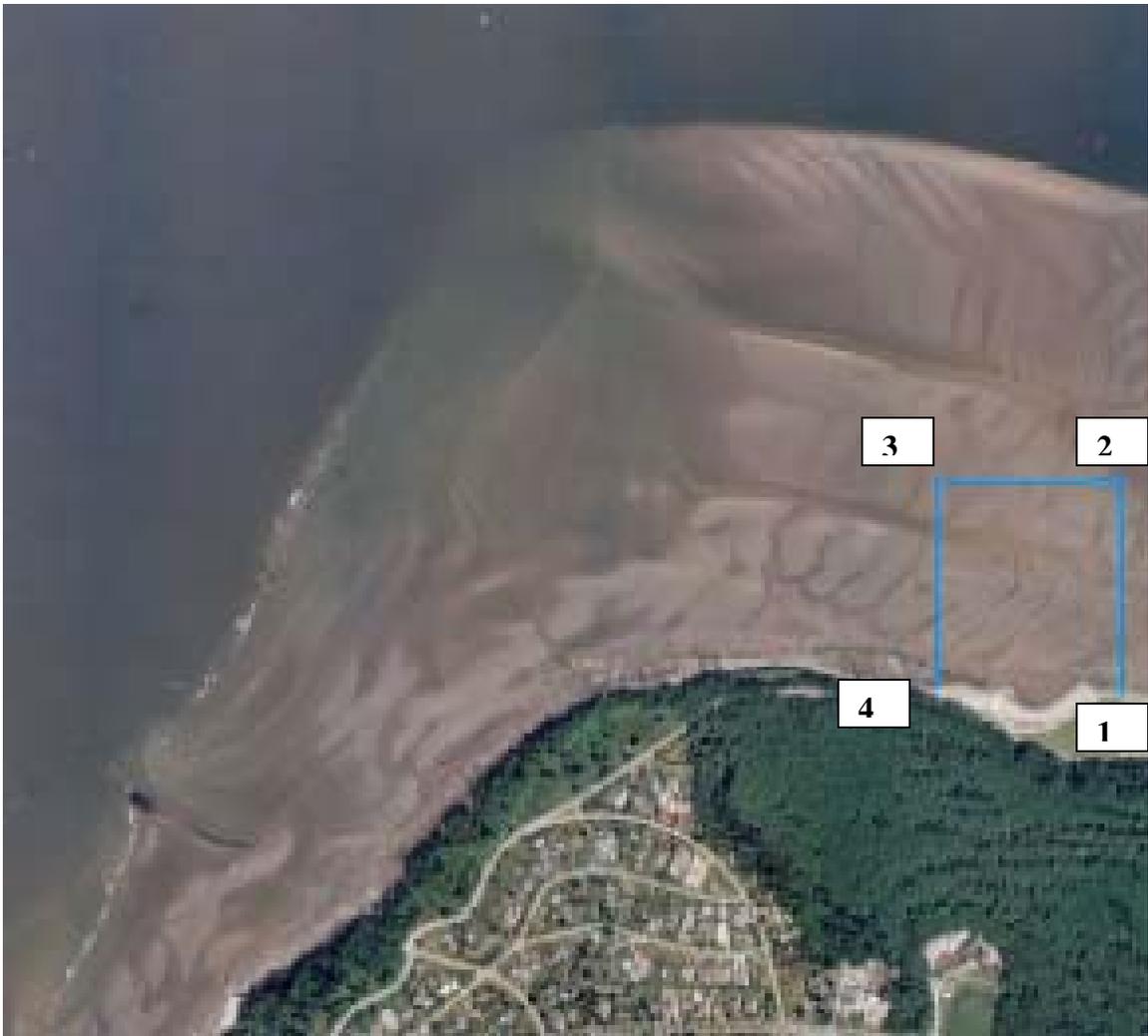
**Figure 8 – Setting gillnet perpendicular to shore at Spanish Banks west study site in dingy on February 02/05. View facing northwest from Spanish Banks. High tide level: 3.7m.**

### *5.1.2 Beach Seining*

Beach seining was used as an alternate method of catching surf smelts. Beach seines were used simultaneously with gill netting on January 05/05 and January 19/05 to determine which method was more successful. A 30m juvenile seine with a mesh size of 25mm was used following guidelines outlined in the “Fish Collection Methods and Standards” (Resource Inventory Standards Committee, 1997).

