

APPENDIX H: FISH AND MEGABENTHIC INVERTEBRATE ASSEMBLAGES

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Appendix H-1. Fish Recurrent Groups

Full taxonomic information is available in Appendix G. Therefore, only common names are referenced here.

Group 1 (Bay and Inner Shelf Sand Bass Group) Group 1 consisted of barred sand bass and spotted sand bass (Figure 1). The group occurred at 9 stations with a depth range of 2-6 m, and a mean depth of 4 m (Table 1). Group 1 did not have affinities with other recurrent groups or associate species. Barred sand bass is predominantly a soft-bottom species but is also associated with rocks and rocky reefs in shallow water. It occurs primarily on the inner shelf zone of the coast but also occurs in bays and harbors. Spotted sand bass is primarily a soft-bottom fish but is more common in estuaries than on the soft-bottom of the coastal Inner Shelf Zone. Like the barred sand bass, the spotted sand bass is also associated with hard structures. In bays and harbors, these may include rocks, hard debris, and/or pier pilings.

Group 2 (Bay, Harbor, and Inner Shelf Benthic Croaker Group) Group 2 consisted of yellowfin croaker and black croaker, both of which cruise near the bottom in search of food (Figure 1). Black croaker finds refuge in crevices among rocks (e.g., found in harbor breakwaters). Yellowfin croaker often moves around in small groups close to the bottom. This group occurred at 4 stations, all at depths of 4 m (Table 1). Both species are typically soft-bottom inner shelf species. Because of the presence of breakwaters bordering harbors, black croaker might be found more frequently in harbors. Yellowfin croaker is common on the shallow inner shelf. Group 2 did not have affinities with other recurrent groups or associate species.

Group 3 (Bay, Harbor, and Inner Shelf Surfperch/Croaker Group) Group 3 consists of black perch and spotfin croaker (Figure 1). Black perch is typically found on or near rocky reefs or near hard substrate, but will cross soft-bottom areas when moving to another reef area. Spotfin croaker is typically a soft-bottom species. This group was found at 3 stations, ranging in depth from 5 to 6 m, with a mean depth of 6 m (Table 1). Both species are inner shelf species and can be found along the coastal inner shelf or in harbors and bays. Group 3 did not have affinities with other recurrent groups but had an associate species: deepbody anchovy, a species typical of bays, estuaries, and harbors (Figure 1).

Group 4 (Bay, Harbor/Inner Shelf Schooling Croaker Group) Group 4 consists of two schooling sciaenid (croaker) species: white croaker and queenfish (Figure 1). This group occurred at 7 stations in Bays and Harbors and on the Inner Shelf, at a depth of 6 to 24 m, and a mean depth of 12 m (Table 1). It was found in Los Angeles/Long Beach Harbors, and at other inner shelf sites in the Southern California Bight. Group 4 did not have affinities with other recurrent groups.

Group 5 (Bay, Harbor/Inner Shelf/Middle Shelf Surfperch Group) Group 5 consists of two surfperch (Embiotocidae) species: shiner perch and white seaperch (Figure 1). This group occurred at 9 stations at depths of 6 to 44 m, with a mean of 19 m (Table 1). Group 5 did not have affinities with any other recurrent group or with any associate species. Both species are typical of bays and harbors, and the inner shelf, but shiner perch is also typical of estuaries, and also the middle shelf of the coast. White seaperch is typical of bays and harbors, and the inner shelf, but is rare on the middle shelf.

Group 6 (Bay, Harbor/Inner Shelf Rockfish/Surfperch Group) Group 6 consists of two species: copper rockfish and rainbow seaperch (Figure 1). This group occurred at 3 stations ranging in depth from 22 to 30 m, with a mean depth of 27 m (Table 1). Copper rockfish and rainbow seaperch are associated with rocky areas of harbors, and inner shelf. Both are predominantly hard-bottom species, that occasionally cross soft-bottom when moving from one rocky reef to another. Group 6 did not have affinities with any other recurrent group, but did have an associate species, kelp rockfish, which is typical of kelp beds, which are often associated with rocky reefs.

Group 7 (Bay, Harbor/Inner Shelf –Middle Shelf Flatfish/Lizardfish Group) Group 7 consists of four species, three flatfishes and one lizardfish. The flatfish species were speckled sanddab, California tonguefish, and hornyhead turbot (Figure 1). This group occurred at 10 stations at depths of 13-42 m, and a mean depth of 28 m (Table 1). This group had affinities with two recurrent groups: Group 8 and Group 9 (Figure 1). It also had two associate species: bigmouth sole and roughback sculpin (Figure 1). The four species comprising Group 7, as well as the two associate species were all soft-bottom species.

Group 8 (Bay, Harbor/Inner Shelf –Middle Shelf Flatfish/Sculpin Group) Group 8 consists of two species, a sculpin and a sanddab: yellowchin sculpin and longfin sanddab (Figure 1). The group occurred at 24 stations at 13 to 86 m, with a mean depth of 48 m (Table 1). Group 8 had affinities with Recurrent Groups 7 and 9, and with associate species bigmouth sole, pygmy poacher, roughback sculpin, California smoothtongue (Figure 1).

Group 9 (Middle Shelf/Outer Fish Shelf Group) Group 9 consists of three flatfish species, a rockfish, surfperch, and midshipman: Pacific sanddab, English sole, and Dover sole, stripetail rockfish, pink seaperch, and plainfin midshipman (Figure 1). The group occurred at 15 stations at depths of 40 to 152 m, and a mean depth of 100 m (Table 1). This group had affinities with four recurrent groups: Groups 7, 8, 10, and 11, and associates bigmouth sole, California smoothtongue, Pacific hake, and rex sole (Figure 1).

Group 10 (Middle Shelf/Outer Shelf Rockfish Group) Group 10 consists of two rockfish species: halfbanded rockfish and greenstriped rockfish. This group had affinities with Groups 9 and 11 (Figure 1). It occurred at 15 stations ranging in depths from 77 to 200 m, with a mean depth of 150 m (Table 1).

Group 11 (Outer Shelf/Upper Slope Benthic Fish Group) Group 11 consists of five fish species: slender sole, shortspine combfish, blackbelly eelpout, blacktip poacher, and pink rockfish (Figure 1). The group occurred at 13 stations ranging in depth from 94 to 225 m, with a mean depth of 166 m (Table 1). Group 11 has affinities with Recurrent Groups 9 and 10, and associates Pacific hake, rex sole, splitnose rockfish, and spotted cusk-eel.

Group 12 (Upper Slope Fish Group) Group 12 consists of two fish species; shortspine thornyhead and dogface witch eel (Figure 1). The group occurred at 9 stations at depths of 348 to 484 m, with a mean depth of 401 m (Table 1). Group 12 did not have affinities with any other recurrent group, but had associate species rex sole, and bigfin eelpout (Figure 1).

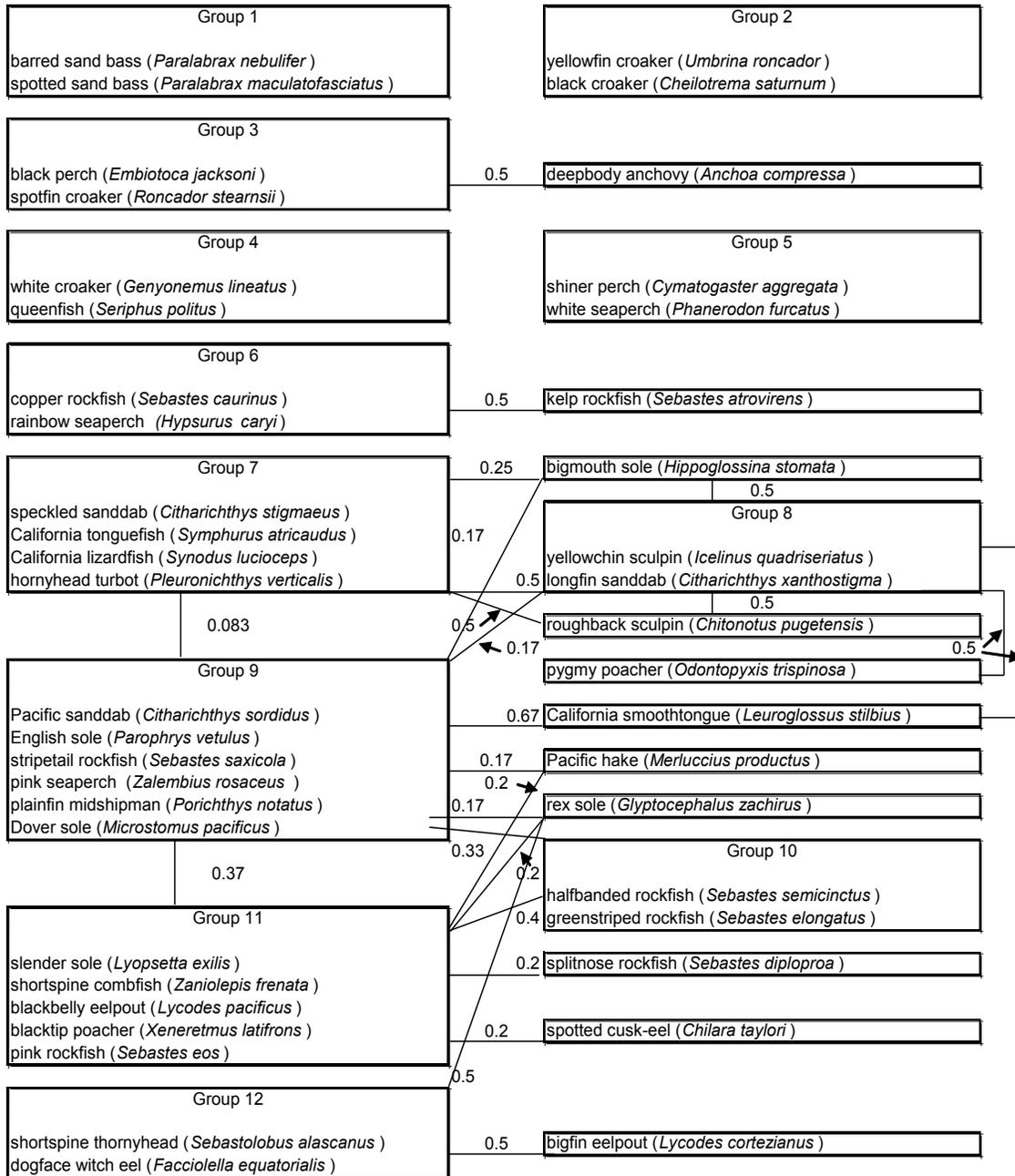


Figure 1. Recurrent groups of demersal fishes on the southern California shelf at depths of 2-484 m, July-September 2008. Index of affinity (I.A. = 0.5 (0.495)). Groups are numbered from shallow to deep. Species within a group are listed in order of abundance. Connex lines show relationships between groups and associates, with values indicating the proportion of possible pairs with IA = 0.5 (0.495).

Table 1. Mean and range of depths of demersal fish recurrent groups on the southern California shelf and slopes at depths of 2-484 m in July-September 2008.

Recurrent Group	No. of Stations	Mean Depth (m)	Depth Range (m)
1	9	4	2-6
2	4	4	4-4
3	3	6	5-6
4	7	12	6-24
5	9	19	6-44
6	3	27	22-30
7	10	28	13-42
8	24	48	13-86
9	15	100	40-152
10	15	150	77-200
11	13	166	94-225
12	9	401	348-484

Appendix H-2. Fish Site and Species Clusters

See Appendix G for full taxonomic information.

Site Cluster 1 (Upper Slope) Site Cluster 1 represents an Upper Slope habitat occurring at 15 mainland upper slope sites. By subregion, this cluster included 12 northern, 3 central mainland sites, and no southern mainland sites (Figure 1, Table 1). Species of two species clusters (Species Cluster F and G) occurred in Site Cluster 1 (Table 1). Of eight species of Species Cluster F and 7 species of Species Cluster G found in this site cluster, two species of Species Cluster F, and three species of Species Cluster G occurred in more than 50% of the stations in Site Cluster 1 (Table 1). Based on frequency of occurrence, these species were the primary demersal fish species at Site Cluster 1 in this survey. Based on frequency of occurrence, these species were Dover sole (G), occurring in 100% of the stations, slender sole (G) occurring at 87%, aurora rockfish (F) occurring at 60%, Pacific hake (G) occurring at 53% and blacktail snail fish (F) occurring at 53% (Table 1). Other Species Cluster F species found in Site Cluster 1 but less frequently (in less than 50% of the stations sampled) included the following species: black eelpout, California grenadier, filetail catshark, longnose skate, longspine thornyhead, and northern lampfish. Other Species Cluster G species included the following species: dogface witch eel, rex sole, bigfin eelpout, and blackbelly eelpout (Table 1). No species of Species Clusters A, B, C, D, or E were found in Site Cluster 1 (Table 1).

