County: Skagit
Grant No: G1200389

PROJECT TITLE: Community Beach Seining at Ship Harbor, Fidalgo Island, Washington

DELIVERABLES FOR TASK NO: 2, Community Beach Seining

PROJECT FINAL REPORT: [X]

PERIOD COVERED: January 1, 2012 to June 30, 2012

DATE SUBMITTED: 28 June 2012

PugetSoundPartnership
our sound, our community, our chance

This project has been funded wholly or in part by the United States Environmental Protection Agency. The contents of this document do not necessarily reflect the views and policies of the Environmental Protection Agency, nor does mention of trade names or commercial products constitute endorsement or recommendation for use.

Acknowledgments

The Skagit County Marine Resources Committee thanks the following for their valuable assistance with the Community Beach Seining Project:

Report Authors: Paul Dinnel and Jude Apple, Shannon Point Marine Center

Project Management: Tracy Alker, Skagit County Public Works.

Vessel Operator: Nathan Schwarck

WSU Beach Watcher, Skagit MRC, Shannon Point Marine Center and Community Volunteers: Dan Penttila, Dixon Elder, Don Clift, Pat Steffani, Pattie Hutchins, Caroline Gibson, Cory Tolman, Tessa Minicucci, Mark Callaghan, Erik Dinnel, Jenna Walker, Jeff Hester, Sarah Deland, Hannah Clark, Helen Harris, Lynn Coffelt, Elyse Eticher, Azucena Castro, Lance Brockie, Tom Richards, Eric Lewis, Patrisha Lane, Vicki McNeil, Lin Folsom, Phyllis Thoreson, Chris Brown, Vincent Felissmo, Judy Bown, Erica Pickett, Elizabeth Richards, Dan McCroskey, Bob Weathers, Bruce McDanold, Kathleen McDanold, Ana-Mai Christmas, Denise Crowe, Rick Haley, Gene McKeen, Jay Dimond, Peter Hasse, Mike Muhundro, Victor Garcia and his Anacortes High School students and various unnamed community members.

Partner Organizations: Shannon Point Marine Center, Skagit County WSU Beach Watchers, City of Anacortes, Port of Anacortes.

United States Environmental Protection Agency

Washington State Department of Ecology

Northwest Straits Marine Conservation Initiative

Shannon Point Marine Center

Community Beach Seining at Ship Harbor, Fidalgo Bay, Washington, 2011 and 2012

Introduction

One of the goals of the Northwest Straits Commission is to facilitate citizen science by training local citizens on how to collect scientific data and monitor the status of our marine resources and habitats. A second goal of the Commission is to provide education and outreach activities for local communities. The purpose of the Community Beach Seining project is to address both of these goals by using community volunteers to collect fish monitoring data and interact with interested community citizens by including them in the sampling efforts and data collection.

Beach seining at Ship Harbor is continuing, in part, the fish sampling initiated at this location in 2010 as part of Skagit County Marine Resources Committee's (Skagit MRC) Cannery Pond Evaluation Project, which was primarily conducted by a WWU graduate student (Dinnel and Seyl 2011). Continuation of fish sampling in 2011, 2012 and beyond will provide a longer term fish database for this North Fidalgo Island (west Guemes Channel) location, which is not being monitored for fish by any other organization. All data collected will be forwarded to Skagit River Systems Cooperative, which maintains an extensive database for seine sampling in Skagit County waters, especially in relation to juvenile salmonid species.

Methods

The location of the beach seining site is Ship Harbor, which is located on the northwest side of Fidalgo Island just east of the Washington State San Juan Island Ferry Terminal (Fig. 1). The tidelands are owned by the Port of Anacortes and the uplands are owned by the City of Anacortes, both which have given their permission for site access

All seining activities were conducted at high tides (+6.0 foot or higher). The site substrate is sand with a cobble fringe at the high tide level. The dominant vegetation is algae, with sea lettuce (*Ulva* spp.) being the dominant vegetation.

The two Community Beach Seine sampling and education events were held on 8 August 2011 and 14 June 2012. Sampling was conducted with a large net beach seine measuring 120' (36.6 m) long by 12' (3.7 m) deep by 1/8" (0.3 cm) mesh knotless nylon net using sampling protocols established by the Skagit River System Cooperative Research Department (SRSC 2003) (Appendix 3). The beach seine was set using Shannon Point Marine Center's research vessel *Fauna* (Fig. 2). The net was set three successive times for four minutes each before being pulled to the beach by volunteers (Figs. 3 and 4). Once the net was retrieved, volunteers then captured all fish in the net and identified each fish to species or genus and measured each fish for total length (or counted excess fish when there were more than 25 of a given species -- Fig. 5), using the following fish guides: Hart 1973, Kramer et al. 1995, The Mountaineers 1984, Steele 2011, and a locally produced laminated fish guide based on illustrations posted on the Oregon Department of Fish and Wildlife's website (http://www.dfw.state.or.us/MRP/FishID/FishIDLists.asp). All fish were handled

carefully, maintained in large buckets of seawater until measured and released alive at the sampling site.

Measurements of surface salinity and water temperature were also collected at the sampling location.

Results

Fish Catches

The three August 2011 beach seine samples contained 97, 136 and 161 fish for a total of 394 fish for all three samples. The three June 2012 seine samples contained 321, 538 and 286 fish for a total of 1,145 fish (Table 1). Nineteen species (or groups of species) were represented in the samples including:

Juvenile Chinook salmon, *Oncorhynchus tshawytscha*
Juvenile coho salmon, *Oncorhynchus kisutch*
Juvenile sockeye salmon, *Oncorhynchus nerka*
Juvenile chum salmon, *Oncorhynchus keta*
Juvenile pink salmon, *Oncorhynchus gorbuscha*
Starry flounder, *Platichtys stellatus*
English sole, *Parophrys vetulus*
Pacific shiner perch, *Cymatogaster aggregata*
Buffalo sculpin, *Enophrys bison*
Staghorn sculpin, *Leptocottus armatus*
Other sculpins, Family Cottidae
Surf smelt, *Hypomesus pretiosis*
Pacific herring, *Clupea pallasi*
Pacific sand lance, *Ammodytes hexapterus*
Greenling sp. (*Hexagrammos* sp.)
Snake prickleback, *Lumpenus sagitta*
Three-spined stickleback, *Gasterosteus aculeatus*
Gunnel sp., Family Pholidae
Larval rockfish, Family Scorpaenidae

All of the above fish species (or groups of species) were observed in the June 2012 catches but only 10 of the species were observed in the August 2011 catches (Table 1). All of these are species common to Puget Sound. Of particular note were the catches of juvenile pink salmon in 2012, the adults having spawned in Puget Sound in the fall of 2011. This salmon species has a two year life cycle, so juvenile pink salmon will normally occur in Puget Sound during the spring/summers of even numbered years (Hart 1973).

