MARINE BIOTOXIN MONITORING PROGRAM

ANNUAL REPORT

2002

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By:

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The Department of Health Services' Marine Biotoxin Monitoring Program would also like to acknowledge the dedicated work of the staff of the Department's Microbial Diseases Laboratory and the Food and Drug Laboratory for their efforts in conducting PSP assays and domoic acid analyses, respectively. Due to the unpredictable nature of marine biotoxin activity the laboratories are often called upon to respond immediately to the influx of samples that result from these events. It is thanks to their efforts that we are able to provide rapid feedback to field samplers and the public.

Shellfish toxicity data is generated on an almost daily basis by the Department of Health Services' Marine Biotoxin Monitoring Program thanks to the continuing efforts of our program participants. Additionally, volunteers are collecting phytoplankton samples on an almost daily basis, providing near real-time observations of the occurrence of toxin producing species. As with all such endeavors, our success in protecting the public is due in large part to the numerous people who contribute their time and effort to collect samples at representative sites along the coast. The monthly listing of our program participants, provided in Appendix B and Appendix D, illustrates the diversity of groups and individuals that contribute to these efforts. The Department of Health Services would like to express its sincere appreciation to our program participants for all of their efforts.

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INTRODUCTION

California has a long history of paralytic shellfish poisoning (PSP), dating back to the time of the coastal Native American tribes. According to Meyer (1928) it was a common procedure for the coastal Pomo tribe to place sentries to watch for luminescence in the waves, having apparently established a link between bioluminescence and mussel poisoning, both of which are caused by dinoflagellates in the phytoplankton. The long-standing concern of California's public health officials for protecting the public from PSP has been warranted, as there have been 542 reported illnesses including 39 deaths attributable to this toxin since 1927 (Price et al., 1991).

In the fall of 1991 another natural toxin was identified along the California coastline. Domoic acid, a neurotoxin of lower potency than the PSP toxins, has become of equal concern because the blooms of diatoms that produce this toxin have been of greater frequency and longer duration than most PSP events over the past 10 years. In addition, domoic acid has had dramatic impacts on marine mammal and seabird populations along the coast, raising the public's awareness of marine biotoxins in general.

Because PSP toxicity represents a serious ongoing public health threat that requires year-round attention, the California Department of Health Services (DHS) has implemented a prevention program comprised of five basic elements: (1) a coastal shellfish monitoring program; (2) monitoring of commercial shellfish product; (3) an annual statewide quarantine on sport-harvested mussels (from May 1 through October 31); (4) mandatory reporting of disease cases; and (5) public information and education activities. This annual report primarily describes the shellfish sampling element of the program for PSP monitoring during 2002. A brief summary is also provided for domoic acid monitoring, phytoplankton monitoring, and quarantine and health advisory activities.

Paralytic Shellfish Poisoning

PSP is an acute, sometimes fatal form of food poisoning that is associated with the consumption of bivalve molluscs that have fed on the toxin-producing dinoflagellate *Alexandrium catenella* (formerly *Protogonyaulax catenella* and *Gonyaulax catenella*). Eating shellfish that contain PSP toxins leads to an acute disturbance of the nervous system within a few minutes to a few hours. The PSP toxins are sodium channel blockers and thus inhibit neural transmission. Symptoms begin with tingling and numbness of the lips, tongue, and fingertips, followed by disturbed balance, lack of muscular coordination, slurred speech and difficulty in swallowing. In severe poisoning, complete muscular paralysis and death from asphyxiation can occur if breathing is not maintained by artificial means. There is no known antidote to the poison. Symptoms tend to resolve entirely in a day or two under proper medical care. Persons who suspect they or others are experiencing PSP symptoms should immediately seek medical treatment.

The type and severity of symptoms depends on the amount of toxic shellfish consumed as well as the specific toxicity of the shellfish. Price et al. (1991) summarize the range of toxin dose responses as follows: 200 to 500 micrograms (µg) will cause al least minor symptoms, 500 to 2000 µg will cause moderate to severe symptoms, and toxin concentrations greater than 2000 µg will produce serious to lethal effects. It should be noted that exceptions exist and serious health effects have also been documented at much lower concentrations (100 to 400 µg). The federal alert level for PSP toxicity is 80 µg per 100 grams (g) of shellfish tissue, and the detection limit for the PSP bioassay is approximately 40 µg/100 g.

Alexandrium is normally absent or constitutes a minor component of the marine phytoplankton community along the California coast. Under favorable environmental conditions this dinoflagellate may undergo periods of rapid population growth, frequently referred to as a “bloom”. The term “bloom” or “red tide” is misleading with respect to *Alexandrium* and the resultant PSP toxicity in shellfish. Visible blooms of *Alexandrium* are rarely seen along the California coast. Conversely, elevated levels of PSP toxins in shellfish can result from the presence of relatively low numbers of *Alexandrium* in the water.

The source of the dinoflagellates that provide the “seed” for such blooms is in question, but two likely scenarios are possible. First, resting cysts of *Alexandrium* in local sediments can, under favorable conditions, produce vegetative cells that can then reproduce both sexually and asexually, resulting in localized “hot spots” of PSP toxicity in shellfish. Second, this dinoflagellate may be transported in offshore warm water masses that can move onshore under certain environmental conditions. This advection process could potentially result in either a quick spike in PSP toxicity if the number of transported cells is high, or it may simply provide the cells necessary for a bloom to initiate. Regardless of the origins of the toxin-producing dinoflagellates, the general pattern has been for these blooms to be detected first along the open coast, occasionally followed by transport into bays and estuaries. The degree to which coastal phytoplankton blooms intrude into bays and estuaries is likely influenced in part by the orientation of the bay relative to coastal currents and by the extent of tidal mixing and transport that occurs inside the bay.

Domoic Acid

In October of 1991 the presence of another marine biotoxin was confirmed in California’s coastal waters. Domoic acid toxicity, which can result in the condition called amnesic shellfish poisoning (ASP), was identified as the cause of death in a large number of brown pelicans and Brandt’s cormorants in the Santa Cruz area of Monterey Bay. The birds had been feeding on schools of anchovies in the bay, which in turn had been feeding on a bloom of the diatom *Pseudo-nitzschia australis* (formerly *Nitzschia pseudoseriata*).

The only documented domoic acid event prior to 1991 was a serious episode in Prince Edward Island, eastern Canada, in 1987 in which three people died and over 100

people were made ill from the consumption of toxic mussels. Domoic acid is a neuroexcitatory amino acid that causes over stimulation of certain nerves cells in the brain, with potentially permanent or fatal effects. Case studies of the Canadian episode indicated that the most common symptoms were gastrointestinal, followed by neurologic symptoms including headaches, loss of balance and/or dizziness, memory loss, varying degrees of confusion, disorientation, changes in the level of consciousness, and in some cases seizures (Teitelbaum, 1990; Perl et al., 1990).

Based on the rather small number of case histories available the following dose responses can be approximated while recognizing the overlap in ranges and symptoms: 27 to 75 µg/g may result in mild to moderate symptoms (gastrointestinal), 40 to 700 µg/g may result in moderate to severe neurologic symptoms, and domoic acid concentrations greater than 450 µg/g may result in severe neurologic symptoms and/or death.

Phytoplankton

There were no documented human health impacts from the 1991 Monterey Bay domoic acid episode, but the severity of the Canadian outbreak made it clear that continued monitoring for domoic acid would be necessary for public health protection. Because of the cost and time involved in running separate analyses for each toxin, in addition to the prospect that other known toxins may be present along the California coast, DHS began a volunteer-based phytoplankton monitoring program in 1993. The intent of this program was to develop a network of volunteer samplers and field observers that would allow the early detection of potentially toxigenic blooms. Early detection is key to mobilizing and focusing additional sampling and analytical resources for plankton, shellfish, and other species in the affected region. As a result of this volunteer effort DHS has been able to detect and track numerous harmful algal blooms, improving the capabilities for protecting the public health.

2002 SAMPLING EFFORT

Paralytic Shellfish Poisoning

Shellfish samples were collected at 71 different sites along the coast of California in 2002 (Figures 1a and 1b). Several commercial growing areas had multiple sites representing different harvest areas. There were 1030 shellfish samples collected statewide for PSP toxin assay during 2002. The greatest number of samples (447) was collected at sites in Marin County (Table 1), with commercial shellfish aquaculture companies providing approximately 96% of the total samples collected in this county. The majority of these (274) were contributed by Johnson Oyster Company in Drakes Estero, which samples four stations on at least a weekly basis. The large proportion of Marin County sites is a reflection of both the number of commercial growers and the frequency of occurrence of PSP toxicity in this region.

Commercial shellfish growers accounted for 70% of all samples collected in 2002, followed by coastal county health departments (16%; Table 2). Several other program participants, including state and federal agencies, universities, and volunteers, provided valuable assistance by contributing their sampling effort in 2002 (Table 3). As mentioned above, monitoring of the outer coast is a key element in California's marine biotoxin monitoring program because all toxic blooms to date have originated offshore or along the coast. Monitoring coastal shellfish resources can therefore provide an early warning of toxic conditions that may soon impact shellfish in bays and estuaries, which harbor the majority of commercial shellfish growers and recreational clam beds.

The majority of samples collected in 2002 consisted of mussels (69%), followed by cultured pacific oysters (30%; Table 4). Additional species of shellfish sampled for PSP toxin analysis in 2002 included rock scallops, Washington clams, and Pismo clams. The Marine Biotoxin Monitoring Program continues to use mussels as a primary indicator species for PSP toxins because of their ability to bioaccumulate these toxins at a faster rate that other bivalve species (Shumway, 1990). Differential uptake in mussels versus oysters during a major PSP event in 1991 was previously documented (California Department of Health Services, 1991).

Domoic Acid

There were 359 shellfish samples analyzed for domoic acid during 2002 compared to 82 samples analyzed the previous year. The significant increase in shellfish samples in 2002 was reflective of the monitoring program's adaptive response to the increased temporal and spatial distribution of *Pseudo-nitzschia spp*. as described in the "Results" section. Samples from 75 different sampling sites, representing all but one coastal county, were targeted for analysis as a result of observations from the volunteer monitoring network of high numbers of *Pseudo-nitzschia spp*. The greatest number of samples (78) was submitted from San Luis Obispo County (Table 1), with commercial shellfish aquaculture providing approximately 76% of the total samples collected in this county. Significant numbers of samples were also collected in Marin (75), Los Angeles (55), and Santa Barbara (52) counties.

Phytoplankton

There were 1071 phytoplankton samples collected during 2002 representing all coastal counties (Table 5). The greatest numbers of samples were collected in Marin (307), San Luis Obispo (151), Los Angeles (137), and Santa Barbara (92) counties. Samples were collected at 104 different sampling sites throughout these counties by 82 volunteers (Figures 1c and 1d). Several areas (e.g., commercial shellfish growing areas) had multiple sites that are not individually identified in the figure. The greatest number of sampling stations per county occurred in Los Angeles (21), Marin (15), and San Luis Obispo (11) counties.

Of the 1071 phytoplankton samples collected in 2002, 558 (52%) contained at least one toxigenic species. Toxin-producing phytoplankton species were detected at 85 different

sampling sites throughout all 15 coastal counties in 2002. The greatest number of samples containing toxin-producing species was collected in San Luis Obispo County (115), followed by Marin (81), Santa Barbara (72) and Los Angeles (72).

2002 RESULTS

Paralytic Shellfish Poisoning: Toxicity and *Alexandrium* Observations

The geographic distribution of PSP toxicity in 2002 was similar to observations in 2001, however the temporal distribution and magnitude of toxicity was greater (Figure 1). Measurable concentrations of PSP toxins were found in shellfish from the following coastal counties: Del Norte, Humboldt, Mendocino, Sonoma, Marin, San Francisco, and Santa Barbara. Concentrations of PSP toxins above the alert level were detected in 23 samples, representing 16 percent of all positive samples, from two coastal counties: Del Norte and Marin. Maps illustrating the weekly relative PSP toxin concentrations for each month are provided in Appendix A and the monthly lists of program participants are provided in Appendix B. Maps illustrating the monthly distribution and relative abundance of *Alexandrium* are provided in Appendix C and the monthly lists of program participants are provided in Appendix D.

PSP toxicity was found most frequently, and at the highest concentrations, along the coast of Marin County during 2002. The highest concentration detected was 1103 µg in mussels from Drakes Estero. PSP toxin concentrations above the alert level were detected in both mussels and oysters. The temporal distribution of PSP toxicity followed a general bimodal pattern comprised of an early spring peak around April 2, a subsequent period of inactivity through mid-July, followed by a period of greater activity that peaked in mid-August (Figure 2).

During February *Alexandrium* increased slightly at several locations, including inside Tomales Bay. The first positive mussel sample of the year (39 µg) occurred on February 26 at Point St. George (Del Norte County). Subsequent positive samples that defined the early spring event were primarily from Tomales Bay (Marin County). *Alexandrium* continued to increase in relative abundance in April. The peak PSP toxicity detected during this event was 169 µg in an oyster sample from a commercial growing area in outer Tomales Bay (April 2). This area had been closed to harvest as of March 31 when toxin levels first increased above the federal alert level of 80 µg/100 g shellfish tissue. Toxin levels declined in Tomales Bay through April 9, with low levels of PSP toxicity occurring over a wide geographic range during the latter half of the month. Low concentrations of PSP toxins were detected in mussel samples from Del Norte, Sonoma, and Santa Barbara counties during this period.

There was no measurable PSP toxicity in shellfish samples collected in May and June. By mid-July *Alexandrium* began increasing in distribution and relative abundance along the northern California coast. These initial observations were associated with low concentrations of PSP toxins in shellfish at several locations along the coast. By July

23 the toxin concentrations at the sentinel mussel buoy in Drakes Estero had increased to 166 µg and remained elevated through the end of the month. On July 16 low concentrations of PSP toxins were detected at our sentinel mussel stations in Drakes Bay and Drakes Estero (Marin County), as well in Humboldt Bay. Within one week the toxin concentration had increased above the alert level at the Drakes Estero sentinel mussel station (166 µg on July 23).

Alexandrium continued to increase in distribution and abundance along much of the California coast in August. Although this dinoflagellate was never a dominant part of the phytoplankton assemblage, cell numbers were high enough to result in continued elevated PSP toxin levels in shellfish. Toxin levels fluctuated above and below the alert level in Drakes Estero through the first week of August, at which point toxicity consistently increased to a peak concentration on August 13: 1056 µg at the Drakes Estero sentinel buoy, 1103 µg in mussels from mid-Estero, and 630 µg at the Drakes Bay sentinel station. Toxin concentrations remained above the alert level in Drakes Estero through August 26. By October *Alexandrium* had begun decreasing in number along the northern California coast. Low levels of PSP toxins persisted in Drakes Estero through October 9, with a brief increase above the alert level from September 27 to September 30.

The low level of PSP toxins initially detected in Humboldt Bay in mid-July persisted through August 20. Persistent PSP toxicity was also detected farther north at Point St. George (Del Norte County). Toxins were detected in mussels from July 23 through August 16, with a peak concentration of 80 µg occurring on August 9. Low levels of PSP toxins were also detected in mussels from Salt Point State Park (Sonoma County; September and October) and Fort Bragg (Mendocino County; October).

Domoic Acid Toxicity and *Pseudo-nitzschia* Observations

Record levels of domoic acid were detected in various shellfish species in 2002. A series of *Pseudo-nitzschia* blooms moved up and down the coast between Santa Cruz and Orange County, becoming the largest domoic acid episode documented in California in terms of both the geographical extent and the toxin concentrations detected. There were no human health effects associated with this event but there were hundreds of marine mammals affected as discussed below. Maps illustrating the weekly relative concentrations of domoic acid for each month are provided in Appendix A. Maps illustrating the monthly distribution and relative abundance of *Pseudo-nitzschia* are provided in Appendix C.

In January the relative abundance of *Pseudo-nitzschia* increased significantly for a brief time at sites along the Santa Barbara coast and at one site in San Diego County. The relative abundance of *Pseudo-nitzschia* increased at the beginning of February just offshore of the Los Angeles coast. In addition, a high relative abundance of *Pseudo-nitzschia* was observed at Gaviota Pier (Santa Barbara County) by February 5, with high numbers of this diatom occurring down coast at Goleta Pier by mid month. Similar increases in the relative abundance of this diatom occurred by mid month at sites along

the San Luis Obispo coast. By the end of February there were reports from researchers at the University of California, Santa Cruz, of a *Pseudo-nitzschia australis* bloom in the Santa Cruz region of Monterey Bay. These observations prompted the collection of shellfish samples by program participants at the university and at the Santa Cruz County Environmental Health Department for DA analysis. There was no toxin detected in mussels from the Santa Cruz Pier on February 2, but by February 21 the level of DA had increased to 120 ppm, the highest level of domoic acid ever recorded in shellfish from California at that time.

The relative abundance of *Pseudo-nitzschia* in the Santa Cruz region appeared to peak by the beginning of March and slowly declined throughout the month. Domoic acid levels began declining as well, although there was a brief increase in toxin levels (44 ppm) by March 12. As the Santa Cruz bloom declined another began offshore of Los Angeles. Volunteer observers on Catalina Island and just offshore of the Island reported a large bloom on the last weekend of March, coinciding with the first reported marine mammal stranding in Los Angeles. A similar pattern of increase in numbers of *Pseudo-nitzschia* was observed along the Santa Barbara coast by the end of March. The concentration of domoic acid in mussels from this area increased to 16 ppm as the bloom increased at the end of the month. The DA level declined to 3.2 ppm within five days at this site.