### *5.1.3 Eel Grass Bed Mapping*

A level 2 survey was conducted using standards outlined in the Sensitive Habitat Inventory and Mapping (SHIM) Methods (Environment Canada, 2002) for mapping eelgrass in BC. The survey identified the locations and areas of eelgrass beds present and helped to characterize the habitat condition within the entire bed. Surveys of the two beaches were conducted January 09 and 10, 2005 during the lowest tide to maximize the amount of area to be mapped. Surveys of the two beaches were conducted on January 09/05 during the lowest tide to maximize the amount of area mapped. Spanish banks was mapped first with a low tide of .0.4 feet at 23:06 (Figure 9); Second beach was mapped the same evening at about one hour after low tide (Figure 10).



**Figure 9 - Orthophoto of Spanish Banks – blue lines delineate area mapped for eelgrass on January 09/05 from 23:00-00:00. Georeference points: (1) 483047, 5458531 (2) 482649, 5458552 (3) 482431, 5459110 (4) 483044, 5459023**



**Figure 1010 – Second Beach orthophoto – blue lines delineate area of eelgrass mapping conducted on January 10/05 between 00:30 – 13:15 Georeference points: (1) 488866, 5460359 (2) 489085, 5460103 (3) 488831, 5460300 (4) 488984, 5460053.**

A hand held *Trimble Geo 3* GPS unit was used to georeference boundaries of eelgrass beds in order to create polygons which were used to calculate the amount of area covered by eelgrass. Preliminary tests suggested that hand held units can be as accurate as a differential GPS for mapping eelgrass beds (Environment Canada, 2002). The distribution of eelgrass within a bed was recorded as either patchy or continuous. Continuous beds were distinguished as having few bare patches whereas patchy beds contained isolated groups of plants. Reference photographs were to be taken during each survey which would include a polygon view and several close ups with a meter stick to provide a scale reference.

Estimates of percent cover of each bed, and primary substrate according to the categories as defined by SHIM were recorded. Differences in percent cover within a bed due to variations in physical variables such as depth or substrates have often been seen (Environment Canada, 2002). If eelgrass densities within the plots were found to be significantly different they were further stratified and data on each inter-plot was collected.

#### **5.1.4 Surf Smelt Analysis**

All fish were identified using Hart's "Pacific Fishes of Canada". Surf smelts were sacrificed immediately and put into Ziploc bags to be taken back to the lab to check for sexual maturity. Data such as fork length and weight were collected on all smelts caught (appendix II data sheet). All by-catch were recorded in our notes with information on species and comments.

## **5.2 Materials for Field Sampling**

The materials needed for sampling were as follows:

- 250 ml plastic jar
- extra large Ziploc bags
- waterproof labels
- 2 x wash buckets
- plastic bucket
- seine net
- trowel
- boat

### 5.3 Laboratory Methods for Surf Smelt Dissection

Dissections of the surf smelt were conducted in the Fish, Wildlife and Recreation (FWR) laboratory at the British Columbia Institute of Technology (BCIT). Gonads of male and female fish were examined to assess sexual maturity of the samples. Depending on the condition of the gonads, the fish were classified as “mature” (ready to spawn) and “immature” (not ready to spawn). The female gonads were examined using a dissecting microscope to see if any egg formation had occurred.

## 6.0 Results

### 6.1 Gillnetting

The results of gillnetting between January 5, 2005 and March 2, 2005 are presented in table 1.

**Table 1 – Gillnetting results from Spanish Banks and Second Beach between January 05/05 and March 02/05 showing sampling intensity, total smelt catch and total by catch.**

Site	Date (mm/dd/yy)	Tide (m)	Intensity (# of 30min sets)	# of smelt caught	By-catch species	CPUE (# of smelt caught per hour)
Spanish Banks	01/05/05	3.8	3	0	0	0
Spanish Banks	01/19/05	3.6	3	1	0	.67
Second Beach	01/26/05	3.6	3	0	0	0
Spanish Banks	02/02/05	3.7	3	0	0	0
Spanish Banks	02/16/05	3.4	4	1	2 Herring	.67
Second Beach	02/23/05	3.5	3	0	0	0
Spanish Banks	03/02/05	3.6	4	5	0	2.5
Totals	7*		23	7	2	Ave:0.55

\*note: total number of field days

Gillnetting results show that nets were set for a total of 11.5 hours. A total of seven surf smelts and two pacific herring were captured. All catch were sacrificed and examined in the lab. While no surf smelt were found to be sexually mature, two females were both found to have 3 eggs in their abdomen. On the other hand, both pacific herring (*Clupea harengus pallasii*) were sexually mature (figure 11).

