9D. Fouling Community Surveys

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9D1. Purpose

Fouling communities in many bays, harbors and estuaries are frequently invaded by NIS associated with shipping traffic (Cohen & Carlton 1995, Hewitt 1993, Coles et al. 1999). Fouling communities have major impact on ships and floating structures, ranging from buoys and floats to aquaculture pens and nets, as well as surfaces of oysters and mussels themselves. Consequently, fouling communities are well-studied in many parts of the world, but they have received little study in Alaskan waters. We conducted surveys of fouling communities in Prince William Sound, Seward and Homer using experimental fouling plates. The use of fouling plates provides a replicated standardized assay for NIS in a community that is prone to invasions, but which has received little prior ecological analysis in Alaska. We also surveyed fouling communities on floats, pilings, and buoys to compare these substrates with our experimental plates.

9D2. Methods

We conducted two surveys that focused on fouling communities that settled on natural surfaces and experimental plates, which we deployed in earlier spring months at an array of sites in Homer, Seward and Prince William Sound. We sampled these fouling plates in 7-17 September 1998 and in 8-16 August 1999.

The team for the fouling community surveys consisted of:

- Greg Ruiz (SERC), molluscs, parasites, fouling communities;
- Anson Hines (SERC), barnacles and decapod crustaceans;
- James Carlton (Mystic Seaport), marine/estuarine invertebrates and global NIS
- Melissa Frey (SERC); technical and field assistance
- George Smith (SERC); technical and field assistance
- Lea Ann Henry (University of Ontario??), hydroid identifications;
- Judy Winston (Virginia Museum of Natural History), bryozoan identifications.

We deployed arrays of fouling plates at 12 locations, including 2 on the Kenai Peninsula (Homer, Seward) and 10 in Prince William Sound (Table 9D.1). At each site we deployed 5 arrays suspended at depths of either 1 meter (3 arrays) or 3 meters (2 arrays) below mean low water level. Each array consisted of settling plates attached to a frame made of 2 crossed pieces of pvc pipe (20 mm diameter, 50 cm long), which was suspended in a horizontal position by a line attached to a dock or float and weighted by a concrete block. Settling plates made of 14 cm x 14 cm x 7 mm thick pvc (3 plates) or plywood (1 plate) were attached to each of the 4 ends of the cross in a horizontal position. The horizontal orientation assured that sediment would not accumulate on the underside, providing a clean surface addition to several irregular surfaces of the frame and top surfaces for settlement. To maximize the chance of detecting possible NIS within each site, the 5 arrays were dispersed as widely as possible to sample the range of microhabitats present. We deployed the plates during April-May of each year and retrieved them in August-September, providing a “soak time” of about 4 months.

Table 9D.1. Sampling Locations for Fouling Community Surveys.

Site	1998	1999
Kenai Sites		
Homer	X	X
Seward	X	X
Prince William Sound		
Port Valdez		
Marine Terminal	X	X
Valdez Area	X	X
Growler Island	X	
Whittier	X	
Chenega	X	
Port Chalmers	X	
Fairmont Bay		X
Tatitlek		
Oyster Culture		X
Docks		X
Cordova		X

At the time of retrieving the arrays, the fouling plates were removed from their frame and placed individually into ziplock plastic bags for transport to a laboratory. Each plate was examined under a dissecting microscope and sessile and motile species were scored as present or absent. Voucher specimens were preserved and sent to taxonomic experts for authoritative identification. At the present stage of this project, we have used the fouling plates to develop an inventory of species. However, using this technique, the occurrence and abundance of species can be quantified and compared statistically for frequency of plates with species present. This type of comparison will proceed in new work during 2000 and 2001 as we sample other locations in Alaska and the major ports of western North America along the lower 48 states.