As the large event in Santa Cruz declined through March, a pattern developed involving a southward progression of *Pseudo-nitzschia* blooms and resultant DA toxicity in shellfish and other species (Figures 4 and 5, respectively). The relative abundance of this diatom increased dramatically along the San Luis Obispo (SLO) coast in April, resulting in elevated levels of DA in mussels. Observed concentrations reached 113 ppm inside Morro Bay on April 8. Samples of rock crab collected by the Department's Food and Drug Branch contained variable levels of DA in the viscera, with one of seven samples exceeding the alert level of 30 ppm for crab viscera (61 ppm).

As the SLO bloom declined throughout April, another bloom had begun along the Santa Barbara coast. The relative abundance of *Pseudo-nitzschia* increased throughout April at several Santa Barbara sites, resulting in increasing levels of DA in mussels from various locations. By the end of April the concentrations of DA had exceeded 100 ppm both at nearshore and offshore stations. Mussels from an offshore oil platform contained 230 ppm of domoic acid. A rock scallop sample collected concurrently from the same platform contained 5.8 ppm of DA in the viscera and < 1 ppm in the adductor muscle.

DA concentrations also increased dramatically in mussels from nearshore stations in Ventura County during the last two weeks of April. Samples collected by the Ventura County Environmental Health Department reached 55 ppm by April 22. Although *Pseudo-nitzschia* abundance was low offshore near Catalina Island, high concentrations of this diatom were observed just offshore of Los Angeles County (inside Santa Monica Bay, and at a nearshore site at Cabrillo Beach) and Orange County (Santa Catalina Channel). Similarly, mussel samples from nearshore sites in Los Angeles County did

not contain detectable levels of DA in April while increasing concentrations were detected in mussels from an oil platform offshore of Orange County. Farther north the relative abundance of *Pseudo-nitzschia* increased along the Marin coast, with low levels of DA detected in shellfish inside Tomales Bay by the end of April.

The southward progression of *Pseudo-nitzschia* along the southern California counties observed in March and April continued through May. The relative abundance of this diatom continued to decrease along the SLO coast but densities remained high along the coast of Santa Barbara and increasing numbers were also observed along the coast of Los Angeles. The Santa Barbara bloom continued to produce very high concentrations of DA in shellfish. A record level of 380 ppm was detected in mussels from an offshore oil platform at the beginning of May. Domoic acid concentrations appeared to peak during the first week of May and steadily declined throughout the month. By May 15 mussel concentrations dropped to 3 ppm at Goleta Pier from an earlier level of 120 ppm on May 1. Thanks to participants at the U.C. Santa Barbara Marine Science Institute (UCSB) we were able to track this event closely and gather additional toxicity data on other species that are less frequently sampled. Rock scallops taken from an offshore platform concurrently with the mussels that contained 380 ppm of DA had only low levels of this toxin in the viscera (4.4 ppm) and adductor muscle (5.4 ppm). A small tellinid clam (tentatively identified by UCSB as *Semele rupicola*) taken from amongst the mussel beds at this site contained 82 ppm of DA. In addition, we detected 10 ppm of DA in gooseneck barnacles (*Pollicipes polymerus*) and 28 ppm in the viscera of brown rock crab (*Cancer antennarius*). Rock scallops from another offshore platform also had a very low level of DA in the viscera (3.5 ppm) and adductor muscle (2.5 ppm) compared to mussels from the same site (200 ppm).

Pseudo-nitzschia numbers and DA concentrations continued to decline along the Ventura coast in May. There was a brief resurgence in toxicity, with mussels from Mussel Shoals increasing from <1 ppm on May 14 to 20 ppm on May 21, returning to a nondetectable level by May 29. Thanks to volunteer collector Bill Weinerth a sample of Pismo clams (*Tivela stultorum*) collected on May 27 was analyzed and found to contain a low level of DA in the viscera (3.7 ppm), with no detectable amount in the muscle tissue.

Members of the Los Angeles County Health Department's Public Health Investigations Branch provided numerous samples from the entire Los Angeles coast in response to this event. The relative abundance of *Pseudo-nitzschia* increased along the Los Angeles coast, as did DA levels in shellfish. Although toxin levels in the upper coastal region of Los Angeles (Malibu) peaked at the beginning of the month (28 ppm), DA levels farther downcoast (Palos Verdes peninsula) increased through May 19. DA concentrations reached 170 ppm in mussels from this area, decreasing to nondetectable levels by the end of the month.

In another fascinating development, program participants began reporting massive beachings of pelagic red crab (*Pleuroncodes planipes*) along the coast of San Diego, Los Angeles, and on a far offshore island. Samples of these "crab", actually a galatheid

shrimp also commonly referred to as “tuna crab”, were obtained by Paul Sims and Randy Dick in San Diego, Mike Mina of the Los Angeles County Public Health Investigations, and the U.S. Navy San Nicolas Island, Environmental Planning and Management Department. All samples contained high concentrations of domoic acid, with the red crab from offshore reaching 374 ppm. The high levels of toxin documented in this species suggests another pathway for transmitting this toxin to marine mammals and human consumers. Apparently pelagic red crab are fished and marketed commercially in other parts of the world.

By June there was little change in the low numbers of *Pseudo-nitzschia* along the northern California coast and the relative abundance of this diatom continued to decrease significantly along the southern California coast. Higher abundances of this toxin producer were detected offshore near the Channel Islands, particularly near Santa Cruz Island. DA was not detected in any mussel samples with the exception of a low level in a sample from Leo Carillo Beach in Los Angeles (2.7 ppm). However, pelagic red crab samples from the LA coast and from offshore continued to contain very high concentrations of domoic acid through the middle of the month when the last samples were collected. Concentrations in red crab were lower than observed in May, ranging from 98 ppm (offshore) to 160 ppm at Cabrillo Beach. Rock scallops from Redondo Beach did not contain DA, however a sample of lobster viscera taken from this area at the same time was found to contain 37 ppm of the toxin.

The relative abundance of *Pseudo-nitzschia* continued to decrease along the southern California coast through July. The only remnant of the massive domoic acid event earlier in the year was the persistent high toxin levels in pelagic red crab. A sample collected offshore of Santa Cruz Island on July 10 contained 120 ppm of DA. In contrast to the declining numbers of *Pseudo-nitzschia* in the south, this diatom began increasing in abundance at several northern California sites towards the end of the month. Volunteer phytoplankton samplers were responsible for catching this increase near the mouth of Tomales Bay. As a result of their efforts a number of shellfish samples were collected and delivered to the DHS’ Food and Drug Laboratory (FDL) for domoic acid analysis. A low concentration (2.5 ppm) of this toxin was detected in oysters collected a few miles farther inside the bay on July 30.

Pseudo-nitzschia numbers remained steady in northern California n August. The low levels of domoic acid detected in Tomales Bay at the end of July continued through the first week of August. A low concentration of this toxin was also detected in mussels from Bodega Harbor (6.9 ppm) and Drakes Estero (1.9 ppm) during the second week of August.

The relative abundance of *Pseudo-nitzschia* increased in relative abundance during September. Volunteer phytoplankton samplers allowed us to catch a bloom of this diatom in the northern California region between Crescent City and Humboldt Bay, as well as farther south along the San Luis Obispo coast. Thanks to their efforts a number of shellfish samples were collected and delivered to FDL for domoic acid analysis at the beginning of November. By the first week of November we detected domoic acid in

shellfish from the northern California sites where *Pseudo-nitzschia* was previously observed in high numbers. The concentration of this toxin exceeded the alert level (20 ppm) in mussels from the U.S. Coast Guard dock just inside Humboldt Bay (27 ppm). The concentration of this toxin was lower in mussels farther inside the bay (13 ppm) and farther north in Del Norte County (9.8 ppm). Domoic acid was not detected at these sites throughout the remainder of November. Despite the high relative abundance of *Pseudo-nitzschia* along the San Luis Obispo coast in October, we did not detect domoic acid in any shellfish samples from this area.

Finally, of particular note with respect to the series of domoic acid events that swept down the California coast in 2002 is the rapidity at which toxin levels increased in shellfish samples. Sentinel mussels in Morro Bay increased from nondetectable levels (less than 1 ppm on March 24) to 56 ppm, well above the alert level, in one week. Mussels from Goleta Pier increased from 10 ppm to 83 ppm in six days. These rapid increases in toxicity illustrate the importance of collecting additional environmental data as an adjunct to routine shellfish monitoring. Our ability to detect these rapid changes was due to the information provided by the volunteer phytoplankton monitoring network and the rapid response of the program participants in the shellfish monitoring program. Their efforts were of tremendous value in allowing us to track these events and provide timely health advisories to the public.

Marine Mammal Impacts

The record levels of DA detected throughout the series of *Pseudo-nitzschia* blooms that occurred in 2002 did not result in any recorded human health impacts. The high toxins levels did have a dramatic impact on a number of marine mammal species, with sea lions and common dolphins suffering the greatest losses. Hundreds of seabirds such as brown pelicans were also affected. Newspaper articles documented the numerous strandings along southern California beaches and the efforts of marine mammal rescue centers to care for the stricken animals. The National Marine Fisheries Service's California Marine Mammal Stranding Network Database documented total strandings of over 1000 California seal lions and 93 common dolphins between January 1 and June 30, 2002. The majority of sea lion strandings occurred between Ventura and San Diego counties, with common dolphin strandings most numerous between Ventura and Los Angeles counties[1]. The Santa Barbara Natural History Museum[2] reported 31 common dolphin strandings from Ventura through San Luis Obispo counties between February and May. The majority of strandings occurred in the Ventura area.

2002 PSP QUARANTINES AND RELATED HEALTH ADVISORIES

The annual quarantine on sport- harvested mussels was implemented early in 2002. As a result of the continued increase in the distribution and concentration of domoic acid in

[1] *Thanks to Joe Cordero for data from the U.S. Department of Commerce, NOAA/National Marine Fisheries Service, Southwest Region, California Marine Mammal Stranding Network Database.*
[2] *Data courtesy of Michelle Berman of the Santa Barbara Natural History Museum.*

February and March the annual quarantine began on April 19 rather than the usual May starting date. This annual quarantine applies only to sport-harvested mussels along the entire California coastline, including all bays and estuaries. This annual quarantine was rescinded on schedule at midnight, October 31.

In addition, in response to the series of domoic acid events along the coast from February to June, a number of warnings were issued to the public. In March the public was advised to avoid eating all sport-harvested species of bivalve shellfish (including clams, mussels, scallops and oysters), as well as anchovies, sardines and crab viscera (commonly known as crab butter) from Monterey Bay. Similar health advisories were issued on April 12 for Morro Bay (San Luis Obispo) and on May 10 for Santa Barbara, Ventura, and Los Angeles counties.

In addition, the California Department of Fish and Game and DHS issued a joint press release on May 1 to provide the public with an update on the series of domoic acid events. This press release addressed the reported impacts on marine mammals, contained background information on domoic acid, and provided instructions for reporting sick or deceased marine mammals.

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TABLES 1 – 7

Table 1. Total number of shellfish samples collected per coastal county in 2002 for PSP assay.

COUNTY	# SAMPLES
Del Norte	17
Humboldt	99
Mendocino	8
Sonoma	8
Marin	447
San Francisco	17
San Mateo	18
Santa Cruz	59
Monterey	3
San Luis Obispo	121
Santa Barbara	58
Ventura	14
Los Angeles	45
Orange	54
San Diego	62
TOTAL	**1030**

Table 2. Number of shellfish samples collected by program participants, per coastal county, in 2002 for PSP assay.

COUNTY (North to South)	COMMERCIAL GROWERS	COUNTY AGENCIES	STATE AGENCIES	FEDERAL AGENCIES	OTHER PARTICIPANTS	TOTAL
Del Norte	--	17	--	--	--	17
Humboldt	87	12	--	--	--	99
Mendocino	--	8	--	--	--	8
Sonoma	--	2	5	--	1	8
Marin	429	--	18	--	--	447
San Francisco	--	17	--	--	--	17
San Mateo	--	18	--	--	--	18
Santa Cruz	--	18	41	--	--	59
Monterey	--	1	1	--	1	3
San Luis Obispo	109	11	1	--	--	121
Santa Barbara	--	--	56	1	1	58
Ventura	--	10	--	--	4	14
Los Angeles	--	45	--	--	--	45
Orange	45	9	--	--	--	54
San Diego	48	--	--	--	14	62
TOTAL =	**718**	**168**	**122**	**1**	**21**	**1030**

Table 3. Program participants by county that submitted shellfish samples in 2002 for PSP assay.

COUNTY	AGENCY
Del Norte	Del Norte County Health Department
Humboldt	Humboldt County Environmental Health Department
	Coast Seafoods Company
Mendocino	Mendocino County Environmental Health Department
Sonoma	Sonoma County Public Health Department
	California Department of Parks and Recreation
	DHS Marine Biotoxin Monitoring Program
	DHS Volunteer
Marin	DHS Marine Biotoxin Monitoring Program
	Cove Mussel Company
	Hog Island Oyster Company
	Johnson Oyster Company
	Marin Oyster Company
	Point Reyes Oyster Company
	Tomales Bay Oyster Company
San Francisco	San Francisco County Health Department
San Mateo	San Mateo County Environmental Health Department
Santa Cruz	Santa Cruz County Environmental Health Department
	University of California Santa Cruz
Monterey	Monterey County Environmental Health Department
	University of California Santa Cruz
	DHS Volunteer
San Luis Obispo	Williams Shellfish Company
	San Luis Obispo County Environmental Health Department
	DHS Marine Biotoxin Monitoring Program
Santa Barbara	University of California Santa Barbara Marine Science Institute
	California Department of Parks and Recreation
	Vandenberg Air Force Base, Environmental Health Services
	DHS Volunteer
Ventura	Ventura County Environmental Health Department
Los Angeles	Los Angeles County Health Department
Orange	Orange County Health Care Agency

	Ecomar, Inc.
San Diego	Carlsbad Aquafarm, Inc.
	DHS Volunteer

Table 4. Number and species of samples collected in 2002 for PSP assay.

SAMPLE TYPE	# SAMPLES
Bay Mussels[3]:	
Sentinel	127
Wild	49
Cultured	142
Total Bay Mussels	***318***
Sea Mussels[4]:	
Sentinel	126
Wild	244
Total Sea Mussels	***370***
Mixed Bay and Sea Mussels	24
Total Mussels	**712**
Pacific Oysters[5]	
Cultured	**314**
Rock Scallops	**2**
Other[6]	**2**
TOTAL	**1030**

[3] *Mytilus edulis or M. galloprovincialis*
[4] *Mytilus californianus*
[5] *Crassostrea gigas*
[6] *Washington clam (1) and Pismo clam (1)*

Table 5. Total number of phytoplankton samples collected per coastal county in 2002.

COUNTY	# SAMPLES
Del Norte	23
Humboldt	63
Mendocino	13
Sonoma	47
Marin	307
San Francisco	48
San Mateo	21
Santa Cruz	40
Monterey	11
San Luis Obispo	151
Santa Barbara	92
Ventura	15
Los Angeles	137
Orange	47
San Diego	56
TOTAL	**1071**

Table 6. Date and location of shellfish samples containing detectable levels of PSP toxins during 2002.