Size frequency histograms were prepared for some of the most commonly caught species (Figs. 6-13). These histograms show that all of the Chinook and pink salmon were caught in 2012 and were juveniles in transit from their natal rivers to the ocean (Figs. 6 and 7). Surf smelt, only caught in 2012, were mostly juveniles (40-100 mm) (Fig 8). English sole and starry flounder were caught in both years and were all juveniles, the sizes indicating that these fish likely represented two year classes (Figs. 9 and 10). Pacific shiner perch were caught in both years and were all adults (Fig. 11). This species should produce live

young later in the year, which will measure on the order of 20-40 mm in length. Snake prickleback were caught in both years and were all adults measuring between 80-220 mm (Fig. 12). Staghorn sculpin were very common in the catches of both years and included a wide range of sizes from juveniles to adults (Fig. 13). Summaries of the individual fish sizes (or subset of fish when many of a given species were caught) appear in Appendix Tables 1 and 2.

Temperature and Salinity

Surface water temperatures recorded at the Ship Harbor seining site were 13.3 and 12.5 °C for 8 August 2011 and 14 June 2012, respectively. The surface water salinities for the site were 27.5 and 29.5‰, for August and June, respectively.

Community Beach Seine Partners and Participants

This project was coordinated by Skagit MRC (project coordination/administration, data management, report preparation and the beach seine) in cooperation with Shannon Point Marine Center (boat and skipper, two Marine Scientists and students), the City and Port of Anacortes (site access) and WSU Beach Watchers (assist with setting the seine, measuring and identifying the fish, recording the data and interacting with the public invited to the events). Volunteers for these two seining events included:

- Thirteen Shannon Point Marine Center participants, including two Marine Scientists (Drs. Paul Dinnel and Jude Apple) SPMC Outreach Coordinator (Denise Crowe), SPMC staff (Gene McKeen and Jay Dimond) and eight graduate and undergraduate students (most from the Research Experience for Undergraduates Program funded by the National Science Foundation)

- Nineteen trained Washington State University Beach Watchers

- Teacher (Victor Garcia) and students from Anacortes High School

- One person (Caroline Gibson) from the Northwest Straits Foundation

- In addition, approximately 30-40 interested citizens and kids from the community (including persons walking the beach while waiting in the ferry line) participated in the event.

Volunteer Hours

Total volunteer time expended for the two Community Beach Seining events, including the sampling efforts, project coordination/administration and progress and final report preparation was 180 hours. This does not include the efforts by the 30-40 citizens from the community who assisted with (or observed) the sampling.

Cost Matching

Most of the cost for this project was for the research vessel used to set the beach seine and the skipper's time. The hourly cost for the vessel and skipper was $110/hour. Four hours of vessel/skipper time were used for the first Community Beach Seine event and five hours for the second. Skagit MRC provided half of the funding ($550) for both sampling events. Dr. Steve Sulkin, Director of the Shannon Point Marine Center, contributed the other half of the vessel charter fees as a co-partner for this effort.

Event Advertising

Advertising for this event appeared in several editions of the local *Anacortes American* weekly newspaper in the Community Events section and one edition of the *Skagit Valley Herald* Following is an example press release prepared for the events and sent to the local newspapers for publication:

Press Release
Invitation to Community Beach Seine Sampling

> Skagit County Marine Resources Committee (Skagit MRC) and Shannon Point Marine Center are co-sponsoring a Community Beach Seine sampling event at Ship Harbor, next to the San Juan Ferry Terminal in Anacortes on Thursday, June 14th. Students, community members and any interested persons are invited to assist and learn about local marine life. Skagit County Beach Watchers, Skagit MRC members and students and staff of Shannon Point Marine Center will be on hand to lead the sampling effort and identify and measure fish caught in the net. Sampling will take place from 3:00 to 5:00 PM. To find out more information or to volunteer for this event, call Paul Dinnel at 360-293-2188 (mornings) or 360-299-8468 (afternoons, evenings, weekends) or e-mail: padinnel@aol.com.

Event Press Coverage

The 14 June 2012 beach seining was covered by Kimberly Jacobson of the *Anacortes American*. Her article was published in the 20 June 2012 issue of the paper (Appendix 4)

Future Community Beach Seining Events

One more Community Beach Seining event will be held during August 2012. This event will be jointly funded by the Northwest Straits Foundation and Shannon Point Marine Center. Additional sampling after August 2012 will depend on continued funding by Skagit County Marine Resources Committee or other funding sources.

References

Dinnel, P. and H. Seyl. 2011. Investigation into the historic status of Cannery Pond, and its potential for restoration as a future pocket estuary. Final Report by Shannon Point Marine Center, Western Washington University for the Skagit County Marine Resources Committee and the Northwest Straits Commission, Mt. Vernon, WA. 51 pp.

Hart, J.L. 1973. Pacific Fishes of Canada. Bulletin 180, Fisheries Research Board of Canada, Ottawa, Canada. 740 pp.

Kramer, D.E., W.H. Barass, B.C. Paust and B.E. Bracken. 1995. Northeast Pacific Flatfishes. Marine Advisory Bulletin No. 47, Alaska Sea Grant Program, University of Alaska Fairbanks. 104 pp.

SRSC (Skagit River System Cooperative). 2003. Estuarine fish sampling methods, March 2003. Beach seine and fyke trap sampling protocol. 8 pp.

Steele, E. 2011. Juvenile salmon identification. http://fisheries.btc.ctc.edu/Handout/Juvenile%20Salmon.pdf.

The Mountaineers. 1984. Mac's field guide to northwest coastal fish. Laminated field guide, Seattle, WA.

Table 1. Total beach seine fish catches by species, August 8, 2011 and June 14, 2012 from Ship Harbor, NW Fidalgo Island. The entries are the total number of fish caught in each of the three replicate sets on each date and total for each date.

	August 8, 2011				June 14, 2012			
Species	Replicate 1	Replicate 2	Replicate 3	**Total**	Replicate 1	Replicate 2	Replicate 3	**Total**
Sockeye salmon	0	0	0	**0**	2	0	0	**2**
Chinook salmon	0	0	0	**0**	0	5	8	**13**
Coho salmon	1	0	1	**2**	0	0	1	**1**
Chum salmon	0	0	0	**0**	0	2	1	**3**
Pink salmon	0	0	0	**0**	46	175	2	**223**
Surf smelt	0	0	0	**0**	37	2	3	**42**
Pacific sandlance	0	0	0	**0**	2	3	1	**6**
English sole	22	39	41	**102**	157	149	48	**354**
Starry flounder	4	16	12	**32**	8	14	14	**36**
Shiner perch	60	53	78	**191**	0	60	136	**196**
Snake prickleback	0	6	0	**6**	15	18	5	**38**
Greenling[1]	0	2	1	**3**	1	0	0	**1**
3-spined stickleback	0	0	2	**2**	1	0	0	**1**
Gunnel[1]	0	1	7	**8**	5	6	4	**15**
Pacific herring	0	0	0	**0**	0	2	1	**3**
Staghorn sculpin	9	19	19	**47**	40	100	31	**171**
Buffalo sculpin	1	0	0	**1**	0	2	0	**2**
Other sculpin sp.	0	0	0	**0**	7	0	28	**35**
Larval rockfish	0	0	0	**0**	0	0	3	**3**
Total fish	97	136	161	**394**	321	538	286	**1,143**

[1]Identified to genus only.

