Epifauna and Fish Abundance Observed by a Towed-Video Camera Along Trawling Transects in Clio Channel, British Columbia, Canada

Peter M. Troffe, Terri F. Sutherland, Colin D. Levings, Victor Keong, Howard Chang, and G. Elizabeth Piercey

Fisheries and Oceans Canada
Science Branch - Pacific Region
Ecosystem Science Division
Pacific Science Enterprise Centre
4160 Marine Drive, West Vancouver, B.C., V7V 1N6

2024

Canadian Data Report of
Fisheries and Aquatic Sciences 1404

Fisheries and Oceans Canada | Pêches et Océans Canada

Canada

Canadian Data Report of Fisheries and Aquatic Sciences

Data reports provide a medium for filing and archiving data compilations where little or no analysis is included. Such compilations commonly will have been prepared in support of other journal publications or reports. The subject matter of the series reflects the broad interests and policies of Fisheries and Oceans Canada, namely, fisheries management, technology and development, ocean sciences, and aquatic environments relevant to Canada.

The correct citation appears above the abstract of each report. Each report is abstracted in the data base *Aquatic Sciences and Fisheries Abstracts*.

Data reports are produced regionally but are numbered nationally. Requests for individual reports will be filled by the issuing establishment listed on the front cover and title page.

Numbers 1-25 in this series were issued as Fisheries and Marine Service Data Records. Numbers 26-160 were issued as Department of Fisheries and Environment, Fisheries and Marine Service Data Reports. The current series name was changed with report number 161.

Rapport statistique canadien des sciences halieutiques et aquatiques

Les rapports statistiques servent de base à la compilation des données de classement et d'archives pour lesquelles il y a peu ou point d'analyse. Cette compilation aura d'ordinaire été préparée pour appuyer d'autres publications ou rapports. Les sujets des rapports statistiques reflètent la vaste gamme des intérêts et politiques de Pêches et Océans Canada, notamment la gestion des pêches, la technologie et le développement, les sciences océaniques et l'environnement aquatique, au Canada.

Le titre exact figure au haut du résumé de chaque rapport. Les rapports à l'industrie sont résumés dans la base de données *Résumés des sciences aquatiques et halieutiques*.

Les rapports statistiques sont produits à l'échelon régional, mais numérotés à l'échelon national. Les demandes de rapports seront satisfaites par l'établissement d'origine dont le nom figure sur la couverture et la page du titre.

Les numéros 1 à 25 de cette série ont été publiés à titre de Records statistiques, Service des pêches et de la mer. Les numéros 26-160 ont été publiés à titre de Rapports statistiques du Service des pêches et de la mer, ministère des Pêches et de l'Environnement. Le nom de la série a été modifié à partir du numéro 161.

Canadian Data Report of
Fisheries and Aquatic Sciences 1404

2024

EPIFAUNA AND FISH ABUNDANCE OBSERVED BY A TOWED-VIDEO CAMERA ALONG TRAWLING TRANSECTS IN CLIO CHANNEL, BRITISH COLUMBIA, CANADA

by

Peter M. Troffe, Terri F. Sutherland, Colin D. Levings, Victor Keong, Howard Chang, and G. Elizabeth Piercey

Fisheries and Oceans Canada
Science Branch – Pacific Region
Ecosystem Science Division
Pacific Science Enterprise Centre
4160 Marine Drive, West Vancouver, B.C., V7V 1N6

Cat. No. Fs97-13/1404E-PDF ISBN 978-0-660-73338-8 ISSN 1488-5395

Correct citation for this publication:

Troffe, P.M., Sutherland, T.F., Levings, C.D., Keong, V., Chang, H., and Piercey, G.E. 2024. Epifauna and Fish Abundance Observed by a Towed-Video Camera Along Trawling Transects in Clio Channel, British Columbia, Canada. Can. Data Rep. Fish. Aquat. Sci. 1404: vii + 32 p.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABSTRACT

Troffe, P.M., Sutherland, T.F., Levings, C.D., Keong, V., Chang, H., and Piercey, G.E. 2024. Epifauna and Fish Abundance Observed by a Towed-Video Camera Along Trawling Transects in Clio Channel, British Columbia, Canada. Can. Data Rep. Fish. Aquat. Sci. 1404: vii + 32 p.

This study is a component of a larger project designed to assess potential effects of shrimp trawling gear on epifauna, shrimp, fish, and benthic habitat of Clio Channel located in Broughton Archipelago, British Columbia, Canada. Replicate beam-trawl surveys were carried out on individual transects in both Bones Bay and Turnour Bay located in the northern and southern portions of Clio Channel, respectively. A submersible, towed video-camera surveyed the seabed to enumerate epifauna and fish taxa before and after trawling activities. In regards to the video surveys, fish and epifauna (e.g. common shrimp) were observed across Clio Channel, while sea whips were predominate in the Turnour Bay video transects.

RÉSUMÉ

Troffe, P.M., Sutherland, T.F., Levings, C.D., Keong, V., Chang, H., and Piercey, G.E. 2024. Epifauna and Fish Abundance Observed by a Towed-Video Camera Along Trawling Transects in Clio Channel, British Columbia, Canada. Can. Data Rep. Fish. Aquat. Sci. 1404: vii + 32 p.

Cette étude fait partie d'un projet plus vaste conçu pour évaluer les effets potentiels des engins de chalutage à crevettes sur l'épifaune, les crevettes, les poissons et l'habitat benthique du canal Clio situé dans l'archipel Broughton, en Colombie-Britannique, au Canada. Des relevés répétés au chalut à perche ont été effectués sur des transects individuels dans la baie Bones et la baie Turnour, situés respectivement dans les parties nord et sud du canal Clio. Une caméra vidéo submersible et remorquée a étudié les fonds marins pour collecter et énumérer l'épifaune et les taxons de poissons avant et après les activités de chalutage. En ce qui concerne les relevés vidéo collectés dans la baie Bones, l'abondance des poissons et de l'épifaune (par exemple, la crevette commune) a été estimée à partir des captures au chalut, tandis que l'épifaune (par exemple, la crevette commune, les sea whips) et les poissons ont été enregistrés par caméra à partir des transects vidéo de Turnour Bay.

1.0 INTRODUCTION

Mobile fishing gear may disturb benthic habitats by modifying sediment texture, community and trophic structure, and natural productivity and diversity (Dayton et al. 1995; Kaiser and Spencer 1996; Kaiser et al. 1998; Jennings and Kaiser 1998; Collie et al. 2000; Lambert et al. 2011; De Juan 2012; Gislason et al. 2017; Cyrielle et al. 2020; Bromhall et al. 2022; McLaverty et al. 2020a, 2020b, 2021, 2023). The magnitude and type of disturbance mobile fishing gear incurs to benthic habitats is largely dependent on the following: 1) type of gear deployed; 2) the nature of the substrate fished; 3) community of organisms present; and 4) frequency of the disturbance.

Most studies exploring the effects of mobile fishing gear have focused on the impacts and recovery of chronically trawled coarse-sediment continental-shelf fisheries globally including north Pacific (Agbayani et al. 2015; Ardron et al. 2007; Galand 2011; Gale et al. 2022), north Atlantic (Schwinghamer et al. 1998; Freese et al. 1999; Prena et al. 1999; Collie et al. 2000; Kenchington et al. 2001), and Australia (Pitcher 2000; Schratzberger et al. 2002a,b). Locally, research efforts in British Columbia (BC) have focused on offshore trawling in Hecate Strait and, specifically, the area of glass-sponge gardens (Malecha and Heifetz 2017; Gale et al. 2022). In comparison to exposed, offshore continental-shelf settings, protected B.C. inlets act as particle traps due to two-layer estuarine circulation patterns, resulting in a preponderance of low-mobility fine or compact sediment subjected to variations of geological processes. Relatively few scientific studies have explored the effects of mobile gear on soft-bottom inshore habitats (e.g. Brylinsky 1994; Tuck et al. 1998; Sanchez et al. 2000). This study will assess potential trawling and effects within a protected inshore BC channel characterized by a sheltered low-energy oceanographic setting and a homogenous seabed consisting of a fine-silt texture.

2.0 STUDY SITE

Clio Channel is located on the south-central coast of British Columbia's mainland within the Broughton Archipelago (Figure 1). More specifically, Clio Channel (50 35' 22" N, 126 24' 9" W) is located between the Turnour and West Cracroft Islands in the Johnstone Strait region. The channel is oriented on a southwest-northeast bearing connecting two bodies of water: Johnstone Strait and Knight Inlet. Clio Channel has an approximate length of 13 km and a width range of 1 to 2 km. Turnour Bay is located in the lower southwest of Clio Channel, while Bones Bay is located in the upper northeast of the Channel (Figure 1). Turnour Bay is approximately 1.5 x 1.0 km^2 and a range of depth between 25m (north-east end) and 40m (north-west end) (Troffe et al. 2005). Bottom sediments are predominantly sand mixed with small boulders, which could be detected from the video camera, along with rock outcrops. Reconnaissance work also included video observations at Bones Bay, a similar-sized embayment about 5 km distant, off the north-east end of Clio Channel. Water depth at Bones Bay ranged between 64m (north-east) and 74m (south-west) across the bay. The transect areas were relatively evenly sloping across muddy sediments.

