Benthic invertebrate community assessment as a phytoplankton consumer and fish and bird prey source before and after the start of the restoration

South Bay Salt Pond Restoration Project
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Abstract

We analyzed spatially-intensive benthic samples collected during three seasons in each of three years prior to the restoration project (1993-1995) and after the restoration activities started (2006-2008). The benthic community structure and its function were analyzed to determine their function as consumers of primary producers and as prey. The benthic community was dominated by bivalve filter feeders until 1999 and then by small filter feeders as the bivalves declined. North of Dumbarton Bridge the surface deposit feeders also increased with the decline in bivalves, possibly reflecting the deposition of phytoplankton to the mud surface as the phytoplankton shifted from direct consumption by filter feeders to settling onto the mud surface. Changes to the benthic community that results in changes in the relative dominance of filter feeders can have far reaching effects when decreases in bivalve filter feeding occurs coincident with increases in phytoplankton biomass. The bivalve biomass south of Dumbarton has been similar to the biomass observed in the 1990's in several of the recent years studied. A comparison of benthic communities before and after the restoration commenced in dry, normal, and above normal freshwater runoff years showed that the benthic community differed most in the dry years and the least in the wet years. Although there may be differences in palatability, quality, and size of prey for the birds in these differences, the function of the community as a consumer of phytoplankton changed only in grazing rates and hence grazing pressue to the phytoplankton community. The benthic communities continued to be dominated by filter feeders and no changes could be attributed to restoration activities.

Background and justification

The effects of the South Bay Salt Pond Restoration Project on the water quality, ecology, and physical habitat of the South Bay are unknown and were highlighted as priority research topics in the RFP for 2008. We addressed the following topics in this study using two sets of existing benthic invertebrate samples that were collected from the South Bay prior to and since the restoration project began: (1) Will the restoration adversely affect water quality and productivity in the Bay (Topic#5, Q1); (2) Will an increased tidal prism affect water quality in the Bay (Topic#5, Q3); (3) Will the habitat value and carrying capacity of the Bay for foraging migratory and resident birds be maintained or improved relative to current conditions (Topic#6, Q2).

The primary goal of the study was to first describe how water quality and physical habitat have structured the benthic invertebrate community in the South Bay in the past, based on past work (Nichols and Thompson 1985a, 1985b, Nichols and Pamatmat 1988, Lee et al. 2003) and the more recent 1993-1995 samples. It should be noted that most of the earlier work occurred prior to the invasion of several important exotic species including *Corbula amurensis* and so some of the conclusions may no longer be relevant. We then discuss if the benthic community has been sufficiently altered since the onset of the restoration project to change the benthos' grazing impact on phytoplankton and the availability of benthic prey for birds and fish.

South bay is a system dependent on phytoplankton as the base to the food web (Jassby et al 1993). Despite abundant nutrients, South Bay has limited phytoplankton production due to poor light conditions and high grazing losses. Thus the system only rarely experiences anoxia that is usually associated with high nutrient systems (Cloern 2001). Our conceptual model for phytoplankton growth in South Bay includes a delicate balance between light availability, grazing losses (primarily in the shallow water) and physical mixing of the water column (Lucas et al 2009). This balance has maintained the phytoplankton in South Bay at low biomass levels relative to other high nutrient urban estuaries (Cloern 2001). Increases in light availability, decreases in benthic grazing rates, or a

reduction in mixing can and have resulted in unusually high phytoplankton biomass on some occasions. Two such occasions occurred in 1993 and 1998 (Figure 1) when periods of increased light availability, caused by density stratification of the water column, increased the phytoplankton growth rate (Thompson et al 2008, Cloern 1996). Other periods of elevated chlorophyll *a* concentrations were seen in summer and fall 1994 (Thompson et al 2008) and in 1999-2004 (Cloern et al 2007) resulting from a sharp reduction in benthic grazers (dominated by bivalves in this system).

In contrast to these episodic fluctuations in bivalve biomass, a fall reduction in bivalves in the shallow water each year allows the spring phytoplankton bloom to develop in the South Bay (Figure 2). Each fall, predation by migratory and resident birds (Thompson et al 2008), fish, and invertebrates (Cloern et al 2007) decimates the shallow water bivalve communities in both South and San Pablo Bay (Poulton et al 2002, 2004, Richman and Lovvorn 2004). This elimination of bivalve grazing in the shallow water allows the phytoplankton to grow if light and mixing are not limiting (Thompson et al. 2008). Bivalves in the shallow water are thus essentially an annual species with larvae settling each spring followed by rapid growth which allows them to become a controlling factor on the phytoplankton by late spring and summer. However, as shown by increases in phytoplankton biomass in South Bay during the strong upwelling events in 1999-2004, the relationship between benthic grazers and phytoplankton is not always so tidy. We found that juvenile demersal fish and invertebrates that rear in the bay thrives during strong upwelling years and that this higher abundance of predators was sufficient to limit bivalve populations throughout the year. The result of the reduced grazing pressure on the phytoplankton was an increasing trend in phytoplankton biomass and the development of fall blooms (Figures 1, 3, Cloern et al 2007). As shown by this example, understanding the ecological dynamics of South Bay is not always straightforward. This is a cautionary story, as it is important that we not misinterpret changes such as were seen in 1999-2004 as salt pond restoration effects.

Changes in the benthic community structure occur normally. Benthic species distributions are dependent on the physical habitat (substrate and depth), physiological limits (i.e. salinity in this system, Lee et al 2003), and predators (Cloern et al 2007). Therefore seasonal and interannual differences in freshwater flow result in both seasonal and episodic patterns in species abundance and community composition (Nichols and Thompson 1985a, 1985b). Episodic events such as invasive species introductions can have lasting effects on the benthic community whereas other events such as wastewater treatment plan malfunctions are likely to have shorter term effects. Contaminants can also restrict the success of some species (Hornberger et al 2000). It should be noted that even when changes in species composition occur within a community, the functional form of the community may remain the same, eg. the community is still dominated by filter feeders. In these instances the effect of a change in the benthic community on the phytoplankton growth rate may be large or minimal depending not only on the type of feeding mode but also on the relative feeding rate of the new species.

The importance of benthic invertebrates as prey is sometimes undervalued but they are considered a sufficiently significant prey resource for many fish species managed by Fisheries Management Plans under the Magnuson Stevens Fishery Conservation and Management Act that they are considered a component of essential fish habitat. Our conceptual model for maintaining appropriate benthic prey for fish and bird species is based on knowing what prey characteristics and habitat of the prey are important for the predator. The effect of species swaps within benthic communities may be very significant to predators. For example, a surface dwelling bivalve like *Corbula amurensis* has a soft shell, is highly caloric, and easy to capture and has been shown to be valuable prey in the Bay (Richman and Lovvorn 2004). A deep burrowing tube-dwelling worm such as *Sabaco elongatus* that is common in South Bay (Lee et al 2003) is unlikely to be fed upon by either fish or birds. For this

reason our analysis of the benthic community includes abundance, grazing rate where appropriate, and functional ecology (feeding mode, habitat, motility, and structures such as tubes and shells which may impede predation) of each species.

In summary, we look for changes in the benthic community within the context of the restoration project for two reasons. First, it appears that the balance between physical and biological factors that determine the net phytoplankton growth rate and thus phytoplankton biomass, a primary water quality indicator, are vulnerable to change due to the restoration actions. In particular, increasing the tidal prism and thereby changing circulation patterns and salinity distribution in time and space may change the makeup of the benthic community due to the physiological tolerances of individual species to salinity. Second, the possible redistribution of sediment into the ponds, resulting in an altered bathymetric profile and a reduction of intertidal mudflat surface area could change the balance between grazing, mixing, and light that is responsible for limiting phytoplankton production. This same action may limit the available habitat for some species and may reduce the area of habitat that is available for specific predators on the benthos. Changes in the circulation and physical habitat may also affect the success and composition of the benthic community larvae that repopulate the shallow water each spring. One disturbing outcome of the physical/chemical habitat and circulation changes would be the invasion (not necessarily an exotic species phenomenon) of a dominant filter feeder that can limit net phytoplankton growth but is unpalatable to predators and therefore is present throughout the year. Although the most common concern is that the South Bay not become eutrophic, it would also be devastating to the food web if phytoplankton blooms were eliminated; such an occurrence in North Bay is believed to have contributed to the decline of key fish species in that system (Sommer et al 2007).

Hypotheses and Tests:

The hypotheses tested by this study include the following:

H_0: The pre-restoration benthic community can be described relative to the known hydrologic conditions and predators present during the period.

H_0: There has been a change in the benthic community structure since the initiation of the restoration project that can not be associated with known stressors. (predators, hydrologic events, invasive species)

Conceptual Model: Benthic species distributions are dependent on the physical habitat (substrate and depth), physiological limits (i.e. salinity), and predators (Cloern et al 2007). Episodic events such as invasive species introductions can have lasting effects on the benthic community.

H_0: Functional changes in the benthic community have resulted in decreased grazing pressure on the phytoplankton resulting in increased phytoplankton bloom frequency and duration.

Conceptual Model: Phytoplankton biomass accumulation (bloom) is a function of light, nutrients, mixing and transport rates, and losses to grazers. A change in any of these factors can limit phytoplankton biomass growth.

H_0: Changes in the benthic community structure have changed the food available to their predators either through changes in biomass, availability, or palatability.

Conceptual model: Benthic organisms are a good food source when the energy needed to find and remove the prey from the sediment is less than the energy assimilated from the prey. Near-surface dwelling, large animals such as bivalves are considered good food for demersal fish, diving ducks,

and shore birds. The balance between energy consumed and assimilated is related to the predators caloric cost of retrieving prey from specific depths in the sediment relative to the calories consumed and then lost due to processing body covering, tubes and other protective structures. Palatability is also an important determinant of a prey species value.

Study Objectives

Our primary objective was to compare the benthic community near the restoration sites in the South Bay before and since the restoration commenced to determine if the benthic community differs in ways that (1) can account for recent trend changes in phytoplankton biomass (ultimately primary production) and (2) could change prey availability for fish and birds. Our secondary objective was to establish a pre- and post- restoration benthic community data set that is available to the scientific community to evaluate other post-restoration benthic community data.

Study Area

The study (Figure 4) is inclusive of the area from the San Mateo Bridge (SMB) into the mouth of Coyote Creek and stations are located in both the subtidal and deep intertidal areas. As shown in Figure 4b, the 22 stations that will be analyzed are a subset of a larger study. The stations adjacent to and south of the Dumbarton Bridge (DB) are near the Alviso complex and the benthic community at these stations has had the longest exposure to the restoration process (Figure 4b, area A). The stations north of the San Mateo Bridge are nearest the Eden Landing restoration site (Figure 4b, area B) and have been included for two reasons. First, Jaffe and Foxgrover (2008) report that loss of intertidal area is most likely to occur north of DB so the eastern shoal due to its size is most likely to be impacted by the redistribution of sediment. Second, this shallow area is of the critical importance in the formation of phytoplankton blooms in this system. Over a 5 year study we consistently saw phytoplankton blooms start on the eastern mudflats between the SMB and DB. Blooms are initiated and grow rapidly in this area due to the isolation of the water on this shoal from the deep channel water where the phytoplankton grows poorly, if at all (Thompson et al 2008). A few channel stations are included as the bivalves in the channel are the source of recruits following the fall predation on the bivalves. Thus to fully understand the benthic community changes through the seasons we need benthic community data from all depths.

Methods

We analyzed the benthic community species composition and the functional composition of the community before and after the restoration during 2 - three year periods which encompass a range of hydrologic and salinity conditions (Figure 3). These samples were previously collected as part of a field and modeling study that examined the mechanisms of phytoplankton bloom development in south bay (Thompson et al, 2008, Lucas et al. 2009). Spatially intensive samples shown in Figure 4b were collected throughout the South Bay in spring, summer and fall of each year. We found that a subset of the full suite of samples was reasonably representative of the larger sampling effort (Thompson 1999) and that it supplied the resolution needed for the questions posed here. Collection dates for the spatial samples were set to match the phytoplankton bloom period in spring, the low bloom period in mid-summer, and the fall bloom period (Thompson et al. 2008). The timing of the sampling is also appropriate for assessment of the benthic prey that are available from spring through fall of each year.

Samples were collected with a $0.05m^2$ weighted van Veen grab that was hand deployed in all but the deep water stations. Samples were sieved through a 0.5mm screen, preserved in 10% buffered formalin, and transferred to 70% ethyl alcohol with Rose Bengal dye. Samples were sorted and well known species enumerated at the USGS. A quality assurance procedure was invoked whereby samples were double sorted/identified in a percentage of the samples depending on the difficulty of the sample and the number of organisms in the sample. More difficult taxonomic groups were contracted out to a taxonomic consultant (Susan McCormick) with a request that all but the rare species be identified and enumerated to the lowest taxon possible. The contractor was asked to supply a taxonomic voucher collection.

Large bivalves were measured for conversion to biomass in the recent samples (2004 -2008) to allow for comparison with the pre-restoration data.

Data are reported as species lists with abundance data (Appendix 1) and functional ecology notes (Appendix 2 and 3). Community structure is discussed as a function of hydrologic conditions (temperature and salinity as reported by USGS: http://sfbay.wr.usgs.gov/access/wqdata/index.html) and demersal fish and invertebrate predators (California Department of Fish and Game Bay Study Database: ftp://ftp.delta.dfg.ca.gov/Bay%20Studies/).

A multivariate analysis was used to delineate differences in community structure (PRIMER ANOSIM) as a function of species and as a function of functional groups between the data sets. If the communities were found to differ, SIMPER was used to identify the species or functional group that contributed most to the difference in community structure. This detailed analysis determined if the functional groups have changed or if there has been an interchange of species with similar ecological functions.

Results and Discussion

1993-1995 Benthic Community

The benthic community described by Nichols and Thompson (1985a, 1985b) was based on an intertidal community. It was dominated by the amphipod *Ampelisca abdita*, the bivalve *Macoma balthica*, the polychaete *Streblospio benedicti*, and the bivalve *Gemma gemma*. The largest difference in the benthic community in this subsection of the southern embayment was the addition of *Corbula amurensis (Corbula* hereafter*)* and *Nippoleucon*, two exotic species introduced after the 1985 papers. *Corbula* is likely to be a good source of food for all birds when present as its size range (0.4mm to 20 mm in length) and its habit of living near the sediment surface makes it highly accessible. *Nippoleucon*, a cumacean, is present in much of South Bay now but is size (<3mm in length and <0.5 mm in width) may limit its usefulness for some predators. In addition, *Streblospio benedicti*, a tube-dwelling surface deposit feeding opportunist, has become rare and *Heteromastus filiformis*, a deep burrowing deposit feeder, *has* become more common. *Streblospio's* feeding niche in the community (surface deposit feeder) may now be occupied by *Nippoleucon* and various Corophidae amphipods. *Streblopsio* was likely a good prey species as its life position (on the surface in a tube) made them easily accessible. Corophidae amphipods may be a good substitute as they live in a similar habitat.

Corbula likely represented a large increase in grazing rate of phytoplankton throughout the system when it invaded in the late 1980's. The only other large bivalves that have comparable

biomass and therefore comparable grazing rates are *Mya arenaria*, which appears to be limited to wet years (e.g. 1995), *Musculista senhousia* and *Venerupis philippanarum*, which are less widely distributed than *Corbula*. *Musculista* likes to attach its bysal threads to a solid surface and is therefore commonly found with *Sabaco* or in regions with shell hash. Based on our observations, the later habitat is also the preferred habitat for *Venerupis*; its major distribution is thus limited to the western and far eastern shoal near San Mateo Bridge and to the eastern shoal in the middle of the South Bay. *Corbula* can be found in all of these regions but is generally less numerous in *Sabaco* beds than is *Musculista*.

The community in the deeper sections of the southern embayment and in the region north of Dumbarton Bridge has many of the same species as seen in the southern intertidal region with the exception of *Gemma gemma* which is limited in its distribution to the shallow water. *Ampelisca* also had smaller populations in the deeper water than in the intertidal until fall. In addition, the subsurface deposit feeding polychaetes *Heteromastus filiformis* and *Sabaco elongata*, a tube dwelling species that lives in sediment depths up to 1m, are common but tend not to co-occur in large numbers. *Sabaco elongata* may be an important physical competitor for many species as their tube extends above the mud surface for 1-2cm and the tubes are tightly packed together. This would make it difficult for burrowing species such as *Heteromastus* to co-habit with it. *Sabaco* is also important as it may have predators when it is very young and its tubes are short, but once they are established as an adult they pull down into the tube with any disturbance (e.g. we frequently only get the tail end in a grab). It seems doubtful that *Sabaco* are a valuable prey source for any birds or fish.

A comparison of the three early years using MDS (Figure 5) reveals few differences between the years. However, the data starts to separate when seasons are noted; fall and spring are most different. The plot with regions delineated also showed more separation than the plot with years noted; the south of Dumbarton Bridge data were most likely to be different from than the rest. This later point is consistent with what we have described above.

Comparing Benthic Community Function Over the Long Term

A comparison of functional feeding groups shows that filter feeders dominate the abundance of individuals in this system in all years and locations (Appendix 3, Figure 6). The most consistent differences in the benthic community feeding functional groups between the northern and southern regions is the higher percentage of filter feeders in the southern region and the lower percentage of subsurface deposit feeders in the southern than the northern communities. This was a bit of a surprise as the southern reach is known to be depositional and we expected that buried labile organic carbon might be in higher concentrations in this region.

When the large bivalves (i.e. not including *Gemma gemma*) and large Ascidians are removed from the percentage of filter feeders, the small filter-feeding species (mostly amphipods) tend to increase in the area south of DB after 2004. A different response to the decline in bivalves is seen north of DB, where surface deposit feeding species (mostly polychaetes and amphipods) increase with the decrease in bivalves. This shift in functional feeding groups in the north probably reflects the increase in food availability on the mud surface as the phytoplankton sinks to the bottom. None of the shifts that we observed could be singularly attributed to the restoration activities as the change in bivalve populations dominates all other dynamics.

Comparing Benthic Communities in Similar Hydrologic Years

We are comparing the benthic community in two critically dry years (1994 vs. 2008), two near normal hydrologic periods (1993 vs. 2004, 2007, 2009) and two wet years (1995 vs. 2006). We will examine each pairing of data by looking at the MDS analysis for each comparison. We will then discuss the shifts in prey species and feeding function as appropriate.

Two Normal Periods (1993 vs. 2004, 2007, 2009)

The community data separated very clearly (MDS/Primer stress level of >0.2 is considered a valid analysis) between 1993 and 2004/2007 (Figure 7). The primary drivers of the community differences were the increased population abundance of *Nippoleucon* and *Philine* in 2004/2007 and the higher abundance of *Corbula* and *Ampelisca* in 1993. *Philine*, a carnivorous opisthobranch, is a predator on *Corbula* so its opposite distribution with *Corbula* is not surprising. In general there was little change in function of the benthic community in these two periods (Figure 6) except for a reduction in filter feeding organisms due to the decrease in bivalves in the later period. We have included a pair of MDS plots (Figure 7) of *Sabaco* and *Heteromastus* to show the restricted overlap in the species at high abundances as noted above. These last two MDS plots are instructive in showing the importance of looking at all species in a functional group before concluding that some years were more favorable than others for a particular feeding guild.

Two Dry Periods (1994 vs. 2008)

The dry year communities also separated very clearly with some overlap in the data in the region south of DB. The *Corbula*, *Corophium* and *Heteromastus* populations were sufficiently higher in 1994 to drive the separation in the two data sets (Figure 8). Both *Ampelisca* and *Nippoleucon* were considerably more numerous in 2008 than in 1994 which further separated the data sets. It is interesting that the filter feeder percentages were more similar in these two periods than in the other comparisons of communities from similar hydrologic years. Therefore although the members of the community differ, the function of the community is likely to be similar. As prey *Ampelisca* and *Corophium* are also similar in size and habitat. We are not able to judge quality of energy supplied from these two species, so what may appear to be similar food may in fact provide different energy levels to their predators.

Two Wet Periods (1995 vs. 2006)

The wet period communities were the most similar. Although they appear to be segregated on the MDS plot labeled with year (Figure 9), the similarity groupings show most of the groups to be related. The only species that show any clear designation between the years are *Corbula* (more abundant in 1995) and a Corophidae amphipod (*Grandidierella*) which was more abundant in 2006 than in 1995. Most of the plots look like the *Ampelisca* plot, with no distinction being visible between the periods. One species, *Mya arenaria*, a filter feeding bivalve, clearly connected the two periods in the data set. Functionally, the communities were very similar except on the eastern shoal south of DB (Figure 6) which showed a marked decrease in bivalve filter feeders and filter feeders in general in 2006 relative to 1995. Since the strongest organizing factor for benthic communities is usually salinity, the similarity of these plots may be a good reflection of the effect of lower salinities during these years. There is no indication in these data that the benthic community in 2006 is being affecting by restoration activities.

Status of Bivalve Grazers

Bivalve biomass, shown in Figure 10, is a good proxy for benthic grazing rates. There are an increasing number of ways to compute grazing rates and it seems most useful to provide the raw data so others can compute grazing rate in their own way (Appendix 4). The advantage of showing the data spatially instead of as an annual average as shown in Figure 3 is that we can see the importance of the spatial changes. We see that there has been a shift in bivalve biomass to the southern embayment starting in 2006. With the exception of one location in the northern channel (due entirely to a localized population of *Musculista*) the biomass levels have been very low north of the DB since 1998. The only period when bivalves moved into the northern embayment, July 2006, was short lived and did not include the entire bay. The biomass levels seen here can be converted to grazing rates ranging from 1-20 $m^3m^{-2}d^{-1}$ in 1993-1995, 1-10 $m3m^{-2}d^{-1}$ in 1996 and 1994, and 1-15 $m^3m^{-2}d^{-1}$ in the post 2000 period (using the method of Thompson et al. 2008). In all but a few locations the grazing rates after 2000 were in the 1-2 $m^3m^{-2}d^{-1}$ range. We have listed other filter feeding groups in our tables and figures and it would be useful to equate these abundances of filter feeding amphipods to clam grazing rates. However, pumping rates are not known for many non-bivalve species. Jones et al. (2009) used very liberal pumping rates for amphipods, the most likely candidates for imposing a large grazing loss to the phytoplankton, and showed the maximum grazing rate attained in Suisun Marsh there was <10 $m^3m^{-2}d^{-1}$. This is of the same order as the grazing loss from the bivalves and thus it may be worth pursuing amphipod grazing as an important factor in our understanding of phytoplankton dynamics in the south bay system.

Conclusions: Hypotheses

H_0: The pre-restoration benthic community can be described relative to the known hydrologic conditions and predators present during the period.

True, the major differences in the benthic community between years were the result of introduced species and the change in bivalves with change in predators (i.e. Cloern et al. 2007). Some differences in the communities during wet and dry years could be attributed to salinity distribution.

H_0: There has been a change in the benthic community structure since the initiation of the restoration project that cannot be associated with known stressors. (predators, hydrologic events, invasive species)

False, or not proven. There have been changes in the benthic community since the restoration began but it is not possible to separate the effect of the bivalve population's demise from other factors.

H_0: Functional changes in the benthic community have resulted in decreased grazing pressure on the phytoplankton resulting in increased phytoplankton bloom frequency and duration.

True, maybe. The biomass of bivalves has declined everywhere except south of Dumbarton Bridge where biomass is similar to that observed in the 1990's. Until we are able to estimate the grazing rate of very small amphipods and some polychaetes we will not be able to confirm or refute this hypothesis.

H_0: Changes in the benthic community structure have changed the food available to their predators either through changes in biomass, availability, or palatability

True. The loss of the bivalves has removed one large source of prey that was easily attainable and high in energy.

Acknowledgements

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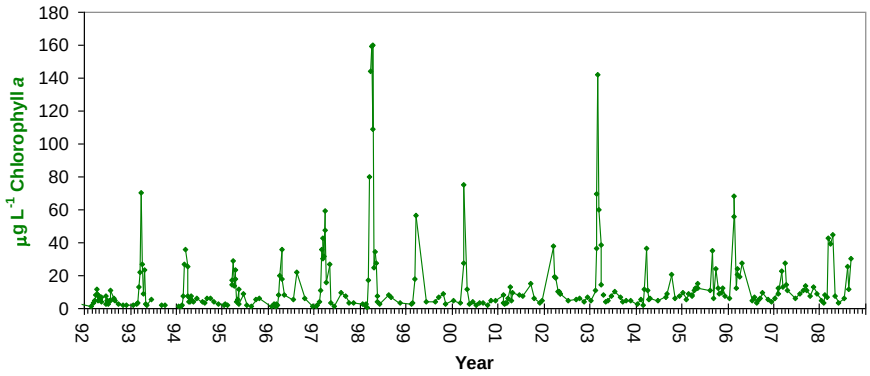


Figure 1. Phytoplankton biomass (as represented by chlorophyll a concentration) from USGS station 36 (at label A on Figure 4b). Data acquired from http://sfbay.wr.usgs.gov/access/wqdata/index.html.

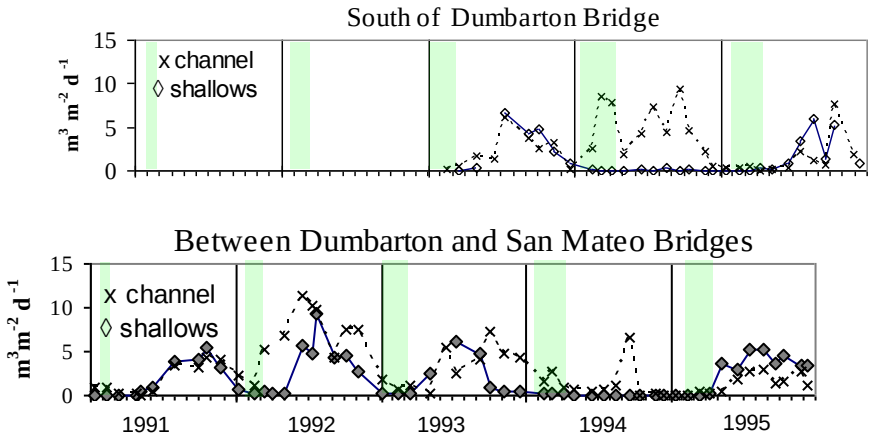


Figure 2. Time series of benthic grazing rate of the bivalves at stations south of Dumbarton Bridge and between the Dumbarton and San Mateo Bridges. Channel and shallow water stations are shown separately. Note the reduction to near zero each winter in the shallow water following the fall migratory bird period. The green panels represent the period when chlorophyll *a* concentration exceeded 10 µg L^{-1} and we considered the phytoplankton to be building biomass (blooming). Data from Thompson (1999).