Figures

Figure 1. Location of the beach seining site at Ship Harbor, just east of the San Juan Island Ferry Terminal, northwest Fidalgo Island. Photo source: Washington Department of Ecology.

Figure 2. Beach seine being set by volunteers and the Research vessel *Fauna*.

Figure 3. Volunteers and citizens from the community pulling in the beach seine.

Figure 4. Volunteers and citizens from the community pulling in the beach seine.

Figure 5. Volunteers and community members identifying, measuring and recording fish caught in the beach seine.

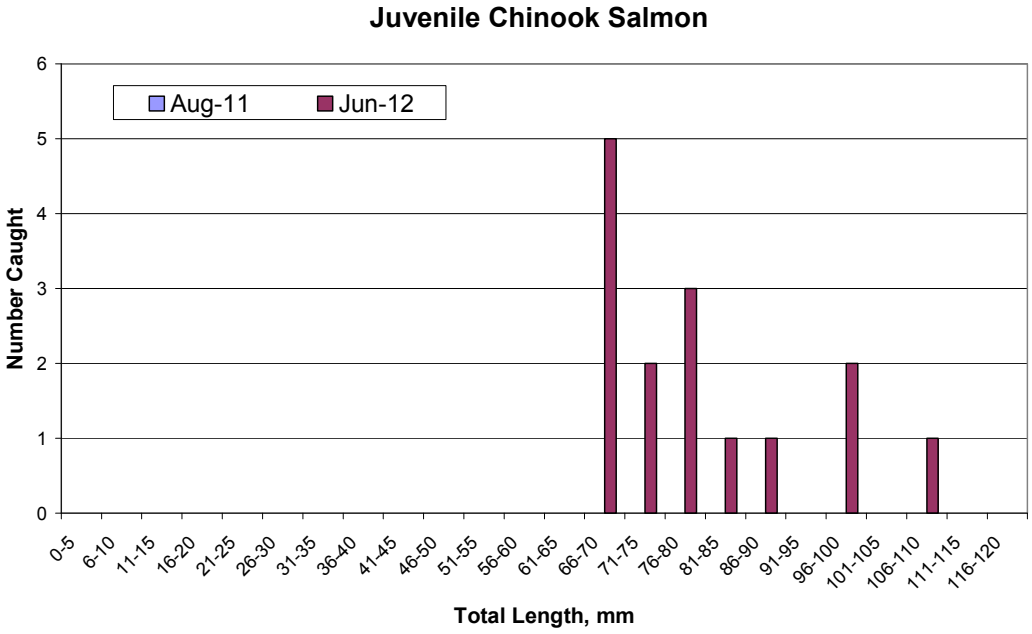


Figure 6. Size frequency distribution for juvenile Chinook salmon caught in June 2012. No Chinook salmon were caught in 2011.

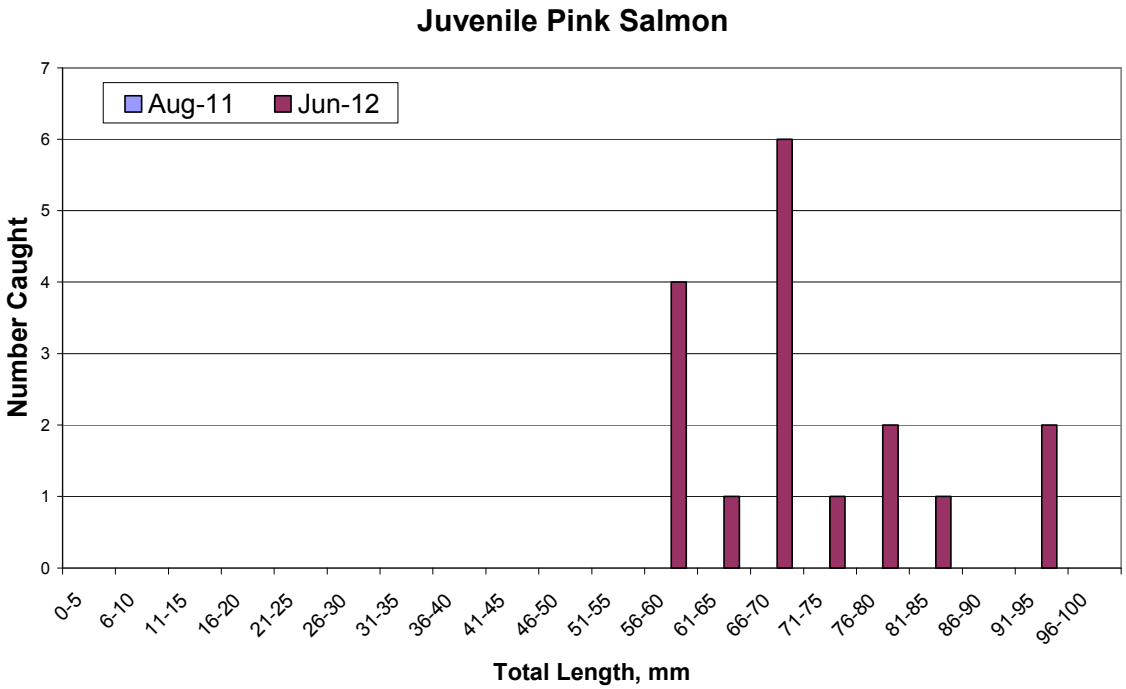


Figure 7. Size frequency distribution for juvenile pink salmon caught in June 2012. No pink salmon were caught in 2011.