9D3. Results

During the soak time of ca. 4 months, the fouling plates accumulated dense community assemblages with large biomasses of mussels, barnacles, ascidians, hydroids, and bryozoans (Table 9.D.2). The fouling communities were rich in species, particularly for bryozoans, hydroids, nudibranchs, and ascidians Combining the 2 years of study across the12 sampling locations, we recorded more than 107 taxa/species on the fouling plates (Table 9D.2), including: 8 families of polychaete worms, 13 species of acidians, 34 species of bryozoans, 1 species of sea anemone, 3 species of barnacle and 13 taxa of motile crustacea, 2 species of echinoderms, 12 species of hydroids, 29+ taxa of molluscs, and 1 species of protozoan. Diversity of hydroids was particularly high at Homer (11 species). Byozoans were most diverse at Chenega (10 species), Homer (13 species), Port Valdez (14 species), and Tatilek (13 species). Acidians were most diverse at Homer (6 species) and Cordova (6 species).

Table 9D.2. Taxa Recovered on Fouling Plates. Asterisk denotes NIS. x denotes presence in 1998 and or 1999. Site Key: AL=Alyeska terminal; CH=Chenega Bay; GR=Growler Isl.; HO=Homer, MI=Montague Isl.; SE=Seward;VA=Port Valdez; WH=Whittier; CORD=Cordova; FRMNT=Fairmount Bay; PTOPT=Potato Pt. TAT=Tatitlek

		Site											
		AL	**CH**	**GR**	**HO**	**MI**	**SE**	**VA**	**WH**	**CORD**	**FRMNT**	**PTOPT**	**TAT**
Protozoan	*Foliculina*	x	x		x		x	x	x	x	x		x
		AL	**CH**	**GR**	**HO**	**MI**	**SE**	**VA**	**WH**	**CORD**	**FRMNT**	**PTOPT**	**TAT**
Cnidaria	*Metridium senile*				x								
	Metridium sp.	x			x				x				
		AL	**CH**	**GR**	**HO**	**MI**	**SE**	**VA**	**WH**	**CORD**	**FRMNT**	**PTOPT**	**TAT**
Hydroids	*Calycella syringa*				x								
	Clytia hemispherca				x								
	Clytia kincaidi									x			
	Companulina rugosa				x								
*	*Garveia franciscana*				x								
	Gonoththyraea clarki				x		x			x	x		
	Obelia longissima		x	x	x		x	x		x	x		x
	Obelia sp.	x	x	x	x	x	x	x	x				
	Opercularella lacerata				x								
	Sarsia eximia				x								
	Sarsia tubulosa				x								
	Sertularia robusta				x								
		AL	**CH**	**GR**	**HO**	**MI**	**SE**	**VA**	**WH**	**CORD**	**FRMNT**	**PTOPT**	**TAT**
Annelida	Capitellidae	x				x		x		x			
	Cirratulidae				x					x			
	Nereidae	x	x	x	x	x	x	x	x		x		
	Polynoidae	x	x	x	x	x			x	x	x		x
	Sabellidae									x	x		x
	Serpulidae	x	x	x	x	x		x	x	x	x		x
	Spirorbidae	x	x	x	x	x	x	x	x	x	x		x
	Syllidae	x		x		x				x	x		x
	Terebellidae									x			
		AL	**CH**	**GR**	**HO**	**MI**	**SE**	**VA**	**WH**	**CORD**	**FRMNT**	**PTOPT**	**TAT**
Mollusca	*Acanthodoris sp.*					x							
	Acmaeidae					x							
	Aelolididae						x						
	Alvania sp.	x	x			x				x			x
	Chlamys sp.	x						x					x
	Clinocardium sp.				x								
	Dendronotus frondosus						x	x					
	Dendronotus sp				x						x		
	Fusitron oregonensis	x											
	Haminoea sp.	x							x				x
	Hermissenda sp.	x	x	x		x	x	x	x	x	x		x
	Hiatella arcitca	x	x	x	x	x	x	x	x	x	x		x
	Hinnites sp.	x											
	Lacuna sp.		x	x		x							x
	Lacuna vincta												x
	Limacina helicina							x					