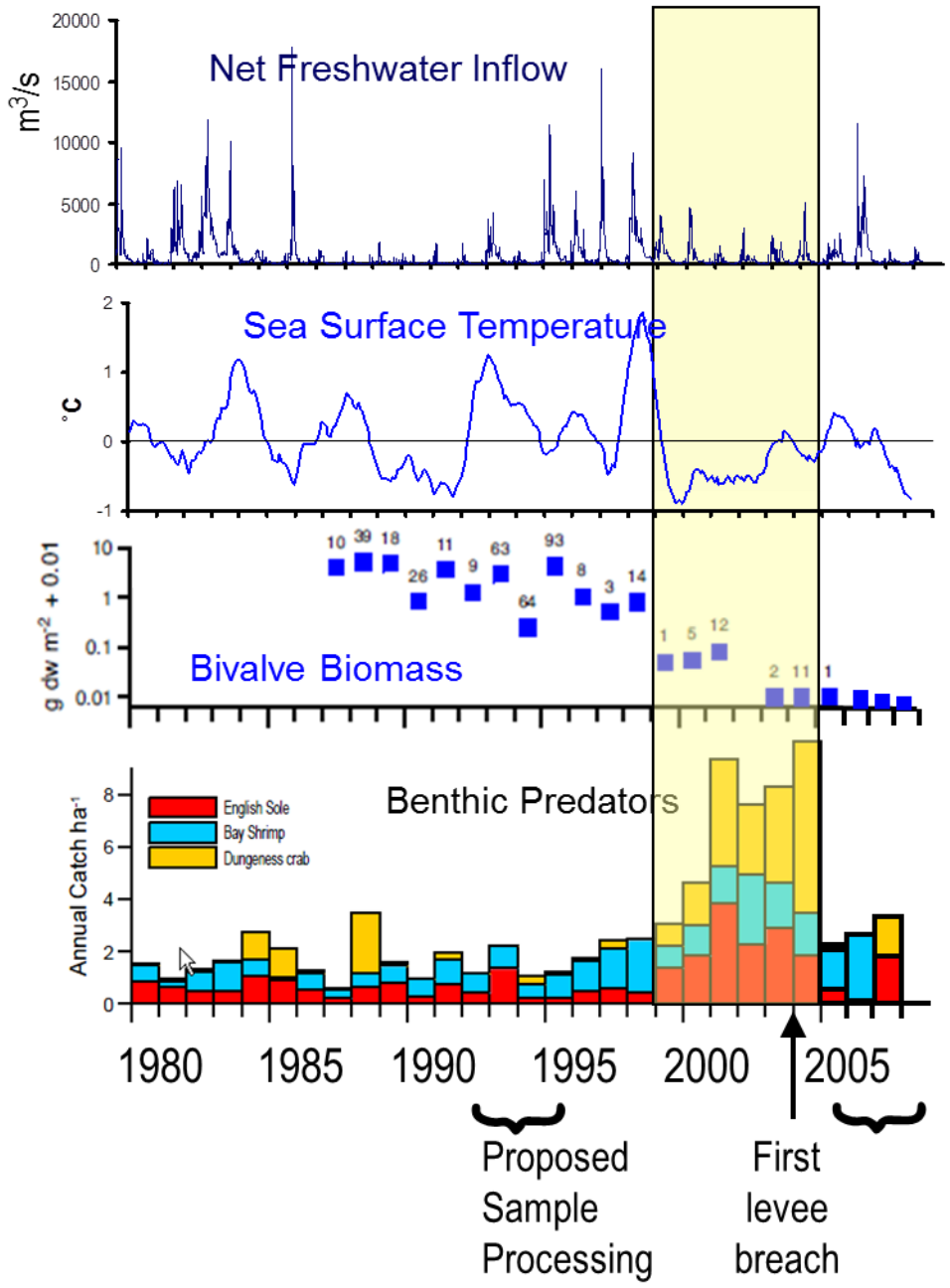


Figure 3. Edited figure from Cloern et al (2007) showing freshwater inflow into North Bay; sea surface temperature near the Farallon Islands which is used as an indicator of upwelling; average annual bivalve biomass (note log scale); and annual catch of the major juvenile fish and invertebrate predators on the bivalves. Arrow shows the onset of the Salt Pond restoration actions and brackets show the period of proposed sample analyses. Highlighted area is the time period reported in Cloern et al (2007).

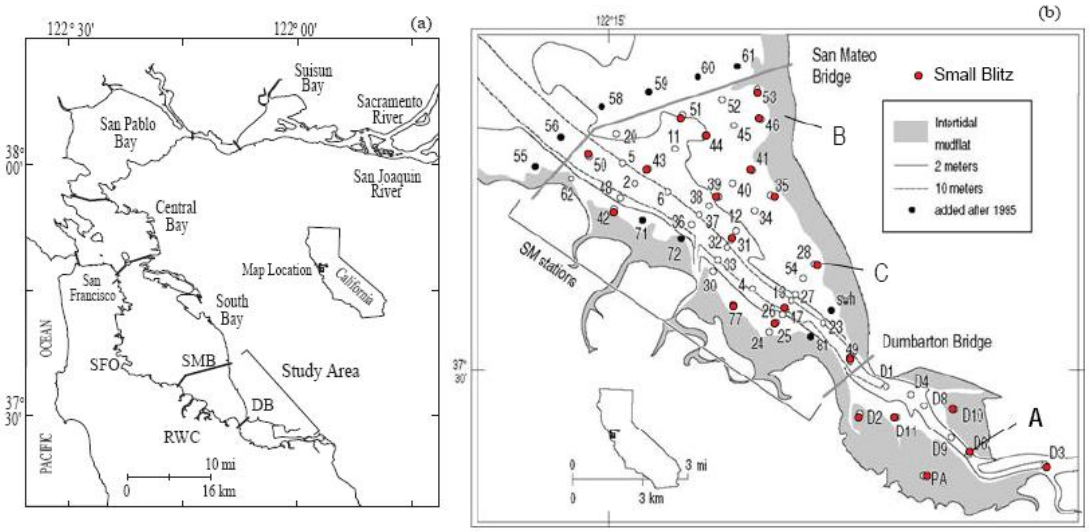


Figure 4. Study site in context of San Francisco Bay. Sampling locations shown in red. The samples at the remaining stations are not part of this proposal.

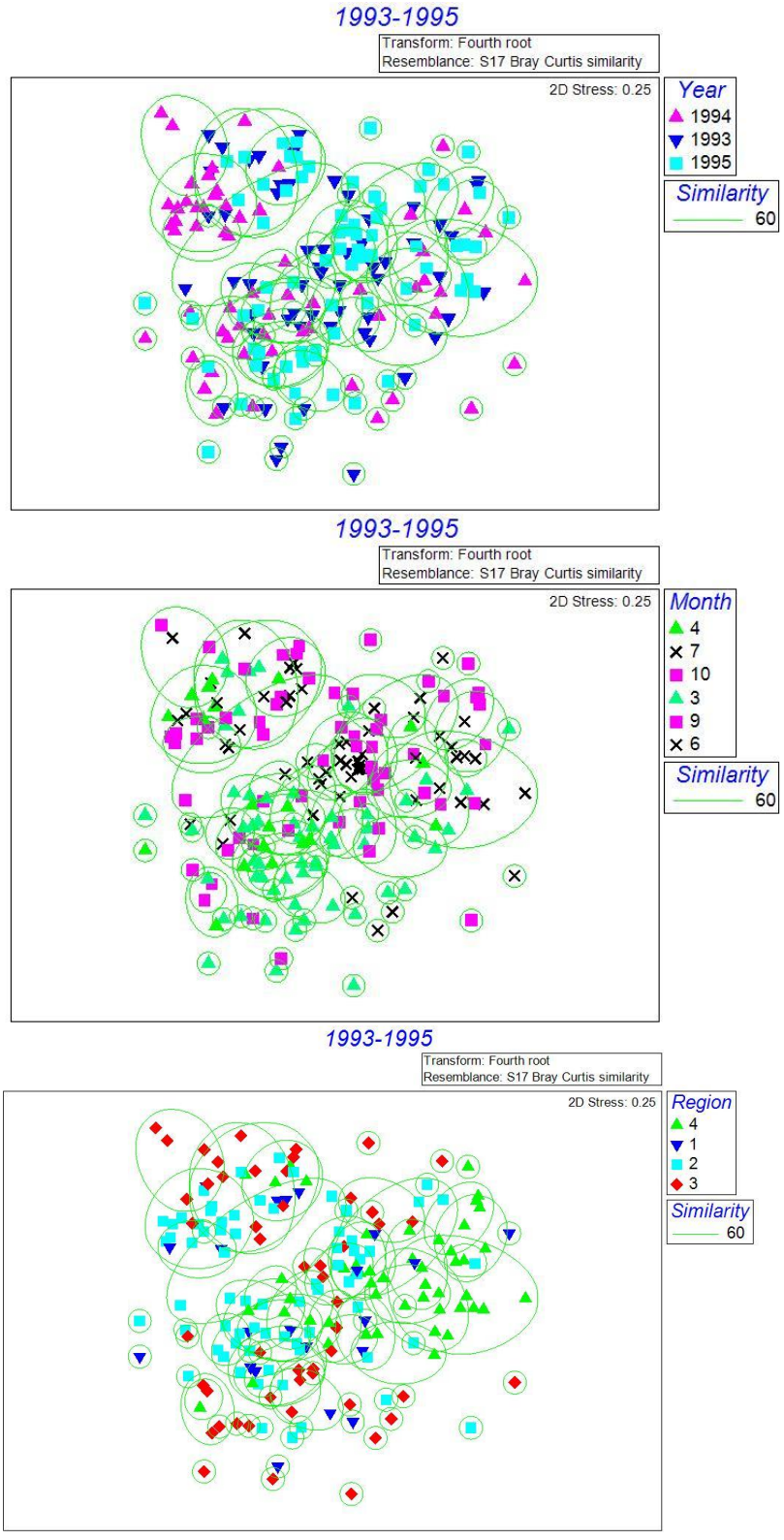


Figure 5. Multi-dimensional scaling of all benthic community data for 1993 through 1995. Data designated by year, month, and region. Region numbers are as follows: 1 : western shoal north of DB, 2: eastern shoal north of DB, 3: channel north of DB, 4: south of DB.

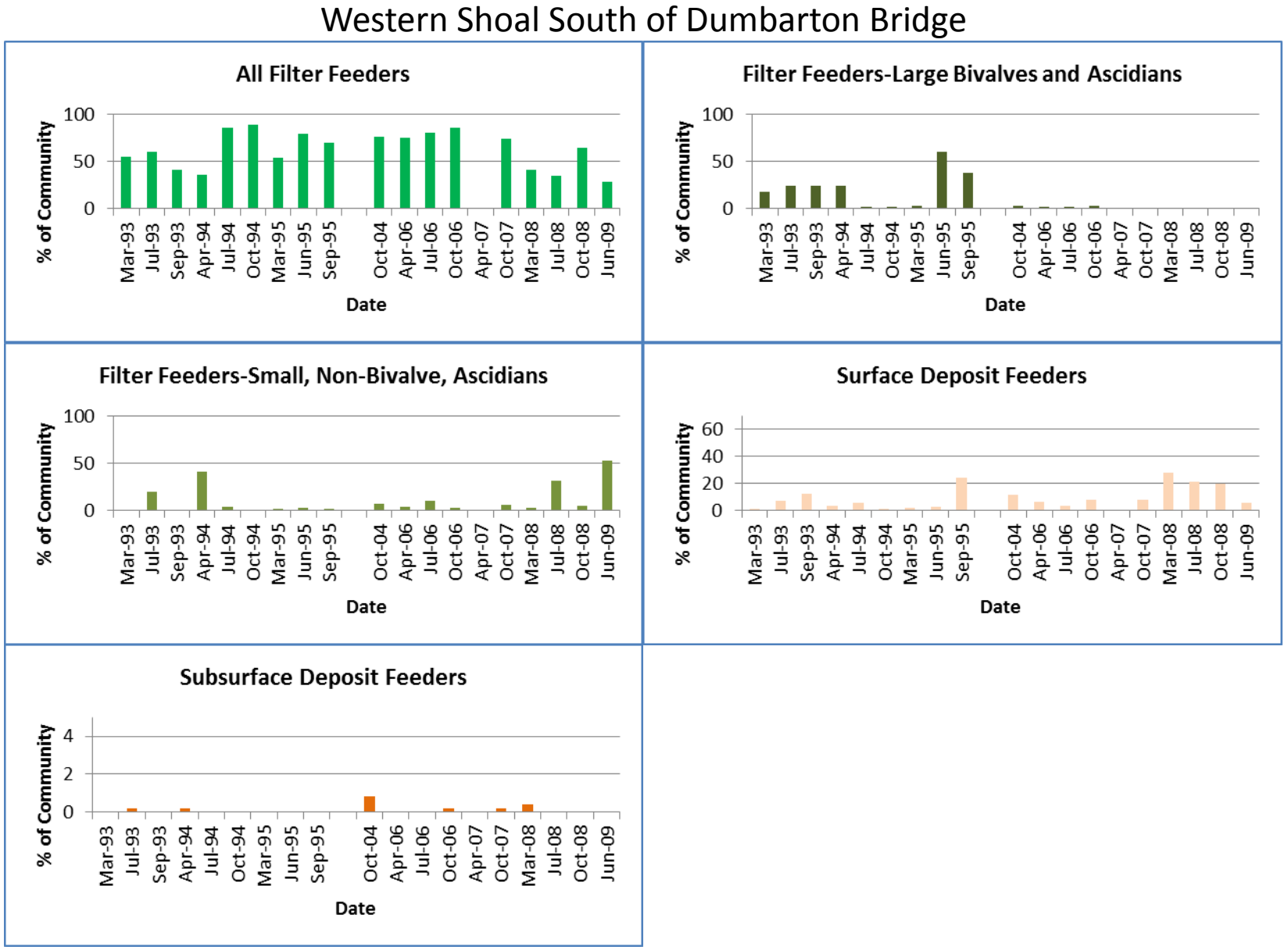


Figure6a . Time series of functional feeding groups at four locations in the south bay.

Channel South of Dumbarton Bridge

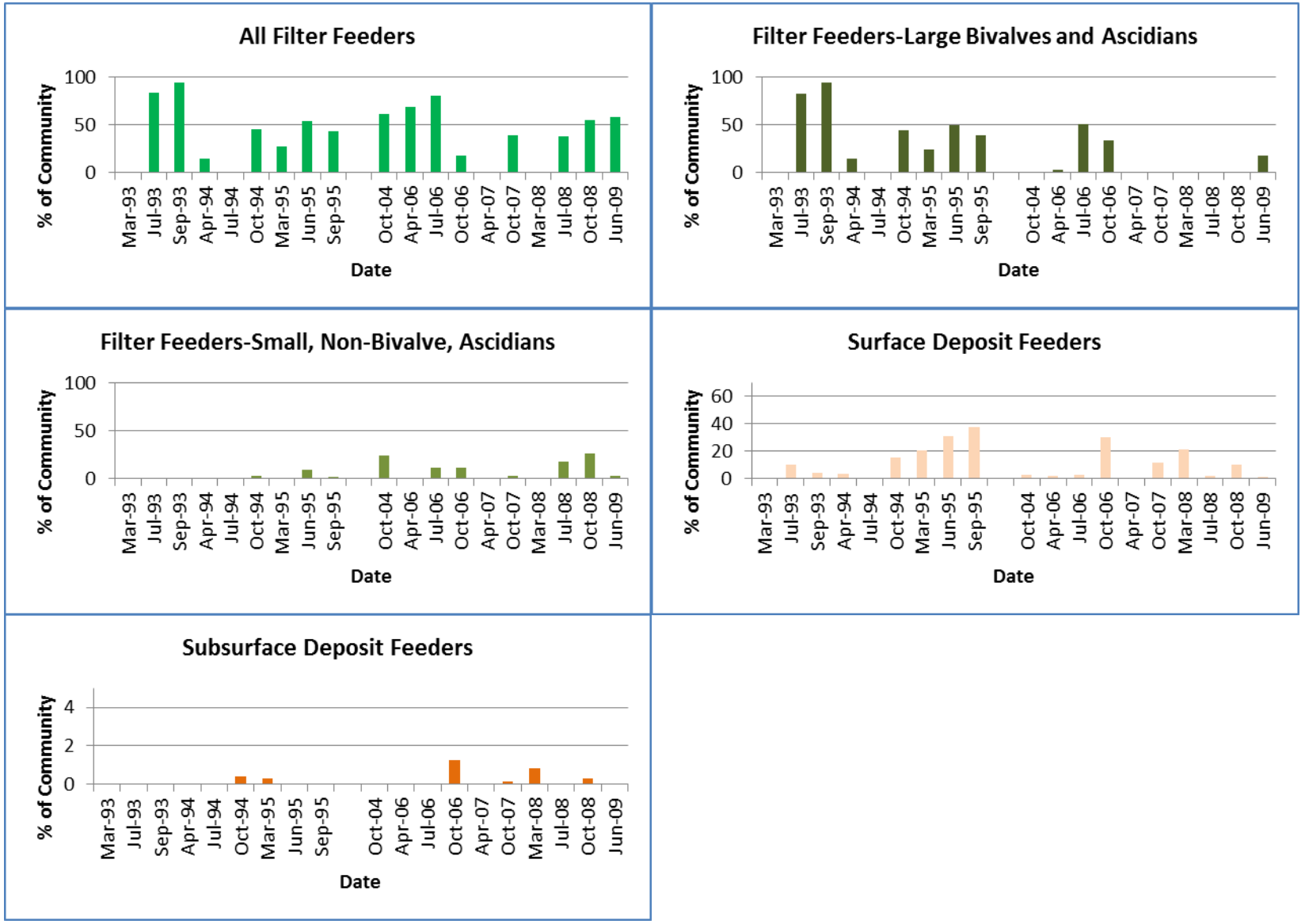


Figure6b . Time series of functional feeding groups at four locations in the south bay.

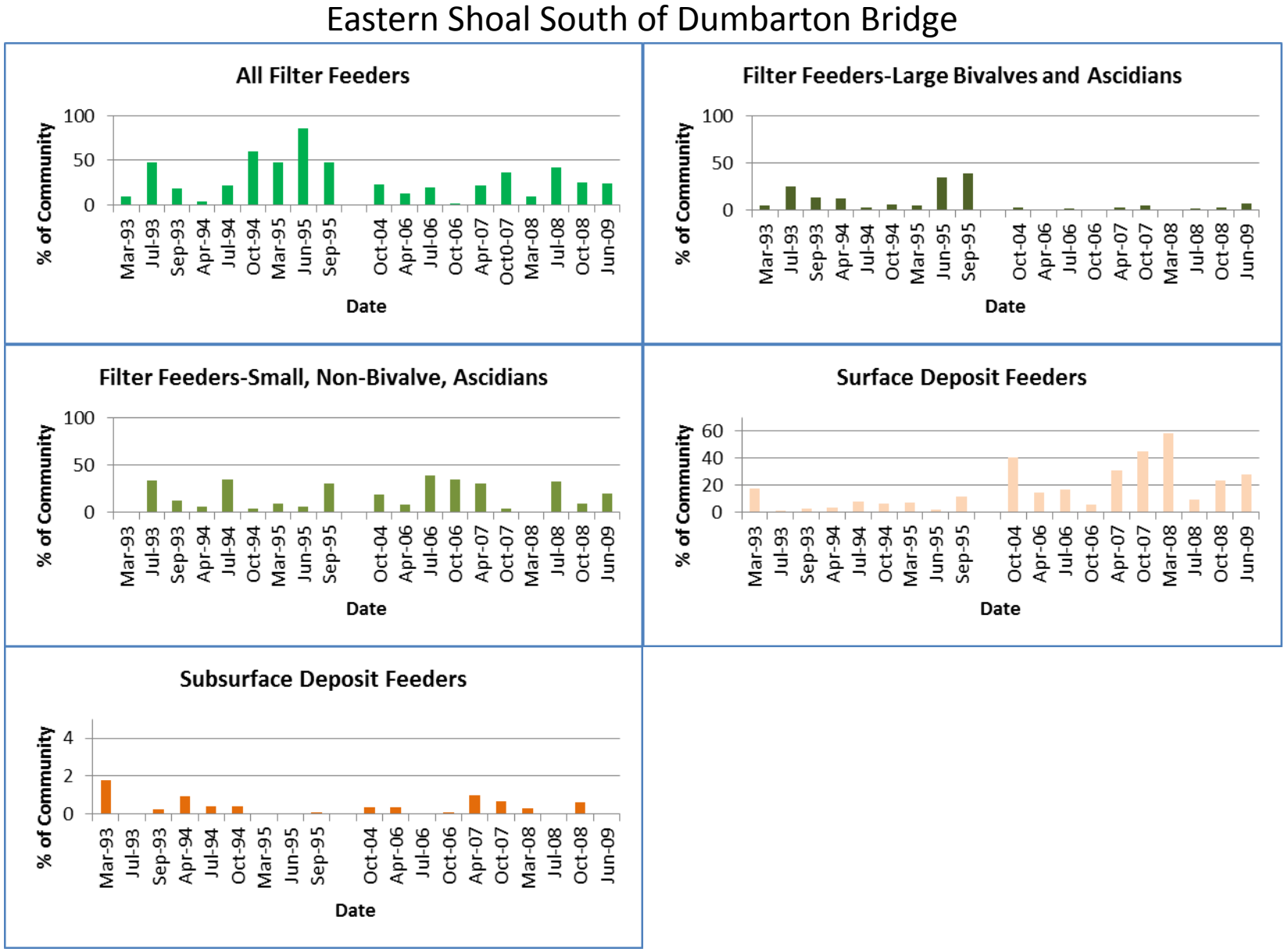


Figure6c . Time series of functional feeding groups at four locations in the south bay.

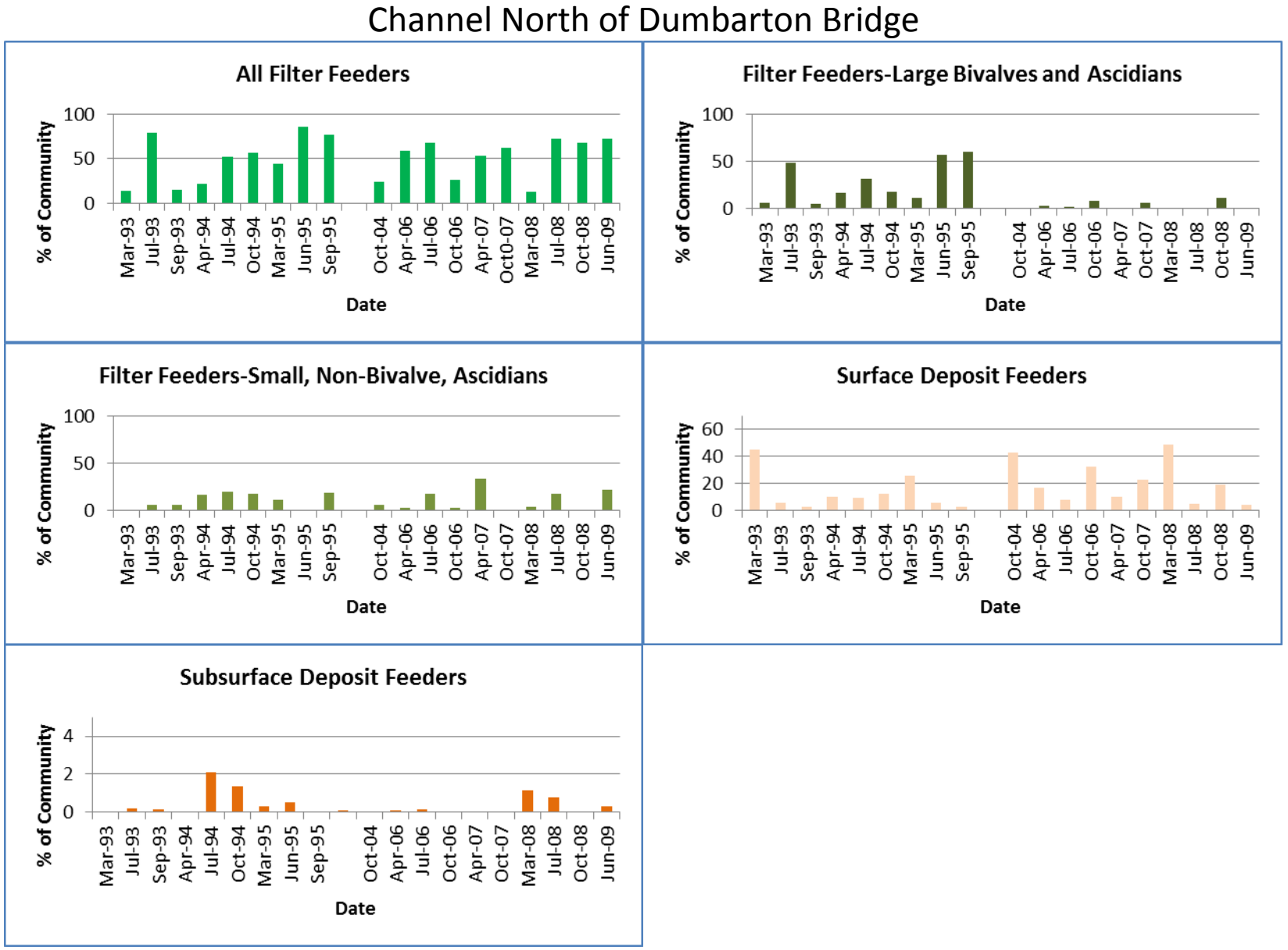
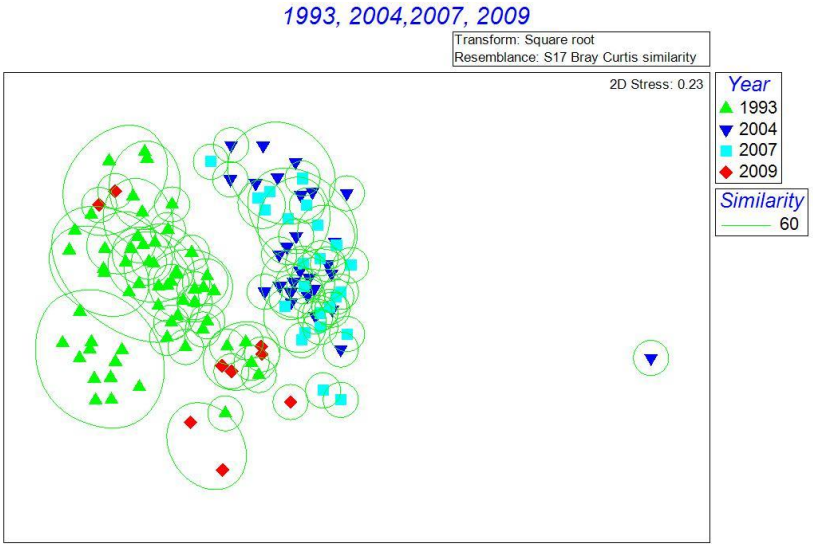


Figure6d . Time series of functional feeding groups at four locations in the south bay.