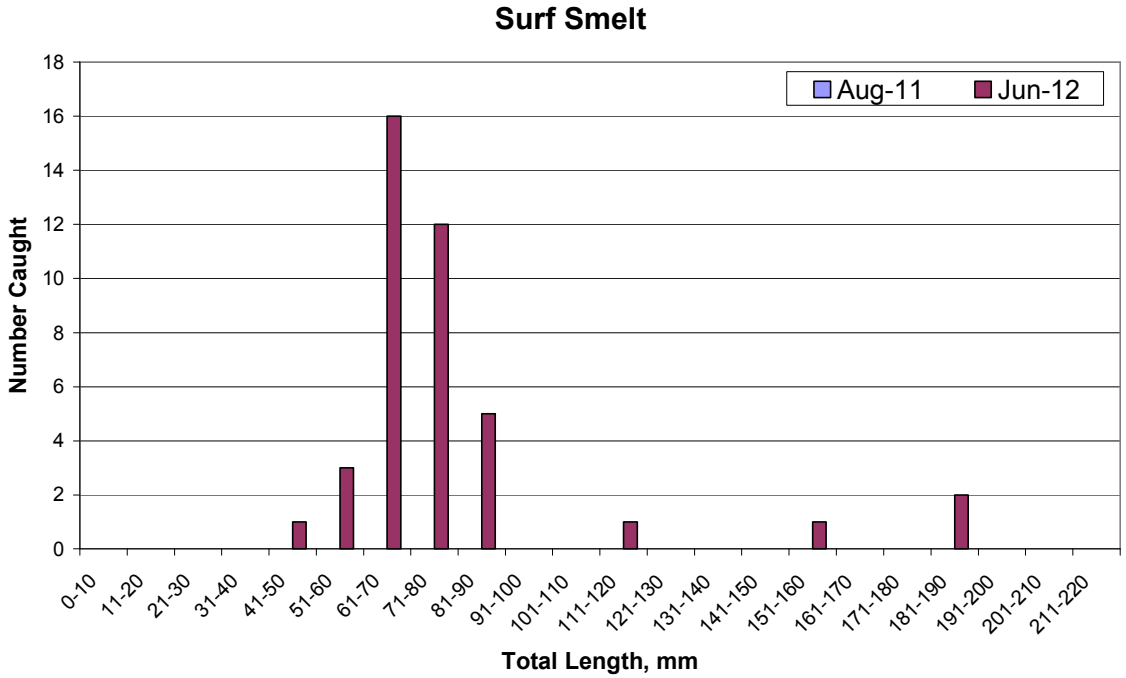


Figure 8. Size frequency distribution for surf smelt caught in June 2012. No surf smelt were caught in 2011.

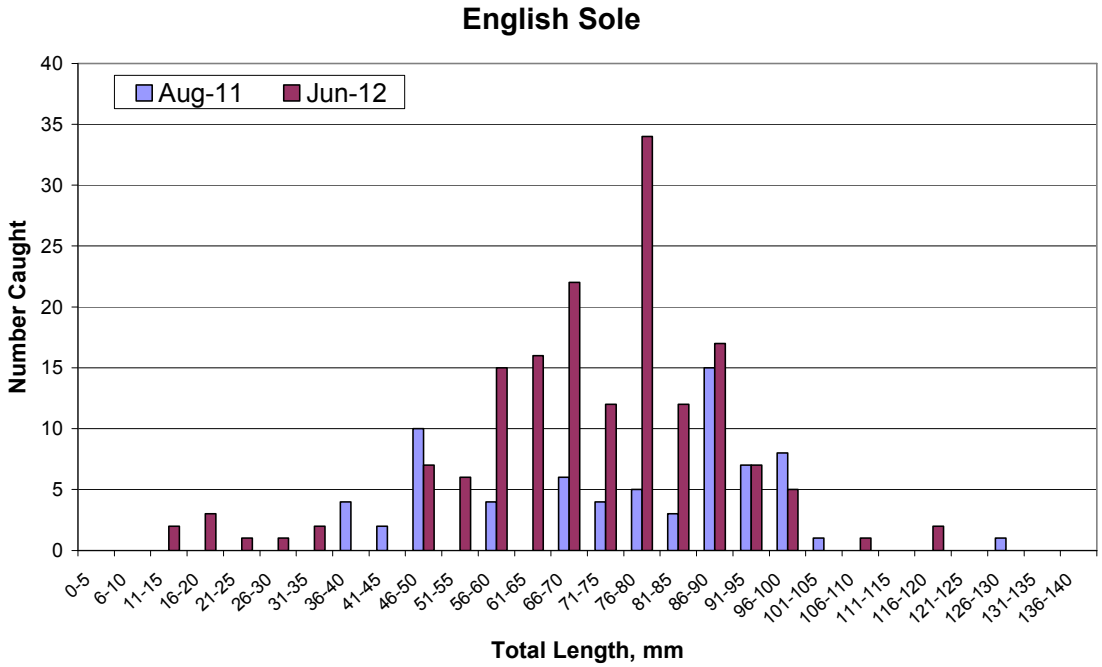


Figure 9. Size frequency distribution for English sole caught in August 2011 and June 2012.

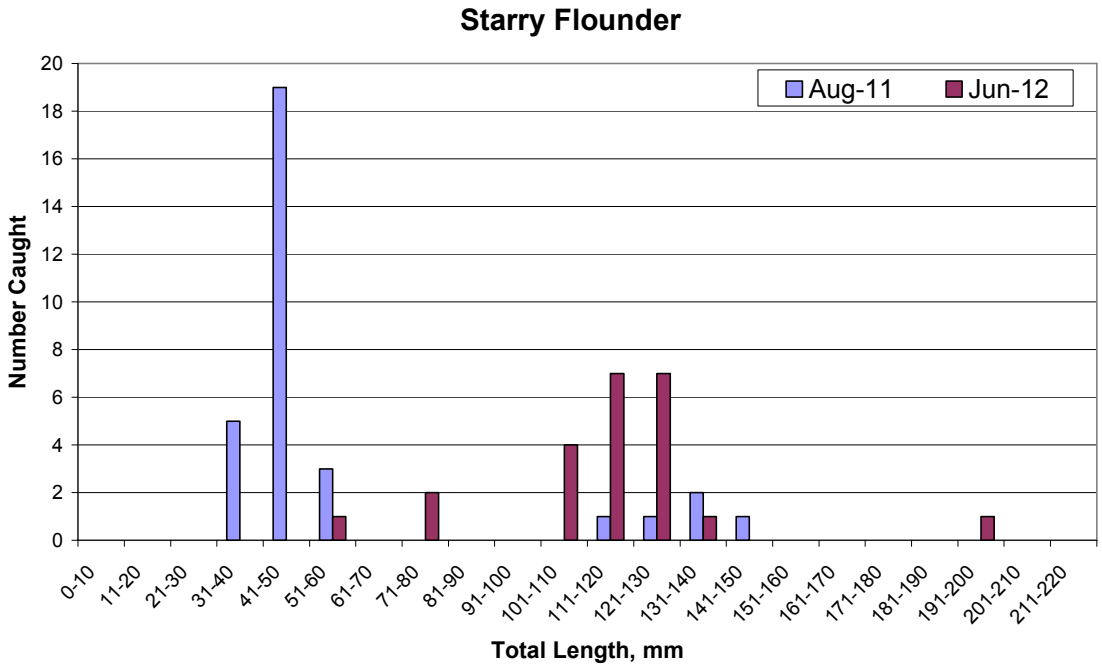


Figure 10. Size frequency distribution for starry flounder caught in August 2011 and June 2012.