DATE	COUNTY	SAMPLE TYPE	SAMPLE SITE	PSP TOXINS (ug/100 g)
FEBRUARY				
02/26/02	Del Norte	Sea Mussel, wild	Point St. George	39
MARCH				
03/12/02	Marin	Bay Mussel, cultured	Tomales Bay, Lease #M430-06	42
03/13/02	Marin	Pacific Oyster, cultured	Tomales Bay, Lease #M430-02	40
03/17/02	Marin	Pacific Oyster, cultured	Tomales Bay, Lease #M430-02	44
03/18/02	Marin	Bay Mussel, cultured	Tomales Bay, Lease #M430-06	43
03/21/02	Marin	Pacific Oyster, cultured	Tomales Bay, Lease #M430-02	44
03/24/02	Marin	Pacific Oyster, cultured	Tomales Bay, Lease #M430-02	47
03/25/02	Marin	Bay Mussel, cultured	Tomales Bay, Lease #M430-06	40
03/25/02	Marin	Pacific Oyster, cultured	Tomales Bay, Lease #M430-11	38
03/31/02	Marin	Pacific Oyster, cultured	Tomales Bay, Lease #M430-02	150
APRIL				
04/02/02	Marin	Pacific Oyster, cultured	Tomales Bay, Lease #M430-02	169
04/02/02	Marin	Pacific Oyster, cultured	Tomales Bay, Lease #M430-11	48
04/03/02	Marin	Pacific Oyster, cultured	Tomales Bay, Lease #M430-11	51
04/04/02	Marin	Pacific Oyster, cultured	Tomales Bay, Lease #M430-02	56
04/04/02	Marin	Pacific Oyster, cultured	Tomales Bay, Lease #M430-04	43
04/04/02	Marin	Pacific Oyster, cultured	Tomales Bay, Lease #M430-14	56
04/08/02	Marin	Bay Mussel, wild	Tomales Bay, Lease #M430-02	67
04/08/02	Marin	Pacific Oyster, cultured	Tomales Bay, Lease #M430-04	39
04/08/02	Marin	Pacific Oyster, cultured	Tomales Bay, Lease #M430-14	41
04/09/02	Marin	Bay Mussel, wild	Tomales Bay, Lease #M430-02	48
04/16/02	Sonoma	Sea Mussel, wild	Bodega Harbor, USCG Dock	43
04/16/02	Del Norte	Sea Mussel, wild	Point St. George	40
04/23/02	Santa Barbara	Mixed Sea/Bay Mussels	Santa Barbara Ch., Plt. Hogan	40
04/24/02	Santa Barbara	Sea Mussel, wild	Goleta Pier	39
JULY				
07/16/02	Marin	Sea Mussel, Sentinel	Drakes Bay, Chimney Rock LBS	41
07/16/02	Marin	Bay Mussel, Sentinel	Drakes Estero, Bed #12	44

07/16/02	Marin	Bay Mussel, Sentinel	Drakes Estero, Channel Buoy	45
07/16/02	Humboldt	Sea Mussel, Sentinel	Humboldt Bay, Indian Is. Ch.	42
07/18/02	Humboldt	Sea Mussel, Sentinel	Humboldt Bay, Indian Is. Ch.	40
07/19/02	Marin	Bay Mussel, Sentinel	Drakes Estero, Channel Buoy	45
07/23/02	Marin	Pacific Oyster, cultured	Drakes Estero, Bed #12	44
07/23/02	Marin	Bay Mussel, Sentinel	Drakes Estero, Bed #12	62
07/23/02	Marin	Pacific Oyster, cultured	Drakes Estero, Bed #7	40
07/23/02	Marin	Bay Mussel, Sentinel	Drakes Estero, Channel Buoy	166
07/23/02	Humboldt	Sea Mussel, Sentinel	Humboldt Bay, Indian Is. Ch.	53
07/24/02	Marin	Pacific Oyster, cultured	Drakes Estero, Bed #12	38
07/24/02	Marin	Bay Mussel, Sentinel	Drakes Estero, Bed #12	60
07/24/02	Marin	Pacific Oyster, cultured	Drakes Estero, Bed #7	37
07/24/02	Marin	Bay Mussel, Sentinel	Drakes Estero, Channel Buoy	64
07/24/02	Humboldt	Sea Mussel, wild	Patrick's Point	44
07/24/02	Del Norte	Sea Mussel, wild	Point St. George	64
07/25/02	Sonoma	Sea Mussel, wild	Bodega Harbor, USCG Dock	37
07/25/02	Marin	Sea Mussel, Sentinel	Drakes Bay, Chimney Rock LBS	44
07/25/02	Humboldt	Sea Mussel, Sentinel	Humboldt Bay, Indian Is. Ch.	55
07/29/02	Humboldt	Sea Mussel, Sentinel	Humboldt Bay, Indian Is. Ch.	42
07/29/02	Humboldt	Sea Mussel, Sentinel	Humboldt Bay, USCG Station	50
07/30/02	Marin	Bay Mussel, Sentinel	Drakes Estero, Bed #12	64
07/30/02	Marin	Bay Mussel, Sentinel	Drakes Estero, Channel Buoy	116
07/30/02	Humboldt	Sea Mussel, Sentinel	Humboldt Bay, Indian Is. Ch.	42
07/30/02	Humboldt	Sea Mussel, Sentinel	Humboldt Bay, USCG Station	45
07/31/02	Marin	Pacific Oyster, cultured	Drakes Estero, Bed #12	43
07/31/02	Marin	Bay Mussel, Sentinel	Drakes Estero, Bed #12	48
07/31/02	Marin	Bay Mussel, Sentinel	Drakes Estero, Channel Buoy	73
AUGUST				
08/01/02	Humboldt	Sea Mussel, Sentinel	Humboldt Bay, Indian Is. Ch.	44
08/01/02	Humboldt	Sea Mussel, Sentinel	Humboldt Bay, USCG Station	50
08/05/02	Humboldt	Sea Mussel, Sentinel	Humboldt Bay, Indian Is. Ch.	41
08/05/02	Humboldt	Sea Mussel, Sentinel	Humboldt Bay, USCG Station	44
08/06/02	Marin	Pacific Oyster, cultured	Drakes Estero, Bed #12	66
08/06/02	Marin	Bay Mussel, Sentinel	Drakes Estero, Bed #12	130

08/06/02	Marin	Pacific Oyster, cultured	Drakes Estero, Bed #22	55
08/06/02	Marin	Pacific Oyster, cultured	Drakes Estero, Bed #9	46
08/06/02	Marin	Bay Mussel, Sentinel	Drakes Estero, Channel Buoy	123
08/06/02	Humboldt	Sea Mussel, Sentinel	Humboldt Bay, Indian Is. Ch.	43
08/06/02	Humboldt	Sea Mussel, Sentinel	Humboldt Bay, USCG Station	43
08/08/02	Marin	Sea Mussel, Sentinel	Drakes Bay, Chimney Rock LBS	56
08/08/02	Marin	Pacific Oyster, cultured	Drakes Estero, Bed #12	43
08/08/02	Marin	Bay Mussel, Sentinel	Drakes Estero, Bed #12	64
08/08/02	Marin	Pacific Oyster, cultured	Drakes Estero, Bed #38	49
08/08/02	Marin	Pacific Oyster, cultured	Drakes Estero, Bed #7	43
08/08/02	Marin	Bay Mussel, Sentinel	Drakes Estero, Channel Buoy	292
08/08/02	Humboldt	Sea Mussel, wild	Patrick's Point	46
08/09/02	Del Norte	Sea Mussel, wild	Point St. George	80
08/13/02	Sonoma	Sea Mussel, wild	Bodega Harbor, USCG Dock	42
08/13/02	Marin	Sea Mussel, Sentinel	Drakes Bay, Chimney Rock LBS	630
08/13/02	Marin	Pacific Oyster, cultured	Drakes Estero, Bed #12	418
08/13/02	Marin	Bay Mussel, Sentinel	Drakes Estero, Bed #12	1103
08/13/02	Marin	Pacific Oyster, cultured	Drakes Estero, Bed #4	161
08/13/02	Marin	Bay Mussel, Sentinel	Drakes Estero, Channel Buoy	1056
08/13/02	Humboldt	Sea Mussel, Sentinel	Humboldt Bay, Indian Is. Ch.	41
08/13/02	Humboldt	Sea Mussel, Sentinel	Humboldt Bay, USCG Station	42
08/14/02	San Francisco	Sea Mussel, Sentinel	San Francisco, NOAA Pier	40
08/16/02	Marin	Pacific Oyster, cultured	Drakes Estero, Bed #12	49
08/16/02	Marin	Bay Mussel, Sentinel	Drakes Estero, Bed #12	678
08/16/02	Marin	Pacific Oyster, cultured	Drakes Estero, Bed #4	61
08/16/02	Marin	Bay Mussel, Sentinel	Drakes Estero, Channel Buoy	945
08/16/02	Del Norte	Sea Mussel, wild	Point St. George	46
08/17/02	Marin	Sea Mussel, Sentinel	Tomales Bay, Lease #M430-15	40
08/18/02	Marin	Pacific Oyster, cultured	Tomales Bay, Lease #M430-02	45
08/19/02	Marin	Pacific Oyster, cultured	Drakes Estero, Bed #12	46
08/19/02	Marin	Bay Mussel, Sentinel	Drakes Estero, Bed #12	682
08/19/02	Marin	Pacific Oyster, cultured	Drakes Estero, Bed #4	42
08/19/02	Marin	Bay Mussel, Sentinel	Drakes Estero, Channel Buoy	292
08/20/02	Marin	Pacific Oyster, cultured	Drakes Estero, Bed #34	50

08/20/02	Humboldt	Sea Mussel, Sentinel	Humboldt Bay, Indian Is. Ch.	40
08/20/02	Humboldt	Sea Mussel, Sentinel	Humboldt Bay, USCG Station	43
08/21/02	Marin	Sea Mussel, Sentinel	Drakes Bay, Chimney Rock LBS	263
08/21/02	Marin	Pacific Oyster, cultured	Drakes Estero, Bed #12	48
08/21/02	Marin	Bay Mussel, Sentinel	Drakes Estero, Bed #12	292
08/21/02	Marin	Pacific Oyster, cultured	Drakes Estero, Bed #9	45
08/21/02	Marin	Bay Mussel, Sentinel	Drakes Estero, Channel Buoy	301
08/26/02	Marin	Pacific Oyster, cultured	Drakes Estero, Bed #12	40
08/26/02	Marin	Bay Mussel, Sentinel	Drakes Estero, Bed #12	74
08/26/02	Marin	Bay Mussel, Sentinel	Drakes Estero, Channel Buoy	211
08/28/02	Marin	Pacific Oyster, cultured	Drakes Estero, Bed #12	43
08/28/02	Marin	Bay Mussel, Sentinel	Drakes Estero, Bed #12	66
08/28/02	Marin	Bay Mussel, Sentinel	Drakes Estero, Channel Buoy	46
SEPTEMBER				
09/02/02	Marin	Bay Mussel, Sentinel	Drakes Estero, Bed #12	67
09/02/02	Marin	Bay Mussel, Sentinel	Drakes Estero, Channel Buoy	56
09/05/02	Marin	Bay Mussel, Sentinel	Drakes Estero, Bed #12	48
09/05/02	Marin	Bay Mussel, Sentinel	Drakes Estero, Channel Buoy	48
09/05/02	Marin	Bay Mussel, cultured	Tomales Bay, Lease #M430-15	40
09/10/02	Marin	Bay Mussel, Sentinel	Drakes Estero, Bed #12	46
09/10/02	Marin	Pacific Oyster, cultured	Drakes Estero, Bed #12	49
09/10/02	Marin	Pacific Oyster, cultured	Drakes Estero, Bed #13	42
09/10/02	Marin	Bay Mussel, Sentinel	Drakes Estero, Channel Buoy	73
09/12/02	Marin	Sea Mussel, Sentinel	Drakes Bay, Chimney Rock LBS	54
09/16/02	Sonoma	Sea Mussel, wild	Salt Point State Park	46
09/17/02	Marin	Sea Mussel, Sentinel	Drakes Bay, Chimney Rock LBS	54
09/17/02	Marin	Sea Mussel, Sentinel	Drakes Estero, Bed #12	43
09/17/02	Marin	Bay Mussel, Sentinel	Drakes Estero, Channel Buoy	46
09/24/02	Marin	Bay Mussel, Sentinel	Drakes Estero, Bed #12	44
09/24/02	Marin	Bay Mussel, Sentinel	Drakes Estero, Channel Buoy	48
09/27/02	Marin	Pacific Oyster, cultured	Drakes Estero, Bed #12	48
09/27/02	Marin	Bay Mussel, Sentinel	Drakes Estero, Bed #12	51
09/27/02	Marin	Bay Mussel, Sentinel	Drakes Estero, Channel Buoy	123
09/28/02	Marin	Sea Mussel, Sentinel	Tomales Bay, Lease #M430-15	43

09/30/02	Marin	Pacific Oyster, cultured	Drakes Estero, Bed #12	50
09/30/02	Marin	Bay Mussel, Sentinel	Drakes Estero, Bed #12	51
09/30/02	Marin	Bay Mussel, Sentinel	Drakes Estero, Channel Buoy	89
09/30/02	Marin	Pacific Oyster, cultured	Tomales Bay, Lease #M430-02	42
OCTOBER				
10/02/02	Marin	Sea Mussel, Sentinel	Drakes Bay, Chimney Rock LBS	50
10/02/02	Marin	Bay Mussel, Sentinel	Drakes Estero, Bed #12	45
10/02/02	Marin	Bay Mussel, Sentinel	Drakes Estero, Channel Buoy	61
10/07/02	Marin	Bay Mussel, Sentinel	Drakes Estero, Bed #12	43
10/07/02	Marin	Bay Mussel, Sentinel	Drakes Estero, Channel Buoy	42
10/09/02	Marin	Bay Mussel, Sentinel	Drakes Estero, Bed #12	40
10/09/02	Marin	Bay Mussel, Sentinel	Drakes Estero, Channel Buoy	42
10/14/02	Sonoma	Sea Mussel, wild	Salt Point State Park	41
10/15/02	Marin	Bay Mussel, Sentinel	Drakes Estero, Bed #12	38
10/21/02	Mendocino	Sea Mussel, wild	Fort Bragg	38

Table 7. Date and location of shellfish samples containing detectable levels of domoic acid toxins during 2002.

DATE	COUNTY	SAMPLE TYPE	SAMPLE SITE	DA (ppm)
FEBRUARY				
02/21/02	Santa Cruz	Sea Mussel, wild	Santa Cruz Pier	120
MARCH				
03/03/02	Monterey	Bay Mussel, wild	Elkhorn Slough, entrance	4.4
03/03/02	Monterey	Sea Mussel, wild	Monterey Bay, Commercial Wharf	6
03/03/02	Santa Cruz	Bay Mussel, wild	Santa Cruz Harbor	3.6
03/04/02	Santa Cruz	Sea Mussel, wild	Santa Cruz Pier	13
03/11/02	Santa Cruz	Sea Mussel, wild	Santa Cruz, Sunny Cove	25
03/12/02	Santa Cruz	Sea Mussel, wild	Natural Bridges	6.8
03/12/02	San Mateo	Sea Mussel, wild	Pescadero State Beach	4.7
03/12/02	Santa Cruz	Sea Mussel, wild	Santa Cruz Pier	44
03/24/02	Santa Cruz	Sea Mussel, wild	Santa Cruz, Sunny Cove	1.4
03/26/02	Orange	Bay Mussel, wild	Santa Catalina Ch., Plt. Eva	1
03/29/02	Santa Barbara	Mixed Sea/Bay Mussels	Goleta Pier	16
APRIL				
04/01/02	San Luis Obispo	Pacific Oyster, cultured	Morro Bay	8.6
04/01/02	San Luis Obispo	Bay Mussel, Sentinel	Morro Bay	56
04/01/02	San Luis Obispo	Sea Mussel, wild	Shell Beach	51
04/03/02	Santa Barbara	Sea Mussel, wild	Goleta Pier	3.2
04/04/02	San Luis Obispo	Bay Mussel, Sentinel	Morro Bay	83
04/08/02	San Luis Obispo	Pacific Oyster, cultured	Morro Bay	19
04/08/02	San Luis Obispo	Bay Mussel, Sentinel	Morro Bay	113
04/08/02	Orange	Bay Mussel, wild	Santa Catalina Ch., Plt. Eva	2.1
04/10/02	San Luis Obispo	Bay Mussel, Sentinel	Morro Bay	73
04/10/02	San Luis Obispo	Bay Mussel, wild	Morro Bay, WQ Station #07	86
04/10/02	San Luis Obispo	Sea Mussel, wild	Port San Luis, Commercial Pier	4.1
04/11/02	Santa Barbara	Sea Mussel, wild	Goleta Pier	9.9
04/15/02	San Luis Obispo	Pacific Oyster, cultured	Morro Bay	15
04/15/02	San Luis Obispo	Bay Mussel, Sentinel	Morro Bay	24
04/16/02	Orange	Bay Mussel, wild	Santa Catalina Ch., Plt. Eva	1.2

04/17/02	Santa Barbara	Sea Mussel, wild	Goleta Pier	83
04/21/02	Santa Barbara	Sea Mussel, wild	Gaviota Pier	60
04/22/02	San Luis Obispo	Pacific Oyster, cultured	Morro Bay	9.2
04/22/02	San Luis Obispo	Bay Mussel, Sentinel	Morro Bay	12
04/22/02	Ventura	Sea Mussel, wild	Mussel Shoals, Oil Piers	55
04/22/02	Santa Barbara	Sea Mussel, wild	Santa Barbara, VAFB Boat Dock	5.2
04/23/02	Santa Barbara	Rock Scallop viscera	Santa Barbara Ch., Plt. Hogan	5.8
04/23/02	Santa Barbara	Mixed Sea/Bay Mussels	Santa Barbara Ch., Plt. Hogan	230
04/24/02	Santa Barbara	Sea Mussel, wild	Goleta Pier	120
04/24/02	San Luis Obispo	Bay Mussel, Sentinel	Morro Bay	1.2
04/28/02	Marin	Pacific Oyster, cultured	Tomales Bay, Lease #M430-02	2
04/29/02	San Luis Obispo	Bay Mussel, Sentinel	Morro Bay	1.2
04/29/02	Orange	Bay Mussel, wild	Santa Catalina Ch., Plt. Eva	16
04/29/02	Marin	Pacific Oyster, cultured	Tomales Bay, Lease #M430-04	2.1
04/30/02	Ventura	Sea Mussel, wild	Mussel Shoals, Oil Piers	40
04/30/02	Ventura	Sea Mussel, wild	Ventura, Port Hueneme Pier	39
MAY				
05/01/02	Santa Barbara	Sea Mussel, wild	Goleta Pier	120
05/01/02	Los Angeles	Sea Mussel, wild	Malibu Beach	28
05/01/02	Orange	Bay Mussel, wild	Santa Catalina Ch., Plt. Eva	12
05/04/02	Santa Barbara	Rock Scallop viscera	Santa Barbara Ch., Plt. Gina	4.4
05/04/02	Santa Barbara	Rock Scallop adductor	Santa Barbara Ch., Plt. Gina	5.4
05/04/02	Santa Barbara	Clam, unidentified	Santa Barbara Ch., Plt. Gina	82
05/04/02	Santa Barbara	Mixed Sea/Bay Mussels	Santa Barbara Ch., Plt. Gina	380
05/04/02	Santa Barbara	Mixed Sea/Bay Mussels	Santa Barbara Ch., Plt. Grace	140
05/05/02	San Luis Obispo	Bay Mussel, cultured	Morro Bay	1.7
05/05/02	Orange	Bay Mussel, wild	Santa Catalina Ch., Plt. Eva	13
05/05/02	Marin	Pacific Oyster, cultured	Tomales Bay, Lease #M430-02	2.3
05/06/02	Marin	Pacific Oyster, cultured	Tomales Bay, Lease #M430-14	1.2
05/07/02	Los Angeles	Sea Mussel, wild	Portuguese Bend	56
05/07/02	Marin	Bay Mussel, Sentinel	Tomales Bay, Lease #M430-15	2.4
05/08/02	Santa Barbara	Sea Mussel, wild	Goleta Pier	57
05/09/02	Santa Barbara	Rock Scallop adductor	Santa Barbara Ch., Plt. Hogan	2
05/09/02	Santa Barbara	Rock Scallop viscera	Santa Barbara Ch., Plt. Hogan	3.5