Site Cluster 2(Upper Slope) Site Cluster 2 also represented a mainland Upper Slope habitat, but included 11 stations at depths of 209 to 421 m, a somewhat shallower range than that of Site Cluster 1 (which ranged in depth from 365 to 484 m; Table 1, and Figures 1 and VII-4). By subregion, this cluster included 1 northern, 6 central, and 4 southern mainland Upper Slope sites (Figure 1, Table 1). Eight species of Species Cluster G, 6 species of Species Cluster F, 4 species of Species Cluster E, and 2 species of Species Cluster D occurred in more than 50% of the stations in Site Cluster 2 (Table 1). The Species Cluster G species found at 50% or more of the stations in Site Cluster 2 included the following: Dover sole and slender sole occurring at 100% of the stations for each species, Pacific hake occurring at 91%; rex sole and bigfin eelpout occurring at 73% for each species, and dogface witch eel at 55% (Table 1). Based on frequency of occurrence, these species occurring at more 50% or more of Site Cluster 2 stations were the primary demersal fish species of Site Cluster 2 (Table 1). Fourteen demersal fish species representing Species Clusters G, F, E, and D also occurred in Site Cluster 2 in this survey, but occurred at less than 50% of the stations in this site cluster. These included the following: Species Cluster G, bigeye poacher, and blackbelly eelpout (Table 1); Species Cluster F species found at less than 50% of the stations in Site Cluster 2 included the following: longnose skate, aurora rockfish, northern lampfish, filetail catshark, black eelpout, and blacktail snailfish (Table 1). The four Species Cluster E species occurring in Site Cluster 2 in less than 50% of the stations included shortspine combfish, stripetail rockfish, greenblotched rockfish, and pink rockfish (Table 1). Although Species Cluster D included 16 species, almost all of these were found primarily in Site Cluster 5 (Middle Shelf/Inner Shelf; Table 1). Two of these species: Pacific sanddab and English sole occurred at less than 50% of the 11 stations in Site Cluster 2. Nevertheless, both of these species occurred more frequently in Site Cluster 5 (Table 1). No species of Species Clusters A, B, or C were found in Site Cluster 2 (Table 1).

Site Cluster 3 (Upper Slope - Outer Shelf - Middle Shelf) Site Cluster 3 represented a mainland Upper Slope, Outer Shelf, and Middle Shelf habitat, including 21 stations at depths of 70-285 m, and hence was generally shallower than Site Clusters 1 and 2 (Table 1). By subregion, Site Cluster 3 included 14 northern subregion, 2 central subregion, and 5 southern subregion sites in the Southern California Bight (Figure 1). Three species of Species Cluster G, 2 of Species Cluster E, and 3 species of Species Cluster D occurred in more than 50% of the stations in Site Cluster 3 (Table 1). In contrast, 2 species of Species Cluster B, 10 species of Species Cluster D, 7 species of Species Cluster E, 3 species of Species Cluster F,

and 3 species of Species Cluster G did not occur in at least 50% of the stations sampled in Site Cluster 3, were found in Site Cluster 3 (Table 1). The Species Cluster D species that occurred in at least 50% of the stations of Site Cluster 3 included the following: Pacific sanddab, occurring at 81% of stations, and English sole and plainfin midshipman each occurred at 52% of stations in Site Cluster 3 (Table 1). Species Cluster E species that occurred in at least 50% of stations of Site Cluster 3 included the following: shortspine combfish (76%) and striptail rockfish (71%; Table 1). Species Cluster G species that occurred in at least 50% of the stations in Site Cluster 3 included the following: Dover sole (90%), slender sole (86%), and blackbelly eelpout (76%; Table 1). Species B species that occurred in Site Cluster 3, but at less than 50% of stations included northern anchovy (*Engraulis mordax*) and California skate (*Raja inornata*). Species cluster D species that occurred at less than 50% of stations in Site Cluster 3 included longfin sanddab (*Citharichthys xanthostigma*), bigmouth sole (*Hippoglossina stomata*), yellowchin sculpin (*Icelinus quadriseriatus*), pygmy poacher (*Odontopyxis trispinosa*), lingcod (*Ophiodon elongatus*), calico rockfish (*Sebastes dallii*), California tonguefish (*Symphurus atricaudus*), pink seaperch (*Zalembius rosaceus*), and longspine combfish (*Zaniolepis latipinnis*; Table 1). Almost all species group D species occurring in Site Cluster 3 were more abundant in Site Clusters 4 or 5, both of which are middle shelf site clusters that do not include the Upper Slope (Table 1). Hence, these species appear to be primarily middle shelf species, and not upper slope species.

Site Cluster 4(Outer Shelf-Middle Shelf) Site Cluster 4 represented a mainland Outer Shelf/Middle Shelf habitat, including 15 stations ranging in depth from 77-198 m, and hence is shallower than Site Clusters 1, 2, and 3 (Table 1). Site Cluster 4 included 6 northern subregion, 2 central subregion, and 7 southern subregion sites (Figure 1). Four species of species group D, 5 species of species group E, and 2 species of species group G occurred in more than 50% of the stations in Site Cluster 4 (Table 1). However, 2 species of Species Cluster B, 7 species of Species Cluster D, 5 species of Species Cluster E, and 4 species of Species Cluster G occurred in less than 50% of the stations in Site Cluster 4 (Table 1). No species of Species Cluster A, C, and F were found in Site Cluster 4 (Table 1). The Species Cluster D species that occurred in 50% or more of the stations in Site Cluster 4 included the following: Pacific sanddab (*Citharichthys sordidus*), English sole (*Parophrys vetulus*), plainfin midshipman (*Porichthys notatus*), and pink seaperch (*Zalembius rosaceus*). The Species Cluster E species occurring in 50% or more of the stations of this site cluster included spotted cusk-eel (*Chilara taylori*), greenstriped rockfish (*Sebastes elongatus*), striptail rockfish (*Sebastes saxicola*), halfbanded rockfish (*Sebastes semicinctus*), and shortspine combfish (*Zaniolepis frenata*; Table 1). The two Species Cluster G species that occurred in 50% or more of the stations in this site cluster included slender sole (*Lyopsetta exilis*) and Dover sole (*Microstomus pacificus*; Table 1).

The Species Cluster B species that occurred in less than 50% of of Site Cluster 4 stations included white croaker (*Genyonemus lineatus*) and California skate (*Raja inornata*). The Species Cluster D species that occurred in less than 50% of the Site Cluster 4 stations were roughback sculpin (*Chitonotus pugetensis*), longfin sanddab (*Citharichthys xanthostigma*), bigmouth sole (*Hippoglossina stomata*), yellowchin sculpin (*Icelinus quadriseriatus*), English sole (*Parophrys vetulus*), California lizardfish (*Synodus lucioceps*), and pink seaperch (*Zalembius rosaceus*). Species cluster E species that occurred in less than 50% of Site Cluster 4 stations included California scorpionfish (*Scorpaena guttata*), greenspotted rockfish (*Sebastes chlorostictus*), pink rockfish (*Sebastes eos*), greenblotched rockfish (*Sebastes rosenblatti*), bluespotted poacher (*Xeneretmus triacanthus*). Species cluster G species occurring in less than 50% of Site Cluster 4 included rex sole (*Glyptocephalus zachirus*), bigfin eelpout (*Lycodes cortezianus*), blackbelly eelpout (*Lycodes pacificus*), and Pacific hake (*Merluccius productus*; Table 1).

Site Cluster 5 (Middle Shelf-Inner Shelf) Site Cluster 5 represented a mainland Middle Shelf/Inner Shelf habitat, including 25 stations ranging in depth from 26-86 m, and hence is shallower than Site Clusters 1, 2, and 3, and generally shallower than Species Cluster 4 (Table 1). Site Cluster 5 included 9 northern subregion, 9 central subregion, and 7 southern subregion sites (Figure 1). Thirteen species of

species group D occurred in 50% or more of the stations in Site Cluster 5 (Table 1). No species of Species Clusters A or G occurred in Site Cluster 5 (Table 1). However, 5 species of Species Cluster B, 6 species of Species Cluster C, 3 species of Species Cluster D, 8 species of Species Cluster E, and 2 species of Species Cluster G occurred in less than 50% of the Site Cluster 5 stations. The 13 Species Cluster D species that occurred in 50% or more of the stations in Site Cluster 5 included the following: roughback sculpin (*Chitonotus pugetensis*), Pacific sanddab (*Citharichthys sordidus*), longfin sanddab (*Citharichthys xanthostigma*), bigmouth sole (*Hippoglossina stomata*), yellowchin sculpin (*Icelinus quadriseriatus*), pygmy poacher (*Odontopyxis trispinosa*), English sole (*Parophrys vetulus*), hornyhead turbot (*Pleuronichthys verticalis*), plainfin midshipman (*Porichthys notatus*), California tonguefish (*Symphurus atricaudus*), California lizardfish (*Synodus lucioceps*), pink seaperch (*Zalembius rosaceus*), and longspine combfish (*Zaniolepis latipinnis*). Note that Species Cluster D was the only species cluster that included species that occurred in 50% or more of the sites in Site Cluster 5.

The species Cluster B species that occurred in less than 50% of the stations in Site Cluster 5 included the following five in Species Cluster B: northern anchovy (*Engraulis mordax*), white croaker (*Genyonemus lineatus*), bay goby (*Lepidogobius lepidus*), specklefin midshipman (*Porichthys notatus*), and California skate (*Raja inornata*; Table 1). Species C species that occurred in less than 50% of the stations in Site Cluster 5 included shiner perch (*Cymatogaster aggregate*), white seaperch (*Phanerodon furcatus*), spotted turbot (*Pleuronichthys ritteri*), vermilion rockfish (*Sebastes miniatus*), barcheek pipefish (*Syngnathus exilis*), and fantail sole (*Xystreuryx liolepis*). The species Cluster D that occurred in less than 50% of the stations in Site Cluster 5 included the following: speckled sanddab (*Citharichthys stigmaeus*), lingcod (*Ophiodon elongatus*), and calico rockfish (*Sebastes dallii*; Table 1). The species Cluster E species that occurred in less than 50% of the stations in Site Cluster 5 included spotted cusk-eel (*Chilara taylori*), California scorpionfish (*Scorpaena guttata*), greenstriped rockfish (*Sebastes elongates*), pink rockfish (*Sebastes eos*), greenblotched rockfish (*Sebastes rosenblatti*), stripetail rockfish (*Sebastes saxicola*), halfbanded rockfish (*Sebastes semicinctus*), and shortspine combfish (*Zaniolepis frenata*). Species Group G species occurring at less than 50% of site cluster sites included slender sole (*Lyopsetta exilis*) and Dover sole (*Microstomus pacificus*; Table 1).

Site Cluster 6 (Middle Shelf-Inner Shelf) Site Cluster 6 represented a mainland Middle Shelf/Inner Shelf habitat, as did Site Cluster 5. Site Cluster 6 included 18 stations ranging in depth from 15-48 m, and hence is shallower than Site Clusters 1, 2, 3, 4, and generally shallower than Site Cluster 5 (Table 1). Site Cluster 6 included 4 northern subregion, 12 central subregion, and 2 southern subregion sites (Figure 1). Four species of species group D occurred in 50% or more of the stations in Site Cluster 6 (Table 1). No species groups F or G occurred at Site Cluster 6. One species of Species Cluster A occurred in less than 50% of the stations of Site Cluster 6. Three species of Species Cluster B occurred at less than 50% of the stations in Site Cluster 6. Three species of Species Cluster C occurred in Site Cluster 6. Ten species of Species Cluster D occurred at less than 50% of the stations in Site Cluster 6. Two species of Species Cluster E occurred at less than 50% of the stations of Site Cluster 6.

The four species D species occurring in 50% or more of the stations in Site Cluster 6 included the following: speckled sanddab (*Citharichthys stigmaeus*), hornyhead turbot (*Pleuronichthys verticalis*), California tonguefish (*Symphurus atricaudus*), and California lizardfish (*Synodus lucioceps*; Table 1). The Species Cluster A species that occurred in less than 50% of the Site Cluster 6 stations was barred sand bass (*Paralabrax nebulifer*; Table 1). The Species Cluster B species that occurred at less than 50% of the stations in Site Cluster 6 included the following: California halibut (*Paralichthys californicus*), specklefin midshipman (*Porichthys myriaster*), and California skate (*Raja inornata*; Table 1). The two Species Cluster C species occurring in less than 50% of the stations in Site Cluster 6 included spotted turbot (*Pleuronichthys ritteri*) and fantail sole (*Xystreuryx liolepis*; Table 1). The 10 species of Species Cluster D that occurred in less than 50% of Site Cluster 6 stations included roughback sculpin (*Chitonotus pugetensis*), Pacific sanddab (*Citharichthys sordidus*), longfin sanddab (*Citharichthys*

xanthostigma), bigmouth sole (*Hippoglossina stomata*), yellowchin sculpin (*Icelinus quadriseriatus*), pygmy poacher (*Odontopyxis trispinosa*), English sole (*Parophrys vetulus*), plainfin midshipman (*Porichthys notatus*), pink seaperch (*Zalembius rosaceus*), and longspine combfish (*Zaniolepis latipinnis*; Table 1). The two Species Cluster E species that occurred at less than 50% of Site Cluster E stations included California scorpionfish (*Scorpaena guttata*) and stripetail rockfish (*Sebastes saxicola*; Table 1).

Site Cluster 7 (Inner Shelf) Site Cluster 7 represented a mainland Inner Shelf habitat. Site Cluster 7 included 8 stations ranging in depth from 8-16 m, and hence is shallower than Site Clusters 1, 2, 3, 4, and 5, and generally shallower than Site Cluster 6 (Table 1). Site Cluster 7 included 2 northern subregion, 2 central subregion, and 4 southern subregion sites (Figure 1). No Species Cluster A, E, F, and G species occurred in Site Cluster 7 (Table 1). Three species of Species Cluster D occurred in 50% or more of the stations in Site Cluster 7 (Table 1). One Species Cluster B and two Species Cluster C species occurred in 50% or more of the stations of Site Cluster 7 (Table 1). Three species of Species Cluster B, five species of Species Cluster C, and six species of species Cluster D occurred in 50% or less of the stations of Site Cluster 7 (Table 1).