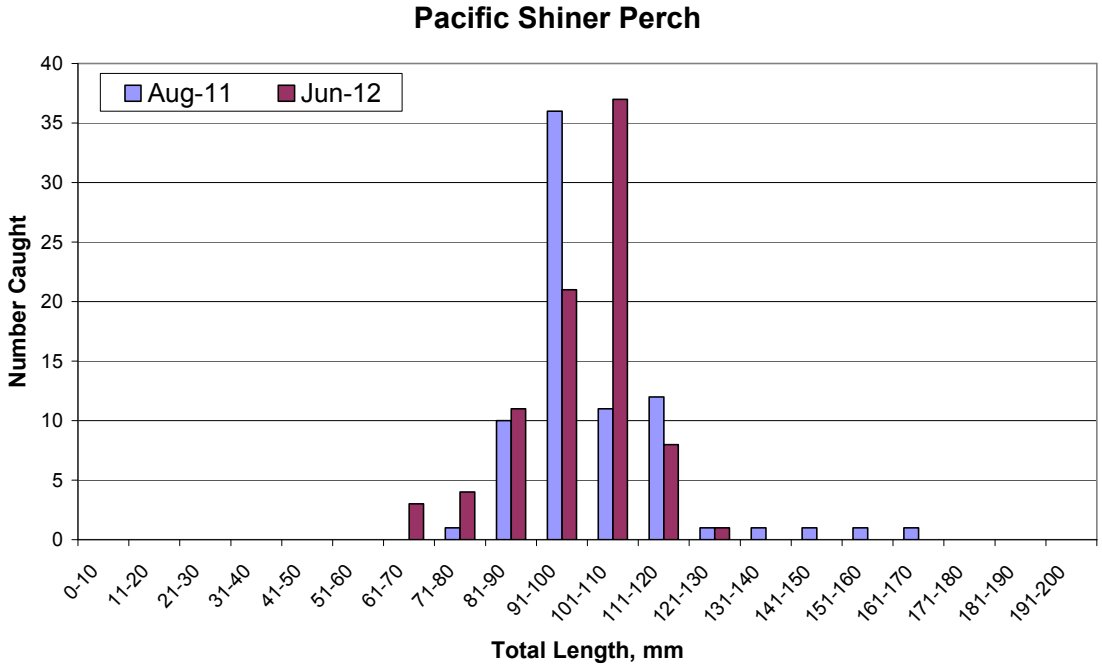


Figure 11. Size frequency distribution for Pacific shiner perch caught in August 2011 and June 2012.

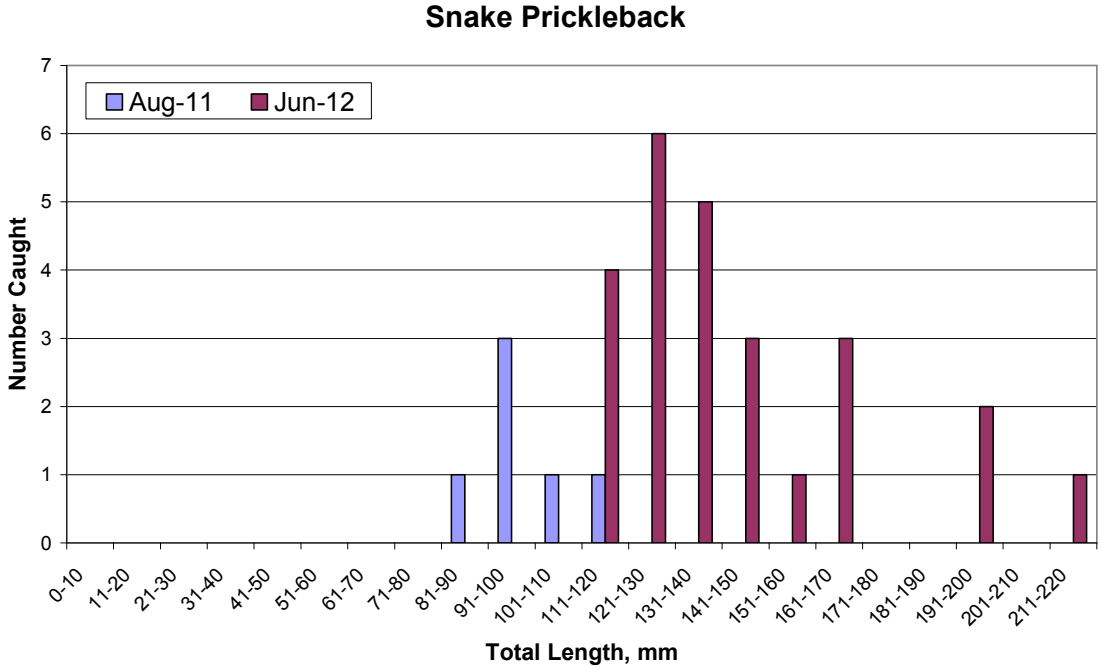


Figure 12. Size frequency distribution for snake prickleback caught in August 2011 and June 2012.

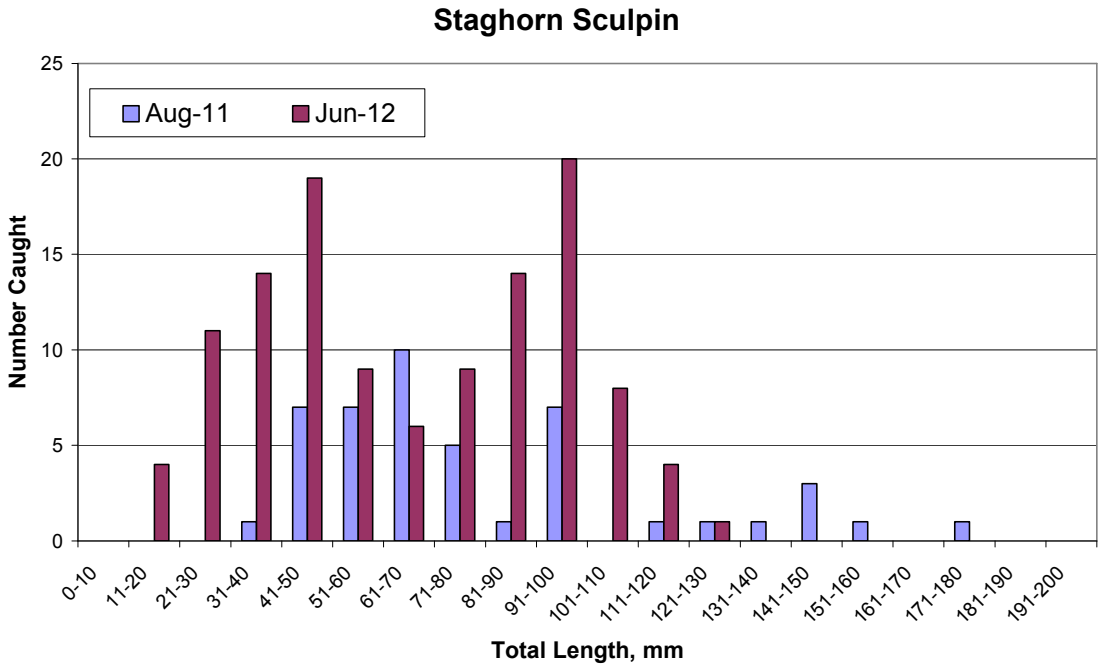


Figure 13. Size frequency distribution for staghorn sculpin caught in August 2011 and June 2012.

Appendix 1. Total lengths (mm) of fish caught in three replicate sets of the Community Beach Seining August 8, 2011.