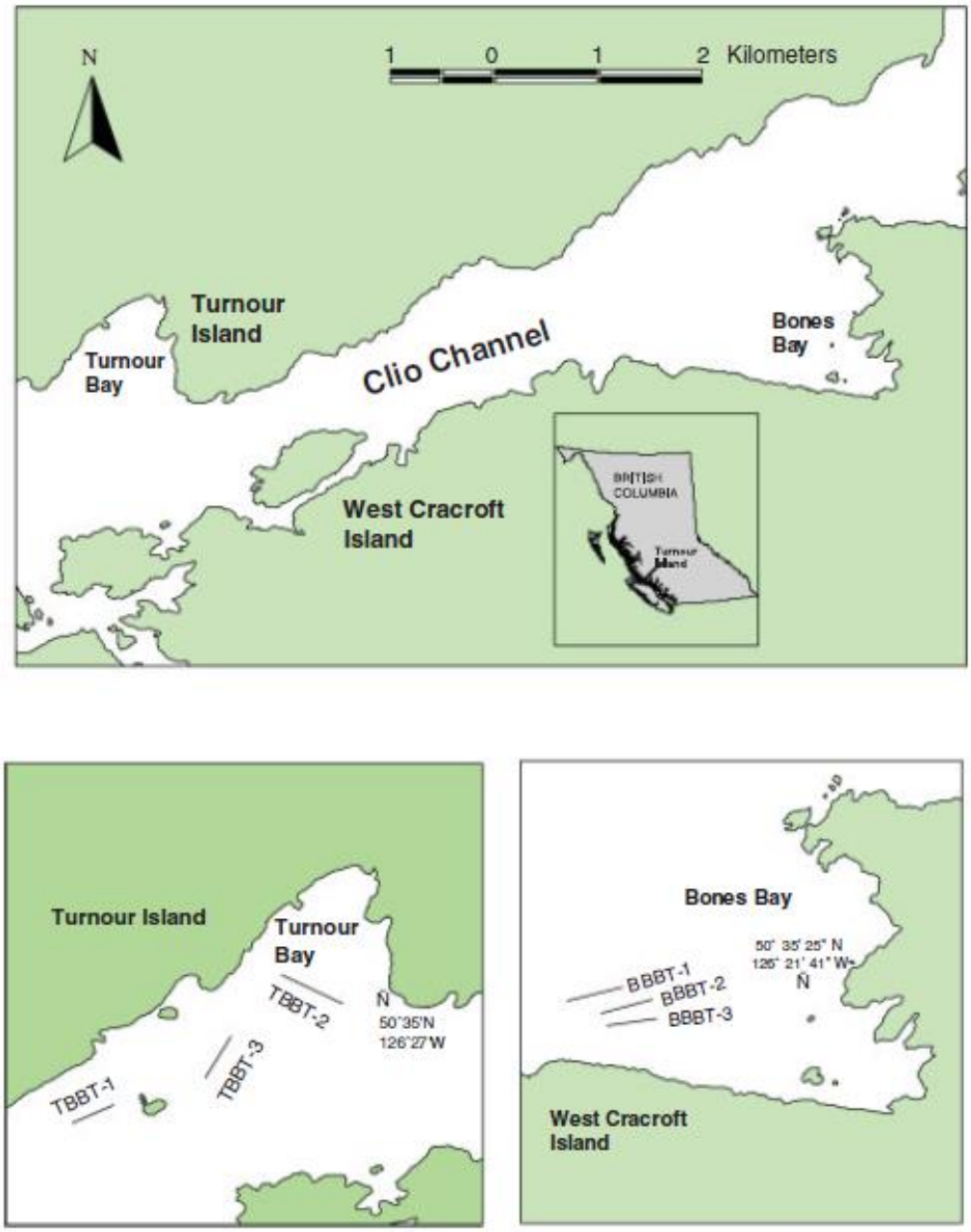

Figure 1: A map of the study areas and trawling lines in Clio Channel located on the central coast of British Columbia, Canada (Troffe et al. 2005). TBBT = Turnour Bay Beam Trawl; BBBT = Bones Bay Beam Trawl; 1, 2, 3 = replicate trawl transects.

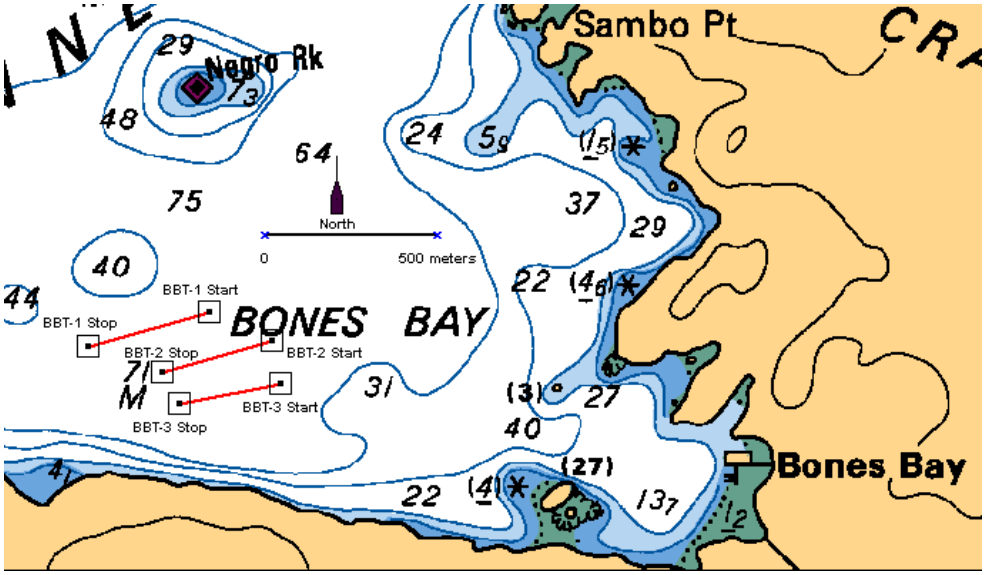

Figure 2: A map of Bones Bay (BB) with replicate transect lines of beam-trawl tracks (BT). The starting positions of the trawling transect lines are denoted where the trawl-net lands on the seafloor at the onset of trawling. The stop locations are denoted where the net is lifted off the seafloor. Base map from Canadian Hydrographic Service Chart (CHS) 3545.

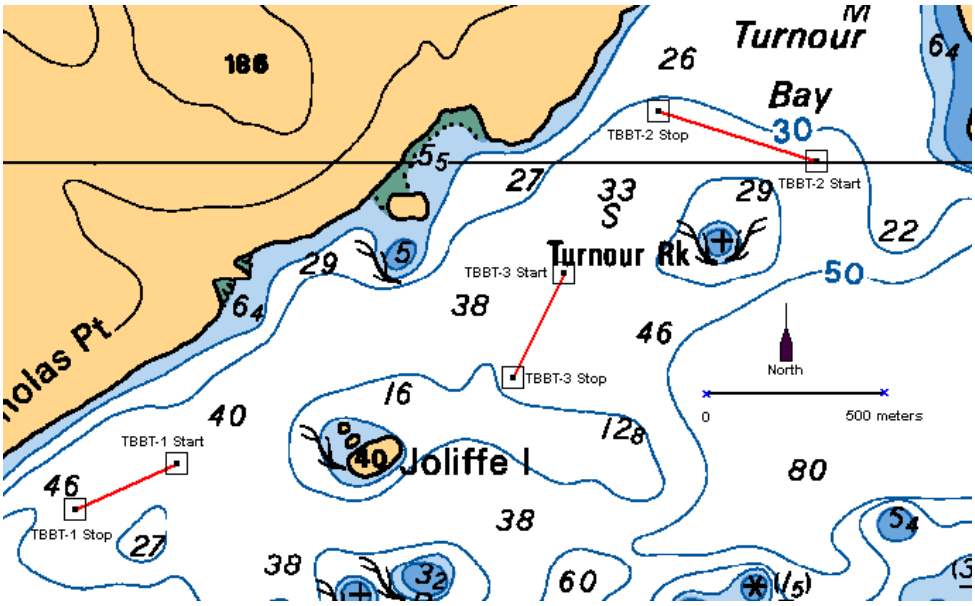

Figure 3: A map of Turnour Bay (TB) with replicate transect lines for beam-trawl tracks (BT). The starting positions of the trawling transect lines are denoted where the trawl-net lands on the seafloor at the onset of trawling. The stop locations are denoted where the net is lifted off the seafloor. Base map from Canadian Hydrographic Service Chart 3545.