Table 9D.2. Continued

		AL	CH	GR	HO	MI	SE	VA	WH	CORD	FRMNT	PTOPT	TAT
Mollusca cont.	*Lottia sp.*									x			
	Margarites helinicus												x
	Margarites pupillis	x			x								
	Mytilus trossulus				x		x						
	Mytilus sp.	x	x	x	x	x	x	x	x	x	x	x	x
	Odostomia sp.		x	x		x		x					
	Onchidoris sp.							x		x	x		x
	Onchidoris murricata	x						x					
	Onchidoris sp.	x	x	x	x			x	x				
	Pododesma macroshisma									x			
	Pododesmus sp.	x						x					
	Sacoglossan sp.			x						x			
	Tritonia sp.		x										
	Vilisina vernicosa												x

		AL	CH	GR	HO	MI	SE	VA	WH	CORD	FRMNT	PTOPT	TAT
Crustacea	*Ampithoe sp.*					x							
	Balanus cariosus		x	x		x		x		x		x	x
	Balanus crenatus	x	x	x	x	x	x	x	x	x	x	x	x
	Semibalanus carriosus	x									x		x
	Cancer magister						x	x					
	Caprellidae		x	x		x				x	x		x
	Corophium sp.	x							x		x		x
	Eogammarus sp.	x											
	Gnorimosphaeroma oregonense	x				x	x	x	x				
	Harpacticus uniramus						x						
	Jassa sp.		x			x							
	Munna sp.		x										
	Oregonia gracilis				x								
	Scyra acutifems				x								
	Spirontocaris sp.		x										

		AL	CH	GR	HO	MI	SE	VA	WH	CORD	FRMNT	PTOPT	TAT
Bryozoa	*Alcyonidium sp.*	x			x	x				x	x		x
	Alcyonidium hirsutum										x		x
	Bugula californica				x					x			
	Bugula pacifica				x		x	x					
	Bugula sp.	x	x		x		x	x	x	x			x
	Calloporella craticula							x			x		x
	Calloporella "lineata"		x										
	Cauloramphus pseudospinifer						x						
	Celleporella hyalina		x		x		x	x			x		x
	Cribrilina sp.	x	x										
	Cribrilina corbicula		x		x			x	x	x			x
	Cribrilina sp.	x	x		x			x		x	x		x
	Crisia serrulata		x										
	Cryptosula okadai						x						
	Electra sp.		x		x	x							
	Fenestruloides eopacifica							x					x
	Filicrisia franciscana							x		x			x
	Harmeria scutulata							x					
	Hippothoa sp.		x		x			x					
	Lichenopora sp.		x										

Table 9D.2. continued

		AL	CH	GR	HO	MI	SE	VA	WH	CORD	FRMNT	PTOPT	TAT
Bryozoa cont.	*Membranipora menbrenacea*				x								
	Membranipora sp.											x	x
	Microporella germana							x					
	Parasmittina trispinosa	x											
	Phidolopora pacifica							x					x
	Porella major	x						x					
	Rhamphostomella gigantea				x								
	Rhamphostomella hincksi	x											
*	*Schizoporella "unicornis"*												x
	Tegella armifera								x				
	Tegella aquilirostris				x								
	Tubulipora tuba	x						x					x
	Tubulipora sp.										x		

		AL	CH	GR	HO	MI	SE	VA	WH	CORD	FRMNT	PTOPT	TAT
Echino-dermata	*Psolus sp.*				x								
	Strongylocentrotus sp.								x				x

		AL	CH	GR	HO	MI	SE	VA	WH	CORD	FRMNT	PTOPT	TAT
Ascidia	*Ascidia sp.*								x				
	Ascidia callosa			x	x					x			
	Ascidia columbiana							x			x		x
*	*Botrylloides violaceus*												x
	Corella sp.	x	x		x								
	Corella inflata	x	x							x			x
	Corella willmariana	x						x					
	Distaplia sp. (new)				x					x			
	Distaplia alaskensis				x								x
	Molgula retortiformis				x								
	Molgula sp.				x					x			
	Ritterella sp.				x			x		x			
	Styela truncata									x			