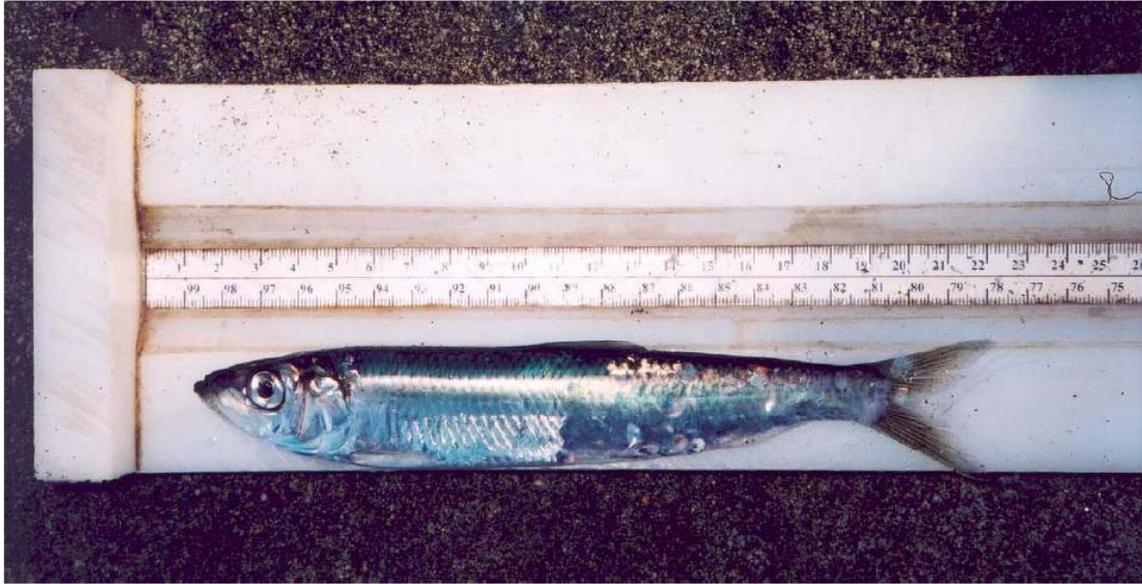


Figure 11- Sexually mature pacific herring caught by gillnet on February 16/05 at Spanish Banks.

## 6.2 Beach Seining

Beach seining was only performed at Spanish Banks, due to beach access and the use of the BCIT truck and row boat. The rowboat was needed to set the net because of water depths and we were not able to use the inflatable due to the heavy weight of the net. The results of our beach seining are shown in Table 2.

Table 2 – Beach seining results to date showing sampling intensity, total smelt catch, and total by-catch.

Site	Date (mm/dd/yy)	Tide (m)	Intensity (# of sets)	# of smelt caught	By-catch species	CPUE (# of smelt per hour)
Spanish Banks	01/05/05	3.8	3	0	1 Starry Flounder	0
Spanish Banks	01/19/05	3.6	1	0	0	0
Totals	2*		4	0	1	0

\*note: total number of field days.

One juvenile starry founder (*Platichthys stellatus*) was captured during sampling.

### 6.3 Fish Data

Because of the low numbers of fish caught, all were sacrificed. Only two female surf smelt showed any obvious gonad development. Caught on March 02/05, both females had very few eggs (3) in their ovaries.

**Table 3 – Data for all surf smelt caught at Spanish Banks between January 01/05 - March 02/05.**

Surf smelt #	Sex	Weight (g)	Fork Length (cm)	Sexual Maturity	Date	Comments
1	F	35.2	16.2	N	Jan 19/05	
2	M	59.9	20.2	N	Feb 15/05	otoliths taken
3	M	18.85	13	N	Mar 02/05	
4	M	16.84	13.5	N	Mar 02/05	
5	F	18.64	13.4	N	Mar 02/05	Very few eggs (approximately 3)
6	F	26.28	15.4	N	Mar 02/05	Very few eggs (approximately 3)
7	M	18.39	13.9	N	Mar 02/05	

### 6.4 Eel Grass Mapping

The survey for eel grass mapping was scheduled for January 09 and 10, 2005 low tides of 0.4 feet at 23:06 and 0.3 feet at 23:56 respectively. These were the lowest tides found between the months of January and April 2005. Spanish Banks was surveyed first at 23:00 and was completed by 24:00. No eel grass or vegetative life was found to be present in the exposed and study site area. Areas searched were from 483047, 5458531 to 483044, 5459023 and extending out towards the water about one kilometre. The entire area was very sandy and barren without rocks or boulders.