3.0 METHODS

The methods used for beam trawling in this study were representative of those employed by the commercial shrimp fishery in British Columbia at the time period associated with our work. In addition, the trawling and video surveys of the replicate seafloor transects were carried out according to those in Simoom Sound in a related study (Sutherland et al. 2023b). Data on the dimensions of the fishing gear and descriptions of the vessels deployed in the study are provided in Ong et al. (2002). A summary of the overall survey design, deployment of different fishing-gear types, and video methods are described below.

Beam trawls were completed on three survey transect lines in Bones Bay (October 24-25, 2001) and in Turnour Bay (January 17-18, 2002) in Clio Channel. Each experimental block included three parallel replicate transects of the seafloor characterised by a relatively uniform depth and sediment texture.

The replicate transects were plotted on *Nobeltec Visual Navigation Suite 5.0* prior to the collection of the pre-trawl similar to Sutherland et al. (2023a,b). A submersible camera attached to a epibenthic sled was towed one metre above the seabed to compare both shrimp and fish abundance before and after replicate transects were fished with the beam trawls.

***Beam Trawl*:** Beam trawl surveys were supported by a chartered commercial shrimp vessel (Amethyst II) in October, 2001 and January 2002. Beam-trawling occurred on each of the three pre-determined replicate transects located northwest of the otter-trawling experimental block (Figure 2). The lengths of each triplicate beam-trawl transects ranged between 539 and 690 m, while the duration of the on-bottom fishing periods ranged between 14 and 17 minutes. The water-depths of the trawl transects ranged between 46 and 58 m. The coordinate readings of each trawl track were plotted using dGPS readings every minute from a hand-held Trimble ProXR.

3.1 EPIFAUNA VIDEO SURVEYS

Seabed video surveys were carried out on fishing transects before and after beam trawling activities to assess epifauna and fish abundance under these scenarios. A support vessel deployed a towed submersible video-camera at height of 1 metre above the seabed along each fishing transect. This video camera, mounted on an epibenthic sled, was used to capture a continuous video survey along each trawl replicate transect. The camera apparatus consisted of a 9.5-m 300 charged-coupled device (CCD) video camera with a sensitivity of two Lux, supported by two five-watt halogen lamps fitted with tungsten filaments. Two ruby lasers were mounted 5.7 cm apart on either side of the camera to provide a scale for size calibration.

The video transect start and end points were matched with the trawl touch-down and lift-off locations for the on-bottom trawling transect. The duration of the video survey ranged between 12 and 14 minutes. Each video transect was divided into segments defined by 4 seconds of video time. Each segment area is based on a length (swath) and width (diameter) that was typically 4.5 m and 0.5 m, respectively. The segment dimensions were calibrated by the average length of representative shrimp observed in the trawl catch. In addition, the distance (5.7 cm) between the tandem lasers attached to the

video camera provided a calibration for the field diameter. Twenty randomly-selected video segments located along the video transect were analyzed for faunal abundance. Taxa identification was analyzed to the lowest taxonomic category possible and shrimp abundance was estimated by counting the number of organisms visible within a calculated area of seafloor (segment). Anguilliform represents fish with a long, slender body typified by eels that travel by anguilliform motion. The catch and bycatch estimates for each of the replicate beam-trawl surveys are included in Troffe et al. 2002.

4.0 RESULTS

TABLE 1: Epifauna and fish abundance before the beam-trawl survey on October 24, 2001, at transect 1 in Bones Bay, British Columbia, Canada.

Transect Segment	Video Time GMT hh:min:sec	Shrimp Count (E=Eualus; P=Pandalus)				Fish Count		Camera visibility & seabed observations	Transect Segment Dimensions	
		E. suckleyi	*P. borealis*	*P. hypsinotus*	*P. platyceros*	Flatfish	Zorcidae & Anguliform		Field Diameter (m)	Swath Length (m)
1	16:25:50 16:25:52 16:25:54	1	1					Camera suspended in vertical position Water clear, good visibility.	n/a	n/a
2	16:26:20 16:26:22 16:26:24							Camera in vertical position Water clear. Poor visibility on left side of screen	0.46	3.60
3	16:26:44 16:26:46 16:26:48		1					Camera in vertical position Water clear, good visibility	n/a	n/a
4	16:27:20 16:27:22 16:27:24							Camera higher off bottom	n/a	n/a
5	16:27:50 16:27:52 16:27:54							Camera higher off bottom	n/a	n/a
6	16:28:20 16:28:22 16:28:24		1					Water clear, good visibility	0.46	3.60
7	16:28:44 16:28:46 16:28:48								n/a	n/a
8	16:29:18 16:29:20 16:29:22		3 3 8						0.65	4.50
9	16:29:54 16:29:56 19:29:58	1	2 4 7						n/a	n/a
10	16:30:30 16:30:32 16:30:34		1 2 2					Camera on bottom	n/a	n/a
11	16:30:50 16:30:52 16:30:54		7 5 7						0.51	4.50
12	16:31:20 16:31:22 16:31:24		1 5 8	1		1			n/a	n/a

TABLE 1 continued: Epifauna and fish abundance before the beam-trawl survey on October 24, 2001, at transect 1 in Bones Bay, British Columbia, Canada.

Transect Segment	Video Time GMT hh:min:sec	Shrimp Count (E=Eualus; P=Pandalus)				Fish Count		Camera visibility & seabed observations	Transect Segment Dimensions	
		E. suckleyi	*P. borealis*	*P. hypsinotus*	*P. platyceros*	Flatfish	Zorcidae & Anguliform		Field Diameter (m)	Swath Length (m)
13	16:31:50 16:31:52 16:31:54		7 3 3	1				Poor visibility on left side of screen Direct light on bottom visually obscuring some animals/objects	n/a	n/a
14	16:31:52 16:31:54 16:32:24		3 3 4				1 1		n/a	n/a
15	16:32:50 16:32:52 16:32:54		3 3 4	 1					n/a	n/a
16	16:33:20 16:33:22 16:33:24		7 4 6						n/a	n/a
17	16:33:50 16:33:52 16:33:54		9 9 3	1 2					0.51	4.50
18	16:34:20 16:34:22 16:34:24		4 3 3	2 1					n/a	n/a
19	16:34:34 16:34:36 16:34:38		3 5 3	1 1					0.51	3.60
20	16:34:50 16:34:52 16:34:54		3 4	1				Camera sled speed increased near end of track	n/a	n/a

TABLE 2: Epifauna and fish abundance before the beam-trawl survey on October 24, 2001, at transect 2 in Bones Bay, British Columbia, Canada.

Transect Segment	Video Time GMT hh:min:sec	Shrimp Count (E=Eualus; P=Pandalus)				Fish Count		Camera visibility & seabed observation	Transect Segment Dimensions	
		E. suckleyi	*P. borealis*	*P. hypsinotus*	*P. platyceros*	Flatfish	*Zorcidae & Anguliform*		Field Diameter (m)	Swath Length (m)
1	16:47:27 16:47:29 16:47:31		5 4 1	2	1	1		Camera in horizontal position Water clear - good visibility Sandy bottom	0.23	2.70
2	16:47:33 16:47:35 16:47:37		6 7 4					Siphon or stalks on surface of substrate	n/a	n/a
3	16:47:39 16:47:41 16:47:43		6 2 9					Water clear - good visibility	n/a	n/a
4	16:47:45 16:47:47 16:47:49		1 5 2	1 1			1	Water clear - good visibility	0.23	2.70
5	16:47:51 16:47:53 16:47:55		5 1 2			1	2		n/a	n/a
6	16:47:57 16:47:59 16:48:01		6				1		n/a	n/a
7	16:48:03 16:48:05 16:48:07		2 5 2	1 1		1	1	Visibility obscured by disturbed sediment	0.22	2.70
8	16:48:09 16:48:11 16:48:13		5 3 4	1	1		1	Water clear - good visibility	n/a	n/a
9	16:48:15 16:48:17 16:48:19		1	1 1				Siphon or stalks on surface of substrate	n/a	n/a
10	16:48:21 16:48:23 16:48:25		2	1			1 1		0.31	1.80
11	16:48:27 16:48:29 16:48:31		1 1		1 1				n/a	n/a
12	16:48:33 16:48:35 16:48:37		3 3	1	1				n/a	n/a

TABLE 2 continued: Epifauna and fish abundance before the beam-trawl survey on October 24, 2001, at transect 2 in Bones Bay, British Columbia, Canada.