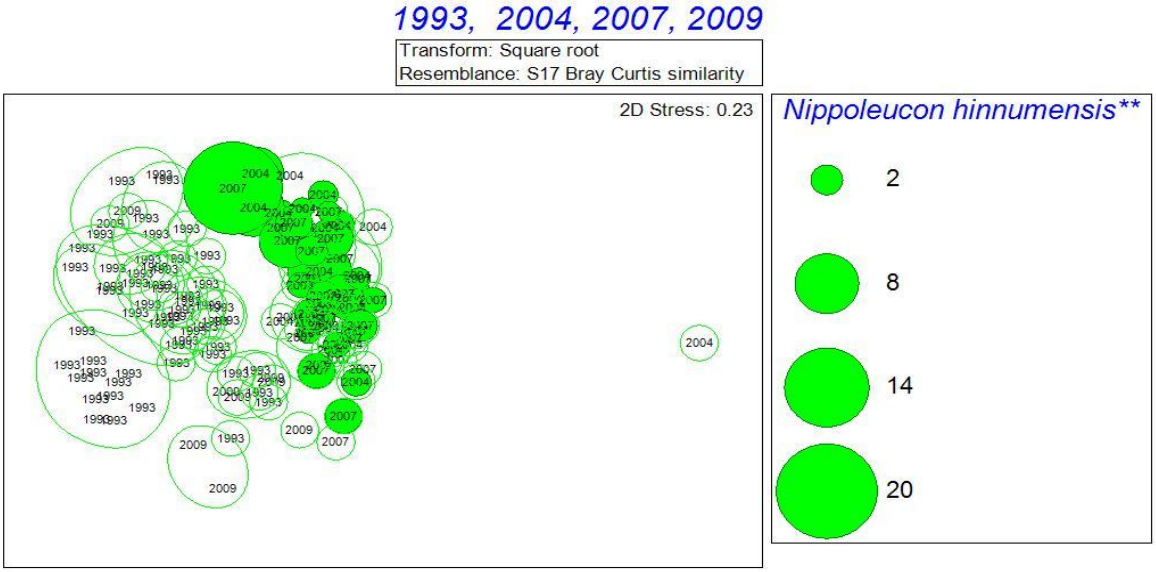


Figure 7. Multi-dimensional scaling of benthic community data for 1993 and 2004, 2007, and 2009. Data designated by year and species (*Nippoleucon*) abundance.

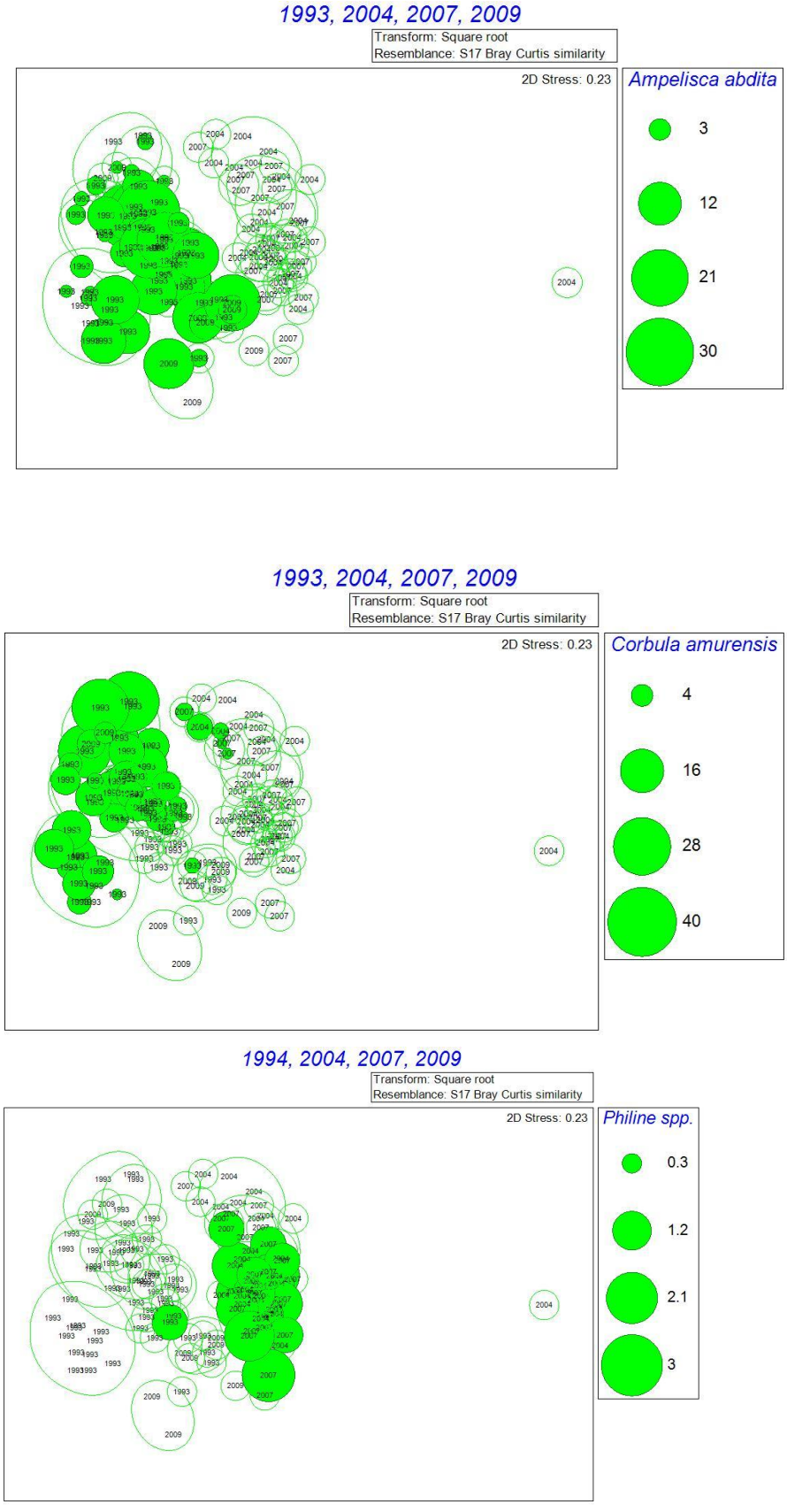


Figure 7 (con't). Multi-dimensional scaling of benthic community data for 1993 and 2004, 2007, and 2009. Data designated by species (*Ampelisca, Corbula, Philne*) abundance.

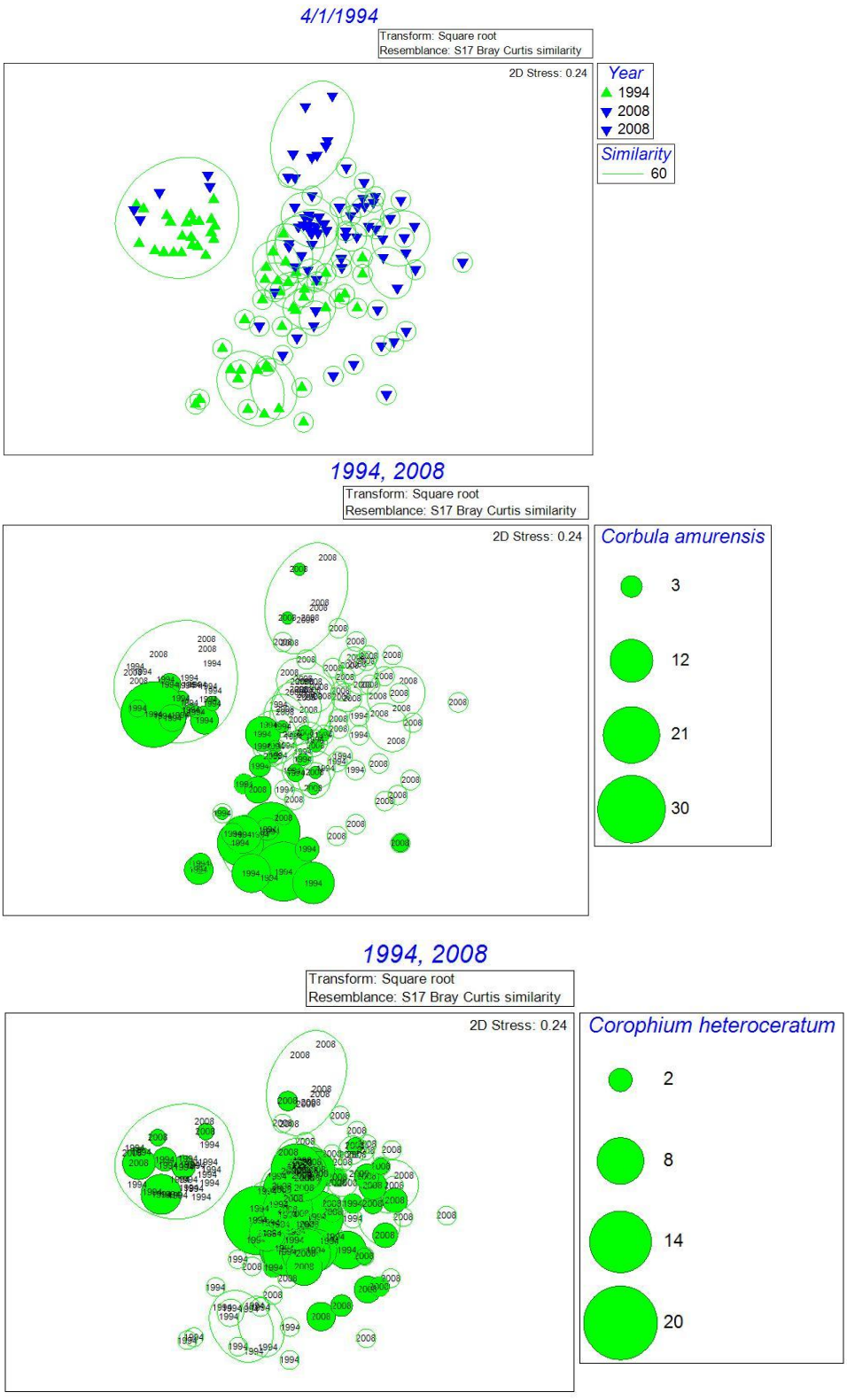


Figure 8. Multi-dimensional scaling of benthic community data for 1994 and 2008. Data labeled by year and by species (*Corbula* and Corophidae) abundance.

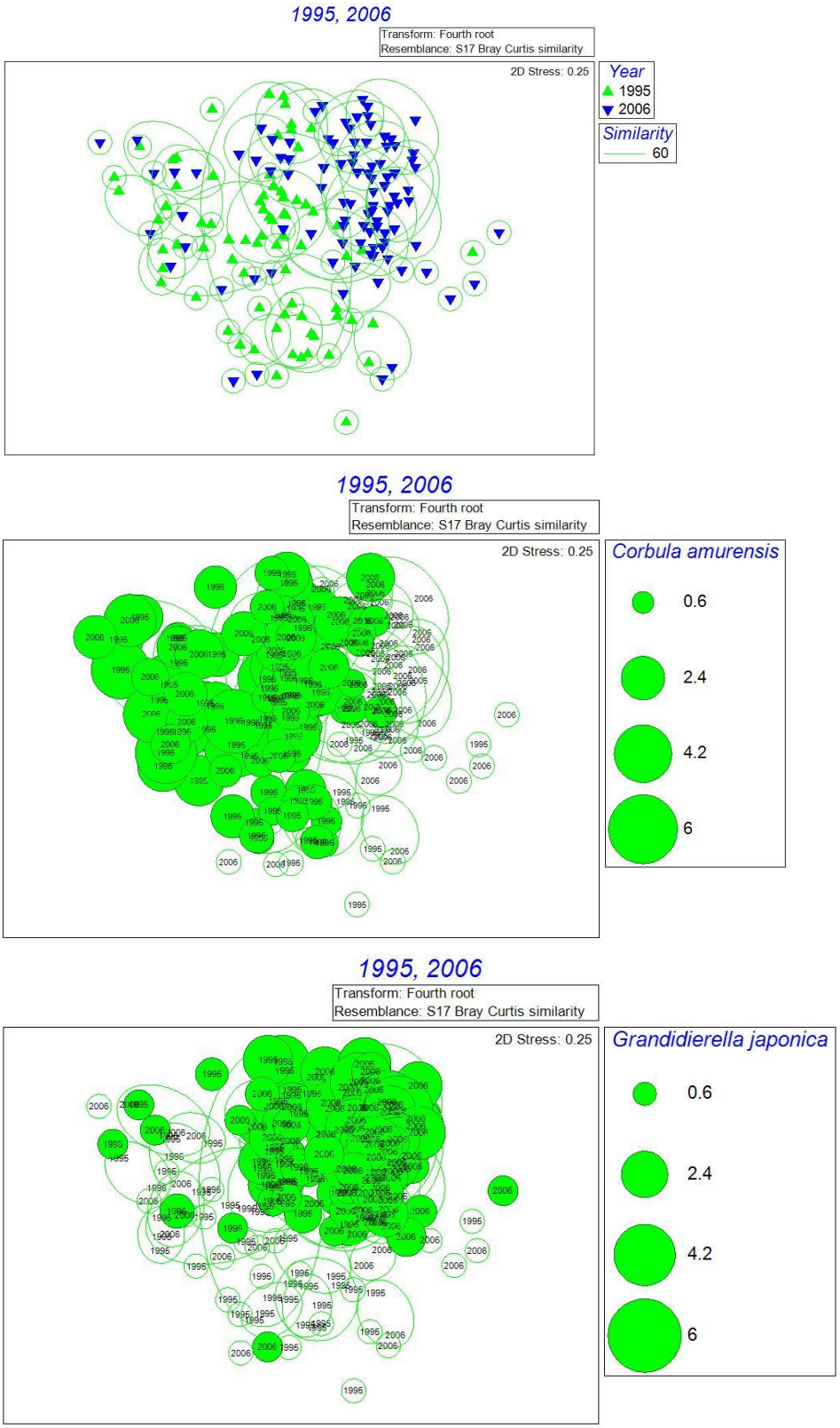


Figure 9. Multi-dimensional scaling of benthic community data for 1995 and 2006. Data labeled by year and by species (*Corbula* and a member of the Corophidae, *Grandidierella*) abundance.

Location	Representative Station	Latitude (N)	Longitude (W)	March-93	July-93	September-93	April-94	July-94	October-94	March-95	June-95	September-95	October-04
North Channel Axis	**SM2**	37.57	122.22	2.92	6.44	5.35	8.64	2.93	0.72	0.24	12.95	25.07	0.00
North Channel Slope	**SM31**	37.545	122.175	1.01	5.31	7.54	0.81	1.64	3.17	0.69	7.72	20.24	0.00
Northwest Shoal	**SM42**	37.56	122.23	1.41	19.54	6.54	7.06	5.88	3.65	0.48	12.79	25.70	1.01
Central Western Shoal	**SM25**	37.515	122.160	0.33	10.47	72.11	0.19	0.38	1.33	0.01	17.71	36.10	0.65
Northeast Eastern Shoal	**SM46**	37.59	122.17	2.92	1.81	5.98	3.81	0.96	0.26	0.40	6.75	23.19	0.16
Northeast Central Shoal	**SM44**	37.58	122.18	0.18	2.67	20.52	0.06	1.49	0.84	0.28	9.35	5.28	0.00
Central Eastern Shell Shoal	**SM35**	37.55	122.15	1.89	5.97	40.94	0.48	3.71	1.38	0.66	10.74	6.60	0.49
Central Eastern nonshell Shoal	**SM28**	37.55	122.14	0.87	12.59	55.83	0.32	0.56	1.38	0.57	11.42	14.19	0.23
Central Channel and Slope	**SM47**	37.53	122.15	1.12	17.30	14.00	3.79	2.21	4.03	0.93	8.96	13.46	2.02
Dumbarton Channel	**D1**	37.49	122.10	5.17	32.96	16.32	48.00	33.83	3.93	1.14	11.58	16.58	0.31
Southern Channel	**D6**	37.47	122.06	0.48	37.63	29.46	144.85	38.37	22.28	1.14	3.88	13.25	0.00
Dumbarton Western Shoal	**D2**	37.49	122.11	0.12	3.46	8.14	0.40	1.62	0.51	0.07	11.79	39.92	1.97
Dumbarton intertidal	**PA**	37.46	122.08	0.00	9.27	8.33	0.00	0.05	0.24	0.14	1.42	5.50	2.22
Coyote Slough Channel	**D3**	37.46	122.03	No Data	32.36	86.90	146.78	49.76	16.10	4.90	3.24	79.42	3.26
Channel N of DB	**SM31**	37.545	122.175	1.69	9.68	8.96	4.41	2.26	2.64	0.62	9.87	19.59	0.67
Eastern Shoal	**SM34**	37.56	122.18	0.98	7.08	39.10	0.29	1.92	1.20	0.50	10.50	8.69	0.24
Western Shoal	**SM77**	37.53	122.17	0.87	15.00	39.32	3.63	3.13	2.49	0.25	15.25	30.90	0.83
shoals N of DB	**SM35**	37.55	122.15	1.27	8.84	33.65	1.99	2.16	1.47	0.40	11.46	18.51	0.42
Dumbarton shoal	**PA**	37.46	122.08	0.00	6.36	8.24	0.20	0.83	0.37	0.10	6.60	22.71	2.10
N DB Channel	**SM31**	37.545	122.175	1.69	9.68	8.96	4.41	2.26	2.64	0.62	9.87	19.59	1.01
DB and S Channel	**D8**	37.49	122.10	2.82	35.29	22.89	96.42	36.10	13.10	1.14	7.73	14.92	0.16
Coyote	**D3**	37.46	122.03	No Data	32.36	86.90	146.78	49.76	16.10	4.90	3.24	79.42	3.26
N Channel and Slope	**SM2**	37.57	122.22	1.97	5.87	6.44	4.72	2.28	1.94	0.47	10.33	22.66	0.00
	units g AFDW/m2												

Figure 10a. Biomass of bivalve grazers in South Bay 1993 through June 2009.

Location	Representative Station	Latitude (N)	Longitude (W)	April-06	July-06	October-06	April-07	October-07	March-08	July-08	October-08	March-09	June-09
North Channel Axis	**SM2**	37.57	122.22	0.18	0.02	0.12	0.00	0.00	0.00	0.00	0.00	73.39	149.23
North Channel Slope	**SM31**	37.545	122.175	0.31	1.85	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Northwest Shoal	**SM42**	37.56	122.23	0.00	0.75	3.01	0.00	0.00	0.00	0.00	0.00	0.00	1.86
Central Western Shoal	**SM25**	37.515	122.160	1.50	19.59	2.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Northeast Eastern Shoal	**SM46**	37.59	122.17	0.00	3.52	0.33	0.00	0.00	2.28	0.00	0.00	0.00	0.00
Northeast Central Shoal	**SM44**	37.58	122.18	0.05	0.17	0.62	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Central Eastern Shell Shoal	**SM35**	37.55	122.15	0.05	10.39	0.50	0.00	0.55	0.00	0.00	0.00	0.92	9.41
Central Eastern nonshell Shoal	**SM28**	37.55	122.14	0.73	13.06	0.81	0.00	0.00	0.82	0.00	0.00	0.00	0.00
Central Channel and Slope	**SM47**	37.53	122.15	0.00	1.97	1.62	0.00	0.36	0.00	0.00	0.00	0.00	0.00
Dumbarton Channel	**D1**	37.49	122.10	0.34	81.30	17.64	0.00	0.00	0.00	0.00	0.00	3.55	0.00
Southern Channel	**D6**	37.47	122.06	0.77	15.25	2.33	0.00	0.00	0.00	0.00	0.00	1.24	10.88
Dumbarton Western Shoal	**D2**	37.49	122.11	0.05	0.79	1.15	0.00	0.56	0.00	0.00	0.00	0.00	0.00
Dumbarton intertidal	**PA**	37.46	122.08	0.55	3.98	3.53	0.00	0.22	0.00	5.13	0.00	0.00	7.05
Coyote Slough Channel	**D3**	37.46	122.03	4.24	32.39	37.37	0.00	0.59	0.22	9.58	15.19	4.67	4.29
Channel N of DB	**SM31**	37.545	122.175	0.16	1.28	0.58	0.00	0.12	0.00	0.00	0.00	24.46	49.74
Eastern Shoal	**SM34**	37.56	122.18	0.28	7.87	0.64	0.00	0.18	0.27	0.00	0.00	0.31	3.14
Western Shoal	**SM77**	37.53	122.17	0.75	10.17	2.66	0.00	0.00	0.00	0.00	0.00	0.00	0.93
shoals N of DB	**SM35**	37.55	122.15	0.39	7.91	1.26	0.00	0.09	0.52	0.00	0.00	0.15	1.88
Dumbarton shoal	**PA**	37.46	122.08	0.30	2.39	2.34	0.00	0.39	0.00	2.57	0.00	0.00	3.53
N DB Channel	**SM31**	37.545	122.175	0.16	1.28	0.58	0.00	0.12	0.00	0.00	0.00	24.46	49.74
DB and S Channel	**D8**	37.49	122.10	0.56	48.28	9.99	0.00	0.00	0.00	0.00	0.00	2.40	5.44
Coyote	**D3**	37.46	122.03	4.24	32.39	37.37	0.00	0.59	0.22	9.58	15.19	4.67	4.29
N Channel and Slope	**SM2**	37.57	122.22	0.25	0.94	0.07	0.00	0.00	0.00	0.00	0.00	36.70	74.62

units g AFDW/m2

Figure 10b. Biomass of bivalve grazers in South Bay 1993 through June 2009.

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Appendix 1. Species abundance data: 1993-1995, 2004-2009.

USGS BENTHIC SOUTH BAY 1993																								
DATE: March, 1993																								
TAXON	STATION #	PA REM	D6	D8	D11	SM25	SM27	SM28	SM30	SM31	SM35	SM37	SM38	SM41	SM42	SM43	SM44	SM46	SM47	SM49	SM50	SM51	SM53	SM54
Phylum Cnidaria																								
Actiniaria - attached - unid spp.										1				5		2					4			
Phylum Nemertea																								
Poseidonemertes collaris																								
Anopla - unidentified spp.																								
Tubulanus spp.															1									2
Phylum Nematoda											1							1						
Phylum Turbellaria																								
Phylum Annelida																								
Oligochaeta																								
Tubificidae unidentified								13			1	1		1	4							1	2	
Polychaeta																								
Harmothoe imbricata									1		1				2			1			1			
Exogone lourei								6				1		2	1			3				1	9	
Sphaerosyllis californiensis													1											
Typosyllis nipponica																								
Eteone nr. Californica																								
Eteone lighti																								
Eteone spp.																								
Dorvillea sp. A (= D. longicornis)																								
Nephtys caecoides					1																			
Glycera americana															1	1	1	1				1		
Glycinde picta	1			4		3	2	2	1	1	1		4	3				4	2	2		2	3	
Neanthes succinea	3			9			1																	
Marphysa sanguinea				1		1						1		1		1		2		2				
Leitoscoloplos pugettensis													1		2		1							1
Streblospio benedicti	8	1																						
Dipolydora caulleryi																								
Dipolydora socialis																					1			
Pseudopolydora kempi																								
Pseudopolydora paucibranchiata																								
Polydora cornuta	1			4			1																2	
Sabaco elongatus	1			6	11	22		50	29	4	24	25	5	3	14	14	16	12	18	5	9	5	28	
Capitella capitata complex												1												
Heteromastus filiformis	11	4		3				2	1			2	4	1			1	2			2	1	4	
Cossura spp.																								
Tharyx parvus																								
Tharyx nr. Parvus																								
Tharyx spp.																								
Cirriformia nr. Moorei											1	5	1		2		1					1		1
Cirratulidae unidentified spp.																								
Euchone limnicola														1	1		1							1
Ameana sp. A (= A. sp. SF1)																								
Neoamphitrite sp. A																								
Polycirrus spp. (= P. californica)																						2		
Annelida unidentified																								
Phylum Arthropoda																								
Copepoda																								
Harpacticoida - unidentified spp.																								
Cirripedia																								
Amphibalanus improvisus																								
Balanomorpha unidentified																								
Mysidacea																								
Alienacanthomysis macropsis																								
Mysidacea unidentified																								
Crustacea																								
Cumacea																								
Nippoleucon hinnumensis	477	1143	401	172	391		1061	22	7	2435		7	1395	1359		153	214	31	4	1	30	929	2	
Isopoda																								

USGS BENTHIC SOUTH BAY 1993																								
DATE: March, 1993																								
TAXON	**STATION #**	PA REM	D6	D8	D11	SM25	SM27	SM28	SM30	SM31	SM35	SM37	SM38	SM41	SM42	SM43	SM44	SM46	SM47	SM49	SM50	SM51	SM53	SM54
Paranthura japonica								2																
Synedotea laevidorsalis								1						24										
Ostracoda																								
Eusarsiella zostericola						1					1						73							1
Amphipoda																								
Americorophium spinicorne																								
Ampelisca abdita		221	2	6	278	24	3	1	190			9		2	54	4	4				4	18	7	154
Ampithoe valida																								
Ampithoe spp.																								
Corophium heteroceratum				1	50	2	2					1			31							3		
Eochelidium cf. miraculum																								
Oedicerotidae unidentified spp.																								
Monocorophium acherusicum									1															1
Monocorophium insidiosum																								
Moncorophium spp. (no antennae or juvenile)									2						1									
Corophiidae unid. Spp.																						1		
Grandidierella japonica						2		1			3	1	1	14	8			1				0	1	
Stenothoe sp.																								
Amphipoda unidentified																								
Decapoda																								
Crangon nigricauda																								
Brachyura zoea																								
Insecta																								
Collembola - unidentified																								
Mollusca																								
Gastropoda																								
Philine spp.																								
Crepidula plana																								
Crepidula convexa																								
Crepidula spp.											2			1										
Urosalpinx cinerea																								
Gastropoda unidentified									1															
Bivalvia																								
Corbula amurensis			20	53		46				4	120					23			22	83		5		1
Cryptomya californica																								
Gemma gemma		380			4		2										4	69	1				45	
Macoma petalum																								
Macoma spp.			3																6					
Mya arenaria									3		1			1										
Musculista senhousia		1					9	2		19	4			2	2	1	4	2		2		1	2	17
Mytilus spp.																								
Theora lubrica																								
Venerupis Philippanarum						17	8		22					4	7	8				1	4	1		37
Veneridae unidentified																								
Bivalvia unidentified+													3											
Echinodermata																								
Ophiuroidea - unidentified																1								
Phylum Bryozoa																								
Bryozoa unidentified spp.																+			+	+				+
Phylum Chordata																								
Ascidiacea																								
Molgula manhattensis																								
Ascidiacea unidentified																								
TOTAL		**1104**	**1173**	**461**	**531**	**495**	**50**	**1091**	**296**	**62**	**2575**	**44**	**42**	**1466**	**1483**	**55**	**256**	**315**	**76**	**112**	**20**	**78**	**1006**	**250**