Because of time availability, Second Beach was surveyed the same morning. We arrived on site at approximately 24:30 and were finished at approximately 13:15. This area was

also found to be void of any eel grass or vegetative life. Areas searched were from 488866, 5460359 and 489085, 5460103 extending out towards the water about 100 meters. This beach was also very sandy but had some larger rocks and boulders to the north of the day beach area by the swimming pool.

## 7.0 Discussion

We have had little success fishing for surf smelt during the months of January to April. We were not able to catch any significant numbers of surf smelt by using either gillnetting or beach seining. Possibilities for our low success could be that adult surf smelt have migrated out of the area during the winter season and juveniles are possibly finding refuge in areas of eel grass which were not found to be present in our study areas; smelts could also be utilizing habitat other than nearshore where we are targeting. Within Burrard Inlet, surf smelt spawning beaches have been heavily affected by shoreline development which altered their spawning substrate. Most drastic impacts have resulted from the deposition of sand over the natural spawning substrate which began in the 1940's (Levy, 1985). Because the deposited sand is finer than the natural substrate it is slowly being transported into the subtidal area where eelgrass beds grow.

During our fishing days, we spoke with anonymous passer-bys who claimed that “years ago you could dip a net in the water and pull it out with many, many smelts.” Others stated that they did not think we would have any success fishing during this time of year and were very surprised that we had caught any. Because little is known about migration and movement patterns of surf smelt, there is no knowledge stating their presence or absence in the waters of Burrard Inlet during these months. Penttila (2000) states that spawning sites and seasons for surf smelt are unpredictable from year to year.

Although we did find two female surf smelt with signs of fertility, the quantity of eggs does not reflect that of a ripe, ready to spawn, female. Possible explanations for these observations are that (1) the eggs are left over from a previous spawn and have not been

re-absorbed, or (2) the eggs are beginning to form in preparation for the summer spawning period.

## **8.0 Conclusions**

Any conclusions about the sexual maturity of surf smelt from January to April of 2005 in the waters off our sample sites in Burrard Inlet could not be made with such a low number of surf smelts to examine. Therefore, not enough data was collected to confirm if surf smelt are spawning during this January to April season. All seven surf smelt caught were examined for maturity. Two females showed possible signs of fertility but the number of eggs present were far too low to confirm sexual maturity. Two possibilities for the presence of the eggs were (1) the eggs were not reabsorbed from last years spawn and (2) the eggs are beginning to develop for this years spawn.

In addition, as eelgrass is an important habitat feature for surf smelt, it was not surprising that with our low capture rate, none was found near our study areas. Our low capture rates might have been adversely affected by this lack of forage and escape cover.

A future study considering our recommendations would be needed to give more accurate results and provide more data.

## **9.0 Recommendations**

### **9.1 Future Studies**

To improve this study in a subsequent year, more data collection is needed. Firstly, permits need to be applied for immediately as they are timely to obtain. Three permits are required to conduct this study including one from the Department of Fisheries and Oceans, one from the City of Vancouver and one from the Greater Vancouver Regional District. It would also be advantageous to apply for permits that are not restricted to specific sampling times and days.

Secondly, we would suggest that while waiting for these permits, line transects be conducted twice a month on the beaches, in order to search for surf smelt spawn. Recommended methodologies are provided by Dr. Levings (Levings, pers. com., 2004). This will allow data to be collected during the fall-early winter period and evaluate potential surf smelt spawning before January.

Thirdly, we recommend increasing the number of nets set for gillnetting. This would increase the number of gillnet panels and subsequently the available catch area.

## **9.2 Future Management**

More data is required to determine if there is winter spawning of surf smelt in the outer harbour of Burrard Inlet. Their abundance seems to be very low but a lack of knowledge on the habits of these forage fish may be an obstruction to winter fishing success. More knowledge on their lifecycles and ecology would be beneficial to their management. In addition, more information regarding their distribution and population size along our coasts would be useful.