Transect Segment	Video Time GMT hh:min:sec	Shrimp Count (E=Eualus; P=Pandalus)				Fish & Crab Count		Camera visibility & seabed observation	Transect Segment Dimensions	
		E. suckleyi	*P. borealis*	*P. hypsinotus*	*P. platyceros*	Flatfish	Zorcidae & Anguliform		Field Diameter (m)	Swath Length (m)
13	16:48:39 16:48:41 16:48:43		2 1 3						0.33	2.70
14	16:48:45 16:48:47 16:48:49		 2 1						n/a	n/a
15	16:48:51 16:48:53 16:48:55		2 1 1						n/a	n/a
16	16:48:57 16:48:59 16:49:01		1 3 1				1		0.26	1.80
17	16:49:03 16:49:05 16:49:07		 3	1		1			n/a	n/a
18	16:49:09 16:49:11 16:49:13		1 4	1			1 1		n/a	n/a
19	16:49:15 16:49:17 16:49:19		 2 1		1				0.31	1.80
20	16:49:21 16:49:23 16:49:25		3 2				1	Siphon or stalks on surface of substrate Turbid water	n/a	n/a

TABLE 3: Epifauna and fish abundance before the beam-trawl survey on October 24, 2001, at transect 3 in Bones Bay, British Columbia, Canada.

Transect Segment	Video Time GMT hh:min:sec	Shrimp Count (E=Eualus; P=Pandalus)				Fish Count		Camera visibility & seabed observation	Transect Segment Dimensions	
		E. suckleyi	*P. borealis*	*P. hypsinotus*	*P. platyceros*	Flatfish	Zorcidae & Anguliform		Field Diameter (m)	Swath Length (m)
1	16:57:40 16:57:42 16:57:44			 1			2	Turbid water, limited visibility Sandy bottom substrate	n/a	n/a
2	16:58:20 16:58:22 16:58:24			1 1			1	Turbid water, limited visibility	0.37	2.70
3	16:58:54 16:58:56 16:58:58							Several boulders/cobbles in area	n/a	n/a
4	16:59:24 16:59:26 16:59:28			2			1 1 1	Turbid water, limited visibility	n/a	n/a
5	16:59:50 16:59:52 16:59:54						1 1	Turbid water, limited visibility	0.35	1.80
6	17:00:20 17:00:22 17:00:24				1				n/a	n/a
7	17:00:50 17:00:52 17:00:54			1	1		2	Turbid water, limited visibility	n/a	n/a
8	17:01:14 17:01:16 17:01:18			 1	1 1		1		0.40	3.60
9	17:01:56 17:01:58 17:02:00		2	3 2	1 1 1	 1	 1	Turbid water, limited visibility	n/a	n/a
10	17:02:30 17:02:32 17:02:34		3 1	3 3	2		1 1	Turbid water, limited visibility	n/a	n/a
11	17:03:00 17:03:02 17:03:04		3 7 3	3 1	2 1 1		2 1	Turbid water, limited visibility	0.33	2.70
12	17:03:21 17:03:23 17:03:25		11 4 11	4 1 1	3 2			Turbid water, limited visibility	n/a	n/a

TABLE 3 continued: Epifauna and fish abundance before the beam-trawl survey on October 24, 2001, at transect 3 in Bones Bay, British Columbia, Canada.

Transect Segment	Video Time GMT hh:min:sec	Shrimp Count (E=Eualus; P=Pandalus)				Fish Count		Camera visibility & seabed observation	Transect Segment Dimensions	
		E. suckleyi	*P. borealis*	*P. hypsinotus*	P. *platyceros*	Flatfish	Zorcidae & Anguliform		Field Diameter (m)	Swath Length (m)
13	17:03:48 17:03:50 17:03:52		13 17 4	 1	1 2			Turbid water, limited visibility	n/a	n/a
14	17:04:22 17:04:24 17:04:26		10 9 7	2 2 2			1 1	Turbid water, limited visibility	0.46	2.70
15	17:04:50 17:04:52 17:04:54		8 15 11	1 3			1	Turbid water, limited visibility	n/a	n/a
16	17:05:21 17:05:23 17:05:25		13 18 6	2 1				Turbid water, limited visibility Camera sled moving laterally	n/a	n/a
17	17:05:50 17:05:52 17:05:54		18 5 9	2				Turbid water, limited visibility Camera sled moving laterally	0.37	2.70
18	17:06:20 17:06:22 17:06:24		9 10 10	 1				Turbid water, limited visibility	n/a	n/a
19	17:06:50 17:06:52 17:06:54		7 2 6	1	 1		1	Turbid water, limited visibility	n/a	n/a
20	17:07:08 17:07:10 17:07:12		2 1 3					Turbid water, limited visibility	0.35	1.80

TABLE 4: Epifauna and fish abundance after the beam-trawl survey on October 25, 2001, at transect 1 in Bones Bay, British Columbia, Canada.

Transect Segment	Video Time GMT hh:min:sec	Shrimp Count (E=Eualus; P=Pandalus)				Fish Count		Camera visibility & seabed observation	Transect Segment Dimensions	
		E. suckleyi	*P. borealis*	*P. hypsinotus*	P. *platyceros*	Flatfish	Zorcidae & Anguliform		Field Diameter (m)	Swath Length (m)
1	20:15:50 20:15:52 20:15:54		7 6 8					Turbid water poor visibility	n/a	n/a
2	20:16:08 20:16:10 20:16:12		6 6 9					Turbid water poor visibility	0.40	2.70
3	20:16:24 20:16:26 20:16:28		7 3 3					Turbid water poor visibility	n/a	n/a
4	20:16:38 20:16:40 20:16:42		4 6 8	 1			 1	Turbid water poor visibility	n/a	n/a
5	20:16:54 20:16:56 20:16:58		3 6 4	 1 			1 	Camera off bottom	0.36	3.60
6	20:17:06 20:17:08 20:17:10		8 5 5				1 	Turbid water poor visibility	n/a	n/a
7	20:17:18 20:17:20 20:17:22		4 3 3	1 			 	Turbid water poor visibility	n/a	n/a
8	20:17:30 20:17:32 20:17:34		3 6 6	 			 1 	Turbid water poor visibility	0.40	2.70
9	20:17:40 20:17:42 20:17:44		7 3 8	 			 	Turbid water poor visibility	n/a	n/a
10	20:17:51 20:17:53 20:17:55		8 3 4	 			1 	Camera on bottom	n/a	n/a
11	20:18:08 20:18:10 20:18:12		12 11 4	 		 1	 	Turbid water poor visibility	0.46	3.60
12	20:18:20 20:18:22 20:18:24		12 10 5	 1 			 	Turbid water poor visibility	n/a	n/a

TABLE 4 continued: Epifauna and fish abundance after the beam-trawl survey on October 25, 2001, at transect 1 in Bones Bay, British Columbia, Canada.

Transect Segment	Video Time GMT hh:min:sec	Shrimp Count (E=Eualus; P=Pandalus)				Fish Count		Camera visibility & seabed observation	Transect Segment Dimensions	
		E. suckleyi	*P. borealis*	*P. hypsinotus*	P. *platyceros*	Flatfish	Zorcidae & Anguliform		Field Diameter (m)	Swath Length (m)
13	20:18:37 20:18:39 20:18:41		5 7 21	1		1			n/a	n/a
14	20:18:46 20:18:48 20:18:50		12 8 17	1				Turbid water poor visibility Camera off bottom	0.36	2.70
15	20:18:54 20:18:56 20:18:58		7 5 9	1			1	Camera on bottom Approx. count due to poor visibility	n/a	n/a
16	20:19:01 20:19:03 20:19:05		15 17 9	1				Turbid water poor visibility Approx. count due to poor visibility	n/a	n/a
17	20:19:47 20:19:49 20:19:51		11 8 5				1	Approx. count due to poor visibility	0.40	3.60
18	20:19:54 20:19:56 20:19:58		17 10 6					Approx. count due to poor visibility	n/a	n/a
19	20:20:06 20:20:08 20:20:10	1	6 4 9	1		1		Approx. count due to poor visibility	0.40	1.80
20	20:20:15 20:20:17 20:20:19		9 7 11					Approx. count due to poor visibility	n/a	n/a

TABLE 5: Epifauna and fish abundance after the beam-trawl survey on October 25, 2001, at transect 2 in Bones Bay, British Columbia, Canada.