Replicate	Coho Salmon	English Sole	Starry Flounder	Shiner Perch	Snake Prickleback	Greenling sp.	Three-spined Stickleback	Gunnel sp.	Staghorn Sculpin	Buffalo Sculpin
1	130	100	45	80					90	130
1		100	130	104					150	
1		100	140	115					80	
1		85	120	132					130	
1		60		100					70	
1		80		95					60	
1		90		115					50	
1		130		100					66	
1		70		90						
1		95		90						
1		100		115						
1		100		105						
1		80		100						
1		70		97						
1		70		100						
1		80		95						
1		50		120						
1		50		95						
1		100		85						
1		50		100						
1		50		90						
1		50		110						
1				110						
1				95						
1				90						
2		60	145	100	90	105		100	150	
2		45	50	110	115	115			120	
2		50	45	95	105				150	
2		40	50	115	95				75	
2		50	45	100	100				60	
2		70	45	95	95				65	

App. 1

Replicate	Coho Salmon	English Sole	Starry Flounder	Shiner Perch	Snake Prickleback	Greenling sp.	Three-spined Stickleback	Gunnel sp.	Staghorn Sculpin	Buffalo Sculpin
2		75	45	115					95	
2		90	135	100					45	
2		90	50	100					75	
2		95	50	120					50	
2		105	55	105					35	
2		80	45	150					180	
2		90	50	170					50	
2		70	50	95					55	
2		75	50	100					100	
2		90	60	100					80	
2		95		100					65	
2		95		100					55	
2		75		115					80	
2		85		125						
2		85		115						
2		75		90						
2		90		120						
2		95		95						
2				100						
3	130	45	55	105		130	70	100	100	
3		50	45	110			70	100	55	
3		90	40	115				90	160	
3		40	40	100				90	135	
3		90	40	90				110	70	
3		90	50	100				100	95	
3		90	50	110				110	100	
3		95	50	100					95	
3		50	40	100					100	
3		70	40	115					70	
3		60	45	90					60	
3		90	45	85					70	
3		60		100					70	

App. 1.

Replicate	Coho Salmon	English Sole	Starry Flounder	Shiner Perch	Snake Prickleback	Greenling sp.	Three-spined Stickleback	Gunnel sp.	Staghorn Sculpin	Buffalo Sculpin
3		90		160					60	
3		40		95					50	
3		40		100					50	
3		50		95					50	
3		90		95					70	
3		90		105					70	
3		95		90						
3		90		100						
3		100		105						
3		100		100						
3		50		100						
3		80		100						

Appendix 2. Total lengths (mm) of fish caught in three replicate sets of the Community Beach Seining June 14, 2012.

Replicate	Sockeye Salmon	Chinook Salmon	Coho Salmon	Chum Salmon	Pink Salmon	English Sole	Starry Flounder	Shiner Perch	Snake Prickleback
1	110				100	110	125		200
1	90				80	75	125		220
1					85	80	130		130
1					80	85	80		130
1					60	80	72		150
1					75	90	110		200
1					60	85	11		130
1					75	100	55		160
1					50	90			130
1					65	25			140
1					70	60			120
1					70	60			170
1					70	75			165
1					75	70			135
1					70	80			135
1					70	90			
1					80	90			
1					85	100			
1					75	75			
1					85	60			
1					80	80			
1					80	60			
1					70	70			
1					90	100			
1					95	60			
1					90	85			
1					80	80			
1					60	75			
1					70	60			
1					60	55			
1					70	72			
1					95	70			
1					70	90			
1					75	92			
1					80	72			
1					65	82			
1					85	72			
1						60			
1						80			
1						70			
1						72			
1						60			
1						60			
1						65			
1						62			
1						80			
1						92			
1						95			
1						82			

App. 2.

Replicate	Sockeye Salmon	Chinook Salmon	Coho Salmon	Chum Salmon	Pink Salmon	English Sole	Starry Flounder	Shiner Perch	Snake Prickleback
1						85			
1						51			
1						15			
1						90			
1						50			
1						55			
1						80			
1						90			
1						35			
1						55			
1						65			
1						50			
1						70			
1						20			
1						80			
1						80			
1						90			
1						65			
1						65			
1						60			
1						20			
1						70			
1						15			
1						30			
1						35			
1						20			
2		75		70	60	80	200	90	130
2		90		75	60	90	120	80	170
2		70			70	90	130	70	120
2		70			70	80	120	82	150
2		70				80	105	105	150
2						120	125	85	
2						80	120	115	
2						80	110	80	
2						90	130	65	
2						70	120	85	
2						80	125	110	
2						80	120	80	
2						50	120	90	
2						50	140	110	
2						90		85	
2						50		70	
2						70		82	
2						80		85	
2						70		95	
2						80		75	
2						70		85	
2						70		130	
2						80		120	

App. 2.

Replicate	Sockeye Salmon	Chinook Salmon	Coho Salmon	Chum Salmon	Pink Salmon	English Sole	Starry Flounder	Shiner Perch	Snake Prickleback
2						70		100	
2						90			
2						95			
2						80			
2						60			
2						85			
2						90			
2						65			
2						65			
2						75			
2						90			
2						80			
2						90			
2						85			
2						65			
2						55			
2						85			
2						70			
2						120			
2						70			
2						75			
2						65			
2						80			
2						80			
2						65			
2						80			
2						80			
2						85			
2						70			
2						65			
2						75			
2						80			
2						100			
2						100			
2						80			
3		77	125	60	90	80	120	100	140
3		100			120	50		110	120
3		110				95		110	140
3		80				60		90	120
3		85				70		110	130
3		100				90		115	
3		70				80		105	
3		80				60		110	
3						60		90	
3						80		110	
3						50		110	
3						95		110	
3						85		110	
3						70		100	

App. 2.

Replicate	Sockeye Salmon	Chinook Salmon	Coho Salmon	Chum Salmon	Pink Salmon	English Sole	Starry Flounder	Shiner Perch	Snake Prickleback
3						85		120	
3						80		110	
3						70		110	
3						80		110	
3						65		110	
3						65		110	
3						65		100	
3						65		110	
3						75		100	
3						80		100	
3						75		100	
3						70		105	
3						65		105	
3						70		110	
3						70		100	
3						55		100	
3						60		105	
3						70		110	
3								95	
3								110	
3								105	
3								100	
3								100	
3								110	
3								120	
3								110	
3								100	
3								100	
3								110	
3								105	
3								110	
3								115	
3								110	
3								100	
3								100	
3								110	
3								95	
3								95	
3								110	
3								110	
3								100	
3								115	
3								120	
3								110	
3								100	
3								110	
3								110	

Appendix 2 continued.

Replicate	Greenling sp.	Three-spined Stickleback	Gunnel sp.	Staghorn Sculpin	Buffalo Sculpin	Surf Smelt	Sandlance	Pacific Herring	Sculpin sp.
1	90	60	100	110		70	65		70
1			140	90		85	75		40
1			140	100		80			35
1			100	90		65			30
1				120		85			20
1				95		70			45
1				100		70			20
1				120		75			
1				90		115			
1				80		85			
1				90		70			
1				95		50			
1				70		70			
1				110		65			
1				100		80			
1				100		80			
1				110		70			
1				90		70			
1				20		70			
1				50		60			
1				85		75			
1				50		70			
1				50		90			
1				48		80			
1				50		70			
1				45		80			
1				45		75			
1				55		65			
1				40		60			
1				40		55			
1				35		80			
1				35		65			
1				40		70			
1				25		75			
1				35		65			
1				40		80			
1				45					
1				40					
1				35					
1				35					
1									
1									
1									
1									
1									
1									
1									

Appendix 2 continued.