05/09/02	Santa Barbara	Sea Mussel, wild	Santa Barbara Ch., Plt. Hogan	200
05/09/02	Orange	Bay Mussel, wild	Santa Catalina Ch., Plt. Eva	1.4
05/11/02	Los Angeles	Sea Mussel, wild	Portuguese Bend	5.1
05/12/02	Orange	Bay Mussel, wild	Santa Catalina Ch., Plt. Eva	1.9
05/13/02	Marin	Pacific Oyster, cultured	Tomales Bay, Lease #M430-02	2
05/14/02	Orange	Bay Mussel, wild	Santa Catalina Ch., Plt. Eva	9.5
05/15/02	Los Angeles	Sea Mussel, wild	Catalina Channel, San Pedro	13
05/15/02	Santa Barbara	Sea Mussel, wild	Goleta Pier	3
05/15/02	Los Angeles	Sea Mussel, wild	Portuguese Bend	61
05/17/02	Los Angeles	Sea Mussel, wild	Portuguese Bend	130
05/19/02	San Luis Obispo	Pacific Oyster, cultured	Morro Bay	3.5
05/19/02	Los Angeles	Sea Mussel, wild	Portuguese Bend	170
05/19/02	Marin	Pacific Oyster, cultured	Tomales Bay, Lease #M430-02	1.7
05/20/02	Orange	Bay Mussel, wild	Santa Catalina Ch., Plt. Eva	4.6
05/21/02	Ventura	Sea Mussel, wild	Mussel Shoals, Oil Piers	20
05/21/02	Los Angeles	Sea Mussel, wild	Portuguese Bend	54
05/22/02	Santa Barbara	Mixed Sea/Bay Mussels	Goleta Pier	10
05/22/02	Orange	Bay Mussel, wild	Santa Catalina Ch., Plt. Eva	16
05/24/02	Los Angeles	Sea Mussel, wild	Portuguese Bend	3.4
05/25/02	Santa Barbara	Gooseneck Barnacle	Santa Barbara Ch., Plt. Gina	10
05/27/02	Marin	Pacific Oyster, cultured	Tomales Bay, Lease #M430-02	1.9
05/27/02	Ventura	Pismo Clam viscera	Ventura, Silverstrand Beach	3.7
05/29/02	Santa Barbara	Sea Mussel, wild	Goleta Pier	4
05/29/02	Ventura	Sea Mussel, wild	Ventura, Port Hueneme Pier	8
05/30/02	Los Angeles	Sea Mussel, wild	Leo Carillo State Beach	2.6
JUNE				
06/03/02	Los Angeles	Sea Mussel, wild	Leo Carillo State Beach	2.7
JULY				
07/30/02	Marin	Pacific Oyster, cultured	Tomales Bay, Lease #M430-15	2.5
AUGUST				
08/01/02	Marin	Pacific Oyster, cultured	Tomales Bay, Lease #M430-02	2.7
08/01/02	Marin	Pacific Oyster, cultured	Tomales Bay, Lease #M430-11	3.9
08/04/02	Marin	Pacific Oyster, cultured	Tomales Bay, Lease #M430-02	4.1
08/06/02	Marin	Pacific Oyster, cultured	Tomales Bay, Lease #M430-15	5

08/08/02	Sonoma	Sea Mussel, wild	Bodega Harbor, USCG Dock	3.9
08/08/02	Marin	Pacific Oyster, cultured	Drakes Estero, Bed #38	1.9
08/13/02	Sonoma	Sea Mussel, wild	Bodega Harbor, USCG Dock	6.9
NOVEMBER				
11/04/02	Del Norte	Sea Mussel, wild	Point St. George	9.8
11/05/02	Humboldt	Sea Mussel, Sentinel	Humboldt Bay, Indian Is. Ch.	13
11/05/02	Humboldt	Sea Mussel, Sentinel	Humboldt Bay, USCG Station	27

FIGURES 1 – 3.

Figure 1a. Locations of shellfish sampling stations during 2002 (Del Norte to Monterey counties).

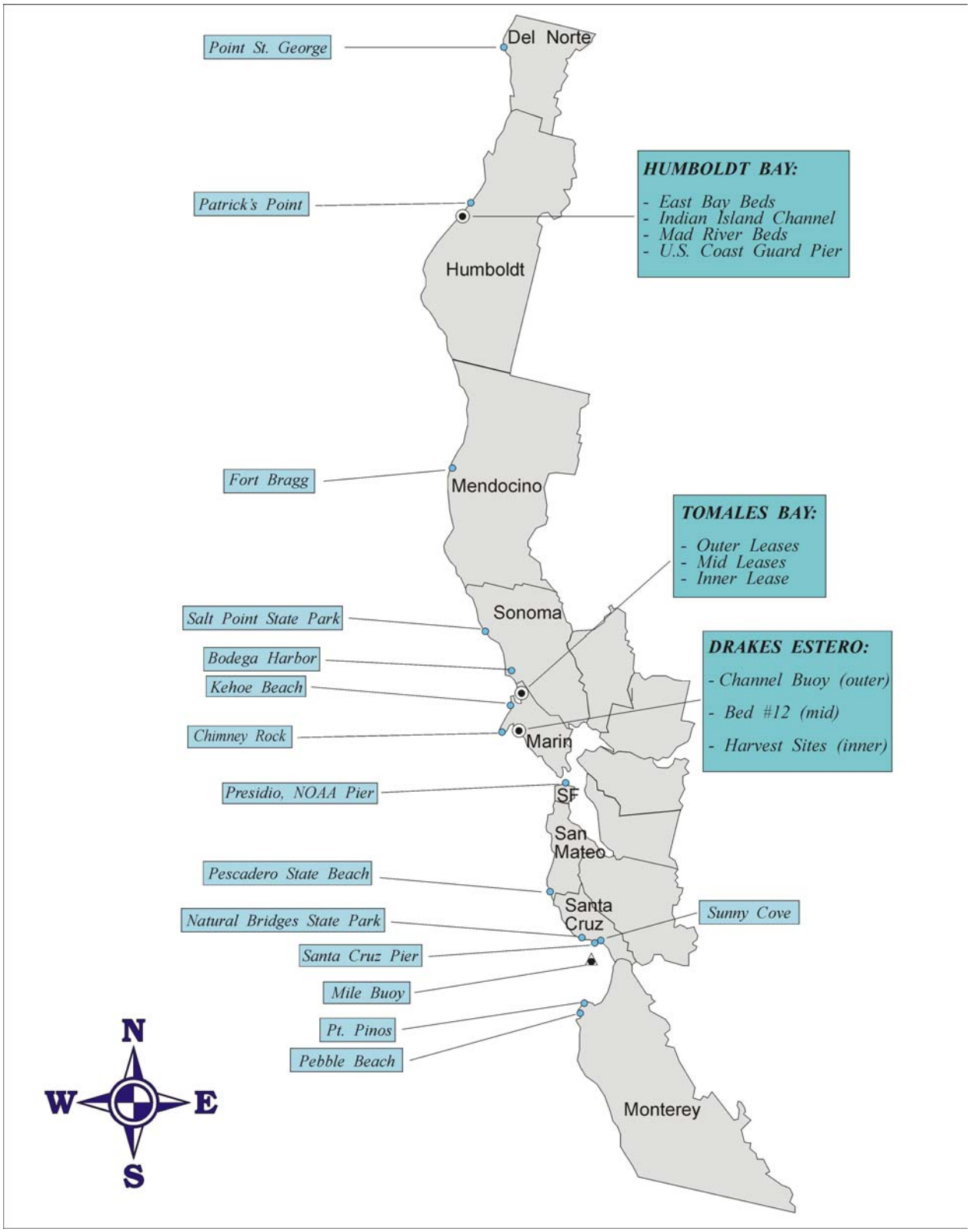


Figure 1b. Locations of shellfish sampling stations during 2002 (San Luis Obispo to San Diego counties).

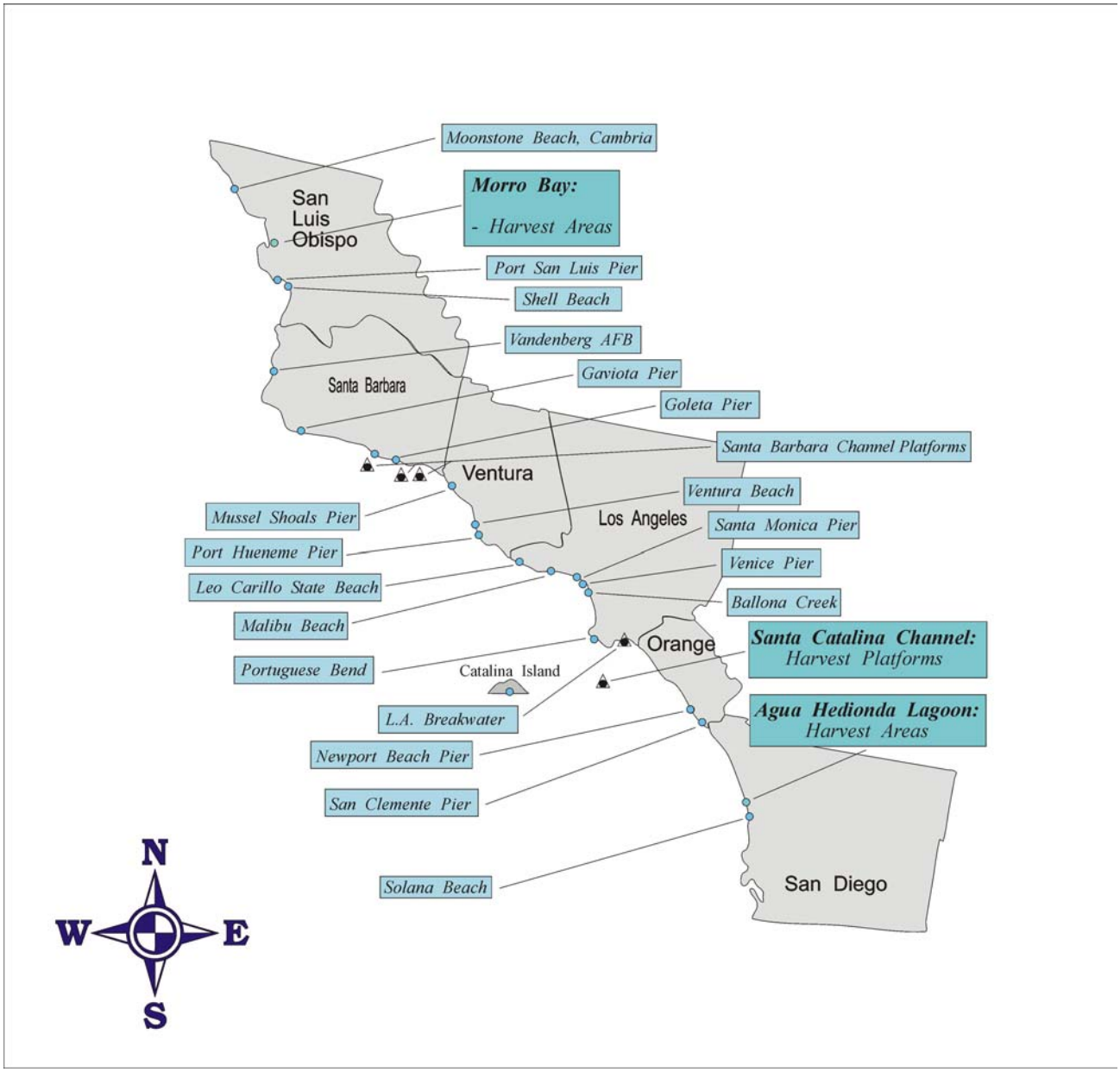


Figure 1c. Locations of phytoplankton sampling stations during 2002 (Del Norte to Monterey counties).

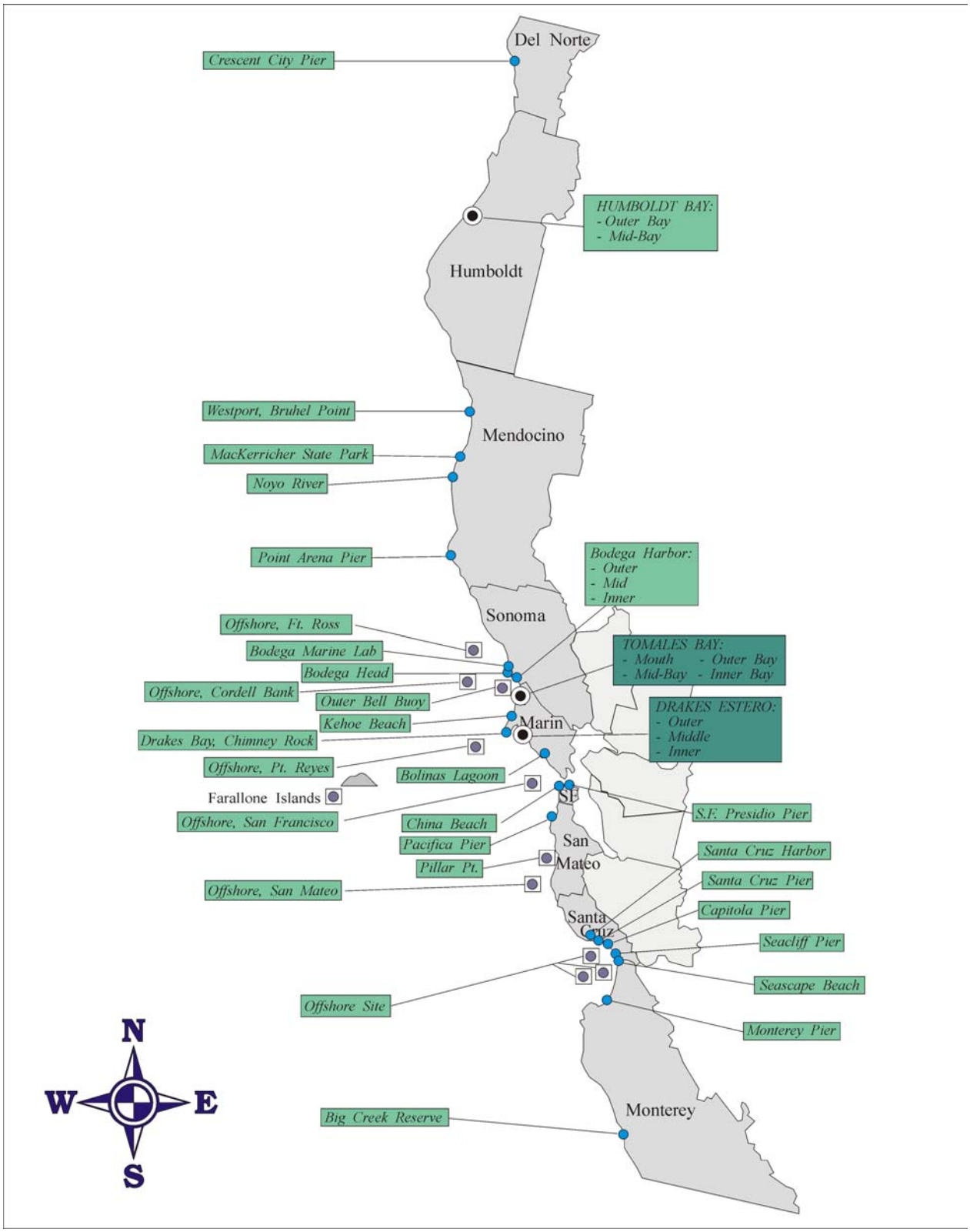


Figure 1d. Locations of phytoplankton sampling stations during 2002 (San Luis Obispo to San Diego counties).