Transect Segment	Video Time GMT hh:min:sec	Shrimp Count (E=Eualus; P=Pandalus)				Fish Count		Camera visibility & seabed observation	Transect Segment Dimensions	
		E. suckleyi	*P. borealis*	*P. hypsinotus*	P. *platyceros*	Flatfish	Zorcidae & Anguliform		Field Diameter (m)	Swath Length (m)
1	19:50:30 19:50:32 19:50:34		5 9 10	1			1	Water relatively clear Good visibility	0.30	1.80
2	19:51:00 19:51:02 19:51:04		6 3 3	1			1 1	Camera on bottom	n/a	n/a
3	19:51:28 19:51:30 19:51:32		5 6 3	2		1		Water relatively clear	n/a	n/a
4	19:51:50 19:51:52 19:51:54		2 2 5					Camera near bottom	0.27	3.60
5	19:52:20 19:52:22 19:52:24		2 7 6	2 1 1					n/a	n/a
6	19:52:50 19:52:52 19:52:54		7 4 5			1	 1		n/a	n/a
7	19:53:20 19:53:22 19:53:24		3 9 8				1 1		0.31	3.60
8	19:53:48 19:53:50 19:53:52	1 1	10 4 6	1			2		n/a	n/a
9	19:54:20 19:54:22 19:54:24		5 4 4						n/a	n/a
10	19:54:54 19:54:56 19:54:58		6 3 7	 1		 1			0.28	3.60
11	19:55:20 19:55:22 19:55:24		6 3 1	 1					n/a	n/a
12	19:55:50 19:55:52 19:55:54		5 6 6						n/a	n/a

TABLE 5 continued: Epifauna and fish abundance after the beam-trawl survey on October 25, 2001, at transect 2 in Bones Bay, British Columbia, Canada.

Transect Segment	Video Time GMT hh:min:sec	Shrimp Count (E=Eualus; P=Pandalus)				Fish Count		Camera visibility & seabed observation	Transect Segment Dimensions	
		E. suckleyi	*P. borealis*	*P. hypsinotus*	P. *platyceros*	Flatfish	Zorcidae & Anguliform		Field Diameter (m)	Swath Length (m)
13	19:56:20 19:56:22 19:56:24		6 2 3	2 1			1		0.40	3.60
14	19:56:50 19:56:52 19:56:54	1	6 5 7	 1 1		1			n/a	n/a
15	19:57:20 19:57:22 19:57:24		6 2 7			1			n/a	n/a
16	19:57:40 19:57:42 19:57:44		4 4 7				 1	Camera off bottom Turbid water	0.44	1.80
17	19:58:20 19:58:22 19:58:24		6 10 10				 1 1	Turbid water, poor visibility. Camera on bottom	n/a	n/a
18	19:58:50 19:58:52 19:58:54	1	7 4 5					Turbid water, poor visibility	n/a	n/a
19	19:59:10 19:59:12 19:59:14		8 6 3					Turbid water, poor visibility	0.40	3.60
20	19:59:37 19:59:39 19:59:41		12 10 10					Turbid water, poor visibility	n/a	n/a

TABLE 6: Epifauna and fish abundance after the beam-trawl survey on October 25, 2001, at transect 3 in Bones Bay, British Columbia, Canada.

Transect Segment	Video Time GMT hh:min:sec	Shrimp Count (E=Eualus; P=Pandalus)				Fish Count		Camera visibility & seabed observation	Transect Segment Dimensions	
		E. suckleyi	*P. borealis*	*P. hypsinotus*	P. *platyceros*	Flatfish	Zorcidae & Anguliform		Field Diameter (m)	Swath Length (m)
1	19:26:10 19:26:12 19:26:14		5 5 3				1 1	Turbid water, limited visibility Camera near bottom	0.33	1.50
2	19:26:36 19:26:38 19:26:40		3 4 2		1			Turbid water, limited visibility	n/a	n/a
3	19:27:24 19:27:26 19:27:28		2 1 2	2		 2			n/a	n/a
4	19:27:56 19:27:58 19:28:00		3 5 8	1		1	 1	Turbid water, limited visibility Camera off bottom	0.44	2.70
5	19:28:10 19:28:12 19:28:14		7 3 4		1		 3		n/a	n/a
6	19:28:36 19:28:38 19:28:40		2 5 15	1 1			1	Turbid water, limited visibility	n/a	n/a
7	19:28:55 19:28:57 19:28:59		5 4 6				 1	Camera near bottom	0.29	3.60
8	19:29:18 19:29:20 19:29:22	 2 	5 4 2	 1 			 1	Turbid water, poor visibility	n/a	n/a
9	19:29:44 19:29:46 19:29:48		4 4 5				2	Turbid water, poor visibility	n/a	n/a
10	19:30:20 19:30:22 19:30:24		4 4 3				 1	Turbid water, poor visibility	0.36	3.60
11	19:30:50 19:30:52 19:30:54		6 9 10					Turbid water, poor visibility	n/a	n/a
12	19:31:10 19:31:12 19:31:14		10 8 6	2 		 1		Turbid water, poor visibility	n/a	n/a

TABLE 6 continued: Epifauna and fish abundance after the beam-trawl survey on October 25, 2001, at transect 3 in Bones Bay, British Columbia, Canada.

Transect Segment	Video Time GMT hh:min:sec	Shrimp Count (E=Eualus; P=Pandalus)				Fish Count		Camera visibility & seabed observation	Transect Segment Dimensions	
		E. suckleyi	*P. borealis*	*P. hypsinotus*	P. *platyceros*	Flatfish	Zorcidae & Anguliform		Field Diameter (m)	Swath Length (m)
13	19:31:30 19:31:32 19:31:34	1 1	10 4 8	1				Camera off bottom. Turbid water, poor visibility	0.48	3.60
14	19:31:50 19:31:52 19:31:54	1 1	11 5 6	1				Turbid water, poor visibility	n/a	n/a
15	19:32:20 19:32:22 19:32:24	3	5 10 8			1		Turbid water, poor visibility	n/a	n/a
16	19:32:55 19:32:57 19:32:59		6 5 4	 1			 1	Turbid water, poor visibility Camera near bottom	0.27	2.70
17	19:33:30 19:33:32 19:33:34		4 4 9					Turbid water, poor visibility	n/a	n/a
18	19:33:48 19:33:50 19:33:52	3	15 7 8					Turbid water, poor visibility	n/a	n/a
19	19:34:30 19:34:32 19:34:34		4 7 10	1				Turbid water Camera off bottom	0.37	3.60
20	19:34:50 19:34:52 19:34:54		4 6 10				 1	Camera on bottom Turbid water, poor visibility	n/a	n/a

TABLE 7: Epifauna and fish abundance before the beam-trawl survey on January 17, 2002, at transect 1 in Turnour Bay, British Columbia, Canada.

Transect Segment	Video Time GMT hh:min:sec	Sea Whip Count				Shrimp Count	Invertebrate Count		Fish Count		Transect Segment Dimensions	
		Vertical	At Angle (bent)	Broken (along stalk)	On Side (horizontal)	Shrimp	Sea Star	Anemones	Flatfish	Zorcidae & Anguliform	Field Diameter (m)	Swath Length (m)
1	23:00:30 23:00:35 23:00:40	4	1		2					1	n/a	n/a
2	23:01:00 23:01:05 23:01:10	2			2					2 1	0.25	2.93
3	23:01:30 23:01:35 23:01:40				2				1		n/a	n/a
4	23:04:30 23:04:35 23:04:40				1 1						n/a	n/a
5	23:05:00 23:05:05 23:05:10	1	1 1		1				1	1	0.22	3.15
6	23:05:30 23:05:35 23:05:40		2		4					1	n/a	n/a
7	23:06:00 23:06:05 23:06:10	5 1 2	1		2					1	n/a	n/a
8	23:06:30 23:06:35 23:06:40	4 2 2	4 1 1		1 1				1		0.35	3.15
9	23:07:00 23:07:05 23:07:10				2 1						n/a	n/a
10	23:07:30 23:07:35 23:07:40		1		1 1					1	n/a	n/a
11	23:08:00 23:08:05 23:08:10				1						0.19	2.93
12	23:08:30 23:08:35 23:08:40	1	1						1		n/a	n/a

TABLE 7 continued: Epifauna and fish abundance before the beam-trawl survey on January 17, 2002. at transect 1 in Turnour Bay, British Columbia, Canada.

Transect Segment	Video Time GMT hh:min:sec	Sea Whip Count				Shrimp Count	Invertebrate Count		Fish Count		Transect Segment Dimensions	
		Vertical	At Angle (bent)	Broken (along stalk)	On Side (horizontal)	Shrimp	Sea Star	Anemones	Flatfish	Zorcidae & Anguliform	Field Diameter (m)	Swath Length (m)
13	23:09:00 23:09:05 23:09:10				 3					 1 1	n/a	n/a
14	23:09:30 23:09:35 23:09:40	 1 2	1 2 2		1 1				 1	1 1	0.48	2.70
15	23:10:00 23:10:05 23:10:10	2 3 2			1 1					 2 1	n/a	n/a
16	23:10:30 23:10:35 23:10:40		2 1		1						n/a	n/a
17	23:11:00 23:11:05 23:11:10	2 2			1 1 1				1		0.38	3.60
18	23:11:30 23:11:35 23:11:40	1 3 2	2		 1 1					 1	n/a	n/a
19	23:12:00 23:12:05 23:12:10	1	 1							1	n/a	n/a
20	23:12:30 23:12:35 23:12:40	1 1 1			 2 1						0.25	3.15

TABLE 8: Epifauna and fish abundance before the beam-trawl survey on January 19, 2002, at transect 2 in Turnour Bay, British Columbia, Canada.