The three Species Cluster D species occurring in 50% or more of the stations of Site Cluster 7 included speckled sanddab (*Citharichthys stigmaeus*), hornyhead turbot (*Pleuronichthys verticalis*), and California lizardfish (*Synodus lucioceps*; Table 1). The two Species Cluster C species occurring in 50% or more of the stations of Site Cluster 7 included fantail sole (*Xystreureys liolepis*) and Pacific staghorn sculpin (*Leptocottus armatus*; Table 1). The only Species Cluster B species occurring in 50% or more of the stations in Site Cluster 7 was California halibut (*Paralichthys californicus*; Table 1). Of fish species occurring at less than 50% of sites in Site Cluster 7, Species Cluster B species included white croaker (*Genyonemus lineatus*), specklefin midshipman (*Porichthys myriaster*), and queenfish (*Seriphus politus*; Table 1). Species cluster C species occurring at this frequency included shiner perch (*Cymatogaster aggregata*), giant kelpfish (*Heterostichus rostratus*), white seaperch (*Phanerodon furcatus*), spotted turbot (*Pleuronichthys ritteri*), barcheek pipefish (*Syngnathus exilis*; Table 1). Species cluster D species occurring at less than 50% of the stations in Site Cluster 7 included the following: roughback sculpin (*Chitonotus pugetensis*), longfin sanddab (*Citharichthys xanthostigma*), yellowchin sculpin (*Icelinus quadriseriatus*), English sole (*Parophrys vetulus*), plainfin midshipman (*Porichthys notatus*), and California tonguefish (*Symphurus atricaudus*; Table 1).

Site Cluster 8 (Inner Shelf-Bays and Harbors) Site Cluster 8 represented mainland inner shelf and bays and harbors habitat (Table 1). It included 15 stations ranging in depth from 5-24 m, which was a somewhat broader depth range than Site Clusters 7 and 9, and shallower than Site Clusters 1-6 (Table 1). Site Cluster 8 included 3 northern subregion, 7 central subregion, and 5 southern subregion sites (Figure 1). No species of Species Cluster E, F, or G were found in Site Cluster 8 (Table 1). One Species Cluster B species (white croaker, *Genyonemus lineatus*) and one Species Cluster C species (shiner perch, *Cymatogaster aggregata*) occurred at 50% or more of the stations of Site Cluster 8. Three species of Species Cluster A occurred at less than 50% of stations in Site Cluster 8. These were spotted sand bass (*Paralabrax maculatofasciatus*), barred sand bass (*Paralabrax nebulifer*), and round stingray (*Urobatis halleri*; Table 1).

Seven species of Species Cluster B occurred at less than 50% of the stations in Site Cluster 8. These included the following: slough anchovy (*Anchoa delicatissima*), northern anchovy (*Engraulis mordax*), bay goby (*Lepidogobius lepidus*), California halibut (*Paralichthys californicus*), specklefin midshipman (*Porichthys myriaster*), California skate (*Raja inornata*), and queenfish (*Seriphus politus*). Five species of Species Cluster C occurred in fewer than 50% of the stations in Species Cluster 8. These included giant kelpfish (*Heterostichus rostratus*), white seaperch (*Phanerodon furcatus*), spotted turbot (*Pleuronichthys ritteri*), barcheek pipefish (*Syngnathus exilis*), and fantail sole (*Xystreureys liolepis*; Table 1). Eleven species of Species Cluster D occurred at less than 50% of Site Cluster 8 stations. These

included Pacific sanddab (*Citharichthys sordidus*), speckled sanddab (*Citharichthys stigmaeus*), longfin sanddab (*Citharichthys xanthostigma*), yellowchin sculpin (*Icelinus quadriseriatus*), pygmy poacher (*Odontopyxis trispinosa*), English sole (*Parophrys vetulus*), Hornyhead turbot (*Pleuronichthys verticalis*), plainfin midshipman (*Porichthys notatus*), California tonguefish (*Symphurus atricaudus*), California lizardfish (*Synodus lucioceps*), and pink seaperch (*Zalembeus rosaceus*; Table 1). One species of species group E occurred in less than 50% of the stations in Site Cluster 8. This was California scorpionfish (*Scorpaena guttata*; Table 1).

Site Cluster 9 (Bays and Harbors) Site Cluster 9 represents the bays and harbors habitat. It included 11 stations ranging in depth from 2-12 m (Table 1). Site Cluster 9 included 3 northern subregion, 7 central subregion, and 5 southern subregion sites (Figure 1). The 11 stations classified as Site Cluster 9 occurred only in the southern subregion of the Southern California Bight, with one station in Mission Bay and 10 in San Diego Bay (Figure 1). No Site Cluster 9 stations occurred in the northern or central subregions of the area surveyed in the Bight 2008 trawl survey (Figure 1). No species of Species Cluster E, F, or G were found in Site Cluster 8 (Table 1). One Species Cluster B species (California halibut, *Paralichthys californicus*) and four Species Cluster A species, including spotted sand bass (*Paralabrax maculatofasciatus*), barred sand bass (*Paralabrax nebulifer*), yellowfin croaker (*Umbrina roncadore*), and round stingray (*Urolophus halleri*) occurred at 50% or more of the stations of Site Cluster 9 (Table 1). One species of Species Cluster A (black croaker, *Cheilodactylus saturnum*), and two species of Species Cluster B: slough anchovy (*Anchoa delicatissima*) and specklefin midshipman (*Porichthys myriaster*) occurred at less than 50% of stations in Site Cluster 9. In addition, two species of Species Cluster C: giant kelpfish (*Heterostichus rostratus*) and spotted turbot (*Pleuronichthys ritteri*) occurred at less than 50% of stations in Site Cluster 9. One species of Species Cluster D (California tonguefish, *Symphurus atricaudus*) also occurred at less than 50% of the stations in this site cluster (Table 1).

Species Clusters.

Seven major species clusters were delineated by the analysis (Table 1). The species clusters generally occupied different depth zones or combinations of these. Each species cluster generally occupied different depth zones, or different combinations of these (Table 1). The relationship of the site clusters with depth is a result of the depth distribution patterns of the fish species found in the species clusters. All site clusters included representatives of two or more species clusters.

Species Cluster A Species Cluster A included 5 species, occurring primarily dominant (with species occurring in 50% or more of the stations) in Site Cluster 9 (Bays and Harbors), and occurred less frequently in Site Clusters 6 (Middle Shelf/Inner Shelf) and Site Cluster 8 (Inner Shelf/Bays and Harbors; Table 1). Species Cluster A did not occur in Site Cluster 1 (Upper Slope); 2 (Upper Slope); 3 (Upper Slope/Outer Shelf/Middle Shelf); 4 (Outer Shelf/Middle Shelf), 5 (Middle Shelf/Inner Shelf), or 7 (Inner Shelf; Table 1).

Species Cluster B Species Cluster B was dominant in Site Cluster 8 (Inner Shelf/Bays and Harbors), and Site Cluster 7 (Inner Shelf; Table 1). It occurred less frequently in Site Cluster 3 (Upper Slope/Outer Shelf/Middle Shelf), Site Cluster 4 (Outer Shelf/Middle Shelf); Site Cluster 5 (Middle Shelf/Inner Shelf), and Site Cluster 6 (Middle Shelf/Inner Shelf; Table 1). Species Cluster B did not occur in Site Cluster 1 (Upper Slope) and 2 (Upper Slope).

Species Cluster C Species Cluster C was dominant in Site Cluster 7 (Inner Shelf) and Site Cluster 8 (Inner Shelf/Bays and Harbors; Table 1). It occurred less frequently in Site Clusters 5 (Middle Shelf/Inner Shelf), 6 (Middle Shelf/Inner Shelf), and 9 (Bays and Harbors). Species Cluster C did not occur in Site Cluster 1 (Upper Slope), 2 (Upper Slope), 3 (Upper Slope/Outer Shelf/Middle Shelf), and 4 (Outer Shelf/Middle Shelf; Table 1).

Species Cluster D Species Cluster D was dominant in Site Cluster 3 (Upper Slope/Outer Shelf/Middle Shelf), 4 (Outer Shelf/Middle Shelf), 5 (Middle Shelf/Inner Shelf), 6 (Middle Shelf/Inner Shelf), and Site Cluster 7 (Inner Shelf; Table 1). It occurred less frequently in Species Cluster 2 (Upper Slope), 8 (Inner Shelf/Bays and Harbors), and 9 (Bays and Harbors; Table 1). Species Cluster D did not occur in Site Cluster 1 (Upper Slope).

Species Cluster E Species Cluster E was dominant in Site Cluster 3 (Upper Slope/Outer Shelf/Middle Shelf) and 4 (Outer Shelf/Middle Shelf; Table 1). It occurred less frequently in Site Clusters 2 (Upper Slope); 5 (Middle Shelf/Inner Shelf), 6 (Middle Shelf/Inner Shelf), and 8 (Inner Shelf/Bays and Harbors; Table 1). It did not occur in Site Cluster 1 (Upper Slope), 7 (Inner Shelf), and 9 (Bays and Harbors).

Species Cluster F Species Cluster F was dominant in Site Cluster 1 (Upper Slope; Table 1). It occurred less frequently in Site Cluster 2 (Upper Slope) and 3 (Upper Slope/Outer Shelf/Middle Shelf; Table 1). It did not occur in Site Clusters 4 (Outer Shelf/Middle Shelf); 5 (Middle Shelf/Inner Shelf); 6 (Middle Shelf/Inner Shelf); 7 (Inner Shelf); 8 (Inner Shelf/Bays and Harbors); or 9 (Bays and Harbors; Table 1).

Species Cluster G Species Cluster G was dominant in Site Cluster 2 (Upper Slope), Site Cluster 1 (Upper Slope), Site Cluster 3 (Upper Slope/Outer Shelf/Middle Shelf), and Site Cluster 4 (Outer Shelf/Middle Shelf). It occurred less frequently in Site Cluster 5 (Middle Shelf/Inner Shelf; Table 1). It did not occur in Site Clusters 6 (Middle Shelf/Inner Shelf); 7 (Inner Shelf); 8 (Inner Shelf/Bays and Harbors); or 9 (Bays and Harbors; Table 1).

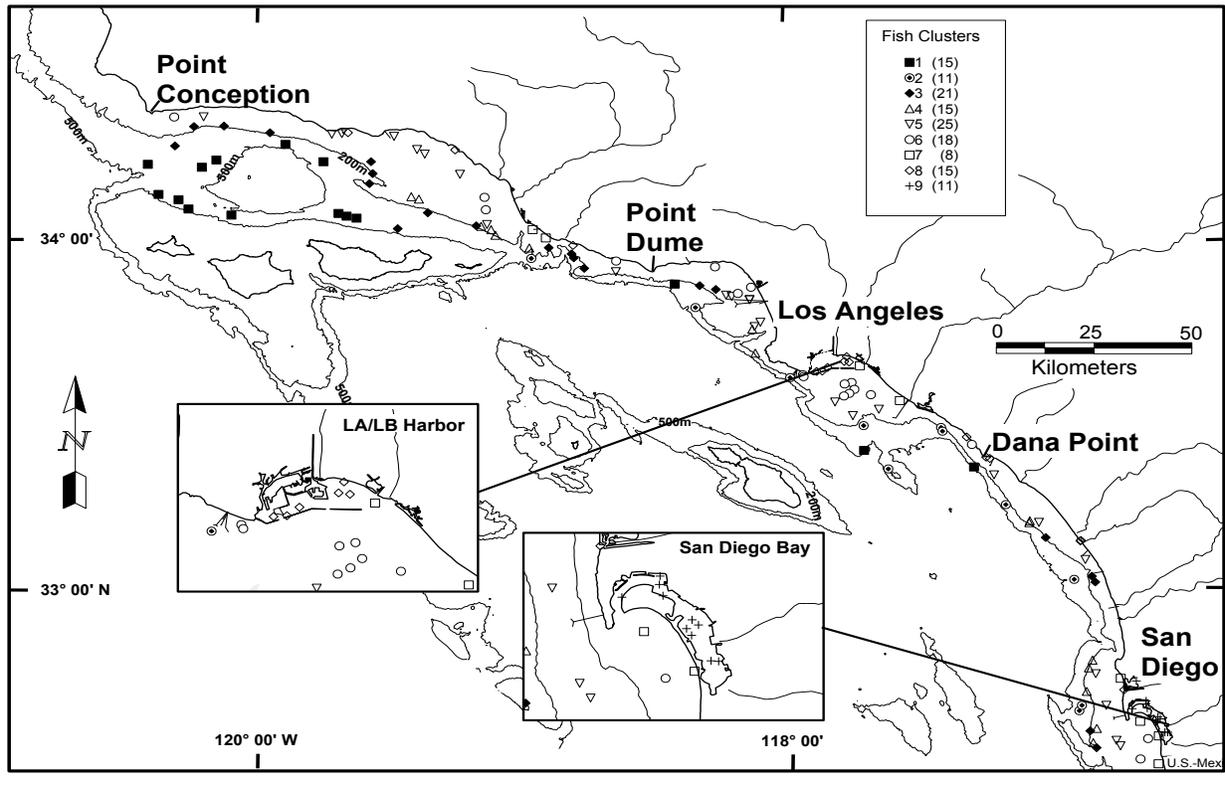


Figure 1. Distribution of fish site clusters on the southern California shelf and upper slope at depths of 2-484 m, July-September 2008.