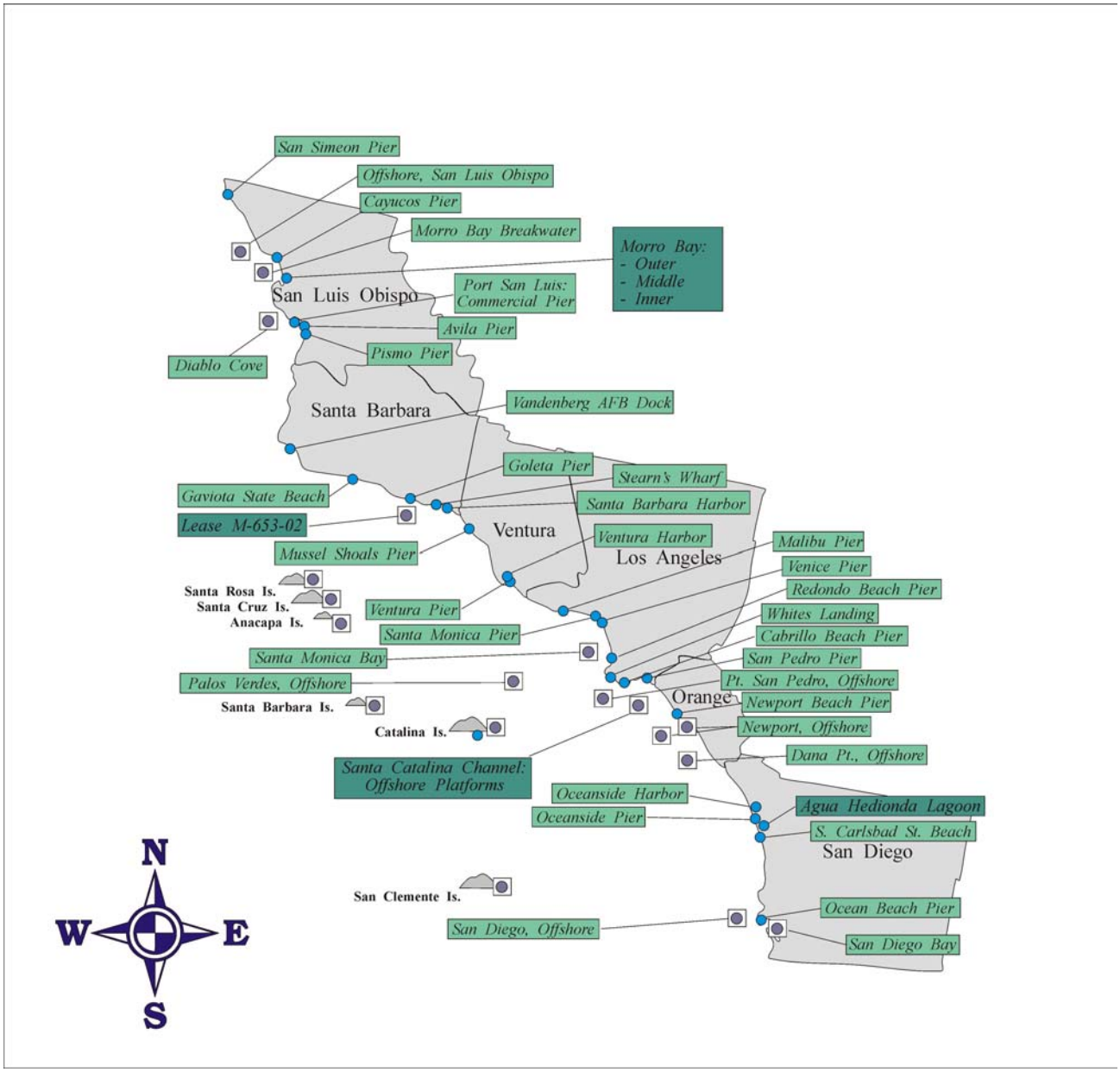


Figure 2. Annual PSP toxin levels in California shellfish from 1991 through 2002.

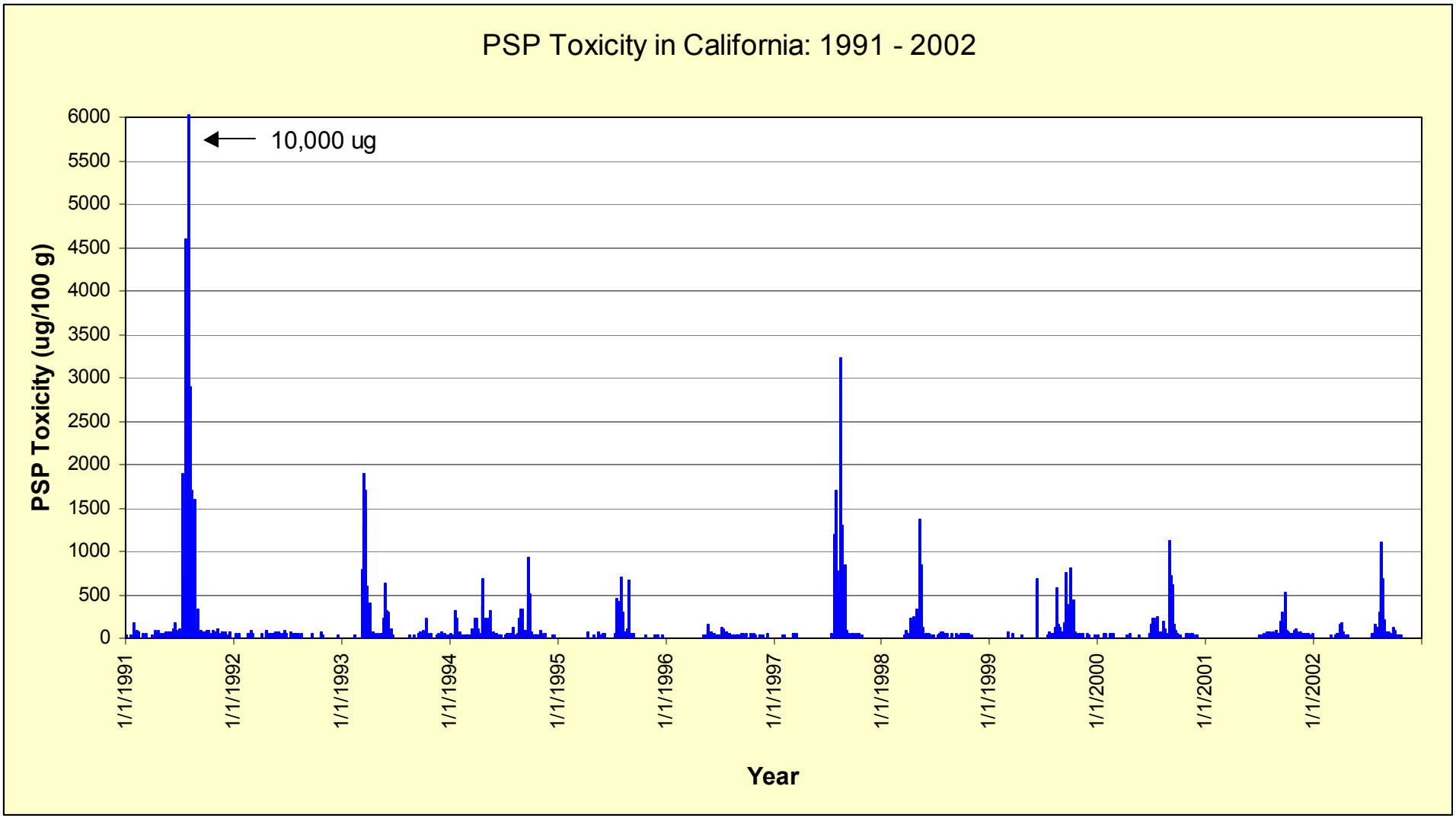


Figure 3. Temporal distribution of PSP toxin levels in California shellfish during 2002.

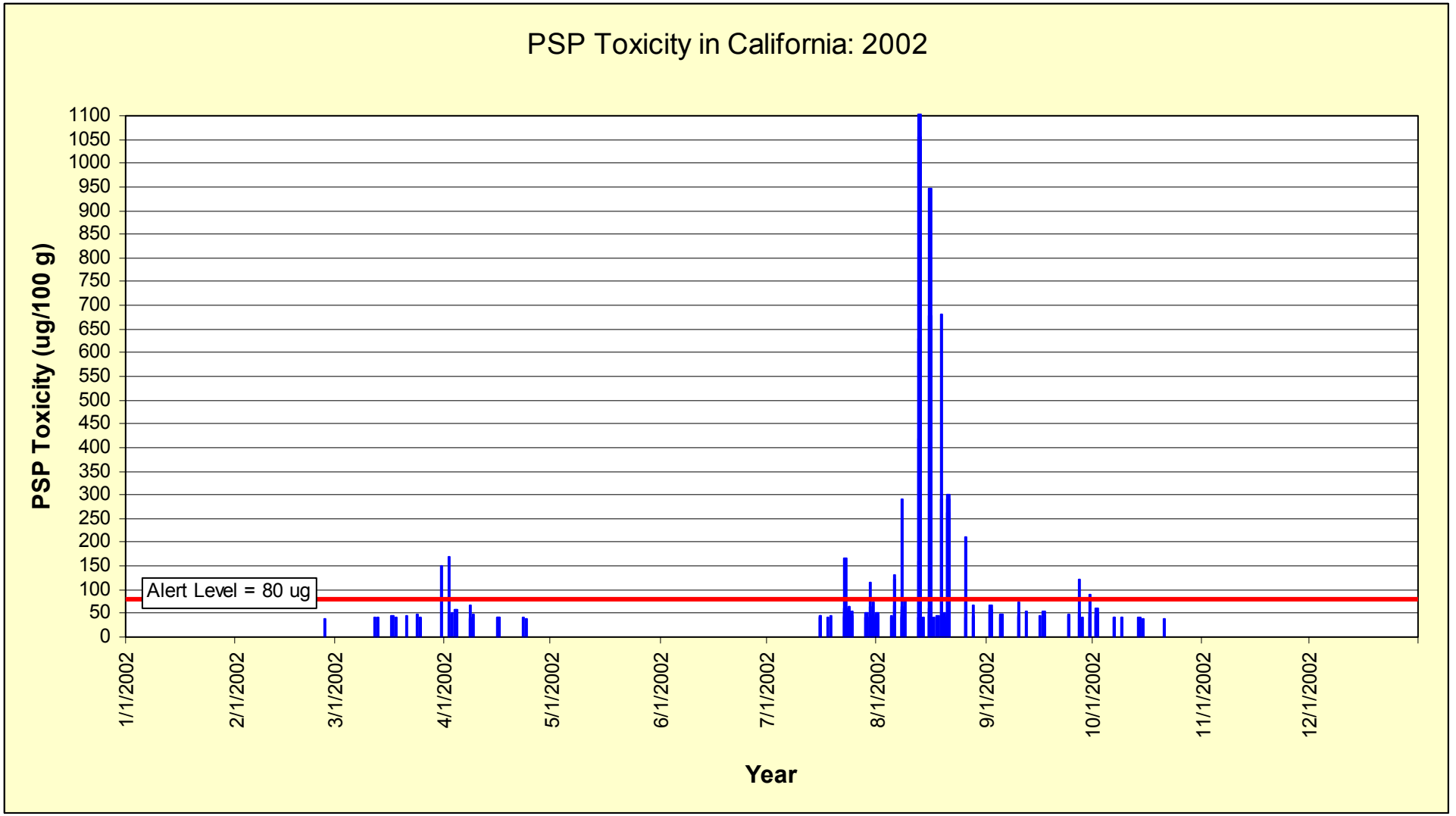


Figure 4. Temporal distribution and relative abundance of *Pseudo-nitzschia spp.* (north to south).

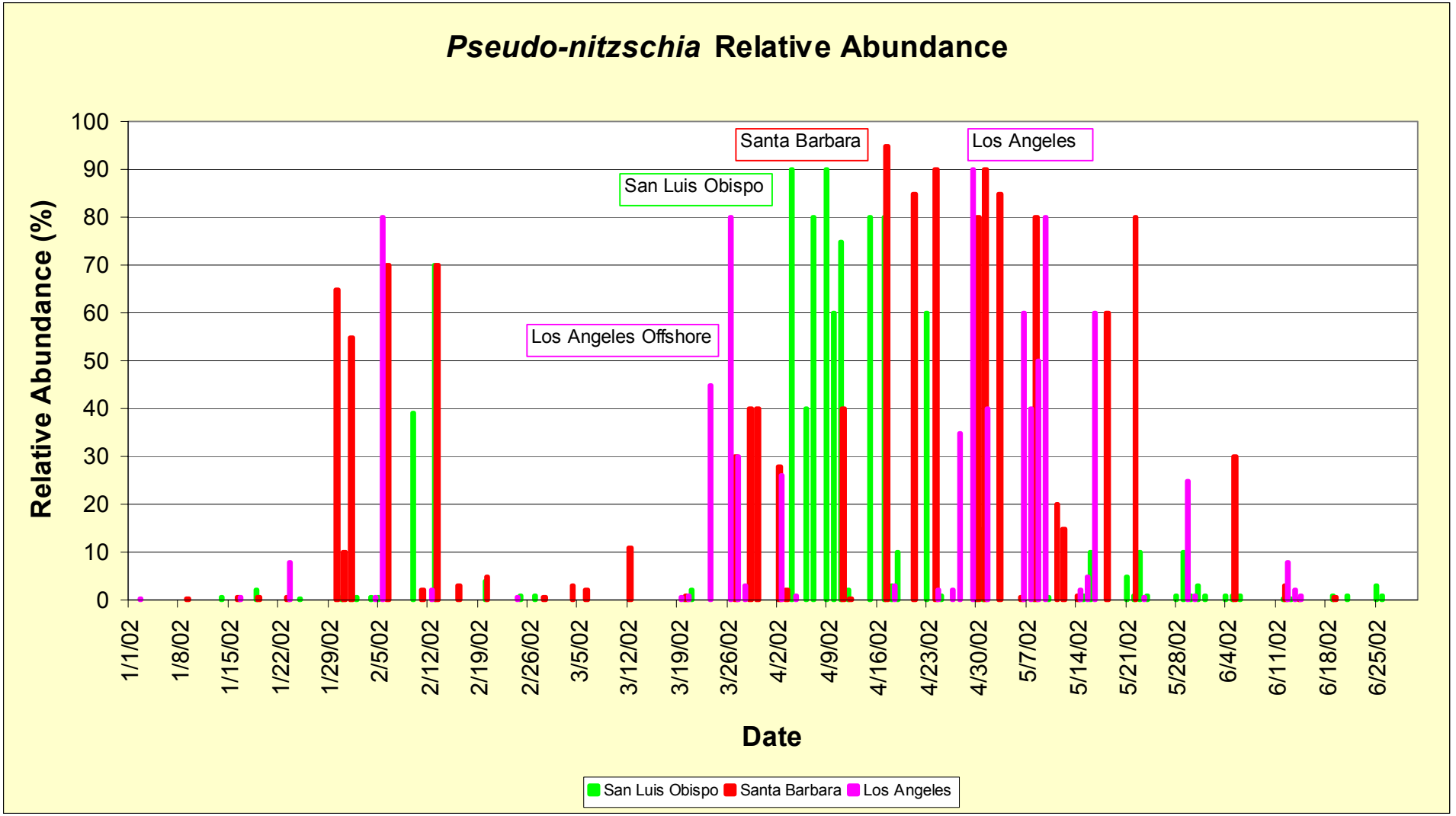
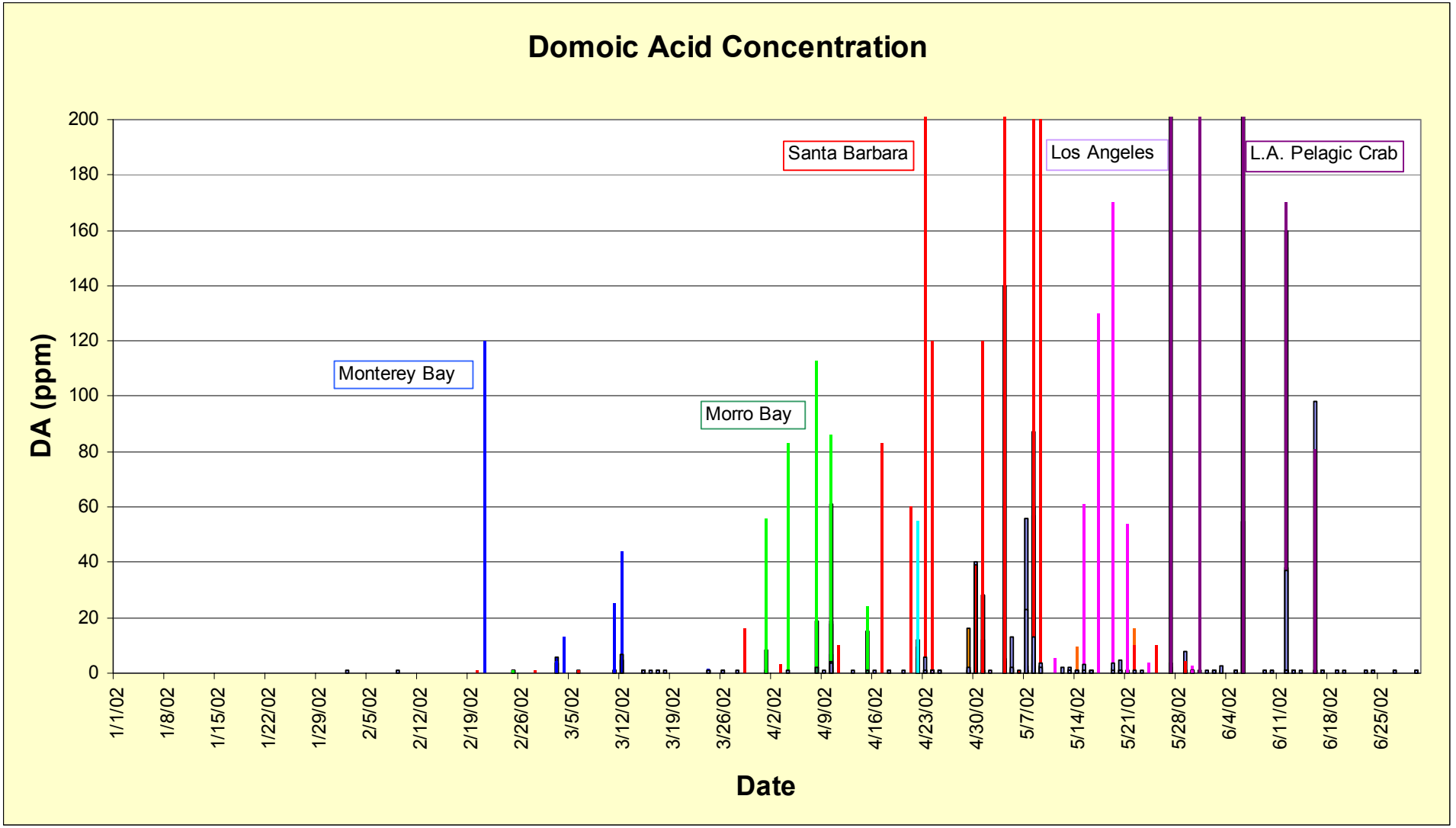


Figure 5. Domoic acid concentrations in shellfish, color-coded to geographical region (north to south).