As our study sites are within areas documented to have the most intensive surf smelt fishing (Therriault and Hay, 2002), we believe it would be wise to monitor catch sizes more closely and enforce regulations. Smelt are not only an important aboriginal and recreational fishery, but they are also an important food source for pacific salmon. Currently the management plan for smelt is contradictory to a precautionary approach to fisheries management and compliance with regulations is poor, thus an unlimited fishery for this resource may be detrimental to the population. One way to try to conserve the smelt populations of Burrard Inlet is to further limit gill net mesh sizes. It has been found by Levy (1990) that females, on average, are larger than male surf smelt and males tend to outnumber females in a population. Harvest rates of male surf smelts could potentially be increased if gill net mesh size regulations were adjusted while alleviating the pressure on the female population.

## 10.0 References

### 10.1 References Cited

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- Fisheries and Oceans Canada. [http://www.glf.dfo-mpo.gc.ca/sci-sci/bysea-enmer/estuaries-estuaire-e.html#who\\_lives\\_where](http://www.glf.dfo-mpo.gc.ca/sci-sci/bysea-enmer/estuaries-estuaire-e.html#who_lives_where). Accessed 2005 March 1.
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## **10.2 Personal Communication**

Ms. Sandie Hollick-Kenyon, Community Advisor  
Department of Fisheries and Oceans Canada  
Salmon Enhancement Program  
100 Annacis Parkway, Unit 3  
Delta, BC  
V3M 6A2  
Phone: 604-666-0743

Dr. Colin Levings  
Department of Fisheries and Oceans Canada  
Marine Environment and Habitat Sciences Division  
4160 Marine Dr  
West Vancouver, BC  
V7V 1N6  
Phone: 604-666-7915

## 11.0 Appendix

### 11.1 Contacts

Ms. Sandie Hollick-Kenyon, Community Advisor  
Department of Fisheries and Oceans Canada  
Salmon Enhancement Program  
100 Annacis Parkway, Unit 3  
Delta, BC  
V3M 6A2  
Phone: 604-666-0743

Dr. Colin Levings  
Department of Fisheries and Oceans Canada  
Marine Environment and Habitat Sciences Division  
4160 Marine Dr  
West Vancouver, BC  
V7V 1N6  
Phone: 604-666-7915

Mr. Robert Gunn  
Fisheries Instructor  
British Columbia Institute of Technology  
3700 Willingdon Ave  
Burnaby, BC  
V5G 3H2  
Phone: 604-451-6860

Mr. Tom Saare  
Assistant Instructor  
British Columbia Institute of Technology  
3700 Willingdon Ave  
Burnaby, BC  
V5G 3H2  
Phone: 604-432-8750

### 11.2 Surf Smelt Survey Data Sheet

## Surf Smelt Survey

**Location:** \_\_\_\_\_ **Surveyors:** \_\_\_\_\_  
**Date:** \_\_\_\_\_ **Weather:** \_\_\_\_\_ **Method Used:** \_\_\_\_\_  
**Start Time:** \_\_\_\_\_ **End Time:** \_\_\_\_\_  
**Tidal Stage Start:** \_\_\_\_\_ **Tidal Stage End:** \_\_\_\_\_  
**Net in:** \_\_\_\_\_ **Net out:** \_\_\_\_\_

#	Sex	Fork Length (cm)	Weight (g)	Eye Tag (colour)	Sacrificed?	Egg present	Comments
1							
2							
3							
4							
5							
6							
7							
8							
9							
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30							



### 11.4 Department of Fisheries and Oceans Permit

12/01/04 WED 08:03 FAX 18048887112

D.F.O FRASER RIVER DIV.

001



Fisheries and Oceans  
Canada

Pêches et Océans  
Canada

100 Annacis Parkway  
Unit 3  
Delta BC V3M 6A2

November 29, 2004

Licence # : 04. 249

Bob Gunn  
BCIT, Wildlife & Recreation  
3700 Willingdon Avenue  
Burnaby, B.C.  
V5G 3H2

Dear Mr. Gunn:

Enclosed please find a licence valid from December 01, 2004 to March 31, 2005 to permit the collection of surf smelts from Burrard Inlet, Second Beach and Spanish Banks, Vancouver, B.C.

Please ensure the Fishery Officer listed on your licence is fully informed of your activities prior to commencement of field work.

In addition, please contact B.C. Ministry of Water, Land and Air Protection for a licence to collect non-salmon species.

I look forward to your report upon completion of the project.

Yours truly,

  
Bridget Ennevor  
Resource Management Biologist  
Lower Fraser Area

Enclosure

cc:

Steveston Fax

Canada

12/01/04 WED 08:03 FAX 16046687112

D.F.O FRASER RIVER DIV.