Table 1. Frequency of occurrence (percent of stations) of demersal fish species of specific species clusters with shading identifying those occurring at 50% or more of the stations in at least one site cluster on the southern California shelf and upper slope at depths of 2-484 m, July-September 2008.

		Site Cluster								
		1	2	3	4	5	6	7	8	9
		Upper slope	Upper slope	Upper Slope-Outer/Middle Shelf	Outer/Middle Shelf	Middle/Inner Shelf	Middle/Inner Shelf	Inner Shelf	Inner Shelf/B&H	B&H
Number of Stations		15	11	21	15	25	18	8	15	11
Depth Range (m)		365-484	209-421	70-285	77-198	26-86	15-48	8-16	5-24	2-12
Species Cluster	Common Name	Scientific Name								
A	black croaker									45
A	spotted sand bass								7	82
A	barred sand bass						6		40	91
A	yellowfin croaker									55
A	round stingray								7	55
B	slough anchovy									7
B	northern anchovy			19		8				33
B	white croaker				7	4		25		60
B	bay goby					28				7
B	California halibut						28	50		73
B	specklefin midshipman					12	22	25		33
B	California skate			10	7	44	6			13
B	queenfish							13		40
C	shiner perch					12		38		53
C	giant kelpfish							13		27
C	Pacific staghorn sculpin								88	
C	white seaperch					12		13		47
C	spotted turbot					8	33	25		7
C	vermillion rockfish					20				
C	barcheek pipefish					8		38		7
C	fantail sole					24	22			63
D	roughback sculpin				7		68	39		13
D	Pacific sanddab		9	81	100	100	33			7
D	speckled sanddab						44	94	100	47
D	longfin sanddab			10	13	56	44	13		7
D	bigmouth sole			10	47	64	28			
D	yellowchin sculpin			19	7	100	44	13		7
D	pygmy poacher			10		64	11			7
D	lingcod			10		20				
D	English sole		45	52	87	68	44	25		13
D	hornyhead turbot				47		88	94		63
D	plainfin midshipman				52	67	76	6	13	7
D	calico rockfish			5		36				
D	California tonguefish			5		84	61	38		40
D	California lizardfish				13	60	50	50		40
D	pink seaperch			43	73	76	6			7
D	longspine combfish			19	47	72	6			
E	spotted cusk-eel			19	67	24				
E	California scorpionfish			14	7	16	44			7
E	greenspotted rockfish			29	20					
E	greenstriped rockfish			38	80	4				
E	pink rockfish			18	48	47	4			
E	greenblotched rockfish			18	10	40	8			
E	stripetail rockfish			18	71	87	40	6		
E	halfbanded rockfish				19	80	20			
E	bluespotted poacher					47				
E	shortspine combfish			9	76	100	28			
F	blacktail snailfish	53		9	5					
F	black eelpout	33		9	5					
F	California grenadier	47								
F	filetail cat shark	47		9						
F	longnose skate	27		18	10					
F	aurora rockfish	60		18						
F	longspine thornyhead	33								
F	northern lampfish	33		18						
G	bigeye poacher			45						
G	dogface witch eel	20	55							
G	rex sole	40	73	48	13					
G	bigfin eelpout	33	73	10	13					
G	blackbelly eelpout	27	18	76	40					
G	slender sole	87	100	86	93	4				
G	Pacific hake	53	91	14	40					
G	Dover sole	100	100	90	100	44				

Appendix H-3. Invertebrate Assemblages

Group 1 (Inner Shelf/Bays and Harbor Mollusk-Sponge Group). Group 1 consisted of California bubble and burgundy bay sponge (Figure 1). It occurred at 6 stations (Table 1) at depths of 2-4 m, with a mean depth of 4 m, on the Inner Shelf and in Bays and Harbors. The group was associated with a gastropod Western Mud Nassa (Figure 1).

Group 2 (Inner shelf Shrimp-Crab Group). Group 2 consisted of blackspotted bay shrimp and tuberculate pear crab (Figure 1). It occurred at 13 stations at depths of 6-34 m, with a mean depth of 16 m (Table 1) on the Inner Shelf.

Group 3 (Middle Shelf Urchin-Sand Star Group). Group 3 consisted of white sea urchin and California sand star (Figure 1). It occurred at 27 stations of 20-174 m with a mean depth of 57m on the Middle Shelf (Table 1).

Group 4 (Middle Shelf/Outer Shelf Shrimp-Sand Star Group) Group 4 consisted of two ridgeback rock shrimp and gray sand star (Figure 1). The group had two associate species: California sea cucumber and California sea slug (Figure 1). Group 4 occurred at 27 stations of 35-195 m with a mean depth of 101 m (Table 18).

Group 5 (Outer Shelf/Upper Slope Shrimp Group) Group 5 consisted of moustache bay shrimp and flagnose bay shrimp (Figure 1). It occurred at 14 stations at depths of 140-414 m (mean of 223 m), primarily on the outer shelf and upper slope (Table 1). The group was associated with slender blade shrimp and Group 6 (discussed next, below; Figure 1).

Group 6 (Outer Shelf/Upper Slope Urchin/Octopus Group). Group 6 consisted of Pacific heart urchin, southern heart urchin, fragile sea urchin, and orange bigeye octopus (Figure 1). It occurred at 15 stations at depths of 172-439 m, with a mean depth of 337 m (Table 1). The group was associated with California sea cucumber, California sea slug, slender blade shrimp, California heart urchin, and sea dandelion. It was also associated with Group 5 (above), and Group 7 (discussed next, below).

Group 7 (Upper Slope Sea Star/Sea Cucumber Group). Group 7 consisted of a sea star (*Myxoderma platyacanthum*) and a sea cucumber (*Pannychia moseleyi*; Figure 1). This group was found at 9 stations at depths of 365-439 m, with a mean depth of 417 m (Table 1). A brittlestar (*Asteronyx longifissus*) was an associate of this group (Table 13).

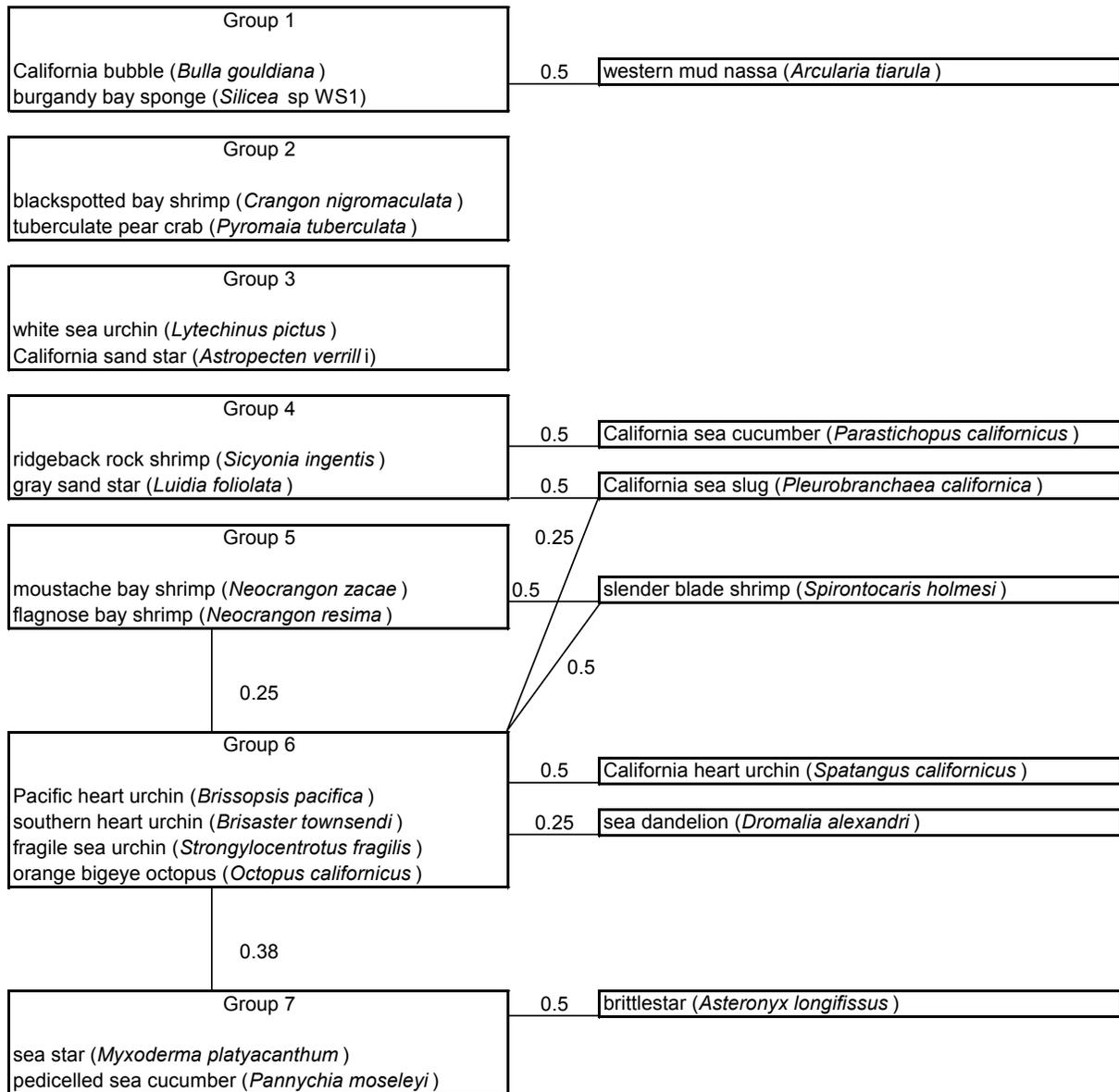


Figure 1. Recurrent groups of megabenthic invertebrates found at multiple sites on the southern California shelf at depths of 2-484 m, July-September 2008. Index of affinity (I.A. = 0.5 (0.495). Groups are numbered from shallow to deep. Species within a group are listed in order of abundance. Connex lines show relationships between groups and associates, with values indicating the proportion of possible pairs with IA = 0.5 (0.495).

Table 1. Mean and range of depth of megabenthic invertebrate recurrent groups on the southern California shelf and upper slope at depths of 2-484 m in July-September 2008.

Recurrent Group	No. of Stations	Mean Depth (m)	Depth Range (m)
1	6	4	2-4
2	13	16	6-34
3	27	57	20-174
4	27	101	35-195
5	14	223	140-414
6	15	337	172-439
7	9	417	365-439

Appendix H-4. Combined Fish and Invertebrate Assemblages

Fish/Invertebrate Group 1 (Inner Shelf/Bay and Harbor Fish / Mollusk Group) Group 1 consisted of barred sand bass, spotted sand bass, and the California bubble (Figure 1). It occurred at 7 stations (Table 1) at depths of 2-4 m, with a mean depth of 4 m, on the Inner Shelf and in Bays and Harbors. The group was associated with round stingray and group 3 (Figure 1), discussed in detail below.

Fish/Invertebrate Group 2 (Bay and Harbor, and Inner Shelf Benthic Croaker Group). Group 2 was the same as Fish Group 2 and associated with Fish/Invertebrate Group 3.

Fish/Invertebrate Group 3. (Inner Shelf/Bays and Harbor Mollusk-Sponge Group). Group 3 was the same as Invertebrate Group 1 and associated with Fish/Invertebrate Group 2.

Fish/Invertebrate Group 4 (Bay, Harbor, and Inner Shelf Surfperch/Croaker Group). Group 4 was the same as Fish Group 3.

Fish/Invertebrate Group 5 (Bay, Harbor/Inner Shelf Schooling Croaker Group). Group 5 was the same as Fish Group 4.

Fish/Invertebrate Group 6 (Inner shelf Shrimp-Crab Group). Group 6 was the same as Invertebrate Group 2.

Fish/Invertebrate Group 7 (Bay, Harbor/Inner Shelf/Middle Shelf Surfperch Group). Group 7 was the same as Invertebrate Group 5.

Fish/Invertebrate Group 8 (Bay and Harbor/Inner Shelf – Hard-bottom Fish/ Nudibranch Group). Group 8 consists of copper rockfish, rainbow seaperch, and maculated triopha (Figure 1). This group was not associated with any other recurrent groups. All three species are typically associated with hard bottom areas and was taken in combination at 3 stations at depths of 22-30 m with a mean depth of 27m (Table 1).

Fish/Invertebrate Group 9 (Bay and Harbor/Inner Shelf–Middle Shelf Flatfish/Lizardfish/Starfish Group). Group 9 consists of speckled sanddab, California tonguefish, hornyhead turbot, California lizardfish, and California sand star (Figure 1). This group occurred at 10 stations at depths of 13-42 m, and a mean depth of 28 m. (Table 1). This group had affinities with two recurrent groups: Group 6 and Group 10 (Figure 1). It also associated with bigmouth sole, white sea urchin, roughback sculpin, and pygmy poacher (Figure 1).