APPENDIX A.

Monthly maps of PSP toxin distribution and sampling effort during 2002.

CALIFORNIA DEPARTMENT OF HEALTH SERVICES
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ENVIRONMENTAL MANAGEMENT BRANCH
Marine Biotoxin Monitoring and Control Program

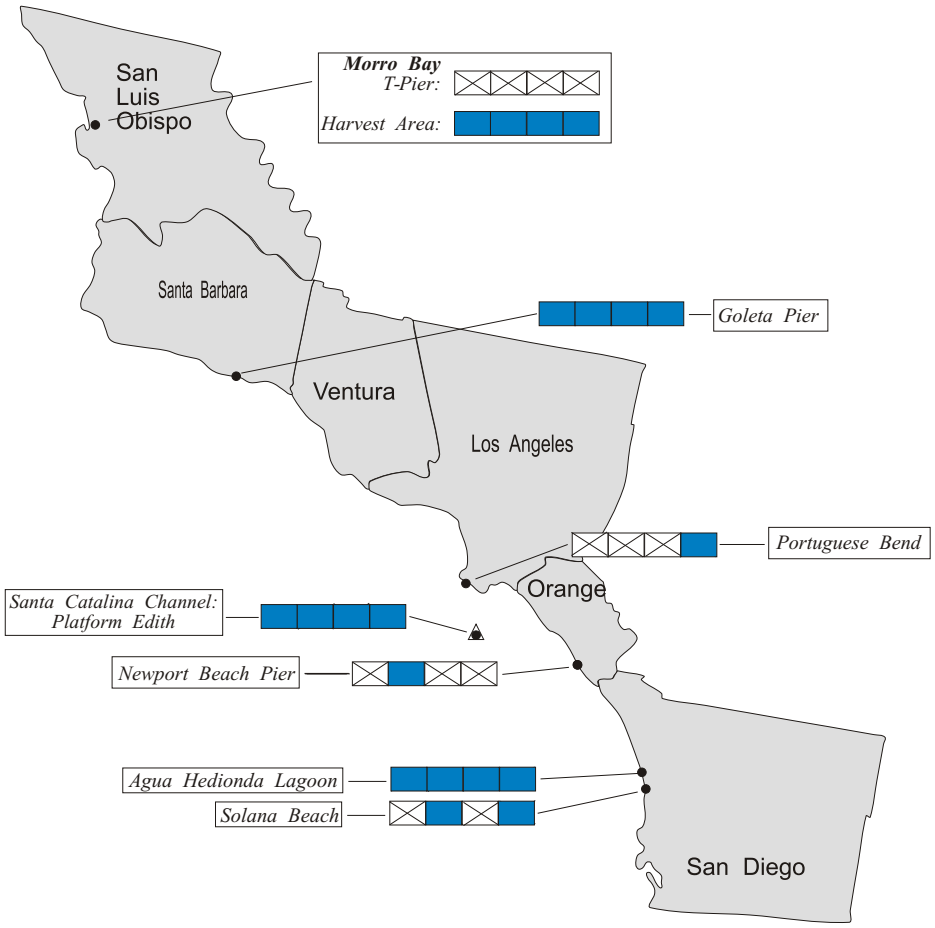
SHELLFISH BIOTOXIN MONTHLY REPORT

January 2002

Technical Report No. 02-09

Distribution of Shellfish Biotoxins

Southern California



KEY FOR SHELLFISH BIOTOXIN DATA

Week:	1	2	3	4
PSP Range: (ug/100 g)	no sample	not detected	< 80[1]	≥ 80
DA Range: (ppm)	no sample	not detected	< 20[2]	≥ 20

[1] PSP Alert Level [2] DA Alert Level
● = Single Site ◉ = Multiple Sites ▲ = Offshore Site

Source: DHS Marine Biotoxin Monitoring and Control Program, January 2002.

INTRODUCTION:

Please note the following conventions: (i) All data are for mussel samples, unless otherwise noted; (ii) All samples are analyzed for PSP toxins; domoic acid (DA) analyses are performed as needed (i.e., on the basis of detected blooms of the diatoms that produce DA). Please refer to the figure key for an explanation of the symbols used for the time of month of sample collection and the toxicity range.

Southern California Summary:

Paralytic Shellfish Poisoning (PSP): PSP toxins were not detected in any shellfish samples from southern California sites during January.

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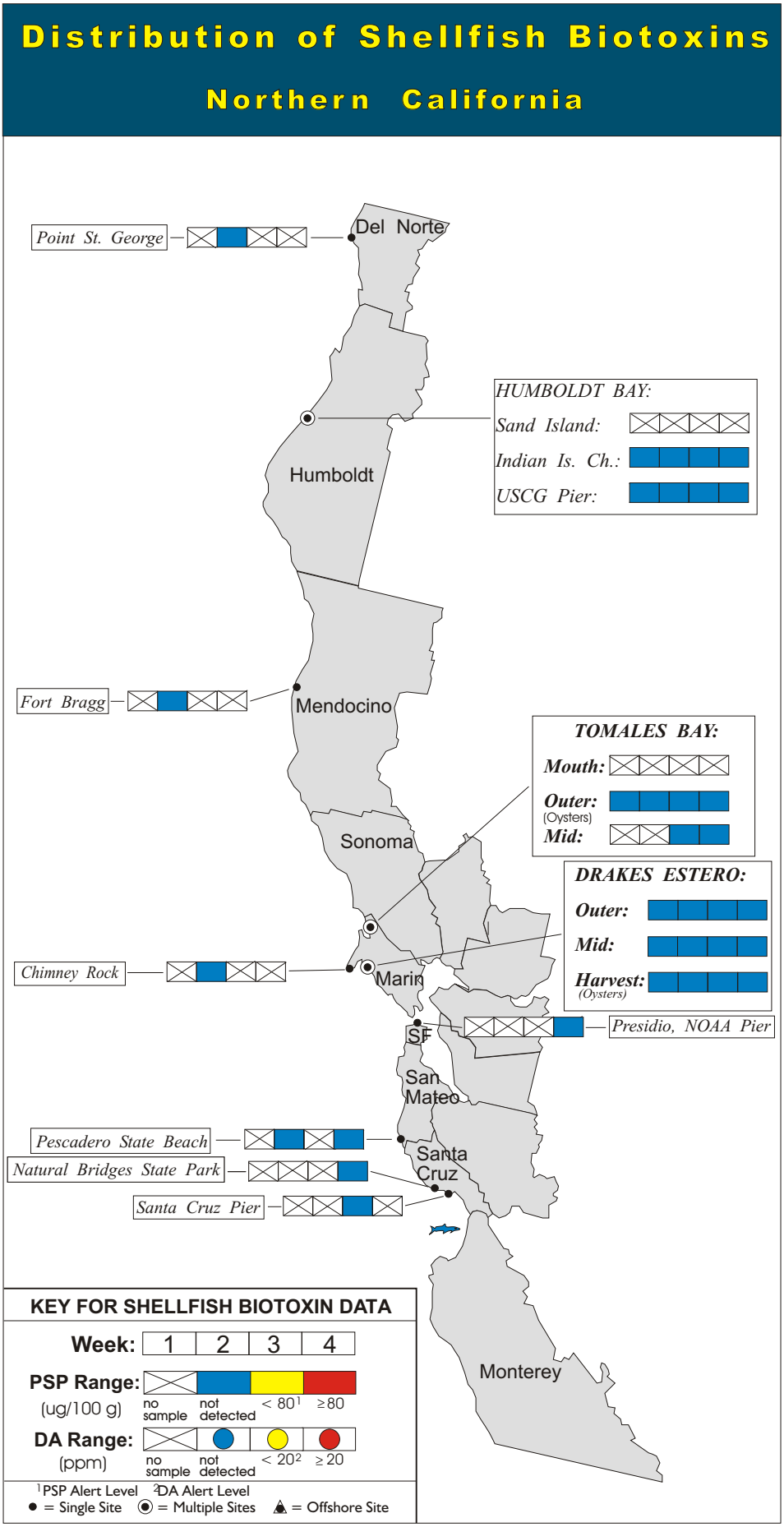

Northern California Summary:

Paralytic Shellfish Poisoning (PSP):

PSP toxins were not detected in shellfish sampled along the northern California coastline during January. The persistent low levels of these toxins that were observed in Humboldt and Del Norte counties during December finally disappeared by January.

Domoic Acid (DA):

Samples of sardines and anchovies caught from Monterey Bay were collected by the DHS Food and Drug Branch and analyzed by the Food and Drug Laboratory. None of the samples tested contained domoic acid.

The Marine Biotoxin Monitoring and Control Program is a state-wide effort involving a consortium of volunteer participants. The shellfish sampling and analysis element of this program is intended to provide an early warning of shellfish toxicity by routinely assessing coastal resources for the presence of paralytic shellfish poisoning (PSP) toxins.

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ENVIRONMENTAL MANAGEMENT BRANCH
Marine Biotoxin Monitoring and Control Program

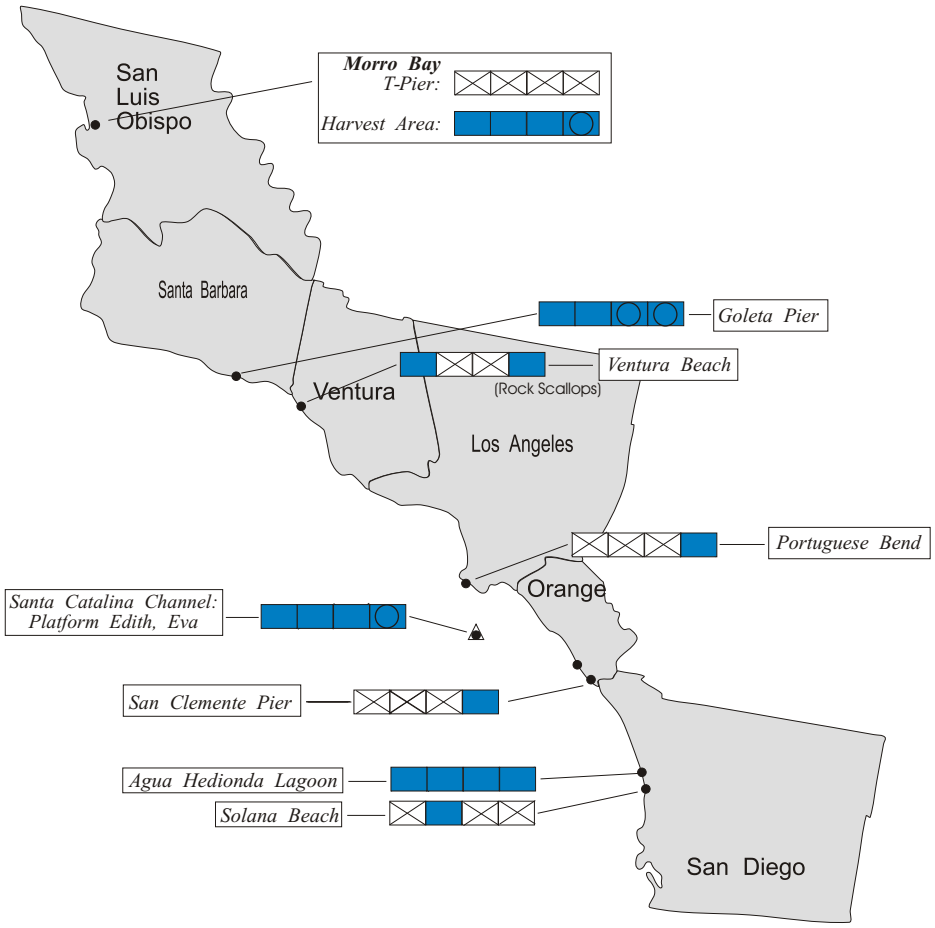
SHELLFISH BIOTOXIN MONTHLY REPORT

February 2002

Technical Report No. 02-11

Distribution of Shellfish Biotoxins

Southern California



KEY FOR SHELLFISH BIOTOXIN DATA

	Week: 1	2	3	4
PSP Range: (ug/100 g)	no sample	not detected	< 80[1]	≥ 80
DA Range: (ppm)	no sample	not detected	< 20[2]	≥ 20

[1] PSP Alert Level [2] DA Alert Level
● = Single Site ◉ = Multiple Sites ▲ = Offshore Site

Source: DHS Marine Biotoxin Monitoring and Control Program, February 2002.

INTRODUCTION:

Please note the following conventions: (i) All data are for mussel samples, unless otherwise noted; (ii) All samples are analyzed for PSP toxins; domoic acid (DA) analyses are performed as needed (i.e., on the basis of detected blooms of the diatoms that produce DA). Please refer to the figure key for an explanation of the symbols used for the time of month of sample collection and the toxicity range.

Southern California Summary:

Paralytic Shellfish Poisoning (PSP): PSP toxins were not detected in any shellfish samples from southern California sites during February.

Domoic Acid (DA):

Although *Pseudo-nitzschia* increased briefly at several locations along the southern California coast in February, DA was not detected in any shellfish samples.

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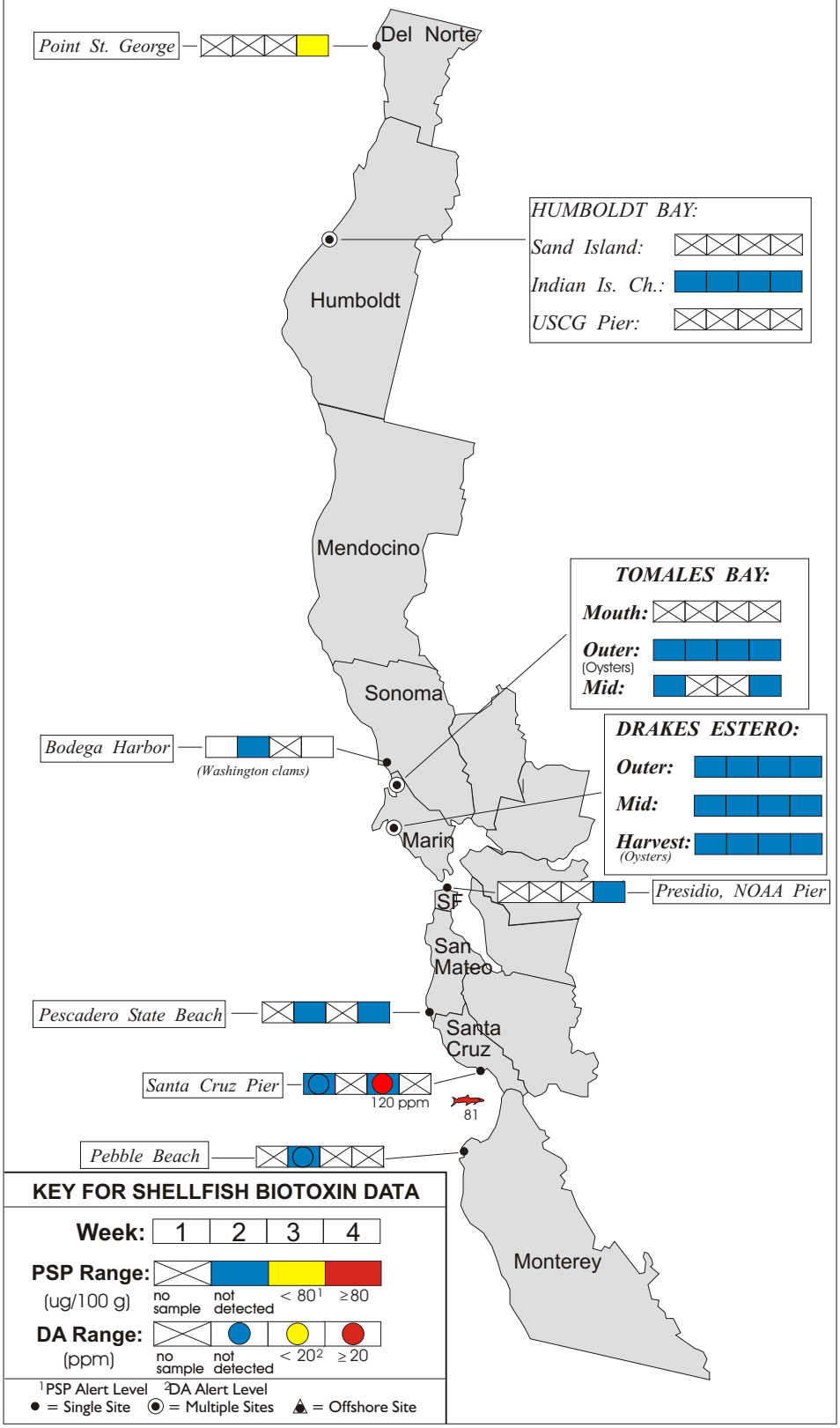
(510) 540-3423

Distribution of Shellfish Biotoxins

Northern California



Northern California Summary:

Paralytic Shellfish Poisoning (PSP):

PSP toxins were detected in shellfish from Point St. George (Del Norte County) on February 26.