002

**Licence Authorizing Fish Collection for Scientific Purposes  
Pursuant to Section 52 of the Fisheries General Regulations**

Lower Fraser Area  
Unit 3 - 100 Annacis Parkway, Annacis Island  
Delta, B.C. V3M 6A2

Licence No: 04.249

Date Issued: November 29, 2004

Licence Holder: Bob Gunn

Company/Institution: BCIT, Wildlife & Recreation  
3700 Willingdon Avenue, Burnaby B.C. V5G 3H2

Phone: (604) 451-6860 Fax: (604) 432-9046

Assistants/Vessel (CFV): Bob Gunn, Ryan Lyth, Emi Mamiya and Crystal Leonard

The following conditions will apply to this licence:

1. Collection Period: from December 01, 2004 to March 31, 2005. This licence is subject to immediate termination upon written or verbal notice from a fishery officer or the Area Manager.
2. Species (Quantity): surf smelts
3. Collection Area (stat-area): Burrard Inlet, Second Beach and Spanish Banks, Vancouver, B.C
4. Collection Methods: 30 meter juvenile seine net; gillnets and line transects for spawn (eggs), some fish will be marked using a latex polymer dye to assess home ranges within the selected study areas
5. Any fish taken and not required for study or specimens must be returned to the water immediately and unharmed if possible.
6. All gear left unattended must be clearly labelled: *DFO LICENCE 04.249*
7. Local Fishery Officers of the Department of Fisheries and Oceans must have prior notice of your intended operation in their area. Contact:
 

Steveston Fax	Lower Mainland	(604) 664-9255
---------------	----------------	----------------
8. Fish taken under the authority of this licence may not enter commercial markets or establishments.
9. Live fish and eggs (spawn) cannot be transported or transplanted without prior written approval of the transplant committees.
10. A copy of this licence must be available for inspection at all times.
11. A summary of collection activities and data (within 30 days) and a final report of the study are to be submitted to the above address.



Bridget Ennevor

I AGREE TO THE ABOVE TERMS AND CONDITIONS

Applicant

Date

### 11.5 Greater Vancouver Regional District Permit

DEC 15 2004 09:03 FR GURD

604 224 5841 TO 6044329046#

P.01

#### FAX COVER PAGE

West Area Office, 4915 West 16<sup>th</sup> Avenue, Vancouver, BC  
Tel: (604) 224-5739 Fax: (604) 224-5841



Date: 15 DEC, 2004 No. of Pages: 3 (includes cover page)

To: BOB GUNN FAX NO: 604-432-9046

AT: BC IT F, W, R Perm Phone: \_\_\_\_\_

From:

- MITCH SOKALSKI  
Area Manager
- TOM MCCOMB  
Park Operations Supervisor
- RICHARD WALLIS  
Park Operations Supervisor
- D. WAYNE MATHER  
Park Operations Supervisor
- GREG PARIS  
Area Planner
- DOLORES MARTIN  
Admin Services
- MARTIN GODIN  
Admin Services
- PILAR ROMAN  
Admin Services

- BRIENNA GREENAWAY  
Admin Services
- LOGER AURE  
Area Research Technician
- SUZANNE STEWART-PATTERSON  
Community Development Coordinator
- JANE PORTER  
Area Visitor Services Coordinator
- JILL DEULING  
Park Interpretation Leader
- DALE MINCHIN  
Park Interpretation
- JOANNE HIEBERT  
Park Interpretation

For Your Info  
 As Requested

For Comment  
 Note Changes

For Approval  
 Please Reply

Originals to be Sent

Yes  No

Message:

HI BOB. - YOUR APPROVED PERMIT.  
HAVE A HAPPY HOLIDAY SEASON!  
SEE YOU IN THE NEW YEAR,  
JANE

DEC 15 2004 09:03 FR GURD 604 224 5841 TO 6044329046 P.02  
 NOV 23 2004 1:30

OCT 08 '03 14:25 FR CENTRAL AREA PARKS 604 520 3520 TO 6044329046 P.02/83  
 JUN 04 '00 10:32 FR PRRAS EHS1



# RESEARCH PERMIT

Database No.