Fish/Invertebrate Group 10 (Bay, Harbor/Inner Shelf –Middle Shelf Flatfish/Sculpin Group). Group 10 consisted of yellowchin sculpin and longfin sanddab (Figure 1). The group occurred at 24 stations at 13 to 86 m, with a mean depth of 48 m (Table 1). This group had affinities with Fish/Invertebrate Recurrent Groups 6 and 9 (above; Figure 1). This group had five associate species: bigmouth sole, white sea urchin, roughback sculpin, pygmy poacher, and California blade barnacle.

Fish/Invertebrate Group 11 (Fish/Nudibranch Middle Shelf/Outer Shelf Group). Group 11 consisted of lingcod and rosy tritonia (Figure 1). This group is not associated with any other recurrent groups but has an associate species: bigmouth sole (*Hippoglossina stomata*; Figure 1). Fish/Invertebrate Group 11 occurred at 6 stations at depths of 41-172 m, with a mean depth of 69 m (Table 1).

Fish/Invertebrate Group 12 (Fish/Invertebrate Middle Shelf/Outer Shelf Group). Group 11 consisted of Pacific sanddab, pink seaperch, longspine combfish, plainfin midshipman, California sea cucumber, and gray sand star (Figure 1). This group was associated with Fish/Invertebrate Groups 10 and 9 (above; Figure 1), and groups 13, 14, 15, and 17 (below; Figure 1). Associate species included bigmouth sole, white sea urchin, red octopus, and halfbanded rockfish. Fish/invertebrate Recurrent Group 12 occurred at 14 stations at depths of 38-136 m, with a mean depth of 78 m (Table 1).

Fish/Invertebrate Group 13 (Shrimp/Sole Inner Shelf-Outer Shelf Group)

Group 13 consisted of ridgeback rock shrimp and English sole (Figure 1). The group was associated with Group 9 (Figure 1) and Groups 12, 14, and 17 (Figure 1). Fish/Invertebrate recurrent Group 13 occurred at 32 stations at depths of 26-209 m, and a mean depth of 114 m (Table 1). It did not have any associate species (Figure 1).

Fish/Invertebrate Group 14 (Outer Shelf-Upper Slope Fish Group)

Group 14 consisted only of stripetail rockfish, shortspine combfish, blacktip poacher, greenstriped rockfish, and pink rockfish (Figure 1). This group had affinities with Fish/Invertebrate Groups 12 and 13 (discussed above), and with Groups 15, 16, and 17 (discussed below). Halfbanded rockfish and spotted cusk-eel were associate species (Figure 1). Fish/Invertebrate recurrent group occurred at 12 stations at depths of 94-225m, with a mean depth of 165 m (Table 1).

Fish/Invertebrate Group 15 (Outer Shelf-Upper Slope Eelpout/Sea Slug Group)

Group 15 consisted of blackbelly eelpout and California sea slug (Figure 1). The group had affinities with Groups 12 and 14 (discussed above), and Group 17 (discussed below). Slender blade shrimp was an associate of this group (Figure 1). Group 15 occurred at 27 stations at depth of 94-407 m, with a mean depth of 205 m (Table 1).

Fish/Invertebrate Group 16 (Outer Shelf-Upper Slope Bay Shrimp Group)

Group 16 was the same as Invertebrate Group 5.

Fish/Invertebrate Group 17 (Outer Shelf-Upper Slope Urchin/Sole/Octopus Group)

Group 17 consisted of Pacific heart urchin, southern heart urchin, fragile sea urchin, slender sole, Dover sole, rex sole, and orange bigeye octopus. This recurrent group had affinities with recurrent groups 12, 13, 14, 15, 16, 19, and 20 (Figure 1). Slender blade shrimp, California heart urchin, sea dandelion, splitnose rockfish, and Pacific hake were associate species (Figure 1). Group 17 occurred at 13 stations at depths of 172-439 m with a mean depth of 342 m (Table 1).

Fish/Invertebrate Group 18 (Upper Slope Brittle Star/Snailfish Group).

Group 18 consisted of a brittlestar (*Asteronyx longifissus*) and blacktail snailfish (Figure 1). This group had affinities with fish/invertebrate recurrent group 20 (Figure 1). It did not have any associate species (Figure 1). Group 18 occurred at 6 stations at depths of 365-426 m, with a mean depth of 395m (Figure 1).

Fish/Invertebrate Group 19 (Upper Slope Thornyhead/Witch Eel Group).

Group 19 was the same as Fish Group 12 and had affinities with Group 17 (discussed above). Offshore blade shrimp (*Spirontocaris sica*) and bigfin eelpout (*Lycodes cortezianus*) were associate species of this group (Figure 1). Group 19 occurred at 9 stations at depths of 348-484 m, and a mean depth of 19 m (Table 1).

Fish/Invertebrate Group 20 (Upper Slope Echinoderm/Rockfish Group)

Group 20 consisted of a sea star (*Myxoderma platyacanthum*), pedicelled sea cucumber, and aurora rockfish. This group had affinities with Groups 17 and 18 (discussed above). Two fishes, filetail cat

shark and California grenadier were associate species of Group 20 (Figure 1). Group 20 occurred at 6 stations at depths of 386-433 m, with a mean depth of 418 m (Table 1).

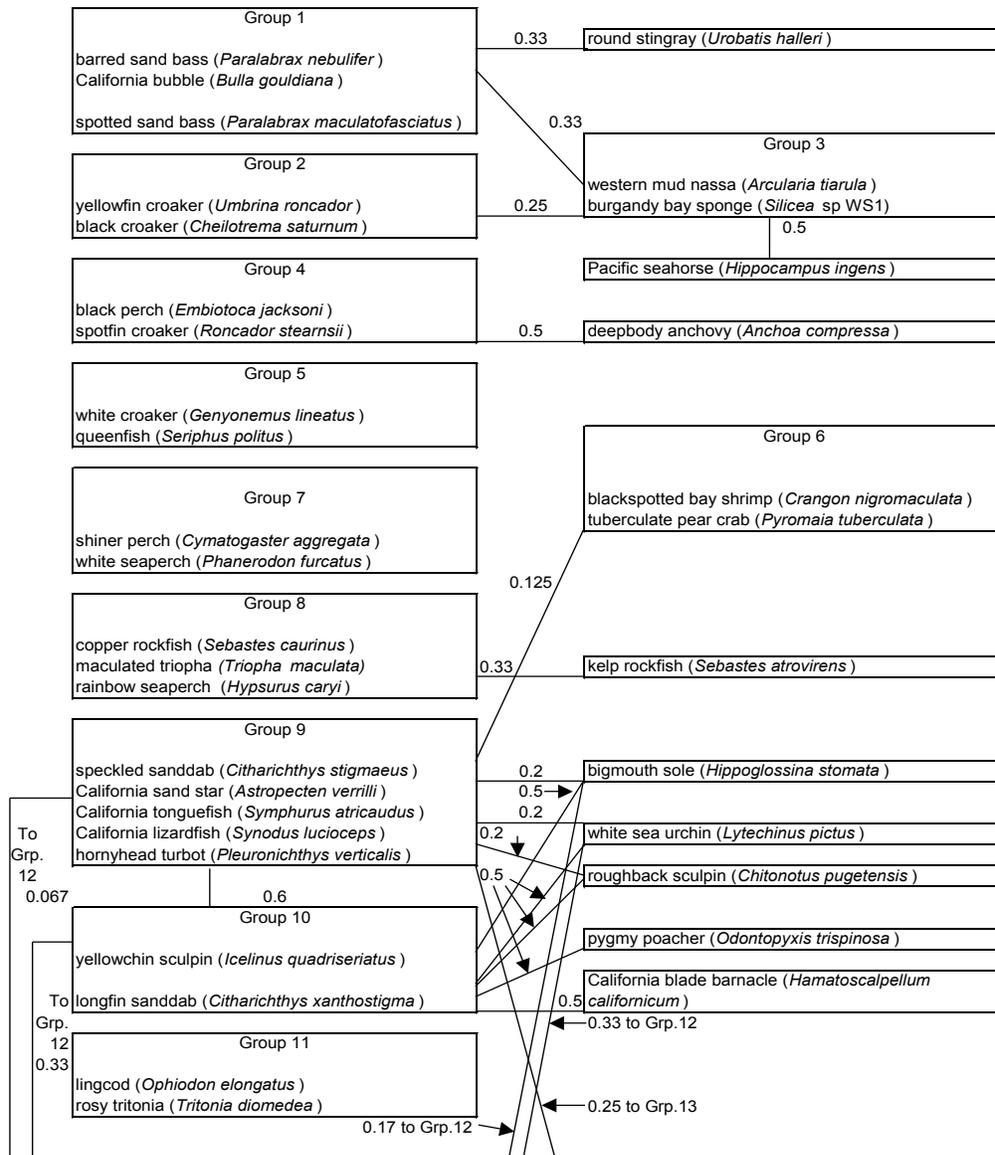
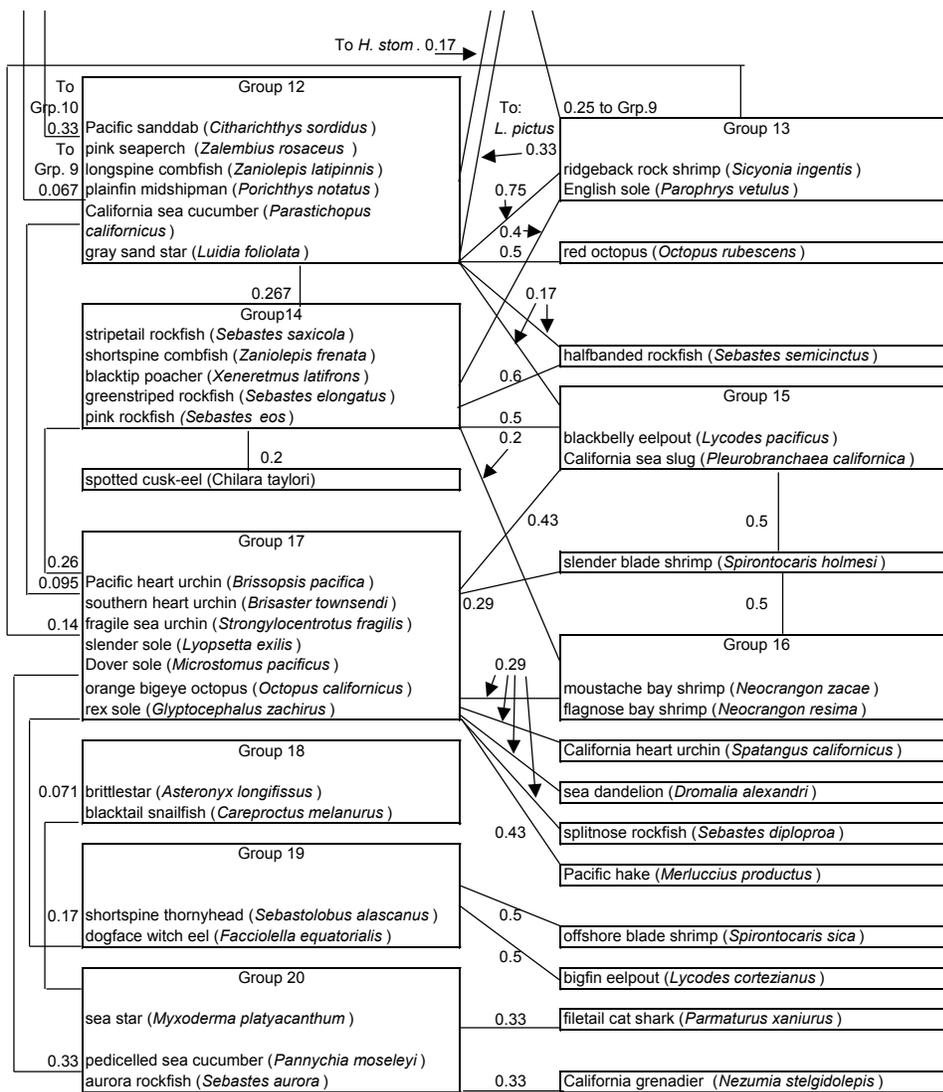


Figure 1. Recurrent groups of combined demersal fishes and megabenthic invertebrates occurring at multiple sites on the southern California shelf and slope at depths of 2-484 m, July-September 2008. Index of affinity (I.A.) = 0.50. Groups are numbered in order of depth. Species within a group are listed in order of abundance. Lines show relationships between groups and associates. Values are the proportion of possible pairs with I.A. = 0.50.



Continuation of Figure 1

Table 1. Mean and range of depths of combined demersal fish and megabenthic invertebrate recurrent groups on the southern California shelf and upper slope in July-September 2008.