Replicate	Greenling sp.	Three-spined Stickleback	Gunnel sp.	Staghorn Sculpin	Buffalo Sculpin	Surf Smelt	Sandlance	Pacific Herring	Sculpin sp.
1									
1									
1									
1									
1									
1									
1									
1									
1									
1									
1									
1									
1									
1									
1									
1									
1									
1									
1									
1									
1									
1									
1									
1									
1									
1									
1									
1									
2			80	70	160	80	90		
2			110	10	130	90	75		
2				80					
2				70					
2				100					
2				100					
2				90					
2				100					
2				90					
2				80					
2				100					
2				100					
2				110					
2				95					
2				90					
2				70					
2				55					
2				55					

Appendix 2 continued.

Replicate	Greenling sp.	Three-spined Stickleback	Gunnel sp.	Staghorn Sculpin	Buffalo Sculpin	Surf Smelt	Sandlance	Pacific Herring	Sculpin sp.
2				70					
2				30					
2				30					
2				60					
2				35					
2				100					
2				100					
2				90					
2				110					
2				80					
2				120					
2				85					
2				80					
2				130					
2				65					
2				80					
2				45					
2				50					
2				60					
2				110					
2				60					
2				90					
2				90					
2				100					
2				100					
2				80					
2				95					
2				95					
2				110					
2				100					
2									
2									
2									
2									
2									
2									
2									
2									
2									
2									
3			120	50		160	55	210	
3			120	50		190			
3				45		190			
3				55					
3				40					
3				20					

Appendix 2 continued.

Replicate	Greenling sp.	Three-spined Stickleback	Gunnel sp.	Staghorn Sculpin	Buffalo Sculpin	Surf Smelt	Sandlance	Pacific Herring	Sculpin sp.
3				30					
3				50					
3				20					
3				25					
3				110					
3				120					
3				80					
3				40					
3				55					
3				45					
3				45					
3				60					
3				30					
3				25					
3				30					
3				50					
3				50					
3				35					
3				30					
3				30					
3				30					
3				20					
3				42					
3				90					
3				80					
3									
3									
3									
3									
3									
3									
3									
3									
3									
3									
3									
3									
3									
3									
3									
3									
3									
3									
3									
3									
3									
3									

Appendix 2 continued.

Replicate	Greenling sp.	Three-spined Stickleback	Gunnel sp.	Staghorn Sculpin	Buffalo Sculpin	Surf Smelt	Sandlance	Pacific Herring	Sculpin sp.
3									
3									
3									
3									
3									
3									
3									
3									

Appendix 3. Protocol used for the beach seine sampling.

Skagit System Cooperative
Research Department
P.O. Box 368
11426 Moorage Way
La Conner, WA 98257-0368

ESTUARINE FISH SAMPLING METHODS
March 2003

We sample estuarine habitat using three different methods (small net beach seine, large net beach seine, and fyke trap) depending on the habitat types.

Small net beach seine methods are used for sampling shallow intertidal shoreline areas of Skagit and Padilla Bays or distributary channel habitat in the Skagit tidal delta and Swinomish Channel. The areas seined are typically less than 4ft deep (1.2m) and have relatively homogeneous habitat features such as: water depth and velocity, substrate, and vegetation. Small net beach seine methodology uses an 80' (24.4m) by 6' (1.8m) by 1/8" (0.3cm) mesh knotless nylon net (Figure 1). The net is set in "round haul" fashion by fixing one end of the net on the beach while the other end is deployed by wading the net "upstream" against the water current using a floating tote, and then returning to the shoreline in a ½ circle. Both ends of the net are then retrieved yielding a catch. We typically conduct three sets per site.

Large net beach seine methods are used for sampling the intertidal-subtidal fringe of the Skagit and Padilla Bays. These areas are typically deeper than the areas seined by small net beach seine, ranging from 6-15ft (1.8-4.6m) requiring a longer and deeper net. Large net beach seine methodology uses a 120' (36.6m) by 12' (3.7m) by 1/8" (0.3cm) mesh knotless nylon net where one end of the net is fixed on the beach while the other end is set by boat across the current at an approximate distance of 60% of the net's length (Figure 2). After the set has been held open against the tidal current for a period of about 4 minutes, the boat end is brought to the shoreline edge and both ends are retrieved yielding a catch in the net's bunt section. We typically conduct three sets per site.

Fyke trap methods are used for sampling blind tidal channel habitat in the Skagit tidal delta, Swinomish Channel corridor, and southern Padilla Bay. Fyke trap methodology uses nets constructed of 1/8" (0.3cm) mesh knotless nylon with a 2' (0.6m) by 9' (2.7m) diameter cone sewn into the net to collect fish draining out of the blind channel site (Figure 3). Overall net dimensions (length and depth) are variable depending on the site's cross-sectional channel dimensions. All nets are sized to completely block fish access at high tide. The net is set across the blind channel site at high tide and "fished" through the ebb tide yielding a catch. The juvenile Chinook catch is adjusted by a trap recovery efficiency (RE) estimate that is derived from mark-recapture experiments using a known number of marked fish released upstream of the trap at high tide. RE is usually related to

hydraulic characteristics unique to the site (e.g., change in water surface elevation during trapping, or water surface elevation at the end of trapping). Multiple RE tests (several times per season) at each site are used to develop a regression model to convert the "raw" juvenile Chinook catch to an estimated population within the habitat upstream of the fyke trap on any sampling day.
Data collected for each beach seine set include:

- Time and date of set
- Tidal stage (ebb, flood, high tide slack, low tide slack)
- Water surface area seined
- Length of time the set is held open (large net only)
- Surface and bottom water temperature of area seined using YSI meter
- Surface and bottom salinity of area seined using YSI meter
- Maximum depth of area seined
- Average surface water velocity (small net only) using a flow meter
- Substrate of area seined following the definitions shown in Table 1 (small net only, unless substrate type is uniform for large net area)
- Vegetation of area seined following the definitions shown in Table 2 (small net only, unless vegetation type is uniform for large net area)
- Complete fish catch records by species following the coding shown in Table 3
- Sub-sample of individual juvenile chinook lengths and weights (following mark coding shown in Table 4)
- Sub-sample of individual lengths on all other fish species (following mark coding shown in Table 4)

Data collected for each fyke trap set include:

- Time at start and end of trapping
- Water surface elevation at start and end of trapping
- Surface and bottom water temperature at start and end of trapping
- Surface and bottom salinity at start and end of trapping
- Complete fish catch records by species following the coding shown in Table 3
- Sub-sample of individual juvenile chinook lengths and weights (following mark coding shown in Table 4)
- Sub-sample of individual lengths on all other fish species (following mark coding shown in Table 4)

REFERENCES

Dethier, M. N.. 1990. A marine and estuarine habitat classification system for Washington State. Washington Natural Heritage Program, Washington Department of Natural Resources. Olympia WA. 56 pages.