Transect Segment	Video Time GMT hh:min:sec	Sea Whip Count				Shrimp Count	Invertebrate Count		Fish Count		Transect Segment Dimensions	
		Vertical	At Angle (bent)	Broken (along stalk)	On Side (horizontal)	Shrimp	Sea Star	Anemones	Flatfish	Zorcidae & Anguliform	Field Diameter (m)	Swath Length (m)
1	17:45:00 17:45:05 17:45:10	 6 	 1 1	 	3 1 	 	2 	2 	 	 	n/a	n/a
2	17:45:30 17:45:35 17:45:40	3 2 1	 1 	 	1 1 	 	 	2 	 	 	0.21	3.60
3	17:46:00 17:46:05 17:46:10	4 2 2	2 	 	1 1 	 	 	1 	 	 	n/a	n/a
4	17:46:30 17:46:35 17:46:40	4 6	1 	 	 1	 	 	1 1 1	 	 	n/a	n/a
5	17:47:00 17:47:05 17:47:10	1 3 1	1 1	 	 2 	 	 	1 2 	 	 	0.19	4.50
6	17:47:30 17:47:35 17:47:40	7 3 4	 2 1	 	 1 	 	 	 	 	 	n/a	n/a
7	17:48:00 17:48:05 17:48:10	4 3 9	1 1 1	 	5 3 	 	 	1 	 	 	n/a	n/a
8	17:48:30 17:48:35 17:48:40	2 4	1 1 1	 	 1	 	 	 1 	 	 	0.27	4.05
9	17:49:00 17:49:05 17:49:10	5 2 12	 2	 1	2 1 1	 	 	 4 	 	 	n/a	n/a
10	17:49:30 17:49:35 17:49:40	9 4 3	3 7 5	 1	1 	 	 	2 1 1	 	1 	n/a	n/a
11	17:50:00 17:50:05 17:50:10	4 9 7	2 5 	 	1 1 1	 	 	3 2 	 	 	0.40	4.50
12	17:50:30 17:50:35 17:50:40	4 6 7	5 6 5	 	 1 1	 	 	 1	 	 	n/a	n/a

TABLE 8 continued: Epifauna and fish abundance before the beam-trawl survey on January 19, 2002, at transect 2 in Turnour Bay, British Columbia, Canada.

Transect Segment	Video Time GMT hh:min:sec	Sea Whip Count				Shrimp Count	Invertebrate Count		Fish Count		Transect Segment Dimensions	
		Vertical	At Angle (bent)	Broken (along stalk)	On Side (horizontal)	Shrimp	Sea Star	Anemones	Flatfish	Zorcidae & Anguliform	Field Diameter (m)	Swath Length (m)
13	17:51:00 17:51:05 17:51:10	5 7 5	1 3 4		2		1	1 3			n/a	n/a
14	17:51:30 17:51:35 17:51:40	5 3 3	2 4								0.33	3.60
15	17:52:45 17:52:50 17:52:55	1 6 4	1 5 4					2 1		 1	n/a	n/a
16	17:53:00 17:53:05 17:53:10	2 9 6	2 5 6				 1	 1 3			n/a	n/a
17	17:53:30 17:53:35 17:53:40	1 2 3	1 2 2		1			1 1			0.47	6.75
18	17:54:00 17:54:05 17:54:10	3 4 6	3 5		 1 						n/a	n/a
19	17:54:30 17:54:35 17:54:40	10 13 13	8 2 3		 1 2		1				n/a	n/a
20	17:55;00 17:55:05 17:55:10	1 5 3	 6 4		 2						0.27	7.20

TABLE 9: Epifauna and fish abundance before the beam-trawl survey on January 18, 2002, at transect 3 in Turnour Bay, British Columbia, Canada.

Transect Segment	Video Time GMT hh:min:sec	Sea Whip Count				Shrimp Count	Invertebrate Count		Fish Count		Transect Segment Dimensions	
		Vertical	At Angle (bent)	Broken (along stalk)	On Side (horizontal)	Shrimp	Sea Star	Anemones	Flatfish	Zorcidae & Anguliform	Field Diameter (m)	Swath Length (m)
1	19:04:00 19:04:05 19:04:10	4 1	2		1						n/a	n/a
2	19:04:30 19:04:35 19:04:40	4 6 1	3 1 1		 1						0.56	3.38
3	19:05:00 19:05:05 19:05:10	3 5 3	1 1 1								n/a	n/a
4	19:05:30 19:05:35 19:05:40	1 4	1	1	1					 1	n/a	n/a
5	19:06:00 19:06:05 19:06:10	 3	 4	 1	1 1				1		0.35	2.70
6	19:06:30 19:06:35 19:06:40	2 3 2	1 2 2								n/a	n/a
7	19:07:00 19:07:05 19:07:10	1 1 3	2 1 3								n/a	n/a
8	19:07:30 19:07:35 19:07:40	2 5 7	1 2 2		 1					 1	0.50	4.50
9	19:08:00 19:08:05 19:08:10	3 2 4	1 3		1 1						n/a	n/a
10	19:08:30 19:08:35 19:08:40	6 5 4	1 1 2		1 1						n/a	n/a
11	19:09:00 19:09:05 19:09:10	3 4 2	2 1 1		1						0.45	4.50
12	19:09:30 19:09:35 19:09:40	3 2 3	1 3 2		 1						n/a	n/a

TABLE 9 continued: Epifauna and fish abundance before the beam-trawl survey on January 18, 2002, at transect 3 in Turnour Bay, British Columbia, Canada.

Transect Segment	Video Time GMT hh:min:sec	Sea Whip Count				Shrimp Count	Invertebrate Count		Fish Count		Transect Segment Dimensions	
		Vertical	At Angle (bent)	Broken (along stalk)	On Side (horizontal)	Shrimp	Sea Star	Anemones	Flatfish	Zorcidae & Anguliform	Field Diameter (m)	Swath Length (m)
13	19:10:00 19:10:05 19:10:10	9 3 1	1 2		1					2	n/a	n/a
14	19:10:30 19:10:35 19:10:40	3 5 4	1 4 2								0.48	4.50
15	19:11:00 19:11:05 19:11:10	3 1 1	 2 3		1 1 1						n/a	n/a
16	19:11:30 19:11:35 19:11:40	5 4 4			 1 2						n/a	n/a
17	19:12:00 19:12:05 19:12:10	2 3 10	1 3 3		1 1 3						0.68	5.40
18	19:12:30 19:12:35 19:12:40	6 5 7	2 4		1 1 1						n/a	n/a
19	19:13:00 19:13:05 19:13:10	5 3	4 2 1		1 1 2						n/a	n/a
20	19:13:30 19:13:35 19:13:40	3 3	1		1 1						0.30	4.95

TABLE 10: Epifauna and fish abundance after the beam-trawl survey on January 19, 2002, at transect 1 in Turnour Bay, British Columbia, Canada.

Transect Segment	Video Time GMT hh:min:sec	Sea Whip Count				Shrimp Count	Invertebrate Count		Fish Count		Transect Segment Dimensions	
		Vertical	At Angle (bent)	Broken (along stalk)	On Side (horizontal)	Shrimp	Sea Star	Anemones	Flatfish	Zorcidae & Anguliform	Field Diameter (m)	Swath Length (m)
1	20:25:00 20:25:05 20:25:10	2 2									n/a	n/a
2	20:25:30 20:25:35 20:25:40	1 2 1	1		1	1				1 1	0.27	2.70
3	20:26:00 20:26:05 20:26:10	2 3 1									n/a	n/a
4	20:26:30 20:26:35 20:26:40	1 1	 1		1 1 1						n/a	n/a
5	20:27:00 20:27:05 20:27:10	1 1 1			1 3					1	0.21	3.15
6	20:27:30 20:27:35 20:27:40	3 1	1 2	1	3 1						n/a	n/a
7	20:28:00 20:28:05 20:28:10	1 1 2	2 1		1 1 2					1 1	n/a	n/a
8	20:28:30 20:28:35 20:28:40	 2	1		 1						0.23	4.50
9	20:29:00 20:29:05 20:29:10	 2	1		1						n/a	n/a
10	20:29:30 20:29:35 20:29:40	2 2 1	 2 2		 1 1					 1	n/a	n/a
11	20:30:00 20:30:05 20:30:10	1 1	1 2							1	0.27	3.15
12	20:30:30 20:30:35 20:30:40	1 2 2			 1						n/a	n/a

TABLE 10 continued: Epifauna and fish abundance after the beam-trawl survey on January 19, 2002, at transect 1 in Turnour Bay, British Columbia, Canada.