Recurrent Group	No. of Stations	Mean Depth (m)	Depth Range (m)
1	7	4	2-4
2	4	4	4-4
3	4	4	4-4
4	3	6	5-6
5	7	12	6-24
6	13	16	6-34
7	9	19	6-44
8	3	27	22-30
9	10	28	13-42
10	24	48	13-86
11	6	69	41-172
12	14	78	38-136
13	32	114	26-209
14	12	165	94-225
15	27	205	94-407
16	14	223	140-414
17	13	342	172-439
18	6	395	365-426
19	9	401	348-484
20	6	418	386-433

Appendix H-5. Changes in Functional Organization of the Communities Relative to Oceanic Regimes

The description of the functional organization of soft-bottom fish communities on the southern California shelf by Allen (1982) was based on data collected in 1972-1973, a cool regime period in the Pacific Ocean (Chavez *et al.* 2003, Allen *et al.* 2004, Allen 2008). Although the oceanic climate has warmed since the 1980s and then cooled following the El Niño (Chavez *et al.* 2003, Allen *et al.* 2004, Goericke *et al.* 2005, and Allen 2008), the model provides a framework for examining changes in the functional organization of the fish communities of the southern California shelf can be compared in for different oceanic periods: 1972-1973 (cool regime; Allen 1982); 1994 (warm regime; Allen *et al.* 1998); 1998 (El Niño period, warm; Allen *et al.* 2002), 2003 (cold regime; Allen *et al.* 2007), and 2008 (cold regime; this document, Figures 1-4).

The extent of distribution of the guilds across the shelf (10-200 m) and the depth displacement pattern within guilds varied by guild. Some guilds occurred across the entire area or most of it in all years. Others had distinct breaks, where a guild was rare, in all years. Some showed gaps primarily during the El Niño period, suggesting a retreat from some depths. In general, the depth displacement sequence of species within a guild did not change from that described in Allen (1982), but in some cases, another guild member became dominant at a depth. Some of these showed evidence of invasion from the south or north during the oceanic period (Allen *et al.* 2007).

Guild 1A1-Neritic Pelagivores (Queenfish Guild). This guild consists of schooling fishes that occur in the water-column over the coastal shelf. The guild distribution showed a stable occurrence on the inner part of the inner shelf (5-20 m), with the queenfish (*Seriphus politus*) being dominant on the inner part of the inner shelf in cold regimes (1972, 2003, and 2008), as well as the very warm El Niño period of 1998. However, in the 1994 warm regime, it was replaced in that zone by northern anchovy (*Engraulis mordax*) a coastal pelagic species. In 2008 northern anchovy was also present at 50m (40-60 m). This species also dominated the middle shelf-outer shelf transition area (140-160m) in 1994 (Figure 1). The guild was rare (<20% occurrence) in all years at 30 m (20-40 m), at 50 m (40-60 m) in 1972, 1994, 1998, but was relatively common at greater depths, although the dominant species varied. In 1972-1973, shortbelly rockfish (*Sebastes jordani*) was dominant on the middle shelf (60-80 m) and outer shelf (100-180 m and 160-180 m). In 2008, it was dominant 100-120 m and 160-180 m on the outer shelf (Figure 1). As noted above, in 1994, northern anchovy occupied the inner shelf (5-20 m) and the middle outer shelf area (140-160 m) was not occupied by a species of this guild (Figure 1). In 1994, the middle shelf-outer shelf transition area (60-140 m) was occupied by Pacific argentine (*Argentina sialis*), a small pelagic species (Figure 1). This species was dominant at 80-160 m in 1998. In 2003, it was dominant at 50 m (40-60m). Juvenile chilipepper (*Sebastes goodei*) was dominant from 60-120m (Figure 1). The guild was also rare or absent at 1998 and 2008 at 60-80 m on the middle shelf, and in 1972 at 80-100m on the middle shelf, and 180-200m on the outer shelf. In 1994 and 1998, Pacific hake (*Merluccius productus*) was dominant at 180-200 m on the outer shelf. In 2003, Pacific hake was dominant at depths of 120-200 m on the outer shelf. In 2008, this species was dominant at depths of 80-100 m on the middle shelf, 120-160 m on the outer shelf, and 180-200 m on the outer shelf (Figure 1).

Guild 1A2a-Bottom-refuge Visual Pelagivores (Rockfish Guild). The bottom-refuge pelagivore guild was rare or absent on the inner shelf 0-20m in 1972, 1994, 1998, and 2003. It was also absent at 20-40m in 1994-1998 (Figure 1). The guild was absent on the Inner Shelf from 0-20 m in 1972, 1994, 1998, and 2003 (Figure 1). It was also absent at depths of 20-40 m in 1994 and 1998. In 2008, giant kelpfish (*Heterostichus rostratus*), although a clinid (kelp blenny) and not a rockfish, was dominant on the inner shelf at depths of 0-20 m (Figure 1). This species can feed on small pelagic prey as many rockfish species do, attacking them from a substrate (in this case, frequently from a kelp bed). Stripetail rockfish (*Sebastes saxicola*) was bathymetrically the most widespread species of this guild (Figure 1). In 1972,

this species was dominant from 20-180m, in 1994, it dominated from 40-160 m, and in 1998 from 80-200 m. In 2003-2008, striptail rockfish was dominant from 20-200m (Figure 1). Halfbanded rockfish (*Sebastes semicinctus*) was much more limited in distribution, only being dominant at 40-60 m (Figure 1). Splitnose rockfish (*Sebastes diploproa*) was dominant in 1972 at 180-200 m, and in 1994 at 160-200 m (Figure 1). The depth replacement pattern of species in this guild was more similar between the two warm years (1994-1998) than among the three cold years (Figure 1).

Guild 1A2b-Bottom-refuge Nonvisual Pelagivores (Midshipman Guild). The Bottom-Refuge Nonvisual Pelagivore Guild (Midshipman Guild) consists of two species: plainfin midshipman (*Porichthys notatus*) and specklefin midshipman (*Porichthys myriaster*; Figure 1). This guild was rare or absent at 0-20m in 1994 (Figure 1). The specklefin midshipman typically lives at shallower depths than the plainfin midshipman (Figure 1). In 1972, 2003, and 2008, specklefin midshipman was dominant at depths of 0-20m (Figure 1). In 1998, specklefin midshipman was dominant at depths of 0-60m (Figure 1). Plainfin midshipman was dominant at depths of 20-180 m in 1972 and 2003 (Figure 1). In 1994 and 2008, it was dominant at depths of 20-200 m. In 1998, it was dominant from 60-200 m (Figure 1). The depth replacement pattern of these two species was identical in 1972 and 2003, both cold regime years (Figure 1).

Guild 1B1-Midwater Pelagobenthivores (Shiner Perch Guild). The Midwater Pelagobenthivore Guild (Shiner Perch Guild) consists of shiner perch (*Cymatogaster aggregata*; Figure 1). In 1972 (a cold year), this guild was dominant from 0-70m in depth. It also occurred rarely at 70-120m in that year. It was absent in trawls at all depths on the shelf in 1994 (Figure 1). The depth distribution pattern of shiner perch was most similar between 1998 (a warm El Niño year), and 2003 and 2008 (both cold regime years). In these years, it was dominant from 0-20 m, and occurred rarely from 20-60 m (Figure 1).

Guild 1B2-Cruising Pelagobenthivores (Sablefish Guild). Among the trawl surveys of the Southern California Bight conducted between 1972 and 2008, sablefish (*Anoplopoma fimbria*) was most widespread during the cold 1972 period. In 1972, it was rare at depths of 20-100 m but was abundant from 100-180 m (Figure 1). It was not collected in 1994, but in 1998 it occurred rarely at 160-180 m, and in 2003 and 2008, it occurred rarely at 180-200 m.

Guild 1C1-Cruising Diurnal Benthopelagivores (Surfperch Guild). The Cruising Diurnal Benthopelagivore Guild (Surfperch Guild) consists of two soft-bottom surfperches: white seaperch (*Phanerodon furcatus*) and pink seaperch (*Zalembeius rosaceus*; Figure 2). In 1972, the white seaperch was dominant at 0-40 m on the inner shelf and shallow middle shelf (Figure 2). In 1998, 2003, and 2008 white seaperch was dominant at 0-20 m. In 1998 the guild was not present in the trawl survey at depths of 20-40 m (Figure 2). In 1972, pink seaperch was dominant at 40-180 m. In 1994 it was dominant from 0-120 m. In 1998, it was dominant from 40-200 m. In 2003 it was dominant from 20-180m and in 2008 from 20-200 m (Figure 2). Clearly, white seaperch is a shallow, predominantly inner shelf species whereas pink seaperch is primarily a middle shelf-outer shelf species (Figure 2).

Guild 1C2-Cruising Nocturnal Benthopelagivores (White Croaker Guild). The Cruising Nocturnal Benthopelagivore Guild is primarily represented in southern California trawl surveys by the white croaker (*Genyonemus lineatus*). In 1972, white croaker was dominant from 0-80 m and 100-140 m (Figure 2). In 1994, white croaker was dominant at 0-20 m, and was found rarely at 20-60 m and 180-200m (Figure 2). In 1998, it was dominant at 0-20 m and 80-100 m, and occurred rarely at 20-80 m, 100-120 m, and 180-200 m (Figure 2). In 2003, it was dominant at 0-40m, and was rare at 40-60 m. In 2008, it was dominant at 0-20 m and was rare at 20-120 m (Figure 2).

Guild 1D-Cruising Nonvisual Benthivores (Cusk-eel Guild). The Cruising Nonvisual Benthivore Guild is primarily represented by the spotted cusk-eel (*Chilara taylori*), although a few nonvisual benthivores with body shapes and behavior different than cusk-eels forage similarly and have been included in this guild (Figure 2). In 1972, the spotted cusk-eel was dominant at depths of 40-60 m and 140-200 m (Figure 2). In that year, it occurred rarely from 0-20 m, and from 60-140 m (Figure 2). In 1994, it was absent at depths of 0-40m, rare at 40-60 m, absent at 60-80 m, dominant at 80-120 m, rare at 120-140 m, and dominant at 140-200 m (Figure 2). In 1998, California corbina (*Menticirrhus undulatus*), which forages similarly was dominant at 0-20 m (Figure 2). The guild occurred rarely from 20-60 m in that year and was absent from 60-80 m. Spotted cusk-eel was dominant from 80-140 m, rare from 140-160 m, dominant at 160-170 m, and was replaced by spotted ratfish (*Hydrolagus colliei*) at 180-200 m. In 2003, the guild was rare from 0-40 m and from 60-80 m. Spotted cusk-eel was dominant from 40-60 m, and 180-200 m (Figure 2). Spotted ratfish was dominant from 160-180 m (Figure 2). In 2008, spotted cusk-eel was rare from 0-20 m but it was the dominant member of this guild from 20-200 m (Figure 2).

Guild 2A-Benthic Pelagivore (Lizardfish/Halibut Guild). The Benthic Pelagivore Guild is primarily represented by the California lizardfish (*Synodus lucioceps*), California halibut (*Paralichthys californicus*), bigmouth sole (*Hippoglossina stomata*), and lingcod (*Ophiodon elongatus*). The species typically lie in wait on the bottom and ambush nektonic prey swimming near the bottom. In 1972, California lizardfish was dominant on the inner shelf at depths of 0-40 m (Figure 2), and bigmouth sole was dominant from 40-180 m (Figure 2). The guild was absent from 180-200 m. In 1994, 1998, 2003, and 2008, California halibut was the dominant member of this guild from 0-20 m (Figure 2). In 1994, California lizardfish was dominant from 20-40 m, and 120-180 m (Figure 2). Bigmouth sole was dominant from 40-120 m, and 180-200 m (Figure 2). In 1998, California lizardfish was dominant from 20-100 m, bigmouth sole from 100-140 m, California lizardfish from 140-160 m, and bigmouth sole from 160-180 m, and the guild occurred rarely from 180-200m (Figure 2). In 2003, bigmouth sole was dominant from 20-60 m, 80-100 m, and 140-180 m (Figure 2). Lingcod was dominant from 60-80 m. The guild occurred rarely from 100-140 m and from 180-200 m (Figure 2). In 2008, the California halibut was dominant from 0-20 m, and the bigmouth sole was dominant from 20-120 m. The guild was absent from 120-200 m.

Guild 2B-Benthic Pelagobenthivores (Sanddab Guild). The Benthic Pelagobenthivore Guild (Sanddab Guild) is primarily represented by the speckled sanddab (*Citharichthys stigmaeus*), Pacific sanddab (*Citharichthys sordidus*), longfin sanddab (*Citharichthys xanthostigma*), and slender sole (*Lyopsetta exilis*). The species lie on the bottom and capture nektonic prey that swim close to the bottom or active prey (such as amphipods) occurring on the bottom. In 1972, 1994, 1998, 2003, and 2008, the speckled sanddab was the dominant species of this guild at 0-40 m (Figure 2). In 1972, the Pacific sanddab was dominant from 40-140 m, and the slender sole was dominant from 140-200 m. In 1994, the Pacific sanddab was dominant from 40-120 m, and the slender sole from 120-200 m. In 1998, the longfin sanddab, a more southerly species, intruded into the typical pattern of speckled sanddab (inner shelf), Pacific sanddab (middle shelf), and slender sole (outer shelf/upper slope). In 1998, longfin sanddab occurred from 40-80 m (Figure 2). In this year, Pacific sanddab occurred from 80-180 m, and slender sole from 180-200 m (Figure 2). In 2003, Pacific sanddab occurred from 40-140 m (as in 1972), and the slender sole from 140-200 m. In 2008, the Pacific sanddab occurred from 40-160 m, and the slender sole from 160-200 m (Figure 2). The depth replacement patterns of the species was identical between 1972 and 2003 (both cold regime years). However, in 2008, the Pacific sanddab distribution extended deeper than in 1972 or 2003, with slender sole first occurring at 160 m, than at 140 m as it did in 1972 (Figure 2).