Domoic Acid (DA):

An increase in *Pseudo-nitzschia* in the Santa Cruz area of Monterey Bay was detected by researchers at the University of California, Santa Cruz (UCSC) towards the latter part of February. UCSC collected mussel samples on February 21 from the Santa Cruz Pier and shipped them to the DHS Food and Drug Laboratory (FDL). FDL reported a concentration of 120 ppm of DA in this sample, the highest concentration of this toxin ever measured in shellfish from the California coast. Earlier samples from this site (February 2) and along the south coast of Monterey County (February 9) did not contain DA. Samples of sardines and anchovies caught in Monterey Bay were collected by the Food and Drug Branch. Low concentrations of DA were first detected in fish caught on February 18. By February 28 DA concentrations had exceeded the alert level. DHS contacted members of the sampling networks for shellfish and phytoplankton to increase our surveillance of the coast. Despite the high concentration of DA in the Santa Cruz sample there were no reports of marine mammal impacts in this region.

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ENVIRONMENTAL MANAGEMENT BRANCH
Marine Biotoxin Monitoring and Control Program

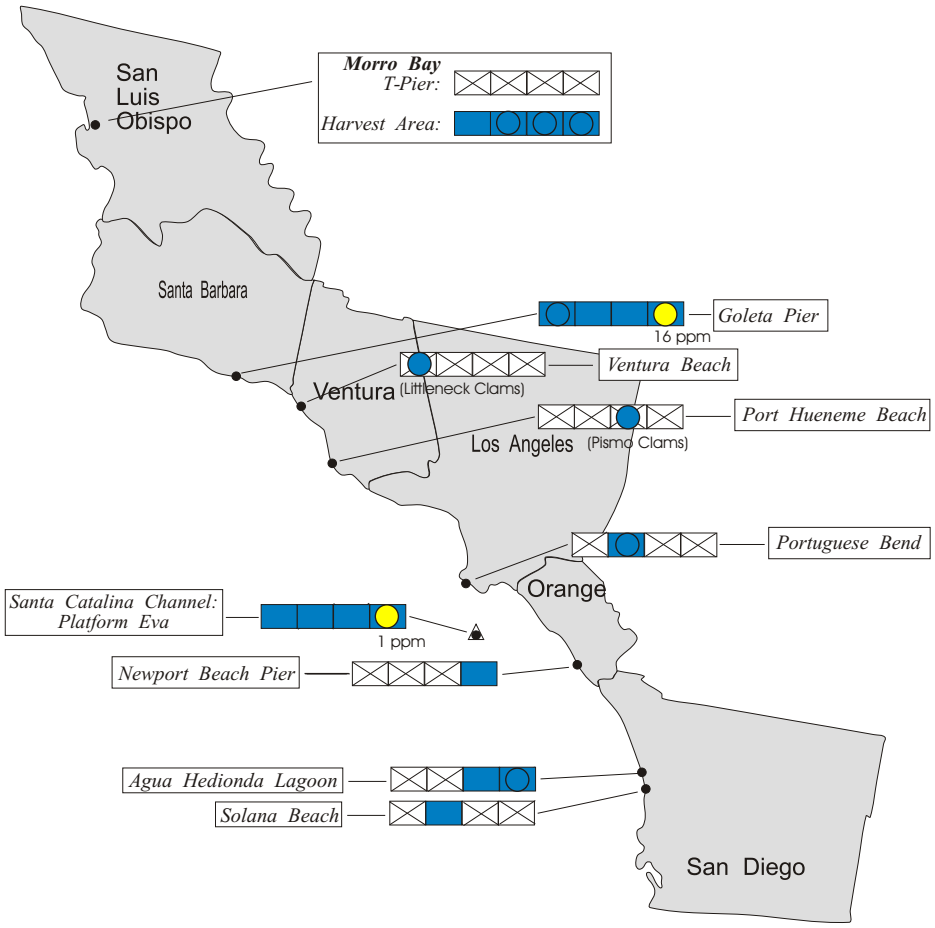
SHELLFISH BIOTOXIN MONTHLY REPORT

March 2002

Technical Report No. 02-13

Distribution of Shellfish Biotoxins

Southern California



KEY FOR SHELLFISH BIOTOXIN DATA

	Week: 1	2	3	4
PSP Range: (ug/100 g)	no sample	not detected	< 80[1]	≥ 80
DA Range: (ppm)	no sample	not detected	< 20[2]	≥ 20

[1]PSP Alert Level [2]DA Alert Level
● = Single Site ◉ = Multiple Sites ▲ = Offshore Site

Source: DHS Marine Biotoxin Monitoring and Control Program, March 2002.

INTRODUCTION:

Please note the following conventions: (i) All data are for mussel samples, unless otherwise noted; (ii) All samples are analyzed for PSP toxins; domoic acid (DA) analyses are performed as needed (i.e., on the basis of detected blooms of the diatoms that produce DA). Please refer to the figure key for an explanation of the symbols used for the time of month of sample collection and the toxicity range.

Southern California Summary:

Paralytic Shellfish Poisoning (PSP): PSP toxins were not detected in any shellfish samples from southern California sites during March.

Domoic Acid (DA):

DA concentrations increased to 16 ppm in mussels from Goleta Pier (Santa Barbara County) by the end of March, coinciding with observed increases in *Pseudo-nitzschia* at this time. A low level of DA was also detected in mussels from offshore of Orange County on March 26.

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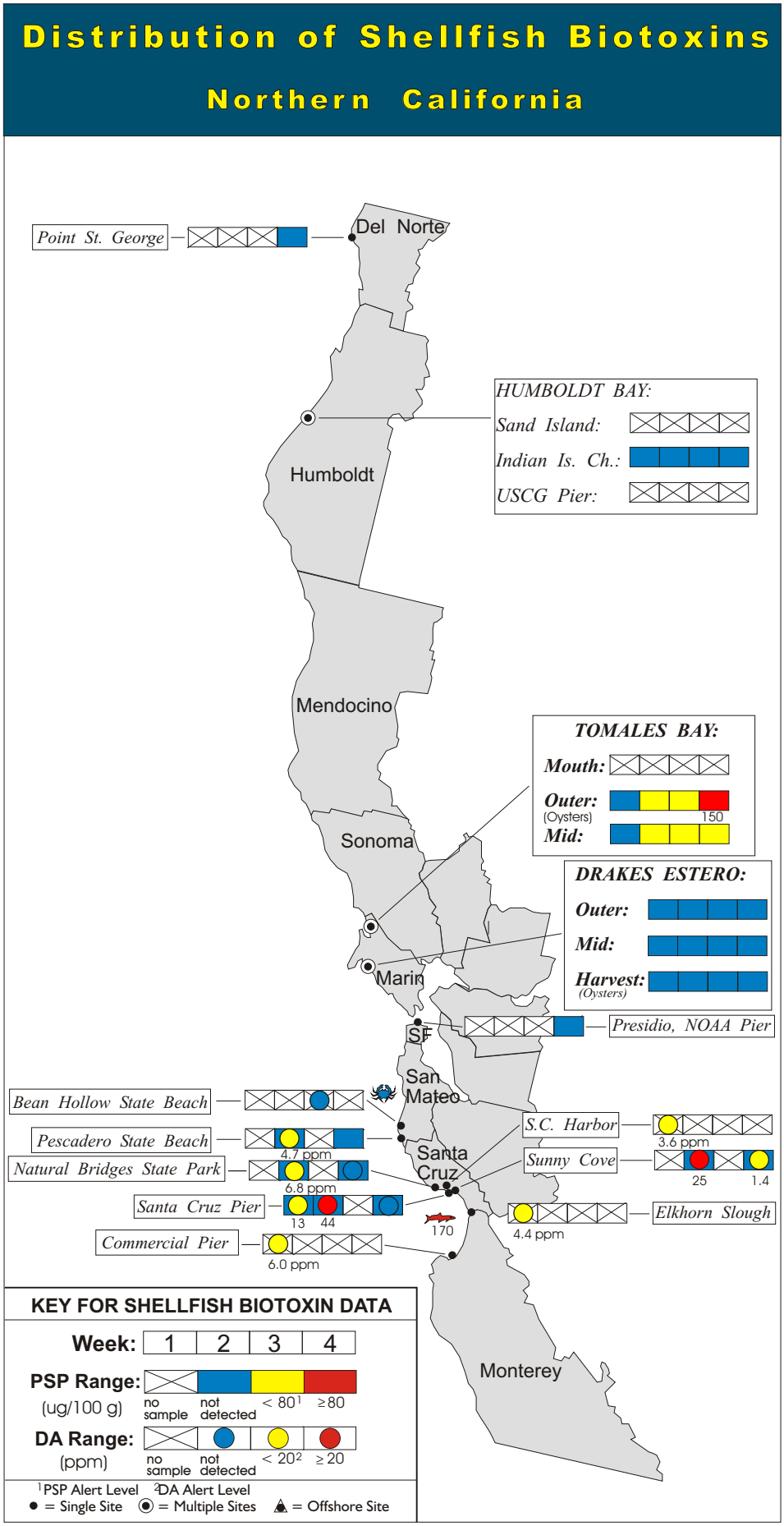

Northern California Summary:

Paralytic Shellfish Poisoning (PSP):

PSP toxins were only detected in shellfish from Tomales Bay (Marin County) during March. By March 31the PSP toxin concentration (150 ug) had exceeded the alert level in the outer Bay, resulting in a harvest closure that remained in effect until the toxin concentration declined to safe levels. Low levels of PSP toxins were also detected in mussels from farther inside Tomales Bay at Marconi Cove. Both of these occurrences are extremely rare, particularly in the absence of PSP toxins elsewhere along the coast.

Domoic Acid (DA):

The high concentration of DA detected in mussels in February from the Santa Cruz Pier declined quickly in the beginning of March. However, there appeared to be a brief increase to 44 ppm on March 12 before concentrations steadily declined to safe levels. The only other location in which DA was detected above the alert level was at Sunny Cove (Santa Cruz County). Mussels collected on March 11 from this site contained 25 ppm DA. Lower levels of DA were detected in mussels from Monterey to San Mateo counties during the first week of March. Anchovies caught in Monterey Bay and collected by the Food and Drug Branch contained elevated levels of DA during the beginning of March and declined throughout the month.

The Marine Biotoxin Monitoring and Control Program is a state-wide effort involving a consortium of volunteer participants. The shellfish sampling and analysis element of this program is intended to provide an early warning of shellfish toxicity by routinely assessing coastal resources for the presence of paralytic shellfish poisoning (PSP) toxins.

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ENVIRONMENTAL MANAGEMENT BRANCH
Marine Biotoxin Monitoring and Control Program

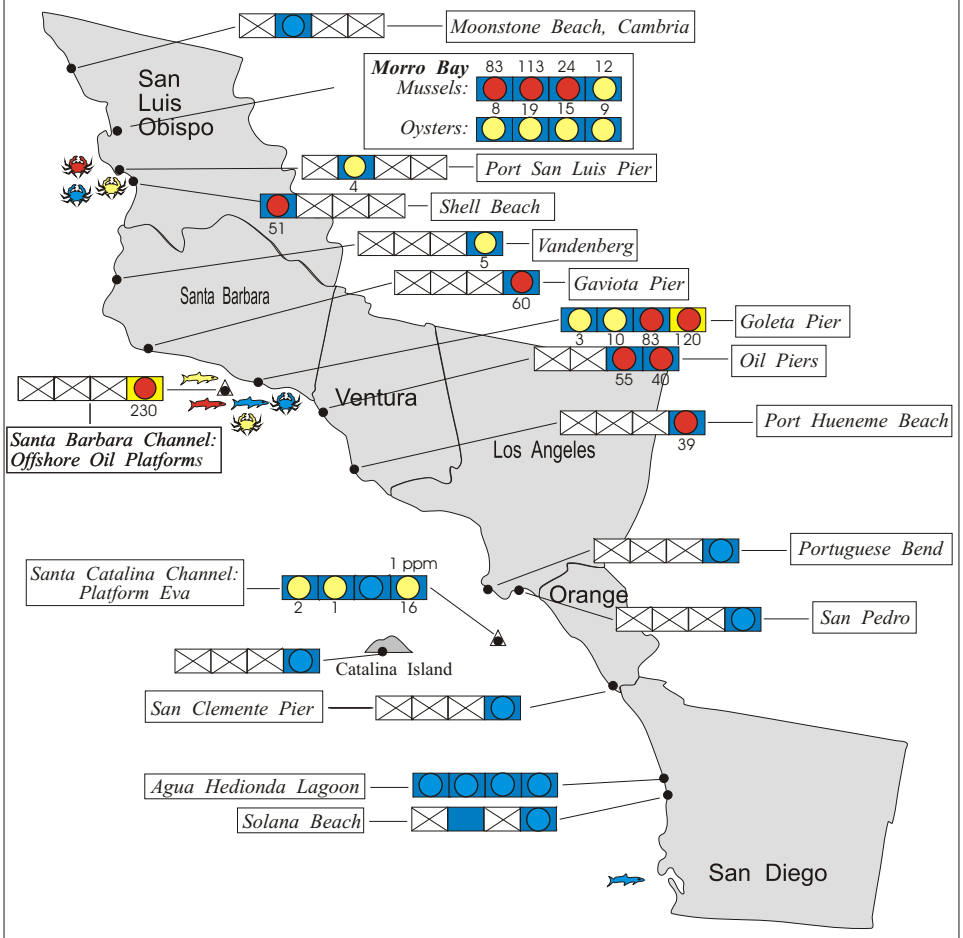
SHELLFISH BIOTOXIN MONTHLY REPORT

April 2002

Technical Report No. 02-15

Distribution of Shellfish Biotoxins

Southern California



KEY FOR SHELLFISH BIOTOXIN DATA

Week:	1	2	3	4
PSP Range: (ug/100 g)	no sample	not detected	< 80[1]	≥ 80
DA Range: (ppm)	no sample	not detected	< 20[2]	≥ 20

[1] PSP Alert Level [2] DA Alert Level
● = Single Site ◉ = Multiple Sites ▲ = Offshore Site

Source: DHS Marine Biotoxin Monitoring and Control Program, April 2002.

INTRODUCTION:

Please note the following conventions: (i) All data are for mussel samples, unless otherwise noted; (ii) All samples are analyzed for PSP toxins; domoic acid (DA) analyses are performed as needed (i.e., on the basis of detected blooms of the diatoms that produce DA). Please refer to the figure key for an explanation of the symbols used for the time of month of sample collection and the toxicity range.

Southern California Summary:

Paralytic Shellfish Poisoning (PSP): Low levels of PSP toxins (40 ug) were detected in mussels from two Santa Barbara County sites during the last week of April.

Domoic Acid (DA):

The first detectable levels of DA in Morro Bay (San Luis Obispo County) occurred on April 1 (56 ppm) and reached a peak concentration of 113 ppm by April 8. The levels of toxin decreased through the month and were nondetectable by May 1.

As DA concentrations in mussels from San Luis Obispo declined, concentrations of this toxin were increasing in shellfish from sites in Santa Barbara County. DA concentrations in mussels from Goleta Pier had briefly increased to 16 ppm at the end of March but declined to lower levels by April 3 (3.2 ppm). DA levels again increased throughout April at this site, exceeding the alert level by April 17 and reaching 120 ppm by April 24. Mussels from an offshore oil platform contained 230 ppm DA, the highest concentration of this toxin ever recorded in California shellfish.