Table 1. Definitions of substrate types modified from Dethier (1990).

Substrate Type	Definition
Bedrock	75% of the surface is covered by bedrock, commonly forming bluffs and headlands.
Boulder	75% of the surface is covered by boulders (>256mm).
Cobble	75% of the surface is covered by clasts 64 to 256mm in diameter.
Gravel	75% of the surface is covered by clasts 4 to 64mm in diameter.
Mixed Coarse	No one size comprises > 75% of surface area. Cobbles and boulders are > 6%.
Fines With Gravel	No one clast size comprises more than 75% of the surface area. Cobbles and boulders make up > 6% of the surface area; Coarse sediments combined make up < 55%. Rich with epibenthic fauna.
Sand	More than 75% of the surface area consists of sand 0.06 to 4 mm in diameter.
Mixed Fines	Fine sand, silt, and clay comprise 75% of the surface area, with no one size class being dominant. May contain gravel (<15%). Cobbles and boulders make up < 6%. Walkable.
Mud	Silt and clay comprise 75% of the surface area. Often anaerobic, with high organics content. Tends to pool water on the surface and be un-walkable.
Artificial	Anthropogenic structures replacing natural substrate within the intertidal zone, including boat ramps, jetties, fill, and pilings.

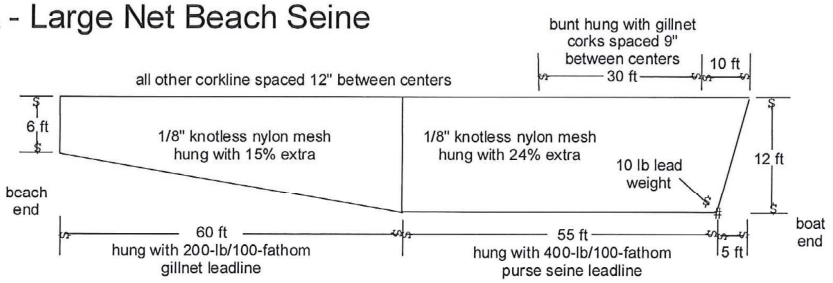
Table 1. Definitions of substrate types modified from Dethier (1990).

Substrate Type	Definition
Bedrock	75% of the surface is covered by bedrock, commonly forming bluffs and headlands.
Boulder	75% of the surface is covered by boulders (>256mm).
Cobble	75% of the surface is covered by clasts 64 to 256mm in diameter.
Gravel	75% of the surface is covered by clasts 4 to 64mm in diameter.
Mixed Coarse	No one size comprises > 75% of surface area. Cobbles and boulders are > 6%.
Fines With Gravel	No one clast size comprises more than 75% of the surface area. Cobbles and boulders make up > 6% of the surface area; Coarse sediments combined make up < 55%. Rich with epibenthic fauna.
Sand	More than 75% of the surface area consists of sand 0.06 to 4 mm in diameter.
Mixed Fines	Fine sand, silt, and clay comprise 75% of the surface area, with no one size class being dominant. May contain gravel (<15%). Cobbles and boulders make up < 6%. Walkable.
Mud	Silt and clay comprise 75% of the surface area. Often anaerobic, with high organics content. Tends to pool water on the surface and be un-walkable.
Artificial	Anthropogenic structures replacing natural substrate within the intertidal zone, including boat ramps, jetties, fill, and pilings.

Table 2. Definitions of vegetation types from Dethier (1990).

Vegetation Type	Definition
Eelgrass	More than 75% of vegetative cover is Zoster marina, Zoster japonica, Phyllospadix spp., Ruppia maratima.
Brown Algae	More than 75% of vegetative cover is brown algae belonging to taxonomic group Division Phaeophyta.
Green Algae	More than 75% of the vegetative cover is algae belonging to the taxonomic group Division Chlorophyta.
Red Algae	More than 75% of the vegetative cover is algae belonging to the taxonomic group Division Rhodophyta.
Mixed Algae	Areas in which red, green or brown algae coexist, no single type occupies more than 75% of vegetated cover.
Kelp	More than 75% of the vegetative cover is large brown algae (Order Laminariales).
Salt Marsh	More than 75% of the vegetative cover is emergent wetland plants.
Spit-Berm	More than 75% of the vegetative cover is plants such as dune grass, gumweed, and yarrow, which generally occur above the highest tides, but still receive salt influence.
Unvegetated	More than 75% of the total surface area is unvegetated.

A - Large Net Beach Seine



B

C

Figure 2. Large net beach seine methodology: A – design of net (not drawn to scale), B – towing on net, C – hauling net.

Beach seine nets new fish information for researchers

BY KIMBERLY JACOBSON
American staff writer

Skagit County Beach Watchers Kathleen McDanold and Judy Bown aren't 100 percent sure what kind of fish they're looking at.

Dr. Jude Apple comes over to take a look.

"I think that's a saddleback," said the Shannon Point Marine Center marine scientist, pointing out the little saddle-like markings.

The fish, measuring 11.5 centimeters, is put back in a bucket as Bown pulls out another fish.

"Sculpin, 4."

"Here's one teeny baby," McDanold says.

"This is 2 1/2," Bown says.

The volunteers were part of a Community Beach Seine sampling event Thursday afternoon at Ship Harbor. It was co-sponsored by the Skagit County Marine Resources Committee and Shannon Point Marine Center.

A net was stretched out 100 feet and left for four minutes to collect a sampling of fish, which is standard practice. Volunteers then identified, measured and counted what was pulled in. They found fish like starry flounders, soles, sockeye salmon and smelt.

KIMBERLY JACOBSON

Skagit County Beach Watchers Kathleen McDanold, Lin Folsom and Roz Krumm (clockwise from left) are among the volunteers helping identify, measure and count fish during a Community Beach Seine sampling event Thursday at Ship Harbor. The event was co-sponsored by the Skagit County Marine Resources Committee and Shannon Point Marine Center.

KIMBERLY JACOBSON

After sitting stretched out for four minutes, a net is pulled around at the beach seine last week. Organizers expect to see about 20 different species of fish when the data is compiled.

Paul Dinnel, one of the organizers, will compile the data by the end of the month.

He said there were two reasons for the event.

First was community outreach and education. Second was the data, which will be summarized and sent to the Skagit River System Cooperative, a regional database for fish.

Dinnel expects to find about 20 different species of fish along with Dungeness crabs and other invertebrates. He noted they found a lot of juvenile pink salmon, which means the salmon spawned last year.

Volunteers included 2012 Beach Watchers graduates as well as about a dozen Anacortes High School AP environmental science students.

"They're learning. They're going to be experts shortly," Dinnel said.

Victor Garcia, the AP class teacher, said the seine was a good experience for the students, who volunteered to come.

"It's real neat to get them out here doing this," he said.

Appendix 4. Beach seining article in the June 20, 2012 issue of the *Anacortes American*.