## APPLICANT INFORMATION

First Name: ROBERT (BOB) Last Name: Givoni  
 Organization: BCIT Fish, Wildlife & Recreation Program  
 Address: 3700 Willingdon AVE  
 City: Richmond Prov.: BC P.C.: Canada  
 Tel. #: 604-451-6840 Fax #: 604-472-9046  
 Other Contact: Tom SARR Contact Tel. #: 604-452-6750

## RESEARCH INFORMATION

Type of Research: Academic research (school project) # of Researchers: 3  
 Purpose: to determine the spawning window of surf smelt & location with group area  
 Method: line transects on the beach looking for eggs  
- beach seining and gill netting looking for spawning adults  
- mapping eel grass beds using GPS  
 After-hour requirements  No  Yes to work at lowest tide to trap eel grass beds  
 # of days required to complete research: 16 days (date(s) of visit: 1-2 days weekly)

## PARK INFORMATION

Parks: Pacific Spirit Park  
 Specific Location: Wreck Beach

## GENERAL CONDITIONS

1. Researchers must comply with GVRD Parks' rules and regulations.
2. Research must be conducted during park hours only; or comply with after-hours guidelines noted in this permit.
3. All flagging or marking materials must be inconspicuous, kept to a minimum and removed when the research is completed. If flagging tape must be used, it should be dated and initialed to ensure that it remains in place for the duration of the research.
4. A report summarizing the research and its findings will be submitted to GVRD Parks.
5. While conducting research, researchers will respond to inquiries from park visitors in a friendly manner so that they are informed about the research and its importance, and understand that the impacts on the park are minimal. *Researchers should also wear high-vis vest while in the field*
6. Researchers will be a resource for GVRD Parks in the development of educational/ interpretive programs that highlight the findings of the research.
7. Researcher safety must comply with WCS guidelines.

## 11.6 City of Vancouver Permit

Vancouver Board of Parks and Recreation  
 2099 Beach Avenue  
 Vancouver, BC V6G 1Z4

(604) 257-8400

BCIT - FWR  
 3700 Willingdon Ave  
 Burnaby, BC V5G-3H2

**Sports Fields**  
 604-257-8489

**Ice Bookings**  
 604-257-8124

**Picnics**  
 604-257-8482

**Special Events/Filming**  
 604-257-8494

**Artist Permits**  
 604-257-8486



Fax 604-257-8501

### Facility Permit

Status: Approved

Customer Type: Special Event

Authorized Agent: Ryan Lyth

Home:

DATE/USER	PERMIT NUMBER	CHARGES	DISCOUNT	TAXES	REFUNDS & CREDITS	PAYMENTS	NEXT PAYMENT DUE	BALANCE DUE
12/13/2004 John Gray	4597	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	N/A	\$0.00

#### RESERVATIONS

EVENT NAME	FACILITY	DATES RESERVED
<b>Student Project - Smelt Sampling</b> Type:Special Event	<b>Second Beach Area Stanley Park Stanley Park Vancouver, BC V</b>	Every 2nd, 3rd and 4th Wednesday from 12/15/2004 to 4/20/2005 @ 08:00AM to 10:00AM  Added or Modified Dates:  Wed - 12/15/2004 - Changed time to 09:00AM - 11:00AM Wed - 12/29/2004 - Added Date 08:00AM - 10:00AM Mon - 1/10/2005 - Added Date 11:30AM - 01:30PM Wed - 1/26/2005 - Changed time to 07:30AM - 09:30AM Wed - 2/9/2005 - Changed time to 06:30AM - 08:30AM Wed - 2/23/2005 - Changed time to 06:00AM - 08:00AM Wed - 3/9/2005 - Changed time to 05:30AM - 07:30AM Wed - 3/23/2005 - Changed time to 05:00AM - 07:00AM Wed - 4/6/2005 - Added Date 05:00AM - 07:00AM Wed - 4/20/2005 - Changed time to 04:00AM - 06:00AM  Deleted or Skipped Dates:  Wed - 12/22/2004 Wed - 1/19/2005 Wed - 2/16/2005 Wed - 3/16/2005 Wed - 4/13/2005

Total Number of Dates: 11

Total Number of Hours: 22

**NOTES:** BCIT - Fish Wildlife and Recreation Student Project  
Surf Smelt Seining  
Ryan Lyth / Emil Mamiya / Crystal Leonard

Permission to Beach Sein for surf smelt, subject to the approvals of DFO, with a 30m seine net. Nets to be closely monitored, and not left unattended. Nets are gill netting, with a 10m gill net.

Equipment on site includes; Line transects, eslon tape, buckets, specimen vials, and field notebook, latex eye tagging, clove oil, latex dye, needle injection unit.