Among these species, there were 3 NIS: the ascidean *Botrylloides violaceus*, the bryozoan *Schizoporella unicornis*, and the hydroid *Garvieia franciscana*. These are the first records for two of these species (*B. violaceus* and *G. franciscana*) in Alaska. *Botrylloides violaceus* (=*Botryllus aurantius* is a colonial tunicate that is native to the northwest Pacific (Japan), and may have been first found on the West Coast in 1973, in San Francisco Bay (Cohen and Carlton 1995). It is now widespread, from southern California to British Columbia (Cohen et al. 1998; Lambert and Lambert 1998). *B. violaceus* was abundant on fouling plates in Prince William Sound in 1999 (G. Lambert 1999 pers. comm.). *Schizoporella unicornis* is a bryozoan found in the northwest Pacific but was first collected in the Eastern Pacific in 1927, in Puget Sound (Carlton 1979; Cohen and Carlton 1995). Its first Alaska collection was made between 1944 and 1949, in Kodiak (U. S. Navy 1951; Carlton, pers. comm.). *Schizoporella unicornis* may have been introduced in ship fouling or with plantings of Pacific Oysters (Cohen and Carlton 1995). In 1999, it was found in Tatilek. This form, while definitely introduced to the Pacific coast, may actually be a complex of several species (Winston 1999 pers. comm.). *Garveia franciscana* (Rope Grass Hydroid) has been found in many estuaries around the world, but its origin is uncertain. The Indo-Pacific and the Black--Caspian Sea basin have been suggested as possible native regions (Cohen and Carlton 1995; Calder 1997 pers. comm.) It was first described from San Francisco Bay in 1902, which was its only known location on the west coast of North America (Cohen and Carlton 1995), until we found it near Homer in 1999 (Lea-Anne Henry

pers. comm. 1999). In other regions of the world, this hydroid has been an economically important fouling organism, adversely affecting ships, power plants and fishing gear (Simkina 1963; Andrews 1973; McLean 1972). In addition, fouling plates at Homer and Cordova had large biomasses of the new/undescribed ascidian, *Distaplia* sp. nov, which has many suspicious characteristics of NIS. *Diastaplia* sp. nov. is a new, undescribed species of tunicate, which is very abundant in fouling communities on floats and man-made substrates in marinas at Homer and Cordova. It was first collected in 1998 in Homer and was found in both Homer and Cordova in 1999. It was not found at other sites within Prince William Sound where other, native species of tunicate were common in fouling communities but lack similar shipping/boating traffic (e.g., Tatitlek, Chenega, Port Chalmers). Its appearance is also suspicious, because it was not found in 1901 when tunicates were collected in the region at nearby sites. This tunicate could be a formerly rare native species that has taken advantage of the newly created marina habitat, or a recent introduction (G. Lambert 1999 pers. comm.).

Fouling communities on the plates suspended at 1m depth were greatly diminished at Seward, Whittier and Port Valdez during the summer, when snow and glacial melt produced markedly low salinities in the surface waters and also thick sediment deposits that covered the plates. Fouling plate arrays at 3 m depth in these locations experienced higher salinities, but still suffered from heavy sediment deposits. It was evident, however, that these plates had developed rich fouling communities prior to the summer season of greatest freshwater runoff and siltation.

Species composition of fouling communities on the experimental plates were generally quite similar to the composition on surrounding surfaces (floats, pilings, lines, oysters, etc) at comparable tidal levels. Since the arrays were suspended below mean low water, the main groups of specie s that the plates did not sample adequately were species on pilings in the intertidal zone, such as *Balanus glandula*, *Semibalanus balanoides*, and various species of acmaeid limpets.