Transect Segment	Video Time GMT hh:min:sec	Sea Whip Count				Shrimp Count	Invertebrate Count		Fish Count		Transect Segment Dimensions	
		Vertical	At Angle (bent)	Broken (along stalk)	On Side (horizontal)	Shrimp	Sea Star	Anemones	Flatfish	Zorcidae & Anguliform	Field Diameter (m)	Swath Length (m)
13	20:31:00 20:31:05 20:31:10	3			1 2					1	n/a	n/a
14	20:31:30 20:31:35 20:31:40	2 1 2		1	1 2				1 1		0.28	4.50
15	20:32:00 20:32:05 20:32:10	1									n/a	n/a
16	20:32:30 20:32:35 20:32:40	3 4	2 2							1	n/a	n/a
17	20:33:00 20:33:05 20:33:10	2	2 1		1						0.23	3.60
18	20:33:30 20:33:35 20:33:40	1 1 1	1 1	1	1 1					1	n/a	n/a
19	20:34:00 20:34:05 20:34:10	1 1 3	2 1		1	1				1	n/a	n/a
20	20:34:30 20:34:35 20:34:40	1 2	2 1								0.20	3.60

TABLE 11: Epifauna and fish abundance after the beam-trawl survey on January 19, 2002, at transect 2 in Turnour Bay, British Columbia, Canada.

Transect Segment	Video Time GMT hh:min:sec	Sea Whip Count				Shrimp Count	Invertebrate Count		Fish Count		Transect Segment Dimensions	
		Vertical	At Angle (bent)	Broken (along stalk)	On Side (horizontal)	Shrimp	Sea Star	Anemones	Flatfish	Zorcidae & Anguliform	Field Diameter (m)	Swath Length (m)
1	21:17:00 21:17:05 21:17:10	4 2 1	 1 2		 1			 2			n/a	n/a
2	21:17:30 21:17:35 21:17:40	2 1	3 1								0.22	4.50
3	21:18:00 21:18:05 21:18:10		 1 1		3 1		 1 1	1 	1 1 1		n/a	n/a
4	21:18:30 21:18:35 21:18:40	 1	 1 4					1 			n/a	n/a
5	21:19:00 21:19:05 21:19:10	1	7 2 5		1 			 2 	 1		0.20	4.50
6	21:19:30 21:19:35 21:19:40		2 3 					 1 2			n/a	n/a
7	21:20:00 21:20:05 21:20:10	3 1 2	2 2 6		1 1		 1	1 2 	 1		n/a	n/a
8	21:20:30 21:20:35 21:20:40	1 5 8	11 5 12	 1	2 1 5			2 3 1			0.26	5.85
9	21:21:00 21:21:05 21:21:10	5 5 3	12 29 14	 1	2 		1 	2 2			n/a	n/a
10	21:21:30 21:21:35 21:21:40	 5 3	9 11 13		 1 			3 1 4			n/a	n/a
11	21:22:00 21:22:05 21:22:10	2 1 6	3 2 7		1 		 1 	3 2 			0.28	3.60
12	21:22:30 21:22:35 21:22:40	4 3 2	4 5 5	 1 	6 2 1		1 	1 2 1			n/a	n/a

TABLE 11 continued: Epifauna and fish abundance after the beam-trawl survey on January 19, 2002, at transect 2 in Turnour Bay, British Columbia, Canada.

Transect Segment	Video Time GMT hh:min:sec	Sea Whip Count				Shrimp Count	Invertebrate Count		Fish Count		Transect Segment Dimensions	
		Vertical	At Angle (bent)	Broken (along stalk)	On Side (horizontal)	Shrimp	Sea Star	Anemones	Flatfish	Zorcidae & Anguliform	Field Diameter (m)	Swath Length (m)
	21:23:00	1	3				13		1	3		
13	21:23:05	2			2				2			2
	21:23:10	3	2		1				3	2		1
	21:23:30	3	2		1		14		3	2		1
14	21:23:35	1	1		1				1	1		1
	21:23:40	1			2				1			2
	21:24:00		2				15			2		
15	21:24:05	5	1						5	1		
	21:24:10	3	4		1				3	4		1
	21:24:30	1					16		1			
16	21:24:35	6	5						6	5		
	21:24:40	3	1						3	1		
	21:25:00	3	3				17		3	3		
17	21:25:05	6	3						6	3		
	21:25:10	2	2						2	2		
	21:25:30		1				18			1		
18	21:25:35											
	21:25:40	1	1		1				1	1		1
	21:26:00	1					19		1			
19	21:26:05	2	2						2	2		
	21:26:10	2	2						2	2		
	21:26:30	3	1				20		3	1		
20	21:26:35				1							1
	21:26:40	5	2		1				5	2		1

TABLE 12: Epifauna and fish abundance after the beam-trawl survey on January 19, 2002, at transect 3 in Turnour Bay, British Columbia, Canada.

Transect Segment	Video Time GMT hh:min:sec	Sea Whip Count				Shrimp Count	Invertebrate Count		Fish Count		Transect Segment Dimensions	
		Vertical	At Angle (bent)	Broken (along stalk)	On Side (horizontal)	Shrimp	Sea Star	Anemones	Flatfish	Zorcidae & Anguliform	Field Diameter (m)	Swath Length (m)
1	20:48:00 20:48:05 20:48:10	1 1 3	2		1						n/a	n/a
2	20:48:30 20:48:35 20:48:40	4 4 1			1					1	0.35	4.50
3	20:49:00 20:49:05 20:49:10	3 2 4	1 1								n/a	n/a
4	20:49:30 20:49:35 20:49:40	1 3			2						n/a	n/a
5	20:50:00 20:50:05 20:50;10	 1 3	 1							 1	0.22	4.50
6	20:50:30 20;50:35 20:50:40	2 2 2	1		1					1	n/a	n/a
7	20:51:00 20:51:05 20:51:10	4 1 6	1	 1	1 1 2				 1		n/a	n/a
8	20:51:30 20:51:35 20:51:40	4 1 3	2		1 2						0.19	4.05
9	20:52:00 20:52:05 20:52:10	2 3 2	 1		1					 1	n/a	n/a
10	20:52:30 20:52:35 20:52:40	1 6 2	 1 1		1 6						n/a	n/a
11	20:53:00 20:53:05 20:53:10	3 2 3	1		3 1					 1	0.29	3.60
12	20:53:30 20:53:35 20:53:40	5 3 3	2 1		1 1						n/a	n/a

TABLE 12 continued: Epifauna and fish abundance after the beam-trawl survey on January 19, 2002, at transect 3 in Turnour Bay, British Columbia, Canada.

Transect Segment	Video Time GMT hh:min:sec	Sea Whip Count				Shrimp Count	Invertebrate Count		Fish Count		Transect Segment Dimensions	
		Vertical	At Angle (bent)	Broken (along stalk)	On Side (horizontal)	Shrimp	Sea Star	Anemones	Flatfish	Zorcidae & Anguliform	Field Diameter (m)	Swath Length (m)
13	20:54:00 20:54:05 20:54:10	2 2 2	1 3		1 2 2						n/a	n/a
14	20:54:30 20:54:35 20:54:40	4 6 3	1 1 1		1 1 1						0.27	3.60
15	20:55:00 20:55:05 20:55:10	3 3 4	1		 2 1						n/a	n/a
16	20:55:30 20:55:35 20:55:40	1 3 5	3 1		 2						n/a	n/a
17	20:56:00 20:56:05 20:56:10	6 5 1	2 1		2 2				1		0.23	4.50
18	20:56:30 20:56:35 20:56:40	1 3 1	 1		1 1					 1	n/a	n/a
19	20:57:00 20:57:05 20:57:10	2 1 3	1		2 2 1					1	n/a	n/a
20	20:57:30 20:57:35 20:57:40	 1 6	 2		7 1				1 1	 1	0.21	4.50

5.0 AKNOWLEDGEMENTS

Funding for this project was provided by the Department of Fisheries and Oceans Science Branch (Environmental Sciences Strategic Research Funding program). We thank the Masters of vessels (Amethyst II; Mary Kate) who was involved in this study. Rick Linden provided his technical expertise and a submersible towed-video apparatus and his boat, Pilea. Meagan Mak provided formatting for data tables for the report. Cher LaCoste provided a review of the report.

6.0 LITERATURE CITED

Agbayani, S., Picco, C.M., and Alidina, H.M. 2015. Cumulative impact of bottom fisheries on benthic habitats: A quantitative spatial assessment in British Columbia, Canada. Ocean Coast. Manag. 116: 423-434.

Ardron, J.A., Jamieson, G.S., and Hangaard, D. 2007. Spatial identification of closures to reduce the by-catch of corals and sponges in the groundfish trawl fishery, British Columbia, Canada. Bull. Mar. Sci. 81(3): 157-167.

Bromhall, K., Dinesen, G.E., McLaverty, C., Eigaard, O.R., Petersen, J.K,. and Saurel, C. 2022. Experimental effects of a lightweight mussel dredge on benthic fauna in a eutrophic MPA. J. Shell. Res. 40: 1–13.