Other activities include;  
Bird Counts- Binoculars, and field note book  
Eel grass mapping ( Jan 10th, 2005) GPS, headlamps, spot light and notebooks

Permission to use boat if required, and should be small enough to be carried to the water from the the parking lot.

Students on site include:  
Ryan Lyth  
Emi Mamiya  
Crystal Lenord

Must carry a copy of this permit along with DFO paperwork while on site at second beach to be displayed on demand. Any changes or problems with this permit please contact John Gray (604) 834-7689

### ADDITIONAL CUSTOMER INFORMATION

Company Phone 1: (604) 432-8270

Company Website: www.bcit.ca

Customer Email: ryanlyth@shaw.ca

### DISCLAIMERS

The Vancouver Park Board hereby grants the permit holder and/or representative permission to use the facilities outlined, subject to the terms and conditions of this agreement contained herein and attached hereto all of which form part of this agreement. In consideration of this permit, the permit holder and/or representatives on behalf of the permit holder agrees:

To comply and to cause those using the facilities under this permit to comply with all of the terms and conditions of this permit;

To inspect the premises and facilities covered by this permit prior to any use by the permit holder to ensure that the facilities are suitable for the permit's holder's intended use;

That all Park Board premises and facilities are accepted "as is" and are used entirely at the permit holder's own risk;

Accepting this permit from the Park Board constitutes an acknowledgement from the permit holder and/or representative that he/she has read and understands the conditions and undertakings contained herein and further that he/she has the authority to represent and bind the licensee on all matters pertaining to this permit.

**TERMS AND CONDITIONS:** The following "Terms and Conditions" are incorporated into and form part of this permit agreement.

1. The licensee is responsible for ensuring that: the assigned area is appropriate for the activity; the activity is conducted in a safe, orderly manner; the activity is restricted to the assigned area; the event/activities do not interfere with other park users.

2. Any property damage which occurs during the permitted activity, set-up or take down, is the responsibility of the licensee. Damage to park property should be reported immediately. It will be assessed and repair costs billed to the licensee.

3. The licensee is responsible for leaving the area clean and litter free and may be billed for any subsequent cost incurred by the Board for clean-up.

4. If traffic control is required, the Vancouver Police Department and the City Engineering Department must be consulted.

5. Barbeques may be used provided they are thirty (30) inches from the ground, but not above or on asphalt, concrete or picnic tables. Coals are to be taken off site or placed in hot coal disposal pits.

6. Only paper or plastic cups may be used for beverages. For safety reason, no glass container are permitted.

7. The City of Vancouver reserves the right to cancel an activity for any reason and shall not be responsible for any associated costs or damages.

8. A cancellation fee of \$50.00 may apply to the cancellation of this contract within 48 hours of the first date shown on the above contract.

**UNLESS SPECIFIED AS A CONDITION OF USE:**

The licensee must obtain Comprehensive General Liability Insurance protecting the City of Vancouver, Vancouver Board of Parks and Recreation, and the Vancouver Police Board against liability for bodily injury, death or property damage, arising out of the activity. The minimum limits shall be \$2,000,000.

Page : 2 of 3

inclusive per occurrence, maximum deductible \$500.00 per occurrence, with a cross liability clause. Acceptable proof of insurance must be received by the Board of Parks and Recreation prior to the use of any facilities covered under this permit. NOTE: The foregoing satisfies the City's minimum insurance requirements. The City does not warrant that this insurance is adequate for the licensee's needs. By accepting this permit, the licensee acknowledges sole responsibility for obtaining whatever coverage the licensee deems necessary.

PARK BOARD BY-LAWS REQUIRE THAT UNLESS SPECIFICALLY PERMITTED:

1. Vehicles are not to be parked or driven onto grassed areas or restricted access and service roads at any time. Non-permitted vehicles may be towed.
2. Service of food is subject to by-law requirements of the City Health Department.
3. The sale of goods, the collection of an admission fee, or the operation of a concession is prohibited.
4. The operation of a public address system or amplified music is not permitted.
5. "No alcoholic beverages are to be dispensed, sold or consumed on the park at any time." (Sections 42 and 43 of the Liquor Control and Licensing Act).
6. Signage, banners or advertisements are not permitted.
7. The erection of structures, fences, poles, tents, stages, bleachers, portable toilets, chairs, the use of fire or fireworks, or the installation of electricity is prohibited.

GST# R121361042