Guild 2C1-Pursuing Benthopelagivores (Combfish Guild). The Pursuing Benthopelagivore Guild (Combfish Guild) is primarily represented by two combfish species: longspine combfish (*Zaniolepis latipinnis*) and shortspine combfish (*Zaniolepis frenata*). The longspine combfish typically occurs at shallower depths than does the shortspine combfish (Figure 3). The bay goby (*Lepidogobius lepidus*), a goby, is much smaller, and is similar in body shape (but without the spiny dorsal fins of a combfish) to a juvenile combfish. However, the bay goby lives in burrows of infaunal invertebrates (Grossman 1979), whereas the combfishes, with longer and stronger dorsal spines reside on the surface of the seafloor (Allen 1982). The replacement pattern of the longspine and shortspine combfishes were identical in the cold regimes of 1972 and 2003, with the guild occurring rarely on the Inner Shelf (Figure 3) and longspine combfish occurring from 20-80 m and the shortspine combfish occurring from 80-200m (Figure 3). In 2008, also a cold regime year, the replacement patterns of the longspine and shortspine combfish were the same as in 1972 and 2003, except that the longspine combfish was absent from the Inner Shelf. Thus, the replacement patterns for longspine and shortspine combfish were virtually the same (except for the Inner Shelf) in all three cold regime years (1972, 2003, 2008). In 1994, a warm regime, longspine combfish was dominant on the Inner Shelf and shallow middle shelf from 0-60 m, and the shortspine combfish was dominant from 80 to 200 m. The bay goby was occurred more frequently at 60-80 m than did either combfish species (Figure 3).

Guild 2C2a-Ambushing Benthopelagivores, Tiny (Poacher Guild). The Tiny Ambushing Benthopelagivore Guild (Poacher Guild) in the 2008 SCB trawl survey was represented primarily by pygmy poacher (*Odontopyxis trispinosa*) and juvenile blacktip poacher (*Xeneretmus latifrons*; Figure 3). The species of this guild in the 2008 survey were small benthic species with heavily armored bodies and small mouths. They typically feed on small crustaceans occurring on or near the seafloor (Allen 1982). The pygmy poacher typically occurs on the Middle Shelf although to some extent on the Inner Shelf or Outer Shelf (Figure 3). In 1972, a cold year, it occurred rarely on the Inner Shelf at depths of 0-20 m and on the Outer Shelf. It occurred primarily on the Middle Shelf from 20-100 m (Figure 3). In 1972, juvenile blacktip poacher occurred at depths from 140-180 m (Figure 3). In 1994, a warm year, pygmy poacher was not collected on the Inner Shelf and shallow Middle Shelf from 0-40 m, but occurred on the Middle Shelf from 40-60 m. It occurred rarely from 60-180 m (Figure 3). In 1998, a warm El Niño year, it was not collected on the Inner Shelf or shallow Middle Shelf from 0-40 m, nor on the outer shelf from 120-200 m. It occurred rarely at 40-60 m. In this year, pygmy poacher occurred primarily from 60-120 m (Figure 3). In 2003, a cold year, pygmy poacher occurred rarely from 0 to 40m and from 90-120 m. In this year, it occurred most frequently from 40-120 m, and from 160-180 m. It was not collected from 120-160 m, and from 160-180 m (Figure 3). In 2008, another cold year, pygmy poacher occurred primarily from 0-100 m, and was not collected from 100-200 m (Figure 3)

Guild 2C2b-Ambushing Benthopelagivores, Small (Sculpin/Poacher Guild). The Small Ambushing Benthopelagivore Guild (Sculpin/Poacher Guild) in the 2008 SCB Trawl Survey was primarily represented by yellowchin sculpin (*Icelinus quadriseriatus*), spotfin sculpin (*Icelinus tenuis*), and blacktip poacher (*Xeneretmus latifrons*; Figure 2). Of this guild, the yellowchin sculpin, a small sculpin, occupied primarily the Middle Shelf Zone, although extending occasionally into the Inner Shelf or Outer Shelf Zones. The blacktip poacher, primarily occupied the Outer Shelf Zone, extending occasionally into the Middle Shelf Zone. The spotfin sculpin occurred at the interface between the Middle Shelf and Outer Shelf Zones (Figure 3). In 1972, a cold year, yellowchin sculpin occurred at depths from 0 to 80 m, where it was replaced by blacktip sculpin from 80 to 200m (Figure 3). In 1994, a warm year, yellowchin sculpins occurred rarely from 0 to 20 m. It occurred primarily from 40 to 120 m in this year. It was replaced at the shelf break from 120 to 140 m by spotfin sculpin. Spotfin sculpin was replaced from 140 to 200 m by blacktip poacher (Figure 3). In 1998, a warm El Niño year, yellowchin sculpin was rare from depths of 0 to 40m, but occurred in trawls at depths from 40 to 100m. It was replaced from 100 to 140m by spotfin croaker, and from 140 to 200m, spotfin sculpin was replaced by blacktip poacher.(Figure 3). In 2003, a cold period, yellowchin sculpin occurred rarely from 0 to 20m but

occurred commonly from 20 to 120m. From 120m to 200m, it was replaced by blacktip poacher. In 2008, another cool year, yellowchin sculpin occurred at depths from 0 to 120m. It was replaced from 120m to 200m by blacktip poacher (Figure 3).

Guild 2C2c-Ambushing Benthopelagivores, Medium (Flatfish/Sculpin/Rockfish Guild).

The Medium Ambushing Benthopelagivore Guild consists of species of flatfish, sculpin, and rockfish that ambush prey on or near the bottom, and tend to feed among other things on shrimp and crabs. Only one flatfish, fantail sole (*Xystreureys liolepis*) has been included in this guild. This is the only flatfish collected in southern California trawls that frequently include crabs, as well as natantian shrimp in their diet (Allen 1982). Other species included in this guild include roughback sculpin (*Chitonotus pugetensis*), California scorpionfish (*Scorpaena guttata*), greenblotched rockfish (*Sebastes rosenblatti*), greenspotted rockfish (*Sebastes chlorostictus*), flag rockfish (*Sebastes rubrivinctus*), pink rockfish (*Sebastes eos*) and shortspine thornyhead (*Sebastolobus alascanus*; Figure 3). The fantail sole primarily occupies the Inner Shelf Zone, the roughback sculpin the Middle Shelf zone, and many of the rockfish species occupy the outer shelf zone (Figure 3). In 1972, a cold period, fantail sole occurred on the Inner Shelf at depths of 0 to 20m, and was replaced by the roughback sculpin on the Middle Shelf at depths of 20 to 80m. The guild was rare at depths of 80 to 100m, but from 100 to 200m, it was dominated by greenblotched rockfish (Figure 3). In 1994 (a warm regime), fantail sole occurred at depths of 0 to 40m. It was replaced by California scorpionfish at depths of 40-60m. Greenblotched rockfish replaced California scorpionfish from 60 to 80m. Greenspotted rockfish replaced greenblotched rockfish at depths of 120 to 180m. This species was then replaced by greenblotched rockfish at depths of 180 to 200m by shortspine thornyhead (*Sebastolobus alascanus*). In 1998 (a warm El Niño year) fantail sole occurred rarely at depths of 0-20m, but the species occurred regularly at depths of 20-60m. Roughback sculpin occurred at depths of 60-100m. It was replaced at depths of 100-120m by greenspotted rockfish, and this species was replaced by greenblotched rockfish at 120-140m. The guild occurred rarely from 140-160m. Then greenspotted rockfish occurred from 160-180m, followed by pink rockfish from 180-200m (Figure 3). In 2003, a cold year,

Guild 2C2d-Ambushing Benthopelagivores, Large (Scorpionfish, Rockfish, Sand Bass Guild).

The Large Ambushing Benthopelagivores Guild consists of California scorpionfish (*Scorpaena guttata*), barred sand bass (*Paralabrax nebulifer*), greenblotched rockfish (*Sebastes rosenblatti*), flag rockfish (*Sebastes rubrivinctus*), pink rockfish (*Sebastes eos*), and shortspine thornyhead (*Sebastolobus alascanus*; Figure 3). These species on soft bottom or hard bottom. They ambush prey on or near the bottom, and tend to feed on fish, shrimp, and crabs, and other benthic or near-bottom nektonic prey (Allen 1982).

Guild 2D1a-Benthic Extracting Benthivores (Turbot Guild).

The Benthic Extracting Benthivore Guild (Turbot Guild) consists of a number of polychaete-feeding flatfishes including the following: hornyhead turbot (*Pleuronichthys verticalis*), curlfin sole (*Pleuronichthys decurrens*), Dover sole (*Microstomus pacificus*), and spotted turbot (*Pleuronichthys ritteri*; Figure 4). These are soft-bottom species that roam the bottom looking primarily for polychaetes and clam siphons which they grab with their small mouths and pull from the bottom, or tubes (in the case of some polychaetes; Allen 1982). Slender siphons from some clams break from the body of the clam when the fish pulls on it. The bathymetric distribution of some of these species was clearly affected by different oceanic regimes (Figure 4). In 1972, a cold regime, hornyhead turbot occupied the Inner Shelf from 0-20m, whereas the curlfin sole occurred on the shallow middle shelf from 20-40m, and Dover sole occupied the middle shelf and outer shelf from 40-200m (Figure 4). In 1994, a warm regime, the bathymetric distribution of hornyhead turbot occurred on the Inner Shelf and shallow Middle Shelf from 0 to 40m (Figure 4). Curlfin sole, a coldwater species common north of Point Conception, California was not present in the 1994 trawl survey of the SCB. However, the bathymetric distribution of Dover sole in 1994 was identical to the Dover sole distribution in 1972 (from 40-200m on the Middle Shelf and Outer Shelf; Figure 4). In 1998

(a warm El Niño year), spotted turbot, rather than the hornyhead turbot, was dominant on the Inner Shelf at depths of 0-20m (Figure 4). Hornyhead turbot dominated the shallow Middle Shelf zone at 20-60m, and Dover sole was dominant at 60-200m (Figure 4). In 2003, hornyhead turbot was dominant at depths of 0-60m, and Dover sole at depths of 60-200m (Figure 4). In 2008, a cold regime, hornyhead turbot had its greatest bathymetric distribution at depths of 0-100 m, throughout the Inner Shelf and Middle Shelf (Figure 4).

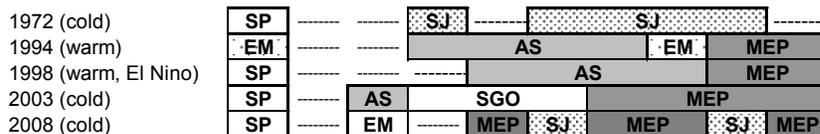
Guild 2D1b-Benthic Excavating Benthivores (English Sole-Eelpout Guild). The Benthic Excavating Benthivore Guild (English Sole-Eelpout Guild) consists of English sole (*Parophrys vetulus*) and blackbelly eelpout (*Lycodes pacificus*). In contrast to the Benthic Extracting Benthivore Guild 2D1a, with members that pull infaunal organisms from the sediments with their mouths, the Benthic Excavating Benthivore Guild dig infaunal organisms from the sediments with their snout and mouth (Allen 1982). In general, English sole was the dominant member of this guild in the shallow portion of the guild's bathymetric range and blackbelly eelpout was dominant in the deep portion of the guild's range (Figure 4). In 1972, a cold year, English sole was dominant on the Inner Shelf and shallow Middle Shelf at depths of 0-80m whereas blackbelly eelpout was dominant on the deeper Middle Shelf and on the Outer Shelf at depths of 80-200m (Figure 4). In 1994, a warm year, English sole was dominant on the Inner Shelf, Middle Shelf, and Shallow Outer Shelf at depths of 0-120m, whereas blackbelly eelpout was dominant on the Outer Shelf at depths of 120-200m (Figure 4). In 1998, (a warm El Niño year), the guild occurred rarely on the Inner Shelf at 0-20m. However, English sole was dominant on the Middle Shelf and shallow Outer Shelf at depths of 20-120m, and on the Outer Shelf at depths of 140-180m (Figure 4). In this year, blackbelly eelpout was dominant on the Outer Shelf at depths of 120-140m and 180-200m (Figure 4). In 2003 (a cold year), English sole was dominant on the Inner Shelf, Middle Shelf, and shallow Outer Shelf at depths of 0-140m, and the blackbelly eelpout was dominant at depths of 140m-200m. In 2008 (a cold year), English sole was dominant across the shelf in the Inner Shelf, Middle Shelf, and Outer Shelf at depths of 0-200m (Figure 4).