Brylinsky, M., Gibson, J., and Gordon, D.C. 1994. Impacts of Flounder trawls on the intertidal habitat and community of the Mina Basin, Bay of Fundy. Can. J. Fish. Aquat. Sci. 51: 650-661.

Collie, J.S., Hall, S.J., Kaiser, M.J., and Poiner, I.R. 2000. A quantitative analysis of fishing gear impacts on shelf-sea benthos. J. Anim. Ecol. 69: 785-798.

Cyrielle, J.A.C., Desroy, N., Certain, G., Foveau, A., Vaz, S., and Labrune, C. 2020. Detecting adverse effect on seabed integrity. Part 1: Generic sensitivity indices to measure the effect of trawling on benthic mega-epifauna. Ecol. Indicat. 117: 106631.

Dayton, P.K., Thrush, S.F., Agardy, M.T. and Hofman, R.S. 1995. Environmental effects of marine fishing. Aquat. Cons. Mar. Fresh. Ecosyst. 5: 205-232.

De Juan, S. 2012. A trawl disturbance indicator to quantify large scale fishing impact on benthic ecosystems. Ecol. Indicat. 18: 183-190.

Freese, L., Auster, P.J., Heifetz, J., and Wing, B.L. 1999. Effects of trawling on seafloor habitat and associated invertebrate taxa in the Gulf of Alaska. Mar. Ecol. Progr. Ser. 182: 119-126.

Galand, L. A. 2011. Analysis of bottom trawling impacts on diversity and community composition of benthic epifauna in Hecate Strait, British Columbia. Master of Resource Management, Simon Fraser University. Conference: America Fisheries Society 140th Annual Meeting. Pp.???????

Gale, K.S., Forrest, R.E., Rooper, C.N., Nephin, J., Wallace, S., Driscoll, J. and Rubidge, E. 2022. Evaluation of collaboratively developed management measures to reduce coral and

sponge bycatch in a fully monitored multispecies trawl fishery. Can. J. Fish. Aquat. Sci. 79(9): 1420-1434.

Gislason, H., F. Bastardie, G.E. Dinesen, J. Egekvist, and O.R. Eigaard. 2017. Lost in translation? Multi-metric macrobenthos indicators and bottom trawling. Ecol. Indicat. 82: 260–270.

Jennings, S., and M.J. Kaiser. 1998. The effects of fishing on marine ecosystems. Adv. Mar. Biol. 34: 201-352.

Kaiser, M.J., and B.E. Spencer. 1996. The effects of beam-trawl disturbance on infaunal communities in different habitats. J. Anim. Ecol. 65: 348-358.

Kaiser, M.J., D.B. Edwards, P.J. Armstrong, K. Radford, N.E.L Lough, R.P Flatt, and H.D. Jones. 1998. Changes in megafaunal benthic communities in different habitats after trawling disturbance. ICES J. Mar. Sci. 55: 353-361.

Kenchington, E.L.R., J. Prena,K.D. Gilkinson, D.C. Gordon, K. MacIsaac, C. Bourbonnais, P.J. Schwinghamer, T.W. Rowell, D.L. McKeown, and W.P. Vass. 2001. Effects of experimental otter trawling on the macrofauna of a sandy bottom ecosystem on the Grand Backs of Newfoundland. Can. J. Fish. Aquat. Sci. 58: 1043-1057.

Lambert, G.I., S. Jennings, M.J. Kaiser, H. Hinz, and J.G. Hiddink. 2011. Quantification and prediction of the impact of fishing on epifaunal communities. Mar. Ecol. Prog. Ser. 430: 71–86.

Malecha, P., and J. Heifetz. 2017. Long-term effects of bottom trawling on large sponges in the Gulf of Alaska. Cont. Shelf Res. 150: 18-26.

McLaverty, C., G. Dinesen, H. Gislason, M. Brooks, and O. Eigaard. 2021. Biological traits of benthic macrofauna show size based differences in response to bottom trawling intensity. Mar. Ecol. Prog. Ser. 671: 1–19.

McLaverty, C., O. Eigaard, G. Dinesen, H. Gislason, A. Kokkalis, A. Erichsen, and J. Petersen 2020a. High-resolution fisheries data reveal effects of bivalve dredging on benthic communities in stressed coastal systems. Mar. Ecol. Prog. Ser. 642: 21–38.

McLaverty, C., O.R. Eigaard, H. Gislason, F. Bastardie, M.E. Brooks, P. Jonsson, A. Lehmann, and G.E. Dinesen. 2020b. Using large benthic macrofauna to refine and improve ecological indicators of bottom trawling disturbance. Ecol. Indicat. 110: 105811

McLaverty, C., O.R. Eigaard, J. Olsen, M.E. Brooks, J.K. Petersen, A.C. Erichsen, K. van der Reijden, and G.E. Dinesen. 2023. European coastal monitoring programmes may fail to identify impacts on benthic macrofauna caused by bottom trawling. J. Env. Manag. 334: 117510.

Ong, S., C.D. Levings, T.F. Sutherland, G.E. Piercey, V. Keong, and R. Davis. 2002. Data record on trawling and trapping effects on humpback shrimp bycatch organisms in Simoom Sound and Northumberland Channel. Can. Dat. Rep. Fish. Aquat. Sci. 1084: v + 47 p.

Pitcher, C.R., I.R. Poiner, B.J. Hill, and C.Y. Burridge. 2000. Implications of the effects of trawling on sessile megazoobenthos on a tropical shelf in northeastern Australia. ICES J. Mar. Sci. 57: 1359-1368.

Prena, J., Schwinghamer, P., Rowell, T.W., Gordon, D.C., Gilkinson, K.D., Vass, W.P, and McKeown, D.L. 1999. Experimental otter trawling on a sandy bottom ecosystem of the Grand Banks of Newfoundland: analysis of trawl by-catch and effects on epifauna Mar. Ecol. Prog. Ser. 181: 107-124.

Sanchez, P., Demestre, M., Ramon, M., and Kaiser, M.J. 2000. The impact of otter trawling on mud communities in the northwestern Mediterranean. ICES J. Mar. Sci. 57: 1352-1358.

Schratzberger, M., Jennings. S. 2002a Impacts of chronic trawling disturbance on meiofaunal communities. Mar. Biol. 141: 991-1000.

Schratzberger M., Dinmore, T., Jennings. S. 2002b. Impacts of trawling on the diversity, biomass and structure of meiofauna assemblages. Mar. Biol. 140: 83-93.

Schwinghamer, P. Gordon, D.C., Rowell, T.W., Prena, J., McKeown, D.L, Sonnichsen, G., and Guigné, J.Y. 1998. Effects of experimental otter trawling on surficial sediment properties of a sandy-bottom ecosystem on the Grand Banks of Newfoundland. Cons. Biol. 12: 1215-1222.

Sutherland, T.F., Levings, C.D., Chang, H., and Piercey, G.E. 2023a. Sediment attributes and infaunal abundance in Simoom Sound, British Columbia, Canada. Can. Dat. Rep. Fish. Aquat. Sci. 1366: viii + 26 p.

Sutherland, T.F., Levings, C.D., Keong, V., MacLean, H., and Piercey, G.E. 2023b. Shrimp and Fish Abundance Observed by a Towed-Video Along Trawling and Trapping Transects in Simoom Sound, British Columbia, Canada. Can. Dat. Rep. Fish. Aquat. Sci. 1378: vii + 39 p.

Troffe, P.M., S. Ong, C.D. Levings, and T.F. Sutherland. 2003. Anatomical damage to humpback shrimp, *Pandalus Hypsinotus* (BRANDT 1851) caught by trawling and trapping. J. Shell. Res. 22(2): 561 – 568.

Troffe, P.M., C.D. Levings, T.F. Sutherland, V. Keong, and G.E. Piercey, 2002. Data report on beam trawl and prawn trap catches in Clio Channel, British Columbia. Can. Dat. Rep. Fish. Aquat. Sci. 1115: vii +21 p.

Troffe, P.M., Levings, C.D., Sutherland, T.F., Chang, H., Piercey, G.E., Petersen, S.A., Keong, V., Poon, P., McDermid, M., and Sunday, J. 2024. Data record on sediment attributes and infaunal diversity on Beam-Trawl and Trap-Line transects in Clio Channel, British Columbia, Canada. Can. Dat. Rep. Fish. Aquat. Sci. 1388: viii + 32 p.

Troffe, P.M., C.D. Levings, G. (Beth) E. Piercey and Victor Keong. 2005. Fishing gear effects and ecology of the sea whip (Halipteris willemoesi *(Cnidaria: Octocorallia: Pennatulacea*)) in British Columbia, Canada: preliminary observations. Aquat. Conserv. Mar. Freshw. Ecosyst. 15: 523-533.

Tuck, I.D., Hall, S.J., Robertson, M.R., and Basford, D.J. 1998. Effects of physical trawling disturbance in a previously unfished sheltered Scottish sea loch. Mar. Ecol. Progr. Ser. 162: 227-242.