USGS BENTHIC SOUTH BAY 1993 - 1995																
DATE: July, 1993																
TAXON	STATION #	PA REM	D2	D3	D6	D10	D11	SM25	SM28++	SM31	SM35	SM42	SM43	SM44	SM47	SM49
Phylum Cnidaria																
Actiniaria - attached - unid spp.													2			
Phylum Nemertea																
Poseidonemertes collaris																
Anopla - unidentified spp.																
Tubulanus sp.													1		1	
Phylum Nematoda																
Phylum Turbellaria																
Phylum Annelida																
Oligochaeta																
Tubificidae unidentified			1	1	3											
Polychaeta																
Harmothoe imbricata							1			3	2		2			
Exogone lourei																
Sphaerosyllis californiensis																
Typosyllis nipponica																
Eteone nr. Californica																
Eteone lighti		1														
Eteone spp.																
Dorvillea sp. A (= D. longicornis)																
Nephtys caecoides																
Glycera americana																
Glycinde picta			8				10	1	8	3	3	8	3	5	5	6
Neanthes succinea		9	31	6	1	92	38	2	2	1	1	2	10		2	6
Marphysa sanguinea											1		1	1		1
Leitoscoloplos pugettensis												3		1		
Streblospio benedicti				3		5										
Dipolydora caulleryi													2			
Dipolydora socialis																
Malacoceros sp.							1									
Pseudopolydora kempi									1		1					
Pseudopolydora paucibranchiata														1		
Polydora cornuta																
Sabaco elongatus		2	1					10	1	6	2	3	10	1	6	12
Capitella capitata complex																
Heteromastus filiformis		8	4	33	3	305	1			1				1	1	
Cossura spp.																
Tharyx parvus																
Tharyx nr. Parvus																
Tharyx spp.																
Cirriformia cf. Moorei													9	1		1
Cirratulidae unidentified spp.										1						
Euchone limnicola																

USGS BENTHIC SOUTH BAY 1993 - 1995																
DATE: July, 1993																
TAXON	STATION #	PA REM	D2	D3	D6	D10	D11	SM25	SM28++	SM31	SM35	SM42	SM43	SM44	SM47	SM49
Ameana sp. A (= A. sp. SF1)																
Neoamphitrite sp. A																
Polycirrus spp. (= P. californica)																
Annelida unidentified																
Phylum Arthropoda																
Copepoda																
Harpacticoida - unidentified spp.																
Cirripedia																
Amphibalanus improvisus																
Balanomorpha unidentified																
Mysidacea																
Alienacanthomysis macropsis																
Mysidacea unidentified																
Crustacea																
Cumacea																
Nippoleucon hinnumensis			178	10	8	27	29	47	149		20	48		14		
Isopoda																
Paranthura japonica											2	25				
Synedotea laevidorsalis								1		11						1
Ostracoda																
Eusarsiella zostericola									6				4	5		
Amphipoda																
Americorophium spinicorne																
Ampelisca abdita		1	116	3	5	3	763	1	13	28	14		570	232	3	2
Ampithoe valida																
Ampithoe spp.																
Corophium heteroceratum		2	2				1			3			1	59		
Eochelidium cf. miraculum																
Oedicerotidae unidentified spp.																
Monocorophium acherusicum			12				287	2		2	2		7	48	1	2
Monocorophium insidiosum										1						
Moncorophium spp. (no antennae or juvenile)			6				53	1				10	2	11	1	
Corophiidae unid. spp.																
Grandidierella japonica			115				51		53	8	119	60	2	7		1
Stenothoe sp.																
Amphipoda unidentified																
Decapoda																
Crangon nigricauda																
Brachyura zoea																
Insecta																
Collembola - unidentified																
Mollusca																
Gastropoda																

USGS BENTHIC SOUTH BAY 1993 - 1995																
DATE: July, 1993																
TAXON	**STATION #**	PA REM	D2	D3	D6	D10	D11	SM25	SM28++	SM31	SM35	SM42	SM43	SM44	SM47	SM49
Philine spp.																
Crepidula plana																
Crepidula convexa																
Crepidula spp.									1							
Urosalpinx cinerea																
Gastropoda unidentified																
Bivalvia																
Corbula amurensis		110	36	146	562	1	40	68	233	8	34		24	24	204	229
Cryptomya californica																
Gemma gemma		47				218										
Macoma petalum				8		12										11
Macoma spp.					12										4	
Mya arenaria								1	2					4		
Musculista senhousia		3						3	3	3	3	21	4			4
Mytilus spp.																
Theora lubrica																
Venerupis Philippanarum			1					8			1	15	15	1		
Veneridae unidentified																
Bivalvia unidentified																
Echinodermata																
Ophiuroidea - unidentified												8	1			
Phylum Bryozoa																
Bryozoa unidentified spp.								+				+				+
Phylum Chordata																
Ascidiacea																
Molgula manhattensis												1	1			
Ascidiacea unidentified																
TOTAL		**183**	**511**	**210**	**594**	**663**	**1275**	**145**	**472**	**79**	**205**	**204**	**671**	**416**	**228**	**276**

USGS BENTHIC SOUTH BAY 1993 - 1995																				
DATE: September, 1993																				
TAXON **STATION #**	PA	D2	D3	D6	D11	SM25	SM28**	SM31	SM35**	SM39	SM41*	SM42	SM43	SM44**	SM46	SM47	SM49	SM50	SM51	SM53
Phylum Cnidaria																				
Actiniaria - attached - unid. spp.						4		5	52	1	2		1					5		
Phylum Nemertea																				
Poseidonemertes collaris																				
Anopla - unidentified spp.																				
Tubulanus sp.																		2	1	
Phylum Nematoda											7							4		
Phylum Turbellaria																				
Phylum Annelida																				
Oligochaeta																				
Tubificidae unidentified									5		107							5		
Polychaeta																				
Harmothoe imbricata						2				4	1	3		1						
Exogone lourei									24		119									
Sphaerosyllis californiensis																				
Typosyllis nipponica												1							3	
Eteone nr. Californica																				
Eteone lighti																				
Eteone spp.																				
Dorvillea sp. A (= D. longicornis)													1							
Nephtys caecoides																				
Glycera americana													1						1	
Glycinde picta		3				1	5	1	23	2	21			6	1	2	1	1	5	9
Neanthes succinea	16	13	11	2	19	2	2	4	1	1		1	7			1	8			
Marphysa sanguinea								1		1	4		2	1			1			5
Leitoscoloplos pugettensis										1		2								
Streblospio benedicti	3	1	1															1		4
Dipolydora caulleryi																				
Dipolydora socialis																				
Pseudopolydora kempi							3		5		2								1	11
Pseudopolydora paucibranchiata																				4
Polydora cornuta							12		36		34			13	1					76
Sabaco elongatus					2	23		10		7	2		5			3	12		6	1
Capitella capitata complex																				
Heteromastus filiformis	187	7	66	7	3	1		1	1					2		3	4	1	3	2
Cossura spp.																				
Tharyx parvus																				
Tharyx nr. Parvus																				
Tharyx spp.																				
Cirriformia nr. Moorei								5			1		10					11		
Cirratulidae unidentified spp.																				
Euchone limnicola																				3
Ameana sp. A (= A. sp. SF1)																				
Neoamphitrite sp. A																				
Polycirrus spp. (= P. californica)																			3	
Annelida unidentified																				
Phylum Arthropoda																				
Copepoda																				
Harpacticoida - unidentified spp.																				
Cirripedia																				
Amphibalanus improvisus																				1

USGS BENTHIC SOUTH BAY 1993 - 1995																				
DATE: September, 1993																				
TAXON **STATION #**	PA	D2	D3	D6	D11	SM25	SM28**	SM31	SM35**	SM39	SM41*	SM42	SM43	SM44**	SM46	SM47	SM49	SM50	SM51	SM53
Balanomorpha unidentified	1																			
Unidentified Cirrepedia spp.																				
Mysidacea																				
Alienacanthomysis macropsis																				
Mysidacea unidentified																				
Crustacea																				
Cumacea																				
Nippoleucon hinnumensis	22	31	1	1	8	1	446	1	82	2	208	38	2	25	108				1	23
Isopoda																				
Paranthura japonica					2		1		6		5	13		5				1	4	1
Synedotea laevidorsalis	1		5	1		4		2	1	1			4			3	8	6		1
Ostracoda																				
Eusarsiella zostericola					10	4	63				60		6	11	59	1			1	
Amphipoda																				
Americorophium spinicorne																				
Ampelisca abdita	48	41			720	3	11	77	23	128	204		572	396	78	1	9	178	200	236
Ampithoe valida																				
Ampithoe spp.									3											3
Corophium heteroceratum							1	10		1				70					24	17
Eochelidium cf. miraculum																				
Oedicerotidae unidentified spp.																				
Monocorophium acherusicum	1		1		1				6		1		5	3				19	1	4
Monocorophium insidiosum																				
Moncorophium spp. (no antennae or juvenile)					2		1		6									6		
Corophiidae unid. spp.													1				1			
Grandidierella japonica	6				5	2	26		114	2	180	1	4	4	95				6	243
Stenothoe sp.																				
Caprellidae - unidentified spp.																				
Pleustidae - unidentified spp.										2										5
Amphipoda unidentified																				
Caprella scaura									8											
Caprella spp.											18									
Decapoda																				
Crangon nigricauda																				
Brachyura zoea																				
Insecta																				
Collembola - unidentified																				
Mollusca																				
Gastropoda																				
Philine spp.										1										
Crepidula plana																				
Crepidula convexa									7		13									5
Crepidula spp.									2		13									3
Urosalpinx cinerea									1											
Gastropoda unidentified																				
Bivalvia																				
Corbula amurensis	122	114	944	775	15	70	166	6	40				32	32	4	167	49		1	
Corbicula fluminea							1													
Cryptomya californica																				
Gemma gemma	415						1								405		1			318
Macoma petalum																				

USGS BENTHIC SOUTH BAY 1993 - 1995																					
DATE: September, 1993																					
TAXON	**STATION #**	PA	D2	D3	D6	D11	SM25	SM28**	SM31	SM35**	SM39	SM41*	SM42	SM43	SM44**	SM46	SM47	SM49	SM50	SM51	SM53
Macoma spp.					14						2						3			4	
Mya arenaria							9														
Musculista senhousia		4	1				14	1	3	1	32	2	10	12	3	4		1		4	1
Mytilus spp.																					
Theora lubrica																					
Venerupis Philippanarum			1				17	1			3	2	18	8	2			1	4	1	1
Veneridae unidentified																					
Bivalvia unidentified																					
Echinodermata																					
Ophiuroidea - unidentified													45	1							
Phylum Bryozoa																					
Bryozoa unidentified spp.							+	+									+		+		+
Phylum Chordata																					
Ascidiacea																					
Molgula manhattensis							2				3				1		1		5		
Ascidiacea unidentified																					
TOTAL		**826**	**212**	**1029**	**800**	**787**	**159**	**741**	**126**	**447**	**194**	**1006**	**132**	**674**	**575**	**755**	**185**	**96**	**249**	**270**	**977**

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DATE: April, 1994*																				
TAXON **STATION #**	D2	D3	D6	D10	D11	SM25	SM28	SM31	SM35	SM39	SM41	SM42	SM43	SM44	SM46	SM47	SM49	SM50	SM51	SM53
Phylum Cnidaria																				
Actiniaria - attached - unid spp.						1		4	2		6	2				1				
Phylum Nemertea																				
Posieonemertes collaris																				
Anopla - unidentified spp.																				
Tubulanus spp.								1		3	1	2						3		
Phylum Nematoda											3	5								
Phylum Turbellaria																				
Phylum Annelida																				
Oligochaeta																				
Tubificidae unidentified		2					23	1		4	8					23		8		11
Polychaeta																				
Harmothoe imbricata	17				30		1	16		3	4	5	1	1	1	1	3	2		2
Exogone lourei	8				6		33		3	3	65	13		1		4				35
Sphaerosyllis californiensis																				
Typosyllis nipponica												1				1				
Eteone nr. Californica																				
Eteone lighti		2																		
Eteone spp.																				
Podarkiopsis glabrus								1												
Dorvillea sp. A (= D. longicornis)												1								
Nephtys caecoides										1										
Glycera americana												2				1				
Glycera spp.												2								
Glycinde picta	29	6	4	6	125	11	7	19	12	2	17	4		5	13	3	1	13	6	3
Neanthes cornuta	1		1					2												
Neanthes succinea	4	8	8	44	18	3	1	5									7			1
Nereidae unidentified species					2															
Marphysa sanguinea					2			2					2		1				1	1
Leitoscoloplos pugettensis	4				2	1	2	1		1		24				9				
Streblospio benedicti	2	5	1	9																3
Dipolydora caulleryi																				
Dipolydora socialis																				
Pseudopolydora kempi	1									3					1					
Pseudopolydora paucibranchiata	2				4		2													
Polydora cornuta	2	3			9							2	1			1				
Sabaco elongatus	9				7	28		85	1	2	2		2	14	8		3		8	2
Capitella capitata complex																				
Heteromastus filiformis	24	46	56	320	90	2		6	1	2		2		2		1		2	1	3
Cossura spp.																				
Tharyx parvus																				
Tharyx nr. Parvus																				
Tharyx spp.																				
Cirriformia nr. Moorei								43				1	1				2	11	1	1
Cirratulidae unidentified spp.			1							1										
Euchone limnicola				1	5	1	1	10	1				1	1					7	
Ameana sp. A (= A. sp. SF1)																				
Neoamphitrite sp. A																				
Polycirrus spp. (= P. californica)																				
Annelida unidentified																				
Phylum Arthropoda																				

USGS BENTHIC SOUTH BAY 1993 - 1995																				
DATE: April, 1994*																				
TAXON	STATION #	D2	D3	D6	D10	D11	SM25	SM28	SM31	SM35	SM39	SM41	SM42	SM43	SM44	SM46	SM47	SM49	SM50	SM51	SM53
Copepoda																					
Harpacticoida - unidentified spp.																					
Cirripedia																					
Amphibalanus improvisus																					
Balanomorpha unidentified													1								
Mysidacea																					
Alienacanthomysis macropsis																					
Mysidacea unidentified																					
Crustacea																					
Cumacea																					
Nippoleucon hinnumensis		336	171	613	401	897	380	566	3	1955	91	908	8		274	478	13	3	3	267	288
Isopoda																					
Paranthura japonica		2						5		1	3	4	1	3	1	4				2	
Synedotea laevidorsalis		2	2			4	2		4									9			
Ostracoda																					
Eusarsiella zostericola					1	2				4		2			3						7
Amphipoda																					
Americhelidium sp.							1														
Americorophium spinicorne																					
Ampelisca abdita		313		1	3	3180	29		26		8			16		2		2	3	8	
Ampithoe valida																					
Ampithoe spp.																					
Corophium heteroceratum		96				300	85		107	35	52	4	2	28	43	2			4	74	
Eochelidium cf. miraculum																					
Oedicerotidae unidentified spp.						1										3				1	
Monocorophium acherusicum		1				6															
Monocorophium insidiosum																					
Moncorophium spp. (no antennae or juvenile)		1				4															
Corophiidae unid. spp.																					4
Grandidierella japonica		11				35		14								9					
Stenothoe sp.																					
Amphipoda unidentified																					
Decapoda																					
Crangon nigricauda																					
Brachyura zoea																					
Crustacea unidentified^^			2																		
Insecta																					
Collembola - unidentified																					
Mollusca																					
Gastropoda																					
Philine spp.									4				2		1			2			
Crepidula plana																					
Crepidula convexa													3								
Crepidula spp.																					
Urosalpinx cinerea																					
Gastropoda unidentified																					
Bivalvia																					
Corbula amurensis			499	198				2	1	1	1						10	791		4	
Cryptomya californica						1															
Gemma gemma		1			59	86		1							2	86				1	578
Macoma petalum																					

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DATE: April, 1994*																				
TAXON	**STATION #**	D2	D3	D6	D10	D11	SM25	SM28	SM31	SM35	SM39	SM41	SM42	SM43	SM44	SM46	SM47	SM49	SM50	SM51	SM53
Macoma spp.		1	3				5		5					2	2			11			
Mactridae unidentified sp.										1											
Mya arenaria																					
Musculista senhousia		6	38			1	3		1	1	16		5	70	6	2	2	1		9	1
Mytilus spp.																					
Theora lubrica																					
Venerupis Philippanarum											2	1	4					1	2		
Veneridae unidentified																					
Bivalvia unidentified																					
Echinodermata																					
Ophiuroidea - unidentified									1												
Phylum Bryozoa																					
Bryozoa unidentified spp.								+		+		+					+	+	+		+
Phylum Chordata																					
Ascidiacea																					
Molgula manhattensis																		1			
Ascidiacea unidentified																					
TOTAL		**873**	**787**	**883**	**844**	**4817**	**552**	**658**	**348**	**2018**	**198**	**1025**	**92**	**127**	**356**	**610**	**70**	**837**	**51**	**390**	**940**

USGS BENTHIC SOUTH BAY 1993 - 1995																									
DATE: July, 1994*																									
TAXON	STATION #	PA	D2	D3	D6	D10	D11	SM2	SM5	SM6	SM25	SM28	SM31	SM34	SM35	SM41	SM42	SM44	SM46	SM47	SM49	SM50	SM51	SM53	
Phylum Cnidaria																									
Actiniaria - attached - unid spp.								1				2			4	3							2	1	
Phylum Nemertea																									
Posieonemertes collaris																									
Anopla - unidentified spp.																									
Tubulanus spp.								1						2				1				3	1		
Phylum Nematoda														12									1		
Phylum Turbellaria																									
Phylum Annelida																									
Oligochaeta																									
Tubificidae unidentified			11	1								7		15	11	15			1			3		6	
Polychaeta																									
Harmothoe imbricata			1				11				3							1	1						
Malmgreniella macginitiei																						1			
Exogone lourei			18									9		9	36	40			2			1	1	32	
Sphaerosyllis californiensis								1						1								1			
Typosyllis nipponica																									
Eteone nr. Californica																									
Eteone lighti																									
Eteone spp.																									
Podarkiopsis glabrus																									
Dorvillea sp. A (= D. longicornis)																									
Nephtys caecoides																				1					
Neanthes cornuta							1	1		1	3		5		3	1		1	1	25	1		3	3	
Glycera americana																									
Glycera spp.			6																						
Glycinde picta		14					7	3	7		4	23	1	18	21	25		7	15		2		5	21	
Neanthes succinea		7	3	1		49	1		1		1										1				
Nereidae unidentified species		1																							
Marphysa sanguinea													1	1		1			3				1	2	
Leitoscoloplos pugettensis			2					1				1		3		2			1					1	
Streblospio benedicti		6		31		53						2			1					1					
Dipolydora caulleryi									17																
Dipolydora socialis																									
Pseudopolydora kempi																									
Pseudopolydora paucibranchiata							1					3													
Polydora cornuta																									
Spiophanes duplex			1																						
Sabaco elongatus		1	6				10				7	2	5	1				17			3		8	3	
Capitella capitata complex																									
Heteromastus filiformis		57	7	80		314	5				1				2	1		1	2			5	1	1	
Cossura spp.																									
Tharyx parvus																									
Tharyx nr. parvus																									
Tharyx spp.																									
Cirriformia nr. Moorei										1			3			1			1			15			
Cirratulidae unidentified spp.											1				3				1			3			
Euchone limnicola			7								16	1		1				2					3		
Ameana sp. A (= A. sp. SF1)																									
Neoamphitrite sp. A																									
Polycirrus spp. (= P. californica)																									
Annelida unidentified																									
Phylum Arthropoda																									
Copepoda																									
Harpacticoida - unidentified spp.																									
Cirripedia																									
Amphibalanus improvisus																									
Balanomorpha unidentified																									
Mysidacea																									
Alienacanthomysis macropsis																									
Mysidacea unidentified																					1				

USGS BENTHIC SOUTH BAY 1993 - 1995																								
DATE: July, 1994*																								
TAXON	STATION #	PA	D2	D3	D6	D10	D11	SM2	SM5	SM6	SM25	SM28	SM31	SM34	SM35	SM41	SM42	SM44	SM46	SM47	SM49	SM50	SM51	SM53
Crustacea																								
Cumacea																								
Nippoleucon hinnumensis		9	58			103	9	1		5	5	122	1	12	24	13		28	34				15	46
Isopoda																								
Paranthura japonica											1	2		2	3	1		3	4				2	4
Synedotea laevidorsalis			3								1								1		1	1		
Ostracoda																								
Eusarsiella zostericola			23				2					3		1	3	3			1				1	1
Amphipoda																								
Americhelidium sp.																								
Americorophium spinicorne																								
Ampelisca abdita		6	2840	2			974	5	13	34	1126	131	416	4	46	7		52	91	5		2	26	
Ampithoe valida																								
Ampithoe spp.																								
Corophium heteroceratum																								
Eochelidium cf. miraculum																								
Oedicerotidae unidentified spp.																								
Monocorophium acherusicum																								
Monocorophium insidiosum																								
Moncorophium spp. (no antennae or juvenile)																								
Corophiidae unid. spp.		4	149				71		11	74	75	73	137	2	93	9		97	103	15			200	162
Grandidierella japonica																								
Stenothoe sp.																								
Amphipoda unidentified																								
Decapoda																								
Crangon nigricauda																								
Brachyura zoea																								
Crustacea unidentified^^																								
Insecta																								
Collembola - unidentified																								
Mollusca																								
Gastropoda																								
Philine spp.																		1						1
Crepidula plana																								
Crepidula convexa																								
Crepidula spp.																								
Urosalpinx cinerea																								
Gastropoda unidentified																								
Bivalvia																								
Corbula amurensis		11	62	531	113		1	14	4	1		26	9		1			1		30	129			
Cryptomya californica																								
Gemma gemma		338					22		1		7			22					1					
Macoma petalum																								
Macoma spp.								1		43				1	1									
Mactridae unidentified sp.																								
Mya arenaria																								
Musculista senhousia			15	30			6			2	3	1		2				5	1				5	2
Mytilus spp.																								
Theora lubrica			41										8										2	2
Venerupis Philippanarum			5				1	12	2		5			8		1						5		
Veneridae unidentified																								
Bivalvia unidentified																								
Echinodermata																								
Ophiuroidea - unidentified														2								2		
Phylum Bryozoa																								
Bryozoa unidentified spp.									+		+	+			+	+		+				+		+
Phylum Chordata																								
Ascidiacea																								
Molgula manhattensis																								
Ascidiacea unidentified																								
TOTAL		**454**	**3258**	**676**		**519**	**1122**	**41**	**56**	**161**	**1259**	**408**	**586**	**119**	**252**	**123**		**217**	**264**	**77**	**138**	**42**	**277**	**288**

USGS BENTHIC SOUTH BAY 1993 - 1995																					
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TAXON STATION #	PA	D2	D3	D6	D10	D11+	SM25	SM28	SM31	SM35	SM39	SM41	SM42	SM43	SM44	SM46	SM47	SM49	SM50	SM51	SM53
Phylum Cnidaria																					
Actiniaria - attached - unid spp.							1		9	17		4		10					4		
Phylum Nemertea																					
Posieonemertes collaris																					
Anopla - unidentified spp.															1						
Tubulanus spp.									2		1			2							
Phylum Nematoda								2				7	23	2							
Phylum Turbellaria																					
Phylum Annelida																					
Oligochaeta																					
Tubificidae unidentified		2						33		1		22	13	6					6		1
Polychaeta																					
Harmothoe imbricata							3					1	5	2		2				2	
Malmgreniella macginitei														1							
Exogone lourei		7						121	3	7	1	104	3		1			1			151
Sphaerosyllis californiensis																					
Typosyllis nipponica							4					1	13		1						
Eteone nr. Californica																					
Eteone lighti			5																		
Eteone spp.																					
Dorvillea sp. A (= D. longicornis)																					
Nephtys caecoides																					
Neanthes cornuta							2		2		4			10	1					1	1
Glycera americana									1												
Glycera spp.													2								
Glycinde picta	7						1	6		10	6	30			2	17		3			4
Neanthes succinea		1	4	2	102			1													
Marphysa sanguinea	6						2		1		2	3								2	1
Leitoscoloplos pugettensis		1														1					
Streblospio benedicti	9			4	3			1						1							
Dipolydora caulleryi																					
Dipolydora socialis																					
Pseudopolydora kempi																					
Pseudopolydora paucibranchiata								6								1					1
Polydora cornuta		1						2			1	1									2
Sabaco elongatus		4					18	1	10		12	1	3	6	15	2	1	2		9	1
Capitella capitata complex																					
Heteromastus filiformis	20	6	63	27	253				3		2	1		4				2	2		
Cossura spp.																					
Tharyx parvus																					
Tharyx nr. Parvus																					
Tharyx spp.																					
Cirriformia nr. Moorei							1		17					7					2		
Cirratulidae unidentified spp.												1		2							
Euchone limnicola		13	1				1	60	128		270	1	11	27	9	1		1		68	
Ameana sp. A (= A. sp. SF1)																					
Neoamphitrite sp. A																					
Polycirrus spp. (= P. californica)																					
Annelida unidentified																					
Phylum Arthropoda																					
Copepoda																					
Harpacticoida - unidentified spp.																					
Cirripedia																					
Amphibalanus improvisus																					