Guild 2D2-Benthic Nonvisual Benthivores (Tonguefish-Rex Sole-Skate-Ray Guild). The Benthic Nonvisual Benthivore Guild (Tonguefish-Rex Sole-Skate-Ray Guild; Figure 4) consists of the California tonguefish (*Symphurus atricaudus*) and rex sole (*Glyptocephalus zachirus*), both flatfishes, and three elasmobranchs: round stingray (*Urobatis halleri*), California skate (*Raja inornata*), and starry skate (*Raja stellulata*; Figure 4). Although both flatfish species have eyes, they primarily locate prey by sense organs on the blind side of the head. In the California tonguefish, these are sensory cells for taste and touch, and enlarged olfactory organs. In the rex sole, prey buried in the sediments are probably detected primarily by vibrations of the cephalic lateral line system on the blind side of the rex sole head that is tightly covered with skin, which perhaps gives it a function like a stethoscope to sense vibrations of organisms in the sediments (Allen 1982). The round stingray, California skate, and starry skate locate prey in the sediments by using electroreceptive organs on the blind side of their disks. With regard to the bathymetric distributions of these species, California tonguefish typically was dominant in the shallow part of the shelf (Inner Shelf and Middle Shelf), whereas the rex sole was dominant on the deeper part of the shelf (Middle Shelf and Outer Shelf; Figure 4). In 1972 (a cold year), California tonguefish was the dominant member of this guild on the Inner Shelf and shallow Middle Shelf at depths of 0-80m, whereas rex sole was dominant on the deeper Middle Shelf and Outer Shelf at depths of 80-200m (Figure 4). In 1994 (a warm year), California tonguefish was dominant on the Inner Shelf, Middle Shelf, and shallow Outer Shelf at depths of 0-120m, whereas the rex sole was dominant on the outer shelf at depths of 120-200m. In 1998 (a warm El Niño year), California tonguefish was dominant on the Inner Shelf and Middle Shelf at depths of 0-100m. Starry skate was dominant at 100-140m in that year, and the guild occurred only rarely on the outer shelf at depths of 140-160m. In that year, rex sole was dominant at depths of 160-200m. In 2003 (a cold year), round stingray (*Urobatis halleri*) was dominant on the Inner Shelf at depths of 0-20m, California tonguefish was dominant on the Shallow and Mid-Middle Shelf at depths of 20-80m, California skate was dominant on the outer Middle Shelf at depths of 80-100m, the guild

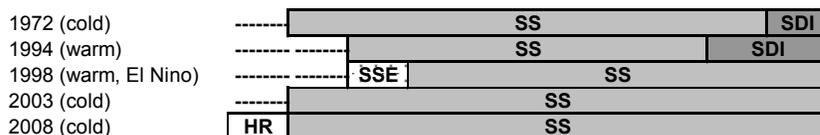
occurred only rarely on the shallow Outer Shelf at depths of 100-120m, and rex sole occurred on the Outer Shelf at depths of 120-200m. In 2008, Calioformia tonguefish was dominant on the Inner Shelf and Middle Shelf at depths of 0-100m, whereas rex sole was dominant on the Outer Shelf at depths of 100-200m (Figure 4).

Guild	Depth Class (m)									
	10	30	50	70	90	110	130	150	170	190
	Inner	Middle Shelf				Outer Shelf				

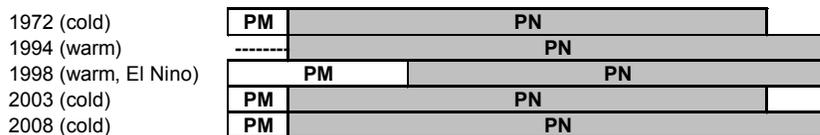
a) 1A1 -Neritic Pelagivores (Queenfish Guild)



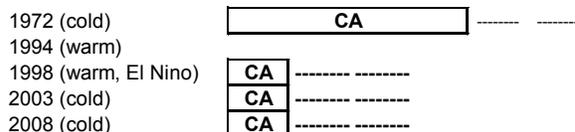
b) 1A2a-Bottom-refuge Visual Pelagivores (Rockfish Guild)



c) 1A2b-Bottom-refuge Nonvisual Pelagivores (Midshipman Guild)



d) 1B1-Midwater Pelagobenthivores



e) 1B2-Cruising Pelagobenthivores

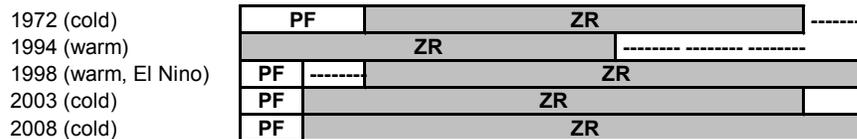


IA1: SP = *Seriphus politus*; SJ = *Sebastes jordani*; EM = *Engraulis mordax*; AS = *Argentina sialis*
 MEP = *Merluccius productus*; SGO = *Sebastes goodei*
 IA2a: SS = *Sebastes saxicola*; SDI = *Sebastes diploproa*; SSE = *Sebastes semicinctus*
 IA2b: PM = *Porichthys myriaster*; PN = *Porichthys notatus*
 IB1: CA = *Cymatogaster aggregata*
 IB2: IB2 = *Anoplopoma fimbria*

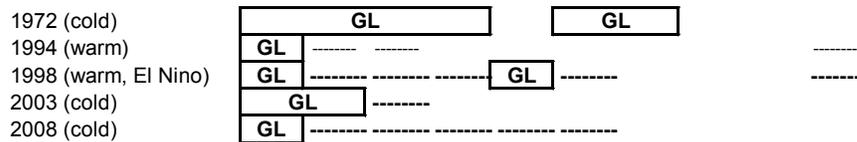
Figure 1. Comparison of changes in depths of dominance of foraging guilds 1A1 to 1B2 of demersal fish communities on the southern California shelf in 1972-1973 (Allen 1982), 1994 (Allen et al. 1998), 1998 (Allen et al. 2002), 2003 (Allen et al. 2007), and 2008 (this document). ‘HR’ is giant kelpfish (*Heterostichus rostratus*), which is not a rockfish but which attacks pelagic prey from a substrate.

Guild	Depth Class (m)									
	10	30	50	70	90	110	130	150	170	190
	Inner			Middle Shelf			Outer Shelf			

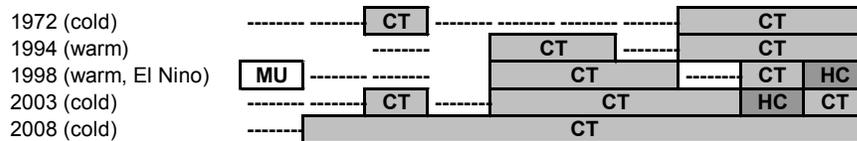
f) 1C1-Cruising Diurnal Benthopelagivores



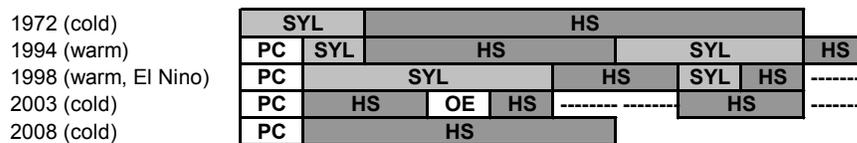
g) 1C2- Cruising Nocturnal Benthopelagivores



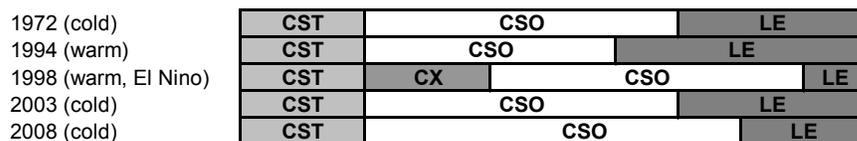
h) 1D-Cruising Nonvisual Benthivores



i) 2A-Benthic Pelagivores



j) 2B-Benthic Pelagobenthivores (Sanddab Guild)



IC1: PF = *Phanerodon furcatus*; ZR = *Zalembeius rosaceus*

IC2: GL = *Genyonemus lineatus*

ID: CT = *Chilara taylori*; MU = *Menticirrhus undulatus*; HC = *Hydrolagus colliei*

2A: SYL = *Synodus lucioceps*; HS = *Hippoglossina stomata*; PC = *Paralichthys californicus*;

OE = *Ophiodon elongatus*

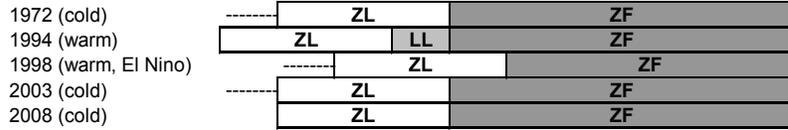
2B: CST = *Citharichthys stigmaeus*; CSO = *Citharichthys sordidus*; LE = *Lyopsetta exilis*;

CX = *Citharichthys xanthostigma*

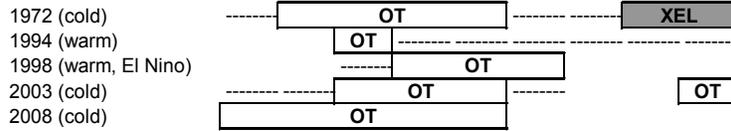
Figure 2. Comparison of changes in depths of dominance of foraging guilds 1C1 to 2B of demersal fish communities on the southern California shelf in 1972-1973 (Allen 1982), 1994 (Allen et al. 1998), 1998 (Allen et al. 2002), 2003 (Allen et al. 2007), and 2008 (this document).

Guild	Depth Class (m)									
	10	30	50	70	90	110	130	150	170	190
	Inner		Middle Shelf				Outer Shelf			

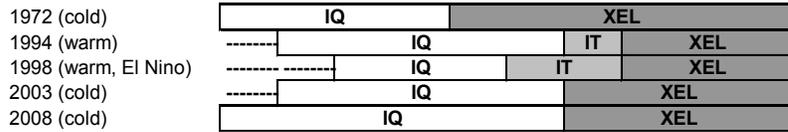
k) 2C1-Pursuing Benthopelagivores (Combfish Guild)



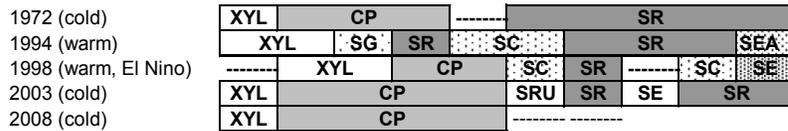
l) 2C2a-Ambushing Benthopelagivores, Tiny



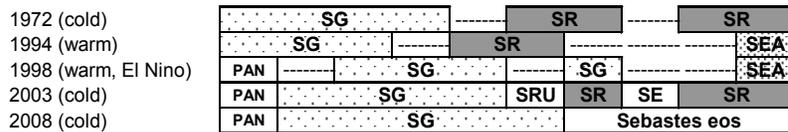
m) 2C2b-Ambushing Benthopelagivores, Small



n) 2C2c-Ambushing Benthopelagivores, Medium



o) 2C2d-Ambushing Benthopelagivores, Large



2C1: ZL = *Zaniolepis latipinnis*; ZF = *Zaniolepis frenat*; LL = *Lepidolepidus lepidus*
 2C2a: OT = *Odontopyxis trispinosa*; XEL = *Xeneretmus latifrons* (S = small)
 2C2b: IQ = *Icelinus quadriseriatus*; XEL = *Xeneretmus latifrons* (L = large); IT = *Icelinus tenuis*
 2C2c: XYL = *Xystreureys liolepis*; CP = *Chitonotus pugetensis*; SR = *Sebastes rosenblatti* (S);
 SG = *Scorpaena guttata* (S); SC = *Sebastes chlorostictus*; SEA = *Sebastes eos* (S)
 SE = *Sebastes eos* (S); SRU = *Sebastes rubrivinctus* (S)
 2C2d: SG = *Scorpaena guttata* (L); SR = *Sebastes rosenblatti* (L); SEA = *Sebastes eos* (S);
 PAN = *Paralabrax nebulifer*; SRU = *Sebastes rubrivinctus* (L); SE = *Sebastes eos* (L)

Figure 3. Comparison of changes in depths of dominance of foraging guilds 2C1 to 2C2d of demersal fish communities on the southern California shelf in 1972-1973 (Allen 1982), 1994 (Allen et al. 1998), 1998 (Allen et al., 2002), 2003 (Allen et al. 2007), and 2008 (this document).

Guild	Depth Class (m)									
	10	30	50	70	90	110	130	150	170	190
	Inner	Middle Shelf				Outer Shelf				

p) 2D1a-Benthic Extracting Benthivores (Turbot Guild)

1972 (cold)	PLV	PD	MP					
1994 (warm)	PLV		MP					
1998 (warm, El Nino)	PLR	PLV	MP					
2003 (cold)	PLV		MP					
2008 (cold)	PLV				MP			

q) 2D1b-Benthic Excavating Benthivores

1972 (cold)	PAV			LP		
1994 (warm)	PAV			LP		
1998 (warm, El Nino)	-----	PAV		LP	PAV	LP
2003 (cold)	PAV			LP		
2008 (cold)	PAV					

r) 2D2-Benthic Nonvisual Benthivores

1972 (cold)	SA			GZ		
1994 (warm)	SA			GZ		
1998 (warm, El Nino)	SA		RS	-----	GZ	
2003 (cold)	UH	SA	RI	-----	GZ	
2008 (cold)	SA			GZ		

2D1a: PLV = *Pleuronichthys verticalis*; PD = *Pleuronichthys decurrens*; MP = *Microstomus pacificus*;

PLR = *Pleuronichthys ritteri*

2D1b: PAV = *Parophrys vetulus*; LP = *Lycodes pacificus*

2D2: SA = *Symphurus atricaudus*; GZ = *Glyptocephalus zachirus*; RS = *Raja stellutata* (S);

UH = *Urobatis halleri*; RI = *Raja inornata*

Figure 4. Comparison of changes in depth of dominance of foraging guilds 2D1a to 2D2 of demersal fish communities on the southern California in 1972-1973 (Allen 1982), 1994 (Allen et al. 1998), 1998 (Allen et al. 2002), 2003 (Allen et al. 2007), and 2008 (this document).