SGS BENTHIC SOUTH BAY 1993 – 1995																					
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TAXON **STATION #**	PA	D2	D3	D6	D10	D11+	SM25	SM28	SM31	SM35	SM39	SM41	SM42	SM43	SM44	SM46	SM47	SM49	SM50	SM51	SM53
Balanomorpha unidentified																					
Mysidacea																					
Alienacanthomysis macropsis																					
Mysidacea unidentified																					
Crustacea																					
Cumacea																					
Nippoleucon hinnumensis	227	17	447		438		6	472	1	88	12	4	561	6	3	5		9		3	44
Isopoda																					
Paranthura japonica		22					6	3		11	3	24	21	2	2	12			1		23
Synedotea laevidorsalis		2							1		1			2	1	1		1	1		11
Ostracoda																					
Eusarsiella zostericola	31	14			3			5		6			1					2			
Amphipoda																					
Americhelidium sp.																					
Americorophium spinicorne																					
Ampelisca abdita	687	986	1	4	12		3	67	1550	79	266	7	4	161	3	3021	2	9		27	2422
Ampithoe valida																					
Ampithoe spp.																					
Corophium heteroceratum																					
Eochelidium cf. miraculum																					
Oedicerotidae unidentified spp.																					
Monocorophium acherusicum																					
Monocorophium insidiosum																					
Moncorophium spp. (no antennae or juvenile)																					
Corophiidae unid. spp.	19	7	1	8	3			11	2	1	15	1		20	5	1	39	1		1	156
Grandidierella japonica								8													
Stenothoe sp.																					
Amphipoda unidentified																					
Decapoda																					
Crangon nigricauda																					
Brachyura zoea																					
Insecta																					
Collembola - unidentified																					
Mollusca																					
Gastropoda																					
Philine spp.							1	3	1	1		2	3	2							
Crepidula plana																					
Crepidula convexa																					
Crepidula spp.										2											
Urosalpinx cinerea																					
Gastropoda unidentified																					
Bivalvia																					
Corbula amurensis	7	1	83	96	10			2									8	23			
Cryptomya californica																					
Gemma gemma	1446				5											2					
Macoma petalum																					
Macoma spp.			1				1				3				3					7	
Mactridae unidentified sp.																					
Mya arenaria																					
Musculista senhousia	5	36	48						10	3	8		7	22	17	3		4		5	12
Mytilus spp.																					
Theora lubrica		27												34							
Venerupis philippanarum		1								1	1	2	1					1	3		5
Veneridae unidentified																					

USGS BENTHIC SOUTH BAY 1993 - 1995																						
DATE: October, 1994*																						
TAXON	**STATION #**	PA	D2	D3	D6	D10	D11+	SM25	SM28	SM31	SM35	SM39	SM41	SM42	SM43	SM44	SM46	SM47	SM49	SM50	SM51	SM53
Bivalvia unidentified										5												
Echinodermata																						
Ophiuroidea - unidentified															3							
Phylum Bryozoa																						
Bryozoa unidentified spp.									+		+		+	+	+				+	+		+
Phylum Phoronida																						
Phoronida unidentified sp.															1							
Phylum Chordata																						
Ascidiacea																						
Molgula manhattensis								5								20						
Ascidiacea unidentified																						
TOTAL		**2464**	**1148**	**654**	**141**	**829**		**55**	**804**	**1746**	**227**	**608**	**217**	**671**	**333**	**84**	**3069**	**50**	**59**	**19**	**125**	**2835**

USGS BENTHIC SOUTH BAY 1993 - 1995																																		
DATE:March, 1995++																																		
TAXON	STATION #	PA	D2	D3	D6	D10	D11	SM12	SM23	SM24	SM26	SM27	SM28	SM30	SM31	SM32	SM33	SM35	SM36	SM38	SM39	SM41	SM42	SM43	SM44	SM46	SM47*	SM48	SM49	SM50	SM51	SM53	SM72	SM77
Phylum Cnidaria																																		
Actiniaria - attached - unid spp.							1	2		1	1				1							1	6							2				
Phylum Nemertea																																		
Posieonemertes collaris																																		
Anopla - unidentified spp.											1																							
Tubulanus spp.										1				1									6	1						1			1	2
Phylum Nematoda																							18							3				
Phylum Turbellaria																																		
Phylum Annelida																																		
Oligochaeta																																		
Tubificidae unidentified				1			9						6										395				2			35			2	1
Polychaeta																																		
Harmothoe imbricata								2			2	1		4	3	2				9			4	1		1				3		1	2	
Malmgreniella macginitei																								1										
Exogone lourei							1		1		2		20									1	124			1			1	5		6		2
Sphaerosyllis californiensis																					1		6							2				
Typosyllis nipponica										1				1									3			2		5		1		1	2
Syllidae unidentified sp.																														1				
Eteone nr. Californica																							14											
Eteone lighti				1																			3											
Eteone spp.																																		
Dorvillea sp. A (= D. longicornis)																					1		5		1									
Nephtys caecoides																																		
Neanthes cornuta								1				3		1				1			1										1			2
Glycera americana																			1				1										1	
Glycera spp.																															1			
Glycinde picta	4	2		1	1	12	1	2	1	2		13		3	1	2				1	15	3	59		8	6	1		4	19	11	12		
Neanthes succinea	3		2	2	65	1		2														1	2						2					
Nereidae unidentified spp.																													1					
Marphysa sanguinea						1					1														1					2	1	1		
Leitoscoloplos pugettensis																																		1
Streblospio benedicti			1	18	4											1										20		4	1				
Dipolydora caulleryi																1																	
Dipolydora socialis																		1															
Pseudopolydora kempi																	1		2	2			1			1						5	
Pseudopolydora paucibranchiata		1				9	2		1			1								3			131		1	2					1	5	1
Polydora cornuta								2	1	3	2	2	40		8	1	1	3	1	1			135							1	1	1	1	1
Sabaco elongatus		2	1			10	23	26	22	26	31	7		40	8	16		26	8	10	1		1	2	15	11		4	53	3	9	9		
Capitella capitata complex																							9											
Heteromastus filiformis		3	16	34	190	5	2	1	4				2	1		4		2					1	1					4	10		2	2	
Cossura spp.																							1											
Tharyx parvus																																		
Tharyx nr. Parvus																																		
Tharyx spp.																																		
Cirriformia nr. Moorei											10				7	1	5						2	2				13		3	1	1	2	
Cirratulidae unidentified spp.							1														1							1		1				
Euchone limnicola								12	1		3		1		17	2	34			354	237		1					1			7		2	
Ameana sp. A (= A. sp. SF1)																																		
Neoamphitrite sp. A																																		
Polycirrus spp. (= P. californica)																	1																	
Annelida unidentified																																		
Phylum Arthropoda																																		
Copepoda																																		
Harpacticoida - unidentified spp.																																		
Cirripedia																																		
Amphibalanus improvisus																																		
Balanomorpha unidentified																																		
Mysidacea																																		
Alienacanthomysis macropsis																																		
Mysidacea unidentified																																		
Crustacea																																		
Cumacea																																		
Nippoleucon hinnumensis	562	135	83	38	205	91			583	2	3	890	10	4	1	1	509			92	308		126	4	48	758	2		4	2		371	53	127
Isopoda																																		
Paranthura japonica						16	5	1			8	4		2	2							1	3		2	13	1	1			3	24	4	
Synedotea laevidorsalis	1					1		2													1				1									
Ostracoda																																		
Eusarsiella zostericola	3																									1								
Amphipoda																																		
Americhelidium sp.																																		
Americorophium spinicorne																																		
Ampelisca abdita	288	82	3	6		490	10	43	15	18	634	612	5	96	73	103	87	20	54	10	6	1	9	5	736	12	18	5	2	22	1052	12	5
Ampithoe valida																																		
Ampithoe spp.																																		
Corophium heteroceratum		1	1			1	4	5	12			6	9	4	90	3	1	16	12	15	1			10	22		28	25		1			28	14
Eochelidium cf. miraculum																																		
Oedicerotidae unidentified spp.																																		

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TAXON STATION #	PA	D2	D3	D6	D10	D11	SM12	SM23	SM24	SM26	SM27	SM28	SM30	SM31	SM32	SM33	SM35	SM36	SM38	SM39	SM41	SM42	SM43	SM44	SM46	SM47*	SM48	SM49	SM50	SM51	SM53	SM72	SM77
Monocorophium acherusicum												7			4										2								
Monocorophium insidiosum																						1												
Moncorophium spp. (no antennae or juvenile)												11						1				1			7					1				
Corophiidae unid. spp.																																		
Grandidierella japonica	1					6						33																			15			
Pleustidae unid. sp.															1																			
Stenothoe sp.																																		
Amphipoda unidentified																																		
Decapoda																																		
Crangon nigricauda																																		
Brachyura zoea																																		
Insecta																																		
Collembola - unidentified																																		
Diptera																																		
Chironomidae - unidentified sp.			5																															
Coleoptera																																		
Staphylinidadae			1																															
Mollusca																																		
Gastropoda																																		
Philine spp.												1										4												
Crepidula plana																																		
Crepidula convexa																																		
Crepidula spp.																						3												
Urosalpinx cinerea																																		
Gastropoda unidentified																																		
Bivalvia																																		
Corbula amurensis	4	9	37	28	3	1	1	6		2		2			18	2	1	31	4	6	1		2			109		3				3	5
Cryptomya californica																																		
Gemma gemma	190				1	1						1			1														1			4		
Macoma petalum																																		
Macoma spp.	2																						2	2							1		
Mactridae unidentified sp.																																		
Mya arenaria																																		
Musculista senhousia	3	4	4				2		1	1		1	4		2	2			3	5		1			5			10			4	5	1	1
Mytilus spp.																																		
Theora lubrica			1																															
Venerupis Philippanarum		5					3			3		1	4		1			1												2	2			
Veneridae unidentified																																		
Bivalvia unidentified			1																															
Echinodermata																																		
Ophiuroidea																																		
Amphiodia spp.																		1					2											
Ophiuroidea - unidentified spp.																																		
Phylum Bryozoa																																		
Bryozoa unidentified spp.																	+				+													
Phylum Phoronida																																		
Phoronida unidentified sp.																																		
Phylum Chordata																																		
Ascidiacea																																		
Molgula manhattensis																																		
Ascidiacea unidentified																																		
TOTAL	1061	244	158	127	469	657	70	92	643	76	683	1619	81	178	217	175	600	103	448		324	1068	37	106	1544	177	68	91	100	64	1502	130	164

USGS BENTHIC SOUTH BAY 1993 - 1995																							
DATE: March, 1995																							
TAXON STATION #	PA REM	D2	D3	D6	D10	D11	SM12	SM25	SM28H	SM31	SM35	SM39	SM41	SM42	SM43	SM44	SM46	SM49	SM50	SM51	SM53	SM77
Phylum Cnidaria																						
Actiniaria - attached - unid spp.														1								
Phylum Nemertea																						
Posieonemertes collaris																						
Anopla - unidentified spp.																						
Tubulanus spp.																						
Phylum Nematoda														2			12					
Phylum Turbellaria																						
Phylum Annelida																						
Oligochaeta																						
Tubificidae unidentified				1					1					31			1		2			5
Polychaeta																						
Harmothoe imbricata										4						1	1			1		1
Malmgreniella macginitei																						
Exogone lourei														1								
Sphaerosyllis californiensis																						
Typosyllis nipponica																						
Syllidae unidentified sp.																						
Eteone nr. Californica																						
Eteone lighti																						
Eteone spp.											1											
Dorvillea sp. A (= D. longicornis)																						
Nephtys caecoides									1													
Nephtys cornuta																						
Glycera americana																						
Glycera spp.																						
Glycinde picta		14				15	13	8	35	4	25	6	29	102	13	20	25		21	11	1	26
Neanthes succinea	1	14	16		35	25	8		57	1	23	3	3	7	2	5	38	20	2	2		6
Nereidae unidentified spp.																						
Marphysa sanguinea								23	3		1			1		1						
Leitoscoloplos pugettensis																						
Streblospio benedicti	1				4				2													
Dipolydora caulleryi																						
Dipolydora socialis																						
Pseudopolydora kempi						1	3		19			6	4				2					4
Pseudopolydora paucibranchiata												1		1								
Polydora cornuta									1		3		1							1		
Sabaco elongatus		7				6	18	37	3	27		12		2	4	19	18	29		10		7
Capitella capitata complex																						
Heteromastus filiformis		1	37	5	229	3	4	2	20			2		2	1		22					10
Cossura spp.																						
Tharyx parvus																			2			
Tharyx nr. Parvus																						
Tharyx spp.																						
Cirriformia nr. Moorei																			2			
Cirratulidae unidentified spp.												1										
Euchone limnicola																						
Ameana sp. A (= A. sp. SF1)																						
Neoamphitrite sp. A																						
Polycirrus spp. (= P. californica)																						
Annelida unidentified																						
Phylum Arthropoda																						
Copepoda																						
Harpacticoida - unidentified spp.																						
Cirripedia																						
Amphibalanus improvisus									1		4			9								
Balanomorpha unidentified																						
Mysidacea																						

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DATE: March, 1995																						
TAXON STATION #	PA REM	D2	D3	D6	D10	D11	SM12	SM25	SM28H	SM31	SM35	SM39	SM41	SM42	SM43	SM44	SM46	SM49	SM50	SM51	SM53	SM77
Alienacanthomysis macropsis																						
Mysidacea unidentified																						
Crustacea																						
Cumacea																						
Nippoleucon hinnumensis	2	380	2	8	71	99	76	2	322	2	4	24	17	138	23	41	126		3	168	3	249
Cumella vulgaris																	3					
Isopoda																						
Gnorimosphaeroma insulare											1											
Paranthura japonica																						
Synedotea laevidorsalis			2						1	5	1		1			1		8	1			1
Ostracoda																						
Eusarsiella zostericola														1			2					
Amphipoda																						
Americhelidium sp.																						
Americorophium spinicorne																						
Ampelisca abdita		216	5	2	3	149	1465	44	6138	144	156	1128	593	200	213	555	1411	1	6	1087	1	249
Ampithoe valida																						
Ampithoe spp.																						
Corophium heteroceratum									1							6				2		1
Eochelidium cf. miraculum																						
Oedicerotidae unidentified spp.																						
Monocorophium acherusicum									12		8		12	34		21				35		3
Monocorophium insidiosum									77	3	16		12	152		2	1			2		
Moncorophium spp. (no antennae or juvenile)									43	3	26		44	200		21	2		3	62		
Corophiidae unid. spp.																						
Grandidierella japonica	1	20				29		1	7		66		53	193		1	33	3				5
Pleustidae unid. sp.													4						1	3		
Stenothoe sp.																						
Amphipoda unidentified																						
Decapoda																						
Crangon nigricauda																						
Brachyura zoea																						
Insecta																						
Collembola - unidentified																						
Mollusca																						
Gastropoda																						
Philine spp.																						
Crepidula plana																						
Crepidula convexa																						
Crepidula spp.														2								
Urosalpinx cinerea																						
Illyanassa obseleta	1																					
Gastropoda unidentified																						
Bivalvia																						
Corbula amurensis	75	1223	19	61	2	173	582	792	609	225	127	393	441	26	330	741	353	232	83	50	122	1041
Cryptomya californica																						
Gemma gemma	19				15	1											3					
Macoma petalum			17										1		2		2					
Macoma spp.																						
Mactridae unidentified sp.																						
Mya arenaria		45		2		22	11	11	30			29	17	1	38	23	39	4	1	9	20	66
Musculista senhousia		6				2	2	5	1	2	1	6	2	6	1		1	6	1	6		3
Mytilus spp.						2			1					2								
Theora lubrica																						
Venerupis Philippanarum													1	4	1		1		1	1		
Veneridae unidentified																						
Bivalvia unidentified																						
Echinodermata																						

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DATE: March, 1995																							
TAXON	**STATION #**	PA REM	D2	D3	D6	D10	D11	SM12	SM25	SM28H	SM31	SM35	SM39	SM41	SM42	SM43	SM44	SM46	SM49	SM50	SM51	SM53	SM77
Ophiuroidea																							
Amphiodia spp.																							
Ophiuroidea - unidentified spp.																							
Phylum Bryozoa																							
Bryozoa unidentified spp.									+	+		+		+	+								
Phylum Phoronida																							
Phoronida unidentified sp.																							
Phylum Chordata																							
Ascidiacea																							
Molgula manhattensis																	1						
Ascidiacea unidentified																							
TOTAL		100	1926	98	79	359	527	2182	925	7385	420	463	1611	1235	1118	628	1459	2096	303	129	1450	147	1677

USGS BENTHIC SOUTH BAY 1993 - 1995																					
DATE: September, 1995																					
TAXON	STATION #	PA	D3	D6	D10	D11	SM28	SM31	SM35	SM39	SM41	SM42	SM43	SM44	SM46	SM47	SM49	SM50	SM51	SM53	SM77
Phylum Cnidaria																					
Actiniaria - attached - unid spp.																		6			
Phylum Nemertea																					
Posieonemertes collaris																					
Anopla - unidentified spp.																					
Tubulanus spp.																					
Phylum Nematoda									13		3	8									
Phylum Turbellaria																					
Phylum Annelida																					
Oligochaeta																					
Tubificidae unidentified			3	4			13		94	7	25	4			2	62		1	2	52	
Polychaeta																					
Harmothoe imbricata										1				1							
Malmgreniella macginitei																					
Exogone lourei																			1		
Sphaerosyllis californiensis									3												
Typosyllis nipponica																					
Syllidae unidentified sp.									1												
Eteone nr. Californica																					
Eteone lighti																					
Eteone spp.																		1			
Dorvillea sp. A (= D. longicornis)																					
Nephtys caecoides																					
Neanthes cornuta																					
Glycera americana																					
Glycera spp.																					
Glycinde picta						2	9		16	9	22	9	1	7	5	6	7	8	10	6	10
Neanthes succinea		12	7	1	21	10	8	1	20		5		5		13	6	9	1	1	7	2
Marphysa sanguinea									3						1		1	1	2	2	
Leitoscoloplos pugettensis																					
Streblospio benedicti		1	22	1	12		4		1						4	7				5	
Dipolydora caulleryi																		2			
Dipolydora socialis																					
Pseudopolydora kempi							2								1				1	4	1
Pseudopolydora paucibranchiata																					
Polydora cornuta						1			4	36	4						21			1	
Sabaco elongatus						4		1	2		2		2	8	3		1		7	8	4
Capitella capitata complex																					
Heteromastus filiformis		183	116	4	271	31	69		32	2	21		2		44			1	11	51	
Cossura spp.																					
Tharyx parvus																					
Tharyx nr. Parvus																					
Tharyx spp.																					
Cirriformia nr. Moorei																		2			
Cirratulidae unidentified spp.										1								3			
Euchone limnicola																					
Ameana sp. A (= A. sp. SF1)																					
Neoamphitrite sp. A																					
Polycirrus spp. (= P. californica)																					
Annelida unidentified																					
Phylum Arthropoda																					
Copepoda																					

USGS BENTHIC SOUTH BAY 1993 - 1995																					
DATE: September, 1995																					
TAXON	STATION #	PA	D3	D6	D10	D11	SM28	SM31	SM35	SM39	SM41	SM42	SM43	SM44	SM46	SM47	SM49	SM50	SM51	SM53	SM77
Harpacticoida - unidentified spp.																					
Cirripedia																					
Amphibalanus improvisus																					
Balanomorpha unidentified																					
Mysidacea																					
Alienacanthomysis macropsis																					
Mysidacea unidentified																					
Crustacea																					
Cumacea																					
Nippoleucon hinnumensis		33			143	66	27		30	4	27	59			13				46	63	17
Isopoda																					
Paranthura japonica														1					2		
Synedotea laevidorsalis		1	1	1			9	1	29		25		10				4	15		1	2
Ostracoda																					
Eusarsiella zostericola		9					4		4												
Amphipoda																					
Americhelidium sp.																					
Americorophium spinicorne																					
Ampelisca abdita		97	1		1	112	83	28	3	100		17	855	1	7	20	56	4	69	31	110
Ampithoe valida																					
Ampithoe spp.																					
Corophium heteroceratum																					3
Eochelidium cf. miraculum																					
Oedicerotidae unidentified spp.																					
Monocorophium acherusicum		1		1		5	77		88	5	93	5	18	11	24		2	531		3	45
Monocorophium insidiosum							23		12		7				1					1	2
Moncorophium spp. (no antennae or juvenile)						3	279		321	4	238		2	8	2	1				1	14
Corophiidae unid. spp.																					
Grandidierella japonica				1		1	9		110	1	100	58	1	1	34			2	34	15	6
Melita nitida									10												
Melitidae unid. sp.											1										
Pleustidae unid. sp.									1									1			
Stenothoe sp.																					
Amphipoda unidentified																					
Decapoda																					
Crangon nigricauda																					
Brachyura zoea																					
Insecta																					
Collembola - unidentified																					
Mollusca																					
Gastropoda																					
Philine spp.														1							
Crepidula plana																					
Crepidula convexa												12									
Crepidula spp.											6								1		
Urosalpinx cinerea																		1			
Gastropoda unidentified											1										
Bivalvia																					
Corbula amurensis		36	342	42	1	45	140	514	66	338	48	4	374	159	334	596	686	26	2	293	609
Cryptomya californica																					
Gemma gemma		461			47						1				4				1		
Macoma petalum		11	5		1																

USGS BENTHIC SOUTH BAY 1993 - 1995																				
DATE: September, 1995																				
TAXON	**STATION #**	PA	D3	D6	D10	D11	SM28	SM31	SM35	SM39	SM41	SM42	SM43	SM44	SM46	SM47	SM49	SM50	SM51	SM53	SM77
Macoma spp.														6							
Mactridae unidentified sp.																					
Mya arenaria		12				7		2	1	18	1			1		10				12	16
Musculista senhousia		3					1			4	1		7	2	2		12		3	1	2
Mytilus spp.																					
Theora lubrica																					
Venerupis Philippanarum										2	4	2		1				2	1		
Veneridae unidentified																					
Bivalvia unidentified																					
Echinodermata																					
Ophiuroidea																					
Amphiodia spp.																					
Ophiuroidea - unidentified spp.																					
Phylum Bryozoa																					
Bryozoa unidentified spp.							+		+		+	+							+		
Phylum Phoronida																					
Phoronida unidentified sp.																					
Phylum Chordata																					
Ascidiacea																					
Molgula manhattensis																					
Ascidiacea unidentified																					
TOTAL		860	497	55	497	287	757	547	864	532	635	178	1277	208	494	708	799	608	194	557	843

USGS BENTHIC SOUTH BAY - 2006-2009																														
DATE: 26 October, 2004																														
TAXON STATION #	PA	D1	D2	D3	D4	D6	D8	D9	D10	D11	SM6	D8	SM25	SM28	SM30	SM31	SM35	SM39	SM40	SM41	SM42	SM43	SM44	SM46	SM47	SM49	SM50	SM51	SM53
Cnidaria																														
Actiniaria – attached								1			12		20	24	79	2	6	26	16	92	11		7					52	1
Nematoda																					3			2						
Annelida																														
Tubificidae - unidentified		5		8	3	5								7			2			2	11			4						
Polychaeta																														
Harmothoe imbricata	1	1			1								1				5		1	3	8		1	2			1	1		
Exogone lourei					1												1			5	39			13						
Sphaerosyllis californiensis																														
Typosyllis nipponica					1						4		3			2	54		29	4		1	28	1	4			23	1	
Eteone nr. Californica																														
Eteone lighti			1	7		1		1	10								1													
Eteone spp.																														
Phyllodoce williamsi																														
Dorvillea sp. A																			2	1	5							1		
Glycinde picta				1	3						4		4	8	8	4	9		1	10	12	1		8					1	
Glycera americana		1		1							2														2		4			
Glyceridae																				1				1						
Nephtys caecoides					1																									
Neanthes succinea	25	1	51	6	5	13	1	4	44	80		1		4	5					2										
Nereidae unidentified																														
Marphysa sanguinea											1		1			1	5		1	57	1			17						3
Leitoscoloplos pugettensis																5	2		2	5	1	1						1		
Streblospio benedicti	4	2	1	43	1	101	5	249	5	3		5																		
Pseudopolydora kempi														121			3		1					12						5
Pseudopolydora paucibranchiata													10	83	2	1	8		2	9	46		13	66				5		8
Polydora cornuta	1			3									1	29			4		4	3	4			23			1	1		31
Dipolydora socialis														1			4		2	3	2			5				4		2
Sabaco elongatus				1	6			1			159		96	9	16	115	176	267	1	263	1	43	25	31	85		58	33		691
Capitella capitata complex														21						2	1		2	2				1		
Heteromastus filiformis	46	2	131	91	3	13	5	6	159	53	9		22	60		25	14		4	26	9	2	49	8	5		6	20		22
Cirriformia nr. Moorei		2		4	10						11		8	1	2	1	6		1	4	1		21		1		1	4		
Cirratulidae unidentified						2								3			4		1					2						
Euchone limnicola	9	3	2	6	51	13	11	27	9	2	8	11	5	48	1	1	6		11	9	3	9	5	39	28		3	34		30
Neoamphtrite sp. A				1							7					1														
Polycirrus spp. (= P. californica)														1			4			185	181									
Phylum Arthropoda																														
Copepoda																														
Harpacticoida unidentified sp.				2																										
Cirripedia																														
Amphibalanus improvisus						1																								
Balanomorpha unidentified																														
Crustacea																														
Cumacea																														
Nippoleucon hinnumensis**	3		1	56		3		4	37					63		2	1	3	19	1	2			5						
Isopoda																														
Paranthura japonica	4	14	4	1	9	5	3	3		1	1	3	1		1		2		2		1		1	8	2			1	5	
Synidotea laevidorsalis	2			7		1		2		2										5	2				2					
Ostracoda																														
Eusarsiella zostericola			1					1	14								2			8				1						
Amphipoda																														
Americorophium spinicorne																														
Ampelisca abdita**	637	39	617	21	171	1291	158	986	10	2474	14		7		5	45			1	3	13	3	22	1	588		3	12		1
Ampithoe spp.																											44			
Eochelidium cf. miraculum																		1												
Oedicerotidae unidentified spp.	1																		2	1	1			1						
Corophium heteroceratum		1038	1	181	65		4	1			42	4	4			2						15	8					5		2
Monocorophium acherusicum	4		3		2	3	4	1	94	20		4	1	2	11		4	1	4	4	8			8				8		1
Monocorophium insidiosum								1							1													1		
Moncorophium spp. (no antennae or juve	2								16	2				1			2				2			3				3		
Corophiidae unid.																							7							
Grandidierella japonica									28						6					1	18									
Pleustidae unidentified sp.																														
Amphipoda unidentified																														
Decapoda																														
Mysidacea unidentified spp.		2																												
Zoea unidentified																														
Pyromaia tuberculata											1							1												
Mollusca																														

USGS BENTHIC SOUTH BAY - 2006-2009																														
DATE: 26 October, 2004																														
TAXON STATION #	PA	D1	D2	D3	D4	D6	D8	D9	D10	D11	SM6	D8	SM25	SM28	SM30	SM31	SM35	SM39	SM40	SM41	SM42	SM43	SM44	SM46	SM47	SM49	SM50	SM51	SM53
Gastropoda																														
Crepidula convexa																			61		17									
Crepidula plana																					1									
Crepidula spp.																				1										
Ilyanassa obseleta		1																												
Odetta bisuturalis				17																										
Philine spp.													1				1		4		3		1					1	1	
Bivalvia																														
Corbula amurensis	5			31																										
Cryptomya californiensis																														
Gemma gemma	159		14	275		5			1150	448																				
Macoma petalum				4																										
Macoma spp.													1						69		32			2						
Mya arenaria				7																										
Mytilus spp.																														
Musculista senhousia	9		21		2	1	1	3		3		1	6	1	2	1	1	3	1	4	2				2		1	1	3
Ostreidae																														
Theora lubrica		1	1		6			2						6			3	3	8	4			16		8	1	5	3	20
Venerupis philippanarum													1		4		1	1		1	2									2
Bivalvia unidentified								1																						1
Hyrozoa - unidentified spp.											+												+							
Bryozoa - unidentified spp.													+	+					+	+				+				+		
Chordata																														
Molgula mahattensis					1								1			1					2									
TOTAL	912	1112	849	774	342	1458	192	1294	1576	3088	275	29	194	493	143	209	331	306	250	719	445	75	206	265	727	1	127	215	831	

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TAXON | STATION #	PA	D2	D3	D4	D6	D9	D10	D11	SM2	SM6	SM12	SM20	SM25	SM27	SM28	SM31	SM35	SM39	SM40	SM41	SM42	SM43	SM44	SM46	SM47	SM49	SM50	SM51	SM53	SM55	SM58	SM59	SM61	SM70	SM72	SM77
Cnidaria																																					
Actiniaria - attached			1							1		3			1			9	1	1			2			1								1	1		2	2
Nematoda																																					
Annelida																																					
Tubificidae - unidentified			2										1		16				6		42			2													2
Polychaeta																																					
Harmothoe imbricata			1					1	1	3			1					1		2	1	3	2	1	2		1			3	1	2				6	1
Exogone lourei																						71		1						1				1			29
Sphaerosyllis californiensis																						2		2													5
Eteone nr. Californica																	2		3				2						1	1		1	4			
Eteone lighti																						1		3												
Eteone spp.							1	1							4				3	1		1							1				5			
Phyllodoce williamsi																																1				
Dorvillea longicornis																			2																	
Glycinde picta			16		1		2	6	1	4	18	9	4	16	7	21	4	24	9	10	14	46	13	3	5	22	2	1	15	8	12	4		13	15	35	18
Glycera americana																							1														
Neanthes succinea		14	17			3	2		42			1																				4				
Nereidae unidentified		1																																		
Marphysa sanguinea													1	8	6		3			14				2				5	3				3			
Leitoscoloplos pugettensis											1						1		5				1					1		4	3			1	1	
Streblospio benedicti		8	2			5	4								2				1					1		8										
Pseudopolydora kempi															2				14	1	4		4	15					48				2	1	1	
Pseudopolydora paucibranchiata															7		5	1	4				19					1	1	3				2	6
Polydora cornuta			10																	7	5	41	15					1	5				3	1		2
Dipolydora socialis																				1															1	
Sabaco elongatus**			1		5					1		28	72	43	71	5	272	12	93	2	200	2	198	13	56	9		50	88	347	0	8		927	4	13	31
Capitella capitata complex																														1							
Heteromastus filiformis		96	58			28		41	17		1			2	3	7		4	1	14		7	3	7	4	1				1	4	2		4	3	5
Cirriformia nr. Moorei					1										1			2		2				4						1	1					
Cirratulidae unidentified			1																																	
Euchone limnicola																												2			1					
Neoamphtrite sp. A											1			2	1											1	3						1			
Polycirrus spp. (= P. californica)																				1	12															
Phylum Arthropoda																																					
Crustacea																																					
Cirripedia																																					
Balanomorpha unidentified																																1					
Mysidacea																																					
Mysidacea unidentified																																	1				
Cumacea																																					
Nippoleucon hinnumensis**		269	77	68	209	157	36	553	122	4	1	300	8	190	429	1262	177	1224	182	406	667	716	14	1142	644	150	462		207	685	40		10	1325	332	12	107
Isopoda																																					
Paranthura japonica												1	1						1	1			2					1			1	1				1
Synidotea laevidorsalis		3	2		1	2			1									3		2	2			1	1	4	1						2			
Ostracoda																							1													
Eusarsiella zostericola			2																					3												
Amphipoda																																					
Americorophium spinicorne																											1									
Ampelisca abdita**		280	1514	2	1155	208	436	33	1111	3788	42	47		71	99		755	8	9	45	34	20	251	19	1244	1055	1405	872	103	84	1	104	32	640	17	8	21
Ampithoe spp.															7					1																
Corophium heteroceratum											5									1	1			1	1		2	1	1							1
Monocorophium acherusicum			72		5	2			15	6		3	7		3	5	1	22	5	7	11	3	7	2	37		2		3	10			2	12	15	1	
Monocorophium insidiosum			10			1	1							3	1	62		17		5	10	3	2	27	24				44	26	8		19	18	68	1	1
Moncorophium spp. (no antennae or juv		1	17		4	2	1		10			3	2	1	2	27	1	25	5	12	8	3	1	8	18	2	1		6	10	8		12	12	39		2
Grandidierella japonica		5	114		2			1	10		1				1	67		2		2	13	28			23	2				3	2			5	4	9	28
Amphipoda unidentified																		2																		
Decapoda																																					
Zoea unidentified			1																																	
Mollusca																																					
Gastropoda																														2						
Crepidula convexa																			25															0		
Crepidula plana																			4																	
Philine spp.													1		2	1	3	1	2	1			2		3				1			1		0	1	2	
Bivalvia																																					
Corbula amurensis		70	4	12				66							2						1		1	1			20									
Cryptomya californiensis							1							2				1												5	2	1		2		
Gemma gemma		23	92	41					108																	1	1									
Macoma spp.		2	2	13		1		12								2		1		2		5	2				2									4
Mya arenaria										7		12	3	2	2			2	3	1	2						2			1			2	1	4	
Mytilus spp.																				1			1											1		
Musculista senhousia		2			1	10			1		9	1	1	5			1			1	1		5	1			5			1	1		1			
Ostreidae																				1																
Theora lubrica																								3	1											
Venerupis philippanarum							2				3				4						2	2								3	1					5
Bivalvia unidentified																										1				1						
Bryozoa																																					
Cheilostomatida - unidentified															+									+							+				+	
Chordata																																					
Molgula mahattensis													2						+				1									1					
TOTAL		**774**	**2016**	**136**	**1384**	**419**	**485**	**713**	**1440**	**3812**	**84**	**409**	**101**	**340**	**633**	**1507**	**1214**	**1371**	**312**	**587**	**985**	**976**	**516**	**1299**	**2107**	**1245**	**1918**	**930**	**478**	**1241**	**93**	**133**	**87**	**2974**	**509**	**101**	**271**

USGS BENTHIC SOUTH BAY - 2006-2009																							
DATE: 6 July, 2006																							
TAXON **STATION #**	PA	D2	D3	D6	D10	D11	SM25	SM28	SM31	SM35	SM39	SM40	SM41	SM42	SM43	SM44	SM47	SM49	SM50	SM51	SM53	SM77	
Phylum Cnidaria																							
Actiniaria - attached				1						3	7	1	1	4							2	2	
Phylum Nematoda													2										
Phylum Annelida																							
Oligochaeta																							
Tubificidae unidentified													6										
Polychaeta																							
Harmothoe imbricata							1			1	3	3	2	2	1					1	2	1	
Eteone nr. Californica											1									3			
Eteone spp.																							
Glycinde picta		1			1			3	1	1	10	9	5	23	1		1		1	11	13	14	
Neanthes succinea	22	22	1	3		25	3	6					1		1							1	
Marphysa sanguinea					3			2	6	6		4	17	2						1	9		
Leitoscoloplos pugettensis																							
Streblospio benedicti											1		3										
Pseudopolydora kempi											1	3	6										
Pseudopolydora paucibranchiata																				3			
Polydora cornuta													7										
Sabaco elongatus**						1	148	21	74	1605	351	45	136	2	37	26	15		1	48	366	30	
Capitella capitata complex																							
Heteromastus filiformis			9								9		8										
Cirriformia nr. Moorei											1												
Euchone limnicola														1									
Neoamphitrite sp. A.													1										
Polycirrus spp. (= P. californica)													34										
Phylum Arthropoda																							
Cirripedia																							
Amphibalanus improvisus?											1			11								3	
Balanomorpha unidentified	2				3		32					3		1									
Crustacea																							
Cumacea																							
Nippoleucon hinnumensis**	92	1	7	4	24	3	76	876	26	748	55	1136	74	1487	31	9	5	14	4	151	330	690	
Isopoda																							
Paranthura japonica																		1					
Synedotea laevidorsalis			1	7	1			34	1	16	4	8	27	1	1	7			1	6	10	3	
Ostracoda																							
Eusarsiella zostericola										3			1										
Amphipoda																							
Americorophium spinicorne																1							
Ampelisca abdita**	319	437	2	63	228	789	767	82	282	124	46	104	58	295	278	586	69	176	95	279	242	689	
Ampithoe valida														1									
Ampithoe spp.								8						20					1		1		
Corophium heteroceratum																							
Monocorophium acherusicum	7	67			6	38	31	8	47	53	95	66	111	83	79	24	8	5	35	12	16	5	
Monocorophium insidiosum	2	2			1	3	69	92		153	5	50	92	132		77			22	88	84	98	
Moncorophium spp. (no antennae or juvenile)		5			2	6	19	244	22	254	575	523	808	934	12	151		1	7	102	218	210	
Grandidierella japonica	31	52			30	50	36	194	1	97	3	27	222	41		7		1	3		181	76	
Amphipoda unidentified															1	1				1			
Mollusca																							
Gastropoda																							
Philine spp.								1	1	1	1												
Crepidula spp.										1													
Gastropoda unidentified														1									
Bivalvia																							
Corbula amurensis	21		267	22	13	3	1	100		75	1					1	3	416			2	14	
Cryptomya californica							1	3				1	7								1	1	
Gemma gemma	35	256			63	144																	
Macoma spp			42	8	45					1													
Mya arenaria							2	3										3	1	3		5	

USGS BENTHIC SOUTH BAY - 2006-2009																							
DATE: 6 July, 2006																							
TAXON	**STATION #**	PA	D2	D3	D6	D10	D11	SM25	SM28	SM31	SM35	SM39	SM40	SM41	SM42	SM43	SM44	SM47	SM49	SM50	SM51	SM53	SM77
Musculista senhousia		7					2	2	4		2							1	4				3
Mytilus spp.											1					1							
Theora lubrica															1	1							
Venerupis Philippanarum		1						3			8			1	3				1				4
Bivalvia unidentified																							
Phylum Bryozoa																							
Cheilostomatida - unidentified											+				+								
Phylum Chordata																							
Molgula manhattensis								1				12	3				1				9		
TOTAL		539	843	329	108	420	1064	1192	1681	461	3153	1182	1987	1629	3045	444	891	102	622	171	718	1477	1849

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DATE: 11 October, 2006

TAXON	STATION #	PA	D2	D3	D4	D6	D8	D9	D10	D11	SHW1	SM4	SM5	SM11	SM12	SM23	SM25	SM28	SM31	SM33	SM34	SM35	SM39	SM40	SM41	SM42	SM43	SM44	SM45	SM46	SM47	SM49	SM50	SM51	SM52	SM53*	SM60	SM65	SM70	SM71	SM72	SM77	SM81
Phylum Cnidaria																																											
Actiniaria - attached														1	1				2	1							1			1	1			2						2	9	21	1
Phylum Nematoda											1				1			6								1																7	
Phylum Turbellaria											4							5																								1	
Phylum Annelida																																												
Oligochaeta																																											
Tubificidae unidentified			1	30		20	25				3							26				7			11	6	1				69				1						5	
Polychaeta																																											
Harmothoe imbricata														2	1	1	1				1		2	1	3	3		3		3			4	2	4	3	5	2	5	5	5	1	
Exogone lourei																						1				2										3							
Typosyllis nipponica																																	1	1									
Eteone nr. Californica																																										1	
Eteone lighti		3	1	5			8			1																																
Eteone spp.			6			1			3																																	
Glycinde picta			5		2		1			10	3	6	7	11		16	7	4	3	1	12	7	5	9	27	1	1	3	4	1		6	10	11	5	10	7	12	15	15	8	9
Neanthes succinea		8	11		2																										2										1	6
Marphysa sanguinea						4				22	2				5			5		1	2	1		5	4	2	1		2	2		1	1	1	5	7	5	1	5				
Leitoscoloplos pugettensis																								1									1		1					1			
Streblospio benedicti		1	55	16			5	1	4	10	6							96				31		4	9				1		5									3	
Dipolydora caulleryi													7																													
Pseudopolydora kempi											19				4			17				4		11	3	1			27						34	1		2			4	
Pseudopolydora paucibranchiata											3			1	3			1														1									1	
Polydora cornuta			1								2				1			8			1	5		5	10				4	3											
Sabaco elongatus			1								46	24		31	289		138	24	108	73	3	67	130	41	62	2	68	4		138	65		72	31	61	397	5	57	12	13	32	38	15
Capitella capitata complex				1		1	1											3				2		1	1		6			3		7				2						
Heteromastus filiformis		90	117	26		37	86	3	75	80	35				22	9	4	54				24		29	11	13	1		2	32	2	42		3		20			5		26	
Tharyx parvus																		5						2																		
Tharyx nr. Parvus																									1																	
Tharyx spp.																									1																	
Cirriformia nr. Moorei														2	1												1							2			1	7			1	
Cirratulidae unidentified																		11				1													1							
Euchone limnicola																																											
Ameana sp. A (= A. sp. SF1)																											1															
Neoamphitrite sp. A																		2														3		1				3	2		
Polycirrus spp. (= P. californica)																									4	27																
Phylum Arthropoda																																											
Cirripedia																																											
Amphibalanus improvisus?																		4																								
Balanomorpha unidentified																								2																		
Crustacea																																											
Cumacea																																											
Nippoleucon hinnumensis**			32		11	1	4	2	16	5	85	13	2	267	65	1	108	597	5	34	204	1176	133	972	601	592		154	66	661	4		37	245	411	457	185	75	717	157	182	418	127
Isopoda																																											
Paranthura japonica			15						1		1			5	9			1			4		5	7		19		2	9	1				6	2	5	3	4	5	9	2	4	
Synidotea laevidorsalis			4	17	5		2	4	16	10	3	10	4	1	1	9	5	12	2		5	26	2	3	32	1		2	4	34	221	2	8	12	8	4	4	2	5	2		1	2
Ostracoda																																											
Eusarsiella zostericola					1						2							5							1																	3	
Amphipoda																																											
Americorophium spinicorne																										1																	
Ampelisca abdita**		444	691	1	98	2	4	10	35	1268	74	61	308	45	238	5	161	36	106	52	11	15	19	13	3	39	9	2	4	5	11				2	5	2	28	2	4	5	438	147
Ampithoe valida														1								2			1					1					1							
Ampithoe spp.			1															59				13	24		4	95			16	77	2			1	2	12						
Corophium heteroceratum																	1																									
Monocorophium acherusicum		1	137		52		1		44	53	86	1	1	18	1		6	80	5	1	22	40	9	58	59	50		7	39	39		2	53	35	29	56	3	32	7	10	5	76
Monocorophium insidiosum				1	2		1	3			15			11			6	20		2	44	42	8	42	41	3		24	61	61	1		48	65	71	44	19	73	2			24
Moncorophium spp. (no antennae or juvenile)			32		7				4	10	274			8	1			226	2		10	38	7	526	1012	11	1	2	1217	356			69	374	155	469	2	95	3		3	145
Grandidierella japonica			12		5	1			1	3	153			32	3		2	393	3		142	241	12	148	932	285	1	24	104	138			102	22	173	6	39	150	2	35	5	10
Amphipoda unidentified																																											
Mollusca																																											
Gastropoda																																											
Philine spp.											1																							2			5			0		0
Crepidula plana											2																																
Crepidula spp.																																											
Gastropoda unidentified																																											
Bivalvia																																											
Corbula amurensis		29	59	153	18	10	91	36	24	4		4			3	17						1						1			3	31								2		19
Cryptomya californica			1							1							3			1		2			7				3							11			2	2		
Gemma gemma		37	2474	49	2			1	142	1766								4				2			1																3
Macoma spp.		4	1	65		8	6		51															1																		
Mya arenaria												1		1					2									1					2	1	3			2		8		1
Musculista senhousia			72							15	1			8	11		15	2			4	3	10	11	1	21		8	3	3	1		1	52	16		2	6	6	20	25		8
Mytilus spp.																																											
Theora lubrica																		1												1					2							
Venerupis Philippanarum									5		1																					1			1						6	1
Bivalvia unidentified																																											
Phylum Bryozoa																																											
Cheilostomatida - unidentified																					+					+																
Phylum Chordata																																											
Molgula manhattensis											1			3	6				6	7						3	1						36	5				1	14	20		
TOTAL		**617**	**3729**	**364**	**205**	**85**	**235**	**60**	**421**	**3248**	**830**	**117**	**328**	**444**	**677**	**42**	**466**	**1710**	**245**	**175**	**467**	**1767**	**344**	**1892**	**2907**	**1117**	**93**	**235**	1537	**1591**	**314**	**158**	**139**	**679**	**1028**	**1388**	**809**	**258**	**1129**	**260**	**355**	**1001**	**594**

DATE: April, 2007								
TAXON	**STATION #**	SM42	SM43	SM44	SM46	SM50	SM51	SM53
Phylum Cnidaria								
Actiniaria - attached					2	1		
Phylum Nematoda								
Phylum Turbellaria								
Phylum Annelida								
Oligochaeta								
Tubificidae unidentified		2						
Polychaeta								
Harmothoe imbricata		4						
Exogone lourei		3						
Typosyllis nipponica								
Eteone nr. Californica								
Eteone lighti								
Eteone spp.								
Dorvillea sp. A				1		2		
Glycinde picta		14		4	5	1	9	3
Nephtys cornuta						1		
Neanthes succinea								
Marphysa sanguinea		1			3		2	8
Leitoscoloplos pugettensis		1		2			1	
Streblospio benedicti					5			
Dipolydora caulleryi								
Pseudopolydora kempi				5	2		1	2
Pseudopolydora paucibranchiata							4	
Polydora cornuta								
Sabaco elongatus			10	19	117	36	19	204
Capitella capitata complex								
Heteromastus filiformis					7	1	3	5
Tharyx parvus								
Tharyx nr. parvus								
Tharyx spp.								
Cirriformia nr. Moorei				5			3	
Cirratulidae unidentified								
Euchone limnicola								
Ameana sp. A (= A. sp. SF1)								
Neoamphitrite sp. A						3		
Terebellidae - unidentified							1	

USGS BENTHIC SOUTH BAY - 2006-2009							
DATE: April, 2007							
TAXON STATION #	SM42	SM43	SM44	SM46	SM50	SM51	SM53
Polycirrus spp. (= P. californica)	53					1	
Phylum Arthropoda							
Crustacea							
Cirripedia							
Amphibalanus improvisus?							
Balanomorpha unidentified							
Mysidacea							
Mysidacea unidentified		1	1				
Cumacea							
Nippoleucon hinnumensis**	3	3	29	10	1		22
Copepoda							
Harpacticoida							
Isopoda							
Paranthura japonica	3		12			14	3
Synedotea laevidorsalis			1			1	1
Ostracoda							
Eusarsiella zostericola							
Amphipoda							
Americorophium spinicorne							
Ampelisca abdita**		50	17	68	238	43	78
Ampithoe valida							
Ampithoe spp.							
Corophium heteroceratum	2	2	18	16	325	149	55
Monocorophium acherusicum	28		1	18	103	5	12
Monocorophium insidiosum	5			1		2	8
Moncorophium spp. (no antennae or juv	6			12	20		4
Grandidierella japonica							
Oedicerotidae			2				
Amphipoda unidentified							
Decapoda							
Crangon nigricauda						1	
Anomura - unidentified larva				1			
Mollusca							
Gastropoda							
Crepidula convexa	2						
Crepidula plana							
Crepidula spp.							

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DATE: April, 2007							
TAXON / STATION #	SM42	SM43	SM44	SM46	SM50	SM51	SM53
Gastropoda unidentified							
Ilyanassa obseleta							
Odetta bisuturalis							
Philine spp.	1		3	1		1	1
Bivalvia							
Corbula amurensis						1	9
Cryptomya californica							
Gemma gemma							
Macoma spp.		2		2		17	
Mya arenaria	1		13				
Musculista senhousia	1			1			
Mytilus spp.							
Theora lubrica					10		6
Venerupis Philippanarum	1				1		
Bivalvia unidentified							
Phylum Bryozoa			+	+			+
Phylum Chordata							
Molgula manhattensis							
TOTAL	131	68	133	271	743	278	421

USGS BENTHIC SOUTH BAY - 2006-2009																								
DATE: October, 2007																								
TAXON STATION #	PA	D2	D3	D6	D10	D11	SM12*	SM25	SM28	SM31	SM35	SM36	SM39	SM41	SM42	SM43	SM44	SM46	SM47	SM50	SM51	SM53	SM72	SM77
Phylum Cnidaria																								
Actiniaria - attached		3					2	2	1				6	1	2		33				1	5	58	6
Phylum Nemertea																								
Paranemertes californiensis															1	1				1				
Anopla - unidentified																		1						
Phylum Nematoda		3													24							10	5	
Phylum Turbellaria																								
Phylum Annelida																								
Oligochaeta																								
Tubificidae unidentified	4	105								2		88		1	54							24	21	
Polychaeta																								
Harmothoe imbricata							1	1	1		2	1	4	2	7		3	4	1	4		24	9	1
Exogone lourei		14										6			67							1	8	1
Sphaerosyllis californiensis																								1
Typosyllis nipponica		7						1		1		10	1		1	4				1		1	6	1
Eteone nr. Californica																								
Eteone lighti	2	1	1				1					1												
Eteone spp.																								
Dorvillea sp. A															8								1	
Glycinde picta	2	8		1	10	11	1	1	7			2	4	7	16	2	5	16	5			8	3	
Glyderidae - unidentified																				1				
Nephtys caecoides																			1					
Neanthes succinea	1	1		1		13			1															1
Marphysa sanguinea		1					2		5		3		3					3			1	5	1	
Leitoscoloplos pugettensis							1					1			3		2	1					1	
Streblospio benedicti	86	21																						
Dipolydora caulleryi																								
Dipolydora socialis																							1	
Pseudopolydora kempi					1			1													1			8
Pseudopolydora paucibranchiata		30							1						8		3	2			1		3	3
Polydora cornuta	4																1							7
Sabaco elongatus						1	71	84	42	17	101	28	155	33	1	17	20	125	6	40	6	317	42	3
Capitella capitata complex												1										2		
Heteromastus filiformis	11	22	18	10	8	9			17				3	1			1	14			6	10		6
Tharyx parvus																								
Tharyx nr. parvus		1																						
Tharyx spp.																								
Cirriformia nr. Moorei								12									1	2						
Cirratulidae unidentified		2										1						1					1	
Euchone limnicola	2	1			1	3	13			3		4		2	2	50	11	1	18	20	1	2		2
Ameana sp. A (= A. sp. SF1)																								
Ameana spp.																							1	
Neoamphitrite sp. A								1				1								1				1
Polycirrus spp. (= P. californica)														6	196						1			
Phylum Arthropoda																								
Crustacea																								
Cirripedia																								
Amphibalanus improvisus?																								
Balanomorpha unidentified																								
Mysidacea																								
Mysidacea unidentified												1	1											
Cumacea																								
Nippoleucon hinnumensis**	2	14	365	1	41	7	2	2	4			5			7		1			2	12	1	7	4
Copepoda																								
Harpacticoida		1																						
Isopoda																								
Paranthura japonica	28	41		1	4	4	20	5	77	1	1	1	3	2		2	11	16	62	16	7	74	3	1
Synedotea laevidorsalis	3		13	1		6		5	11			1							6	4				
Ostracoda																								

USGS BENTHIC SOUTH BAY - 2006-2009																								
DATE: October, 2007																								
TAXON **STATION #**	PA	D2	D3	D6	D10	D11	SM12*	SM25	SM28	SM31	SM35	SM36	SM39	SM41	SM42	SM43	SM44	SM46	SM47	SM50	SM51	SM53	SM72	SM77
Eusarsiella zostericola	6		1		3																			
Amphipoda																								
Americorophium spinicorne																								
Ampelisca abdita**	729	671	3	41	643	2902	18	4	3243	5	9	51		1		2	33		613	106	8	3545	1	5
Ampithoe valida																								
Ampithoe spp.																								
Corophium heteroceratum	49		2		1			3		1			1				13	2			3		1	1
Monocorophium acherusicum	9				19	8		1	59					3			1					1	1	
Monocorophium insidiosum									5															
Moncorophium spp. (no antennae or juvenile)		7		1	7	3			74															
Corophiidae - unidentified																								
Grandidierella japonica	19		6		60	58			1															
Eochelidium cf. miraculum					2					1			1			1								4
Odecerotidae - unidentified							1								1									
Amphipoda unidentified																								
Mollusca																								
Gastropoda																								
Crepidula convexa																							14	
Crepidula plana														1										
Crepidula spp.															15		1							1
Gastropoda unidentified																								
Ilyanassa obseleta		1																						
Odetta bisuturalis	1																							
Philine spp.					1		3	1			1		1		5		2	2	1		1	1	4	1
Bivalvia																								
Corbula amurensis	1		7		1																			
Cryptomya californica													1				4							
Gemma gemma	2		14		1																			
Macoma spp.			9													3								
Mya arenaria						1			4		11		1		1				4	43				
Musculista senhousia		3	1		2	16			14	8					3	3		2	2			4	2	3
Mytilus spp.																								
Theora lubrica								6				10				4						12	3	
Venerupis Philippanarum	1				1									5					1				2	
Bivalvia unidentified																								
Phylum Phoronida - unidentified																								1
Phylum Bryozoa - unidentified														+										
Phylum Chordata																								
Molgula manhattensis	1																1						26	
TOTAL	**963**	**958**	**440**	**57**	**806**	**3042**	**136**	**130**	**3567**	**39**		**213**	**185**	**65**	**422**	**89**	**147**	**192**	**720**	**239**	**49**	**4047**	**225**	**62**

USGS BENTHIC SOUTH BAY - 2006-2009																										
DATE: March, 2008																										
TAXON	STATION #	PA	D2	D3	D6	D10	D11	SM12	SM25	SM28	SM31	SM35	SM36	SM39	SM41*	SM42	SM43	SM44*	SM46*	SM47	SM49	SM50	SM51*	SM53	SM72	SM77
Phylum Cnidaria																										
Actiniaria - attached - unid spp.													1	2		5								1	1	3
Phylum Nemertea																										
Posieonemertes collaris			1																							
Anopla - unidentified spp.				1																						
Phylum Nematoda				19	2		1			8	4	1	1	3		203	2					2		25	8	
Phylum Turbellaria																										
Phylum Annelida																										
Oligochaeta																										
Tubificidae unidentified		2	32	469	22	3	29			20	33		4		60	19	31		10	4	23	12		25	2	13
Polychaeta																										
Harmothoe imbricata		1					2					4	1	1	3	11	1		2					2	1	
Exogone lourei			4			1	2		1		16	38	6		148	572	4		26		1		1	27	3	23
Sphaerosyllis californiensis				1						2		4			1	6			6			1		22		2
Typosyllis nipponica													3				3		1							
Eteone nr. Californica																										
Eteone lighti				15																						
Eteone spp.																										
Dorvillea sp. A (= D. longicornis)													1			1								1	1	
Nephtys caecoides																	2									1
Glycinde picta		3		1	4	1	4	1	3	5		5	4	3	1	1		5	6			1		2		
Glycinde spp.		1	2				1	2		3		6	1	3	11	3			2					2		
Neanthes succinea							4																			
Marphysa sanguinea								2		2		2	2	2	11	10		2	6					5		
Leitoscoloplos pugettensis															4	1	1	2					2	1		3
Streblospio benedicti		30	11	222	65	82	25										1			13	29	1				1
Dipolydora caulleryi																										
Dipolydora socialis												4				2										
Pseudopolydora kempi			2		1			2	1	1					1		3		1		2					13
Pseudopolydora paucibranchiata			3							2		4		20			3	7	36				1			2
Polydora cornuta						14	8					1			2	16								2		1
Sabaco elongatus			1				1	62	73	15	60	476	219	118	22	1	30	29	114				2	329		32
Capitella capitata complex				2										1	1									1	1	4
Heteromastus filiformis		3	1	8	2	2	16	1	2	6	1	3	1	9	2	2	1	2				2	1	3	1	1
Cossura spp.																	1									
Tharyx parvus																										
Tharyx nr. Parvus																										
Tharyx spp.																										
Cirriformia nr. Moorei												1	1	3				4					1			
Cirratulidae unidentified spp.					2	3	1					4			3	1	1	1								
Euchone limnicola		4				1	1	1	1	1			1	5	2	9	7	18	7	5		15			5	14
Ameana sp. A (= A. sp. SF1)																										1
Neoamphitrite sp. A														1			1					3				
Polycirrus spp. (= P. californica)			1									21			101	179										
Annelida unidentified																1										
Phylum Arthropoda																										
Copepoda																										
Harpacticoida - unidentified spp.				104																						
Cirripedia																										
Amphibalanus improvisus																										
Balanomorpha unidentified																										
Mysidacea																										
Alienacanthomysis macropsis								3	2		1	2		3		1								1		4
Mysidacea unidentified																2										
Crustacea																										
Cumacea																										
Nippoleucon hinnumensis		269	34	1278		71	19	2	4	23		2		1		2								1		6
Isopoda																										
Paranthura japonica			1				8	1		5		1	2			1								10		
Synedotea laevidorsalis																										
Synedotea spp. (prob. S. laevidorsalis juv.)																										

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DATE: March, 2008																									
TAXON STATION #	PA	D2	D3	D6	D10	D11	SM12	SM25	SM28	SM31	SM35	SM36	SM39	SM41*	SM42	SM43	SM44*	SM46*	SM47	SM49	SM50	SM51*	SM53	SM72	SM77
Ostracoda																									
Eusarsiella zostericola		1				10			2		4	1			1										
Amphipoda																									
Americorophium spinicorne																									
Ampelisca abdita	387	32	1		1	864		2	41			4	2		1	2					3		52	2	
Ampithoe valida																									
Ampithoe spp.																									
Corophium heteroceratum	7	5			2	1		5	2		1		8			1				15				1	5
Eochelidium cf. miraculum																								3	
Oedicerotidae unidentified spp.																									1
Monocorophium acherusicum	9	1			2	15					3												2		1
Monocorophium insidiosum																									
Moncorophium spp. (no antennae or juvenile)					1																				
Grandidierella japonica	16	2	3		1	2					1				1										
Stenothoe sp.						1																			
Amphipoda unidentified															1										
Decapoda																									
Crangon nigricauda																							1		
Brachyura zoea		1				1			3		1									1					1
Insecta																									
Collembola - unidentified				15																					
Mollusca																									
Gastropoda																									
Philine spp.				1			1														1				
Crepidula plana															3										
Crepidula convexa																								1	
Crepidula spp.											1														
Urosalpinx cinerea															1										
Gastropoda unidentified																									
Bivalvia																									
Corbula amurensis			4																						
Cryptomya californica					1		2	1					1												3
Gemma gemma	5		39										1												
Macoma petalum			10																						
Macoma spp.	1				6																				
Mya arenaria																									
Musculista senhousia	5	2									1	2	1		1	1							4	1	1
Mytilus spp.																									
Theora lubrica		2		1			10	8	2	1	14	10	9			12			3		6		3		9
Venerupis Philippanarum								2	1		2		1		3										1
Veneridae unidentified																							1		
Bivalvia unidentified																									1
Phylum Bryozoa																									
Bryozoa unidentified spp.															+	+			+	+				+	
Phylum Chordata																									
Ascidiacea																									
Molgula manhattensis															1										
Ascidiacea unidentified																									
TOTAL	**743**	**139**	**2177**	**115**	**192**	**1016**	**90**	**105**	**144**	**116**	**607**	**265**	**198**	**373**	**1062**	**108**	**70**	**217**	**25**	**71**	**47**	**8**	**523**	**31**	**147**

USGS BENTHIC SOUTH BAY - 2006-2009																										
DATE: July, 2008																										
TAXON	STATION #	PA	D2	D3	D6	D10	D11	SM12	SM25	SM28	SM31	SM35	SM36	SM39*	SM41	SM42	SM43	SM44	SM46	SM47	SM49	SM50	SM51	SM53	SM72	SM77
Phylum Cnidaria																										
Actiniaria - attached								2	5	4	1					8		1	8				1		12	2
Phylum Platyhelminthes																										
Playtyhelminthes - unidentified sp.												1			1								1			
Phylum Nemertea																										
Poseidonemertes collaris												1														
Phylum Nematoda								1	4	22		120	7		26	109	5	1	6			6	1	1	49	4
Phylum Turbellaria																										
Phylum Sipuncula					1																					
Phylum Annelida																										
Oligochaeta																										
Tubificidae unidentified			16	1	3	2	15		1	9	8	5	22			54	18		3	86	30	46		9		
Polychaeta																										
Harmothoe imbricata		4	7				22	9	31	47	13	23	4	22		48	2	6	6	8		3	21	7	43	14
Exogone lourei			1	1			2	6	28	10	22	325	17	5	65	1634	11		15	10		7		105	174	75
Sphaerosyllis californiensis										8		11			6	2				1				2		
Typosyllis nipponica			2					1	1	2	1	3		5	1	6		2		14		2	4			3
Syllidae unidentified														2												
Eteone nr. Californica																										
Eteone lighti						3																				
Eteone spp.																										
Dorvillea sp.A														1		9		1					1			
Glycinde picta		2	3		2	11	7	9	26	8	2	20		18	15	37		14	16	5	5	6	12	14	23	13
Nephtys caecoides										1										2		1				
Nephtys cornuta											6						5					5				
Neanthes succinea		23	2			5	2			1		2				3			1					4	3	7
Marphysa sanguinea				4				4		6		15		7	7				2					8	2	
Leitoscoloplos pugettensis								1	3							1	1	1				2	1		4	4
Streblospio benedicti				83		225	1						1				1			15	5					
Dipolydora caulleryi																										8
Dipolydora socialis									6			12		45		17		1	4			1	4	5	4	1
Pseudopolydora kempi						12				3									1						1	7
Pseudopolydora paucibranchiata							1	1	1	15		4		11	3	34			23				4	16	77	11
Polydora cornuta					8	12		6	2		1	8	7	15		4	30					1		29	2	10
Sabaco elongatus			1				1	23	45	19	46	75	107	102	7		55	27	37	3		33	25	241	57	22
Capitella capitata complex																										
Heteromastus filiformis				1		1			2			2		3									2	4		1
Tharyx parvus												2														
Tharyx nr. Parvus																										
Tharyx spp.																										
Cirriformia nr. Moorei								2			2	4	3	7		1	4	6	1				4	1		1
Cirratulidae unidentified		1								2		2			4				1				1			
Cossura spp.																	5			13						
Euchone limnicola								211	35	21		3		7	1	4	4	73	23	40	8	2	12	10	12	90
Ameana sp. A (= A. sp. SF1)																										
Neoamphitrite sp. A														2								5				
Polycirrus spp. (= P. californica)												146		2	35	386										
Polychaeta unid. sp. (juv.)												2														
Phylum Arthropoda																										
Crustacea																										
Copepoda																										
Harpacticoida - unidentified																										1
Cirripedia																										
Amphibalanus improvisus?																										
Balanomorpha unidentified																										
Cumacea																										
Nippoleucon hinnumensis		1	7	205	1	54	4	6	14	100	2	9			7	33	1		5	43	2	2	1	4	31	13
Eudorella pacifica											1															
Isopoda																										
Paranthura japonica							2		1	35		1				3			2				3	9	2	
Synidotea laevidorsalis				1	1				1	1	1									2	4					

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DATE: July, 2008																									
TAXON STATION #	PA	D2	D3	D6	D10	D11	SM12	SM25	SM28	SM31	SM35	SM36	SM39*	SM41	SM42	SM43	SM44	SM46	SM47	SM49	SM50	SM51	SM53	SM72	SM77
Ostracoda																									
Cyprideis spp.			2																						
Eusarsiella zostericola				1		3					1			2				1							2
Amphipoda																									
Americorophium spinicorne																									
Ampelisca abdita	1	56	7	190	59	149	583	269	1489	430	17	878		776	337	966	259	882	1557	931	1642	435	736	275	249
Ampithoe valida																									
Ampithoe spp.																									
Corophium heteroceratum	3			24			14	2		12		25				9	1		23	82	97	3		10	94
Corophium spp.					1																				
Eochelidium cf. miraculum																1					1				
Monocorophium acherusicum	10	176	4	16	133	44	100	100	100	166	100	14		100	99	68	100	99	100	79	47	100	100	100	100
Monocorophium insidiosum															1			1							
Moncorophium spp. (no antennae or juvenile)		20	5	6	59	25	168	861	443	177	746	8		538	1375	22	53	847	202	2	4	514	818	330	475
Grandidierella japonica			16	4	338	7		2	21		2	1		15	214		2	19		5		1	17	27	19
Oedicerotidae																									2
Pacificulodes spinipes							1																		
Pleustidae unidentified							1																		
Amphipoda unidentified																									
Pycnogonida																									
Pycnogonum rickettsi										1															
Decapoda																									
Carridea - larvae																									1
Scleroplax granulata																									3
Mollusca																									
Gastropoda																									
Philine spp.							2	1			1				1			1				1		1	
Crepidula convexa															5			4							
Crepidula plana															1										
Crepidula spp.							1	1							87		2	4						10	
Ilyanassa obseleta			2	2																					
Gastropoda unidentified																									
Bivalvia																									
Corbula amurensis		1	45	1	2	2																			
Cryptomya californica		1				1																		2	2
Gemma gemma			2								1														
Lyonsia californica							1								2			1	1			1			
Macoma spp.			64		6																	1			
Mya arenaria					8				3					2			3					2			
Musculista senhousia	1						17	10	2		1			1	3	3	10	9	8		1	5	3	1	7
Mytilus spp.																									
Theora lubrica		1			4	8	12	14	59	22	2	14		1	1	59	10	4	20	19	23	18	11	8	14
Venerupis Philippanarum		1					2	14			6			14	2		1	1	2			5		2	4
Bivalvia unidentified							4			1							3								
Phylum Phoronida																									
Phoronida - unidentified																									12
Phylum Bryozoa																									
Bryozoa - unidentified									+		+														
Phylum Chordata																									
Molgula manhattensis							2	7			1			2	5		31			3		1		1	14
TOTAL	**46**	**295**	**443**	**260**	**935**	**296**	**1190**	**1487**	**2431**	**915**	**1674**	**1108**	**254**	**1629**	**4526**	**1270**	**608**	**2027**	**2155**	**1175**	**1937**	**1185**	**2154**	**1263**	**1285**

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DATE: October, 2008																										
TAXON	STATION #	PA	D2*	D3	D6	D10	D11*	SM12	SM25	SM28	SM31	SM35	SM36	SM39	SM41	SM42	SM43	SM44	SM46	SM47	SM49	SM50	SM51	SM53	SM72	SM77
Phylum Cnidaria																										
Actiniaria - attached			1					1	13		13	5		9	21	10	3	69	14	7	3	4	3	4	107	5
Actiniaria - burrowing											1							5								
Phylum Nematoda						1	1		1	1		2	9	1	100		1	3	15		15	6	1	3	41	3
Phylum Nemertea																										
Anopla - unidentified																		1								
Phylum Platyhelminthes																										
Platyhelminthes unidentified									1																	
Phylum Annelida																										
Oligochaeta																										
Tubificidae unidentified		1	22	87	20	21	10	1	13		7		117		10	45			24	12	318	23		8	14	2
Polychaeta																										
Harmothoe imbricata			2					2	12	9	5	4	12	2	12	10	2	6	3	4		1	1	1	5	
Exogone lourei			4				2		75	1	31	46	85	3	72	200		1	142	8	11	4		104	48	5
Sphaerosyllis californiensis															1											1
Typosyllis nipponica			1					3	1		9	1	2	2			7	8	2	21	4	5			3	3
Syllidae - unidentified																1			1							
Eteone nr. Californica																										
Eteone lighti				4		1																				
Eteone spp.																										
Dorvillea sp. A									1				2			5					1	1			1	
Glycinde picta					1	5		1	5	4	3	5			2			2	4	2	1			4	1	2
Glycinde spp.																		1			14		1			3
Glycera spp.													1													
Nephtys caecoides											2						1									
Nephtys cornuta													10					1								
Neanthes succinea		43	1		1	5	1					1			3				1					1		2
Marphysa sanguinea				17				3	17	6	2	9	4	3	15	2		12	3					11	2	2
Leitoscoloplos pugettensis									1				2			1			1				1	1	3	
Streblospio benedicti		11	2	12	44	82	2																			
Dipolydora caulleryi																			1							2
Dipolydora socialis									2			2		2	15	4		18	13				4	8	9	
Pseudopolydora kempi					2	1																			2	3
Pseudopolydora paucibranchiata						1	4		1	11		3		1			1	12	136				6	4	107	18
Polydora cornuta		1		1	20		1		4			1	56					1				4		2	2	3
Sabaco elongatus			2				2	3	49	13	73	90	113	1	8		37	33	57			27	2	375	53	
Capitella capitata complex									2				13		2			2	1						7	
Heteromastus filiformis												1							1		1			2	3	
Tharyx parvus																										
Tharyx nr. Parvus																			4							
Tharyx spp.																										
Cirriformia nr. Moorei									3			6			10		6	8		1	2	2	1			
Cirratulidae unidentified			2				4					3	1													
Cossura spp.													1													
Euchone limnicola			23		1	7	71	9		3		2	156	2	1		3	3	2	15	119	11	3		2	3
Ameana sp. A (= A. sp. SF1)													1													
Neoamphitrite sp. A								1	1				1									2				1
Polycirrus spp. (= P. californica)												167			253	159							1			
Phylum Arthropoda																										
Cirripedia																										
Amphibalanus improvisus?				1																						
Balanomorpha unidentified																										
Crustacea																										
Cumacea																4										
Nippoleucon hinnumensis		1	6	2		106	8			32		2		4				2	1						53	5
Isopoda																										
Paranthura japonica		3	12		3		12	9	9	1	7	1	12	1	11	4	6	1	3	29	17		1	1	2	3
Synedotea laevidorsalis			1	30		11	3	1			1	1	4							3	5	1				
Synedotea spp. (prob. S. laevidorsalis juv.)																					2					
Munnidae - unidentified sp.																									1	
Ostracoda																										

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DATE: October, 2008																									
TAXON STATION #	PA	D2*	D3	D6	D10	D11*	SM12	SM25	SM28	SM31	SM35	SM36	SM39	SM41	SM42	SM43	SM44	SM46	SM47	SM49	SM50	SM51	SM53	SM72	SM77
Eusarsiella zostericola	1				9	2				1	2									2					
Amphipoda																									
Americorophium spinicorne																									
Ampelisca abdita	4	467	356	113	1187	1470	1005	4	7	7	1	1960			2	42	13	3	833	1768	32	1	1	8	21
Ampithoe valida																									
Ampithoe spp.																									
Corophium heteroceratum	9			75	22				2	1			1						1	2					1
Monocorophium acherusicum			13	40			2																		
Monocorophium insidiosum															1										
Moncorophium spp. (no antennae or juvenile)			17	2	7												1							1	
Grandidierella japonica	1		24	5	79															1			1		
Photis brevipes												1													
Oedicerotidae - unidentified						1			1																
Amphipoda unidentified																									
Pycnogonida - unidentified																		1							
Decapoda																									
Carngon nigromaculata																									1
Scleropolax grannulata																									1
Mollusca																									
Gastropoda																									
Philine spp.							1	2		1	1	3	1			1	4				1		1	5	
Crepidula convexa								22						2	11									4	
Crepidula plana																									
Crepidula spp.								7			1	1	1	2	24									8	
Ilyanassa obseleta	6																								
Odetta bisuturalis			1																						
Gastropoda unidentified																									
Bivalvia																									
Corbula amurensis			22	1	1										1					1					
Cryptomya californica					1								3										1		
Gemma gemma			216	2	2						1														
Macoma petalum			8																						
Macoma spp.			12																						
Mya arenaria			9																			1			
Musculista senhousia		2		1	2	3	2	4		22	2	25	1		3	28	3	1	4	3	67			1	1
Mytilus spp.																									
Theora lubrica		1				1			7	1		6				6		10	4	3	3		1	1	1
Venerupis Philippanarum				1		4		1			6			1	1				3	3					2
Bivalvia unidentified																	2								
Phylum Bryozoa																									
Bryozoa - unidentified								+			+				+					+		+		+	
Phylum Chordata																									
Molgula manhattensis								56			2													4	
TOTAL	**81**	**549**	**832**	**332**	**1551**	**1602**	**1044**	**307**	**98**	**187**	**368**	**2598**	**38**	**541**	**488**	**144**	**212**	**444**	**947**	**2296**	**194**	**29**	**535**	**497**	**94**

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DATE: June, 2009														
TAXON	STATION #	D3	D6	D10	D11	SM12	SM25	SM31	SM35	SM36	SM41	SM42	SM50	SM72
Phylum Cnidaria														
Actiniaria - attached					2		6		3					
Actiniaria - burrowing										1				
Phylum Nematoda								1	51					
Phylum Turbellaria														
Phylum Annelida														
Oligochaeta														
Tubificidae unidentified					36	4	3	3	1	3				
Polychaeta														
Harmothoe imbricata					18	2	16	1	6	1				
Exogone lourei					5	3	54		92					
Sphaerosyllis californiensis														
Typosyllis nipponica								2						
Syllidae - unidentified							1							
Eteone nr. Californica														
Eteone lighti					1									
Eteone spp.														
Nephtys caecoides										1				
Glycinde picta					6		4							
Glycinde spp.					7		12							
Neanthes succinea		3		18	4									
Marphysa sanguinea							1		14					
Leitoscoloplos pugettensis														
Streblospio benedicti														
Dipolydora caulleryi														
Pseudopolydora kempi					4									
Pseudopolydora paucibranchiata					53		1							
Polydora cornuta							3							
Scolelepis squamata					1									
Sabaco elongatus					2	3		46	1	45				
Capitella capitata complex							1							
Heteromastus filiformis							1							
Tharyx parvus														
Tharyx nr. Parvus														
Tharyx spp.														
Cirriformia nr. Moorei								1						
Cirratulidae unidentified					9		1							

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TAXON	STATION #	D3	D6	D10	D11	SM12	SM25	SM31	SM35	SM36	SM41	SM42	SM50	SM72
Euchone limnicola					1	4	2	2						
Ameana sp. A (= A. sp. SF1)										2				
Neoamphitrite sp. A							1							
Polycirrus spp. (= P. californica)						1								
Phylum Arthropoda														
Cirripedia														
Amphibalanus improvisus?														
Balanomorpha unidentified														
Crustacea														
Cumacea														
Nippoleucon hinnumensis		101		2	11		2		7					
Isopoda														
Paranthura japonica							1	1						
Synedotea laevidorsalis										1				
Synedotea spp. (prob. S. laevidorsalis juv.)														
Ostracoda														
Eusarsiella zostericola				9	5				4					
Cyprideis spp.		2												
Amphipoda														
Americorophium spinicorne														
Ampelisca abdita				1	272	285	48	436		29				
Ampithoe valida														
Ampithoe spp.														
Corophium heteroceratum						3	179	73		11				
Monocorophium acherusicum		9		3	606	26	195	135	52					
Monocorophium insidiosum														
Moncorophium spp. (no antennae or juvenile)					23	8	96	30	32	1				
Grandidierella japonica				1	13									
Amphipoda unidentified														
Decapoda														
Cancridae - zoea														
Mollusca														
Gastropoda														
Philine spp.														
Crepidula plana							26							
Crepidula spp.									7					
Ilyanassa obseleta				1										

USGS BENTHIC SOUTH BAY - 2006-2009														
DATE: June, 2009														
TAXON	**STATION #**	D3	D6	D10	D11	SM12	SM25	SM31	SM35	SM36	SM41	SM42	SM50	SM72
Odetta bisuturalis (=Boonea bisuturalis)				1										
Gastropoda A		1												
Gastropoda B		6		6										
Gastropoda unidentified									1					
Bivalvia														
Corbula amurensis		47		16										
Cryptomya californica		1										2		
Gemma gemma		112												
Macoma spp.		9		4										
Mya arenaria		3		22										
Musculista senhousia			1							1	1		87	
Mytilus spp.														
Theora lubrica								1		1				
Venerupis Philippanarum			3	1	1		2		5		22	2		1
Bivalvia unidentified		3		3			2							
Lyonsia												1		
Phylum Bryozoa					+				*					
Cheilostomatida - unidentified														
Phylum Chordata							2							
Molgula manhattensis		**297**		**88**	**1080**	**339**	**660**	**732**	**276**	**97**				
TOTAL														

Appendix 2. Species list with functional feeding group listed for each species.

Species and Functionality List

TAXON	Feeding Group
Cnidaria	
Hydrozoa	Filter Feeder
Anthozoa	Filter Feeder
Actiniaria	Filter Feeder
Actiniaria - attached	Filter Feeder
Actiniaria - burrowing	Filter Feeder
Nemertea	Surface Carnivore
Anopla - unidentified	Surface Carnivore
Posieonemertes collaris	Surface Carnivore
Tubulanus spp.	Surface Carnivore
Nematoda	Parasite/Deposit or Carnivore
Turbellaria	Surface Carnivore
Phoronida	Filter Feeder
Phoronis spp.	Filter Feeder
Annelida	
Oligochaeta	Subsurface Deposit Feeder
Tubificidae	Subsurface Deposit Feeder
Tubificoides wasselli	Subsurface Deposit Feeder
Polychaeta	
Ameana sp. SF 1	Surface Deposit Feeder
Capitella capitata complex	Subsurface Deposit Feeder
Cirratulidae unidentified	Surface Deposit Feeder
Cirriformia nr. moorei (=sprirabrancha)	Surface Deposit Feeder
Cossura spp.	Subsurface Deposit Feeder
Dipolydora caulleryi	Surface Deposit Feeder
Dipolydora socialis	Surface Deposit Feeder
Dorvillea sp. A	Subsurface Carnivore
Eteone nr. Californica	Surface Carnivore
Eteone lighti	Surface Carnivore
Eteone spp.^^	Surface Carnivore
Euchone limnicola	Filter Feeder
Exogone lourei	Surface Deposit Feeder
Glycera americana	Surface Carnivore
Glycera spp.	
Glycinde picta	Subsurface Carnivore
Glycinde spp.	Subsurface Carnivore
Harmothoe imbricata	Surface Deposit Feeder
Heteromastus filiformis	Subsurface Deposit Feeder
Leitoscoloplos pugettensis	Subsurface Deposit Feeder
Malmgreniella macginitei	Surface Deposit Feeder
Marphysa sanguinea	Surface Deposit Feeder
Neanthes succinea	Subsurface Deposit Feeder
Neoamphitrite sp. A	Surface Deposit Feeder
Nephtys caecoides	Subsurface Deposit Feeder
Nephtys cornuta	Subsurface Deposit Feeder
Nereidae unidentified species	
Podarkiopsis glabrus	Surface Carnivore
Polycirrus spp. (= P. californica)	Surface Deposit Feeder
Polydora cornuta	Filter & Surface Deposit Feeder
Pseudopolydora kempi	Filter & Surface Deposit Feeder
Pseudopolydora paucibranchiata	Filter & Surface Deposit Feeder
Sabaco elongatus	Subsurface Deposit Feeder

Species and Functionality List

TAXON	Feeding Group
Sphaerosyllis californiensis	Surface Deposit Feeder
Streblospio benedicti	Surface Deposit Feeder
Syllidae - unidentified	Surface Deposit Feeder
Tharyx parvus	Surface Deposit Feeder
Tharyx nr. Parvus	Surface Deposit Feeder
Tharyx spp.	Surface Deposit Feeder
Typosyllis nipponica	Surface Deposit Feeder
Arthropoda	
Crustacea	
Copepoda	Surface Deposit Feeder
Harpacticoida - unidentified spp.	Surface Deposit Feeder
Amphibalanus improvisus?	Filter Feeder
Balanomorpha unidentified	Filter Feeder
Mysidacea	
Alienacanthomysis macropsis	Filter Feeder
Mycidacea unidentified	Filter Feeder
Cumacea	Surface Deposit Feeder
Nippoleucon hinnumensis	Surface Deposit Feeder
Isopoda	Surface Deposit Feeder
Paranthura japonica	Surface Deposit Feeder
Synidotea laevidorsalis	Surface Deposit Feeder
Synidotea spp.	Surface Deposit Feeder
Munnidae - unidentified sp.	Surface Deposit Feeder
Gnorimosphaeroma insulare	Surface Deposit Feeder
Ostracoda	Surface Deposit Feeder
Eusarsiella zosteracola	Surface Deposit Feeder
Amphipoda	
Americhelidium sp.	Filter & Surface Deposit Feeder
Americorophium stimpsoni	Filter & Surface Deposit Feeder
Ampelisca abdita	Filter Feeder
Ampithoe valida	Surface Deposit Feeder
Ampithoe spp.	Surface Deposit Feeder
Corophium heteroceratum	Filter & Surface Deposit Feeder
Corophium spp.	Filter & Surface Deposit Feeder
Eochelidium cf. miraculum	Filter & Surface Deposit Feeder
Oedicerotidae.	Filter & Surface Deposit Feeder
Grandiderella japonica	Filter & Surface Deposit Feeder
Melitidae unid. sp.	Surface Deposit Feeder
Melita nitida	Surface Deposit Feeder
Monocorophium acherusicum	Filter & Surface Deposit Feeder
Monocorophium insidiosum	Filter & Surface Deposit Feeder
Monocorophium spp.	Filter & Surface Deposit Feeder
Oedicerodidae unidentified	Surface Deposit Feeder
Pleustidae unid. sp.	Surface Carnivore
Photis brevipes*	Surface Deposit Feeder
Caprella scaura	Surface Deposit Feeder
Caprella sp. A female	Surface Deposit Feeder
Caprella spp. (too small to id to species)	Surface Deposit Feeder
Stenothoe sp.	Surface Carnivore
Decapoda	
Crangon nigromaculata	Surface Carnivore
Scleropolax grannulata	Surface Carnivore

Species and Functionality List

TAXON	Feeding Group
Mollusca	
Gastropoda	
Crepidula convexa	Filter Feeder
Crepidula plana	Filter Feeder
Crepidula spp.	Filter Feeder
Ilyanassa obseleta	Surface Deposit Feeder
Odetta bisuturalis	Surface Carnivore
Urosalpinx cinerea	Surface Carnivore
Philine spp. ***	Surface Carnivore
Bivalvia	
Corbula amurensis	Filter Feeder
Cryptomya californica	Filter Feeder
Gemma gemma	Filter Feeder
Macoma balthica/petalum	Filter & Surface Deposit Feeder
Macoma spp.	Filter & Surface Deposit Feeder
Musculista senhousia	Filter Feeder
Mactridae unidentified^	Filter Feeder
Mya arenaria	Filter Feeder
Mytilus spp.	Filter Feeder
Theora lubrica^	Surface Deposit Feeder
Venerupis philippinarum	Filter Feeder
Bryozoa	Filter Feeder
Bryozoa unidentified spp.	
Phoronida	Filter Feeder
Phoronis spp.	Filter Feeder
Chordata	Filter Feeder
Ascidiacea	
Molgula manhattensis	Filter Feeder
Ascidiacea unidentified	Filter Feeder

Appendix 3. Functional feeding groups for regions of south bay for each sampling period. Percentages are based on abundance.

Function Feed Summary

(Percent Abundance)

Mar-93	South of Dumbarton Bridge			North of Dumbarton Bridge		
abundance %	Western Shoal	Eastern Shoal	Channel	Western Shoal	Eastern Shoal	Channel
Filter	54.31		0.95	23.31	9.82	13.57
Filter Feeders-Bivalves and Ascidians	17.64		0.00	2.18	4.28	5.60
Filter and Surface	0.05		0.00	0.32	0.01	0.00
Surface Deposit	43.56		99.05	67.61	66.15	31.44
Subsurface Deposit	1.26		0.00	6.23	17.35	45.10
Surface Carnivore	0.00		0.00	0.05	1.77	0.21
Subsurface Carnivore	0.43		0.00	0.30	0.63	4.08
Parasite	0.00		0.00	0.00	0.00	0.00

Jul-93	South of Dumbarton Bridge			North of Dumbarton Bridge		
abundance %	Western Shoal	Eastern Shoal	Channel	Western Shoal	Eastern Shoal	Channel
Filter	60.30	33.48	83.20	37.00	47.17	79.28
Filter Feeders-Bivalves and Ascidians	24.04	0.15	82.07	36.65	25.38	48.59
Filter and Surface	19.42	0.00	0.00	18.19	33.75	5.37
Surface Deposit	12.40	4.83	3.77	34.44	16.45	5.56
Subsurface Deposit	6.89	59.88	10.11	6.10	0.94	5.89
Surface Carnivore	0.18	0.00	0.00	0.00	0.00	0.15
Subsurface Carnivore	0.78	0.00	0.00	2.31	1.45	2.15
Parasite	0.00	0.00	0.00	0.00	0.00	0.00

Sep-93	South of Dumbarton Bridge			North of Dumbarton Bridge		
abundance %	Western Shoal	Eastern Shoal	Channel	Western Shoal	Eastern Shoal	Channel
Filter	40.75		94.31	47.08	18.02	14.57
Filter Feeders-Bivalves and Ascidians	23.96		94.31	45.83	12.96	5.00
Filter and Surface	0.62		0.92	1.01	12.15	6.17
Surface Deposit	6.93		0.47	24.29	38.75	38.29
Subsurface Deposit	12.35		4.30	9.31	2.74	2.96
Surface Carnivore	0.00		0.00	0.00	0.24	0.00
Subsurface Carnivore	0.47		0.00	0.31	1.35	0.22
Parasite	0.00		0.00	0.00	0.18	6.55

Function Feed Summary

(Percent Abundance)

Apr-94	South of Dumbarton Bridge			North of Dumbarton Bridge		
abundance %	Western Shoal	Eastern Shoal	Channel	Western Shoal	Eastern Shoal	Channel
Filter	35.57		14.71	8.51	3.78	21.87
Filter Feeders-Bivalves and Ascidians	23.58		14.71	6.79	11.96	16.57
Filter and Surface	40.82		0.88	11.87	5.94	16.35
Surface Deposit	30.26		80.65	62.23	76.95	41.93
Subsurface Deposit	3.54		3.70	7.07	3.00	9.99
Surface Carnivore	0.17		0.00	4.89	0.92	2.11
Subsurface Carnivore	1.11		0.00	2.72	0.00	0.00
Parasite	0.21		0.00	2.72	0.31	2.25

Jul-94	South of Dumbarton Bridge			North of Dumbarton Bridge		
abundance %	Western Shoal	Eastern Shoal	Channel	Western Shoal	Eastern Shoal	Channel
Filter	85.86	0.00		91.90	22.08	52.23
Filter Feeders-Bivalves and Ascidians	1.88	0.00		0.64	2.73	31.70
Filter and Surface	3.96	0.00		5.96	34.74	19.66
Surface Deposit	3.31	30.06		2.14	25.22	13.63
Subsurface Deposit	5.65	69.94		0.95	7.99	9.37
Surface Carnivore	0.00	0.00		0.00	0.41	1.37
Subsurface Carnivore	1.30	0.00		0.32	9.73	3.06
Parasite	0.00	0.00		0.00	1.31	0.00

Oct-94	South of Dumbarton Bridge			North of Dumbarton Bridge		
abundance %	Western Shoal	Eastern Shoal	Channel	Western Shoal	Eastern Shoal	Channel
Filter	88.69		45.63	13.23	59.52	56.86
Filter Feeders-Bivalves and Ascidians	1.90		44.06	7.75	5.92	17.17
Filter and Surface	0.73		2.99	0.88	3.91	17.18
Surface Deposit	9.29		35.59	61.63	26.24	12.35
Subsurface Deposit	1.14		15.41	20.47	6.61	11.95
Surface Carnivore	0.00		0.38	1.10	0.41	0.28
Subsurface Carnivore	0.14		0.00	2.70	3.30	1.15
Parasite	0.00		0.00	1.68	0.42	0.12

Function Feed Summary

(Percent Abundance)

Mar-95	South of Dumbarton Bridge			North of Dumbarton Bridge		
abundance %	Western Shoal	Eastern Shoal	Channel	Western Shoal	Eastern Shoal	Channel
Filter	53.84	0.85	27.31	8.69	47.10	44.41
Filter Feeders-Bivalves and Ascidians	2.60	0.64	24.00	3.43	4.77	10.74
Filter and Surface	1.18	0.00	0.32	25.52	9.11	11.12
Surface Deposit	41.87	44.56	48.95	52.40	33.57	13.95
Subsurface Deposit	2.10	54.37	20.50	10.47	7.02	25.98
Surface Carnivore	0.00	0.00	0.32	1.18	0.01	0.50
Subsurface Carnivore	1.01	0.21	0.39	1.74	3.08	3.49
Parasite	0.00	0.00	0.00	0.34	0.00	0.30

Jun-95	South of Dumbarton Bridge			North of Dumbarton Bridge		
abundance %	Western Shoal	Eastern Shoal	Channel	Western Shoal	Eastern Shoal	Channel
Filter	79.15	5.57	53.38	65.15	86.18	85.42
Filter Feeders-Bivalves and Ascidians	59.56	0.56	49.57	52.35	34.07	57.35
Filter and Surface	2.58	0.00	8.67	17.62	6.38	1.04
Surface Deposit	14.20	20.89	7.10	9.24	3.96	3.72
Subsurface Deposit	2.87	73.54	30.84	4.08	1.74	5.69
Surface Carnivore	0.00	0.00	0.00	0.00	0.03	0.00
Subsurface Carnivore	1.19	0.00	0.00	3.91	1.65	3.98
Parasite	0.00	0.00	0.00	0.06	0.07	0.00

Sep-95	South of Dumbarton Bridge			North of Dumbarton Bridge		
abundance %	Western Shoal	Eastern Shoal	Channel	Western Shoal	Eastern Shoal	Channel

Filter	**69.91**	**57.14**	**43.11**	**53.54**	**47.93**	**77.06**
Filter Feeders-Bivalves and Ascidians	**37.37**	**18.12**	**38.28**	**42.24**	**38.60**	**60.35**
Filter and Surface	**1.20**	**3.48**	**1.92**	**21.91**	**29.91**	**18.47**
Surface Deposit	**4.87**	**23.00**	**17.41**	**17.70**	**8.30**	**1.21**
Subsurface Deposit	**24.01**	**15.68**	**37.56**	**1.48**	**11.18**	**2.54**
Surface Carnivore	**0.00**	**0.00**	**0.00**	**0.00**	**0.06**	**0.07**
Subsurface Carnivore	**0.00**	**0.70**	**0.00**	**5.37**	**2.60**	**0.62**
Parasite	**0.00**	**0.00**	**0.00**	**2.25**	**0.25**	**0.00**

Function Feed Summary

(Percent Abundance)

Oct-04	South of Dumbarton Bridge			North of Dumbarton Bridge		
abundance %	**Western Shoal**	**Eastern Shoal**	**Channel**	**Western Shoal**	**Eastern Shoal**	**Channel**
Filter	**76.39**	**74.18**	**61.36**	**16.04**	**22.59**	**23.80**
Filter Feeders-Bivalves and Ascidians	**2.25**	**0.00**	**0.91**	**4.76**	**2.92**	**0.42**
Filter and Surface	**6.56**	**8.76**	**24.19**	**16.97**	**18.25**	**6.25**
Surface Deposit	**4.57**	**3.55**	**11.66**	**29.76**	**16.26**	**25.34**
Subsurface Deposit	**11.81**	**12.88**	**2.59**	**33.37**	**40.74**	**42.57**
Surface Carnivore	**0.80**	**0.63**	**0.02**	**0.59**	**0.36**	**0.06**
Subsurface Carnivore	**0.06**	**0.00**	**0.16**	**3.28**	**1.75**	**1.48**
Parasite	**0.00**	**0.00**	**0.00**	**0.34**	**0.08**	**0.00**

Function Feed Summary

(Percent Abundance)

Apr-06	South of Dumbarton Bridge			North of Dumbarton Bridge		
abundance %	Western Shoal	Eastern Shoal	Channel	Western Shoal	Eastern Shoal	Channel
Filter	75.30	13.88	68.19	22.49	13.00	58.84
Filter Feeders-Bivalves and Ascidians	2.01	9.26	2.68	1.48	0.88	3.06
Filter and Surface	4.13	1.82	0.98	18.23	8.03	2.65
Surface Deposit	13.99	77.56	28.66	41.23	70.04	20.91
Subsurface Deposit	6.27	5.75	2.05	12.70	14.59	16.61
Surface Carnivore	0.00	0.14	0.00	2.22	0.36	0.15
Subsurface Carnivore	0.30	0.84	0.12	3.13	1.35	0.84
Parasite	0.00	0.00	0.00	0.00	0.00	0.00

Jul-06	South of Dumbarton Bridge			North of Dumbarton Bridge		
abundance %	Western Shoal	Eastern Shoal	Channel	Western Shoal	Eastern Shoal	Channel
Filter	80.54	88.16	80.18	38.71	19.73	68.40
Filter Feeders-Bivalves and Ascidians	1.95	0.47	50.79	0.39	1.64	2.08
Filter and Surface	10.49	9.12	10.74	24.47	38.64	17.26
Surface Deposit	5.82	0.28	6.21	31.39	24.78	5.83
Subsurface Deposit	3.04	2.44	2.87	4.83	16.42	8.06
Surface Carnivore	0.00	0.00	0.00	0.00	0.03	0.04
Subsurface Carnivore	0.04	0.00	0.00	0.51	0.34	0.36
Parasite	0.00	0.00	0.00	0.00	0.02	0.00

Oct-06	South of Dumbarton Bridge			North of Dumbarton Bridge		
abundance %	Western Shoal	Eastern Shoal	Channel	Western Shoal	Eastern Shoal	Channel

Filter	**85.50**	**44.14**	**17.60**	**5.55**	**1.80**	**26.40**
Filter Feeders-Bivalves and Ascidians	**2.90**	**10.72**	**33.12**	**1.00**	**0.92**	**7.52**
Filter and Surface	**2.59**	**16.46**	**11.00**	**5.08**	**34.13**	**2.54**
Surface Deposit	**1.27**	**9.23**	**7.11**	**12.09**	**29.75**	**20.69**
Subsurface Deposit	**7.51**	**18.70**	**29.84**	**4.69**	**5.75**	**32.12**
Surface Carnivore	**0.19**	**0.75**	**1.24**	**0.00**	**0.06**	**0.00**
Subsurface Carnivore	**0.04**	**0.00**	**0.08**	**0.85**	**0.49**	**0.81**
Parasite	**0.00**	**0.00**	**0.00**	**0.01**	**0.01**	**0.01**

Function Feed Summary

(Percent Abundance)

Apr-07	South of Dumbarton Bridge			North of Dumbarton Bridge		
abundance %	Western Shoal	Eastern Shoal	Channel	Western Shoal	Eastern Shoal	Channel
Filter				3.82	21.50	53.65
Filter Feeders-Bivalves and Ascidians				1.53	3.16	0.00
Filter and Surface				31.30	30.03	33.09
Surface Deposit				50.38	14.29	2.95
Subsurface Deposit				3.05	30.80	9.91
Surface Carnivore				0.76	0.99	0.00
Subsurface Carnivore				10.69	2.39	0.20
Parasite				0.00	0.00	0.00

Oct-07	South of Dumbarton Bridge			North of Dumbarton Bridge		
abundance %	Western Shoal	Eastern Shoal	Channel	Western Shoal	Eastern Shoal	Channel
Filter	73.60	96.06	38.81	21.22	36.09	62.07
Filter Feeders-Bivalves and Ascidians	0.31	0.56	0.91	7.63	4.51	5.62
Filter and Surface	6.14	2.27	2.81	9.65	3.62	0.88
Surface Deposit	11.81	0.56	45.70	31.24	11.32	11.50
Subsurface Deposit	7.56	0.76	11.69	30.84	45.36	23.03
Surface Carnivore	0.21	0.00	0.11	1.40	0.68	1.17
Subsurface Carnivore	0.68	0.36	0.88	4.04	2.62	1.05
Parasite	0.16	0.00	0.00	1.98	0.02	0.00

Function Feed Summary

(Percent Abundance)

Mar-08	South of Dumbarton Bridge			North of Dumbarton Bridge		
abundance %	Western Shoal	Eastern Shoal	Channel	Western Shoal	Eastern Shoal	Channel
Filter	41.11	1.56	1.01	15.00	9.19	12.51
Filter Feeders-Bivalves and Ascidians	0.53	0.52	0.09	3.39	0.51	0.52
Filter and Surface	2.99	6.25	0.30	5.63	0.74	3.68
Surface Deposit	25.12	81.77	66.43	31.71	20.56	28.79
Subsurface Deposit	27.77	2.60	21.44	31.04	58.76	48.76
Surface Carnivore	0.38	0.00	0.80	0.19	0.27	0.77
Subsurface Carnivore	1.50	0.52	3.07	12.87	4.45	2.50
Parasite	0.89	0.00	1.31	11.23	1.38	1.59

Jul-08	South of Dumbarton Bridge			North of Dumbarton Bridge		
abundance %	Western Shoal	Eastern Shoal	Channel	Western Shoal	Eastern Shoal	Channel
Filter	34.27	51.35	38.20	21.86	41.91	72.02
Filter Feeders-Bivalves and Ascidians	1.06	1.01	0.46	2.39	1.90	0.55
Filter and Surface	30.91	25.68	18.04	48.19	31.93	17.93
Surface Deposit	11.41	14.19	40.27	21.18	11.80	4.32
Subsurface Deposit	20.88	6.08	1.57	3.15	9.49	4.57
Surface Carnivore	0.00	0.00	0.00	0.12	0.05	0.03
Subsurface Carnivore	2.31	2.36	0.38	3.12	2.87	0.45
Parasite	0.00	0.00	0.00	1.72	1.21	0.13

Oct-08	South of Dumbarton Bridge			North of Dumbarton Bridge		
abundance %	Western Shoal	Eastern Shoal	Channel	Western Shoal	Eastern Shoal	Channel

Filter	**63.79**	**77.37**	**54.30**	**26.63**	**24.80**	**67.60**
Filter Feeders-Bivalves and Ascidians	**0.18**	**0.26**	**0.55**	**15.13**	**2.45**	**11.09**
Filter and Surface	**4.63**	**7.09**	**25.66**	**12.74**	**9.00**	**0.62**
Surface Deposit	**11.66**	**13.41**	**9.85**	**39.33**	**37.44**	**11.21**
Subsurface Deposit	**19.90**	**1.68**	**9.72**	**14.81**	**23.19**	**18.82**
Surface Carnivore	**0.00**	**0.06**	**0.32**	**1.03**	**0.62**	**0.31**
Subsurface Carnivore	**0.02**	**0.39**	**0.15**	**5.12**	**4.92**	**1.26**
Parasite	**0.02**	**0.06**	**0.00**	**2.94**	**3.54**	**0.74**

Function Feed Summary

(Percent Abundance)

Jun-09	South of Dumbarton Bridge			North of Dumbarton Bridge		
abundance %	Western Shoal	Eastern Shoal	Channel	Western Shoal	Eastern Shoal	Channel
Filter	28.46	48.10	57.64	13.33	23.61	72.54
Filter Feeders-Bivalves and Ascidians	0.00	41.77	17.71	4.55	7.33	0.00
Filter and Surface	52.35	5.06	3.13	71.82	19.82	21.71
Surface Deposit	9.76	15.19	35.76	11.36	20.27	1.29
Subsurface Deposit	5.24	22.78	1.04	0.91	27.86	4.38
Surface Carnivore	0.00	1.27	0.00	0.00	0.00	0.00
Subsurface Carnivore	4.15	0.00	0.00	2.42	8.28	0.07
Parasite	0.05	0.00	0.00	0.00	8.28	0.07

Appendix 4. Estimated bivalve biomass in geographic regions for all dates.

1993-2009 Biomass as g as free dry wt tissue/m2

Location	Representative Station	Latitude (N)	Longitude (W)	March-93	July-93	September-93	April-94	July-94	October-94	March-95	June-95	September-95	October-04
North Channel Axis	**SM2**	37.57	122.22	2.92	6.44	5.35	8.64	2.93	0.72	0.24	12.95	25.07	0.00
North Channel Slope	**SM31**	37.545	122.175	1.01	5.31	7.54	0.81	1.64	3.17	0.69	7.72	20.24	0.00
Northwest Shoal	**SM42**	37.56	122.23	1.41	19.54	6.54	7.06	5.88	3.65	0.48	12.79	25.70	1.01
Central Western Shoal	**SM25**	37.515	122.160	0.33	10.47	72.11	0.19	0.38	1.33	0.01	17.71	36.10	0.65
Northeast Eastern Shoal	**SM46**	37.59	122.17	2.92	1.81	5.98	3.81	0.96	0.26	0.40	6.75	23.19	0.16
Northeast Central Shoal	**SM44**	37.58	122.18	0.18	2.67	20.52	0.06	1.49	0.84	0.28	9.35	5.28	0.00
Central Eastern Shell Shoal	**SM35**	37.55	122.15	1.89	5.97	40.94	0.48	3.71	1.38	0.66	10.74	6.60	0.49
Central Eastern nonshell Shoal	**SM28**	37.55	122.14	0.87	12.59	55.83	0.32	0.56	1.38	0.57	11.42	14.19	0.23
Central Channel and Slope	**SM47**	37.53	122.15	1.12	17.30	14.00	3.79	2.21	4.03	0.93	8.96	13.46	2.02
Dumbarton Channel	**D1**	37.49	122.10	5.17	32.96	16.32	48.00	33.83	3.93	1.14	11.58	16.58	0.31
Southern Channel	**D6**	37.47	122.06	0.48	37.63	29.46	144.85	38.37	22.28	1.14	3.88	13.25	0.00
Dumbarton Western Shoal	**D2**	37.49	122.11	0.12	3.46	8.14	0.40	1.62	0.51	0.07	11.79	39.92	1.97
Dumbarton intertidal	**PA**	37.46	122.08	0.00	9.27	8.33	0.00	0.05	0.24	0.14	1.42	5.50	2.22
Coyote Slough Channel	**D3**	37.46	122.03	No Data	32.36	86.90	146.78	49.76	16.10	4.90	3.24	79.42	3.26
Channel N of DB	**SM31**	37.545	122.175	1.69	9.68	8.96	4.41	2.26	2.64	0.62	9.87	19.59	0.67
Eastern Shoal	**SM34**	37.56	122.18	0.98	7.08	39.10	0.29	1.92	1.20	0.50	10.50	8.69	0.24
Western Shoal	**SM77**	37.53	122.17	0.87	15.00	39.32	3.63	3.13	2.49	0.25	15.25	30.90	0.83
shoals N of DB	**SM35**	37.55	122.15	1.27	8.84	33.65	1.99	2.16	1.47	0.40	11.46	18.51	0.42
Dumbarton shoal	**PA**	37.46	122.08	0.00	6.36	8.24	0.20	0.83	0.37	0.10	6.60	22.71	2.10
N DB Channel	**SM31**	37.545	122.175	1.69	9.68	8.96	4.41	2.26	2.64	0.62	9.87	19.59	1.01
DB and S Channel	**D8**	37.49	122.10	2.82	35.29	22.89	96.42	36.10	13.10	1.14	7.73	14.92	0.16
Coyote	**D3**	37.46	122.03	No Data	32.36	86.90	146.78	49.76	16.10	4.90	3.24	79.42	3.26
N Channel and Slope	**SM2**	37.57	122.22	1.97	5.87	6.44	4.72	2.28	1.94	0.47	10.33	22.66	0.00

units g AFDW/m2

1993-2009 Biomass as g as free dry wt tissue/m2

Location	Representative Station	Latitude (N)	Longitude (W)	April-06	July-06	October-06	April-07	October-07	March-08	July-08	October-08	March-09	June-09
North Channel Axis	**SM2**	37.57	122.22	0.18	0.02	0.12	0.00	0.00	0.00	0.00	0.00	73.39	149.23
North Channel Slope	**SM31**	37.545	122.175	0.31	1.85	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Northwest Shoal	**SM42**	37.56	122.23	0.00	0.75	3.01	0.00	0.00	0.00	0.00	0.00	0.00	1.86
Central Western Shoal	**SM25**	37.515	122.160	1.50	19.59	2.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Northeast Eastern Shoal	**SM46**	37.59	122.17	0.00	3.52	0.33	0.00	0.00	2.28	0.00	0.00	0.00	0.00
Northeast Central Shoal	**SM44**	37.58	122.18	0.05	0.17	0.62	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Central Eastern Shell Shoal	**SM35**	37.55	122.15	0.05	10.39	0.50	0.00	0.55	0.00	0.00	0.00	0.92	9.41
Central Eastern nonshell Shoal	**SM28**	37.55	122.14	0.73	13.06	0.81	0.00	0.00	0.82	0.00	0.00	0.00	0.00
Central Channel and Slope	**SM47**	37.53	122.15	0.00	1.97	1.62	0.00	0.36	0.00	0.00	0.00	0.00	0.00
Dumbarton Channel	**D1**	37.49	122.10	0.34	81.30	17.64	0.00	0.00	0.00	0.00	0.00	3.55	0.00
Southern Channel	**D6**	37.47	122.06	0.77	15.25	2.33	0.00	0.00	0.00	0.00	0.00	1.24	10.88
Dumbarton Western Shoal	**D2**	37.49	122.11	0.05	0.79	1.15	0.00	0.56	0.00	0.00	0.00	0.00	0.00
Dumbarton intertidal	**PA**	37.46	122.08	0.55	3.98	3.53	0.00	0.22	0.00	5.13	0.00	0.00	7.05
Coyote Slough Channel	**D3**	37.46	122.03	4.24	32.39	37.37	0.00	0.59	0.22	9.58	15.19	4.67	4.29
Channel N of DB	**SM31**	37.545	122.175	0.16	1.28	0.58	0.00	0.12	0.00	0.00	0.00	24.46	49.74
Eastern Shoal	**SM34**	37.56	122.18	0.28	7.87	0.64	0.00	0.18	0.27	0.00	0.00	0.31	3.14
Western Shoal	**SM77**	37.53	122.17	0.75	10.17	2.66	0.00	0.00	0.00	0.00	0.00	0.00	0.93
shoals N of DB	**SM35**	37.55	122.15	0.39	7.91	1.26	0.00	0.09	0.52	0.00	0.00	0.15	1.88
Dumbarton shoal	**PA**	37.46	122.08	0.30	2.39	2.34	0.00	0.39	0.00	2.57	0.00	0.00	3.53
N DB Channel	**SM31**	37.545	122.175	0.16	1.28	0.58	0.00	0.12	0.00	0.00	0.00	24.46	49.74
DB and S Channel	**D8**	37.49	122.10	0.56	48.28	9.99	0.00	0.00	0.00	0.00	0.00	2.40	5.44
Coyote	**D3**	37.46	122.03	4.24	32.39	37.37	0.00	0.59	0.22	9.58	15.19	4.67	4.29
N Channel and Slope	**SM2**	37.57	122.22	0.25	0.94	0.07	0.00	0.00	0.00	0.00	0.00	36.70	74.62

units g AFDW/m2