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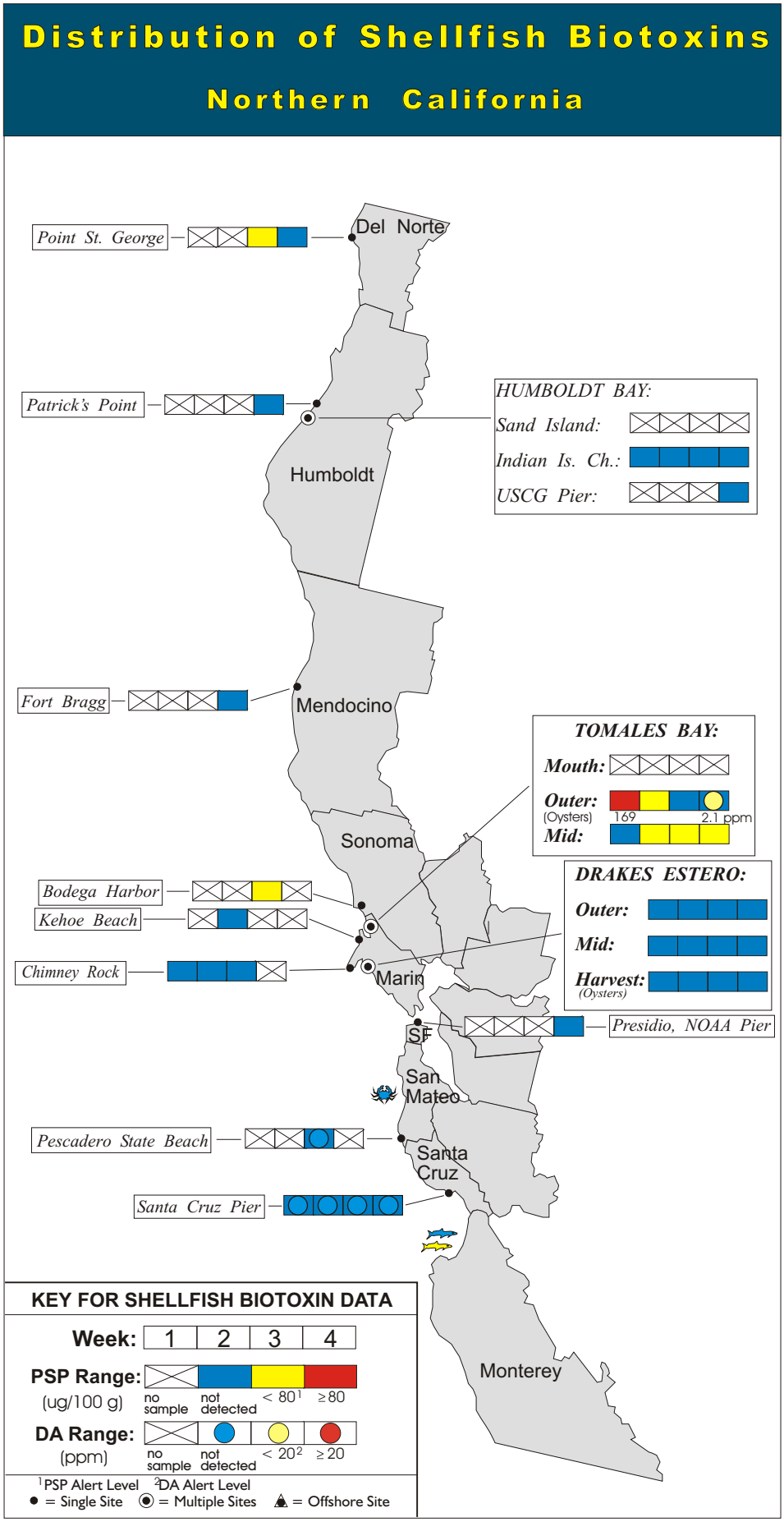

Northern California Summary:

Paralytic Shellfish Poisoning (PSP):

The elevated levels of PSP toxins detected in shellfish from Tomales Bay (Marin County) during March persisted into the first week of April. Oysters from the outer Bay contained 169 ug of toxins on April 2. These high levels steadily declined throughout the month, allowing termination of the harvest closure that had been imposed in March.

Low levels of PSP toxins were also detected in mussels from Bodega Harbor (Sonoma County) and Point St. George (Del Norte County) during the third week of April.

Domoic Acid (DA):

DA was only detected at one northern California site during April. Oysters collected from outer Tomales Bay during the last week in April contained 2 ppm DA.

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ENVIRONMENTAL MANAGEMENT BRANCH
Marine Biotoxin Monitoring and Control Program

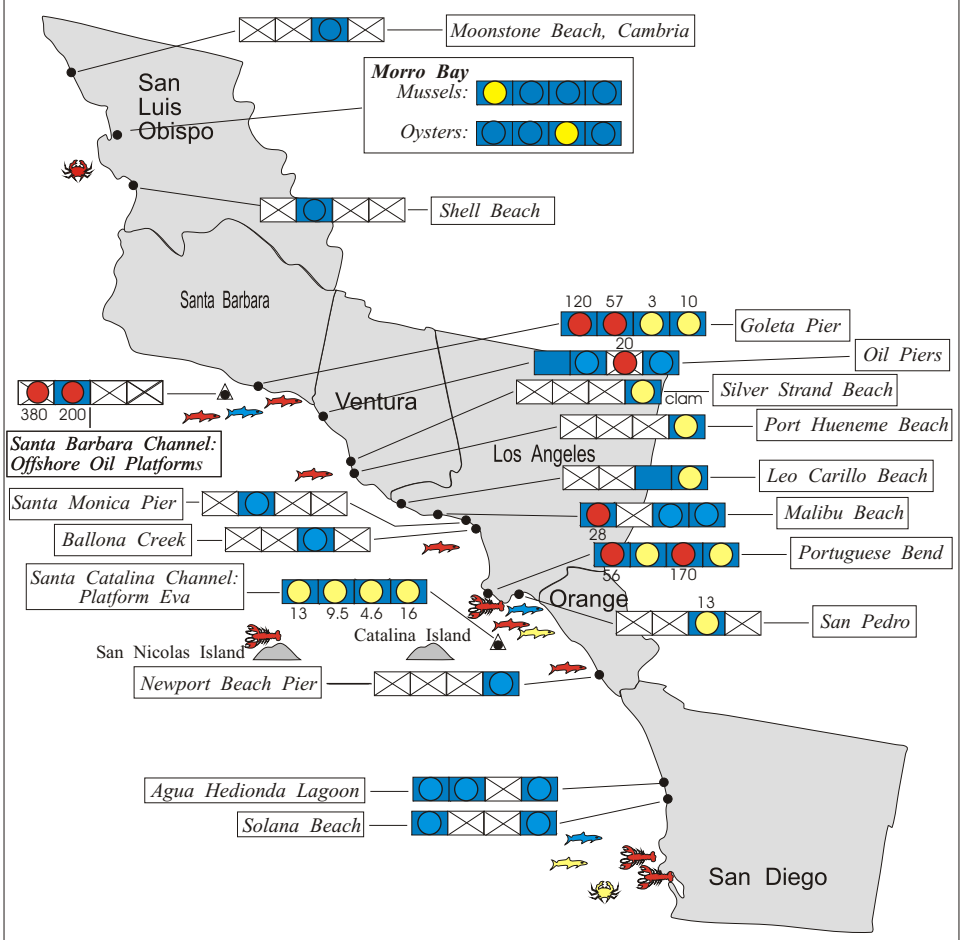
SHELLFISH BIOTOXIN MONTHLY REPORT

May 2002

Technical Report No. 02-17

Distribution of Shellfish Biotoxins

Southern California



KEY FOR SHELLFISH BIOTOXIN DATA

Week:	1	2	3	4
PSP Range: (ug/100 g)	no sample	not detected	< 80[1]	≥ 80
DA Range: (ppm)	no sample	not detected	< 20[2]	≥ 20

[1]PSP Alert Level [2]DA Alert Level
● = Single Site ◉ = Multiple Sites ▲ = Offshore Site

Source: DHS Marine Biotoxin Monitoring and Control Program, May 2002.

INTRODUCTION:

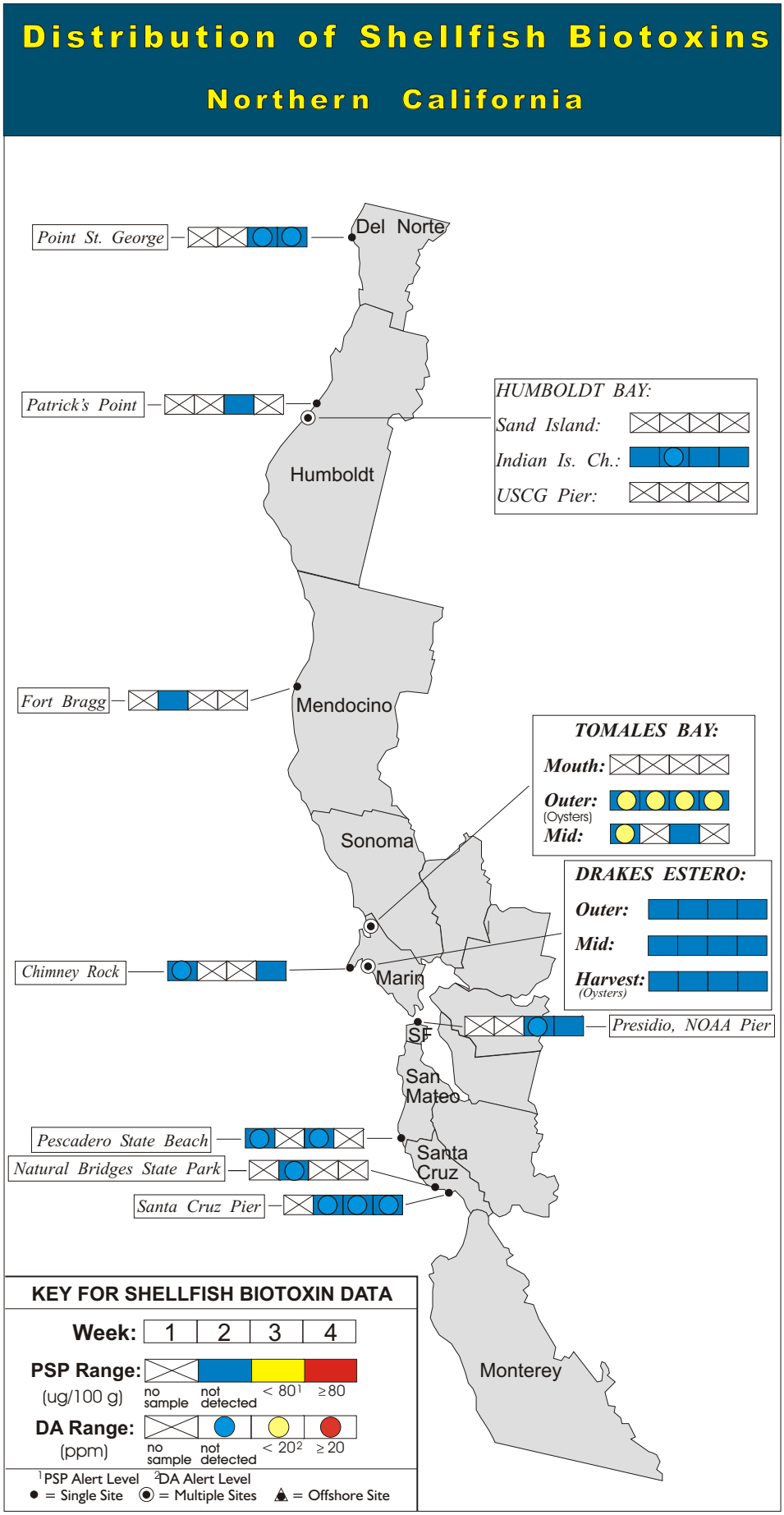
Please note the following conventions: (i) All data are for mussel samples, unless otherwise noted; (ii) All samples are analyzed for PSP toxins; domoic acid (DA) analyses are performed as needed (i.e., on the basis of detected blooms of the diatoms that produce DA). Please refer to the figure key for an explanation of the symbols used for the time of month of sample collection and the toxicity range.

Southern California Summary:

Paralytic Shellfish Poisoning (PSP): PSP toxins were not detected during May.

Domoic Acid (DA):

Concentrations of DA in mussels from Santa Barbara County sites continued to increase through the beginning of May. Peak domoic acid concentrations were detected on May 4 (380 ppm) in mussels collected from an offshore oil platform by researchers from the University of California Santa Barbara. This is the highest concentration of DA ever recorded in California shellfish. As the concentration of DA steadily declined at sites in Santa Barbara, levels of this toxin began increasing at sites along the Los Angeles coast, reaching 170 ppm on May 19. DA concentrations ranged from high to nondetectable in samples of sardine and anchovy collected by the DHS Food and Drug Branch. Pelagic red crab sampled by participants in San Diego, San Nicolas Island, and Los Angeles contained high levels of DA, reaching 374 ppm in an offshore sample (May 27). This is the first known documentation of elevated DA levels in this species and has potential significance both for human health risk and as a vector of DA for other marine species (e.g., mammals, birds). See the quarterly newsletter for more information on these and other findings.



Northern California Summary:

Paralytic Shellfish Poisoning (PSP):

PSP toxins were not detected in shellfish from northern California sites during May.

Domoic Acid (DA):

DA was only detected inside Tomales Bay during May. The low levels of DA in oysters from outer Tomales Bay detected in April continued through May. DA concentrations in this region did not exceed 2.4 ppm. DA was also detected in oysters farther inside the Bay near Cypress Point (1.2 ppm).

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ENVIRONMENTAL MANAGEMENT BRANCH
Marine Biotoxin Monitoring and Control Program

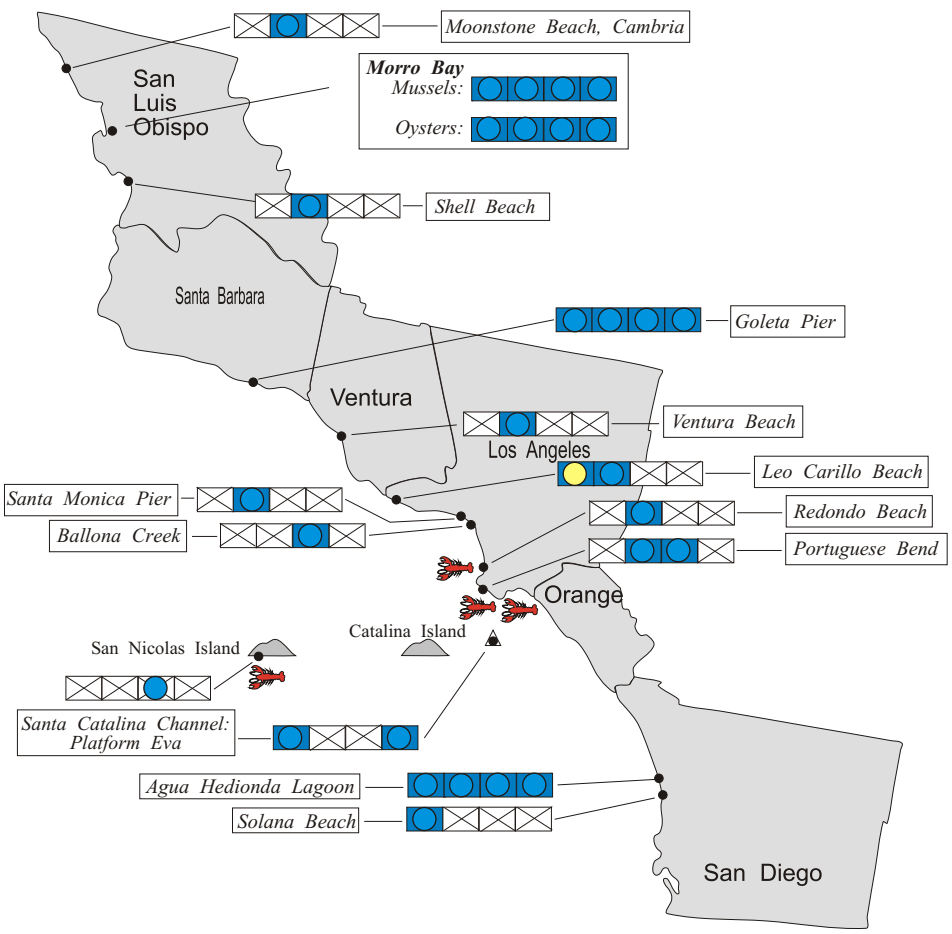
SHELLFISH BIOTOXIN MONTHLY REPORT

June 2002

Technical Report No. 02-19

Distribution of Shellfish Biotoxins

Southern California



KEY FOR SHELLFISH BIOTOXIN DATA

Week:	1	2	3	4
PSP Range: (ug/100 g)	no sample	not detected	< 80[1]	≥80
DA Range: (ppm)	no sample	not detected	< 20[2]	≥ 20

[1]PSP Alert Level [2]DA Alert Level
● = Single Site ◉ = Multiple Sites ▲ = Offshore Site

Source: DHS Marine Biotoxin Monitoring and Control Program, June 2002.

INTRODUCTION:

Please note the following conventions: (i) All data are for mussel samples, unless otherwise noted; (ii) All samples are analyzed for PSP toxins; domoic acid (DA) analyses are performed as needed (i.e., on the basis of detected blooms of the diatoms that produce DA). Please refer to the figure key for an explanation of the symbols used for the time of month of sample collection and the toxicity range.

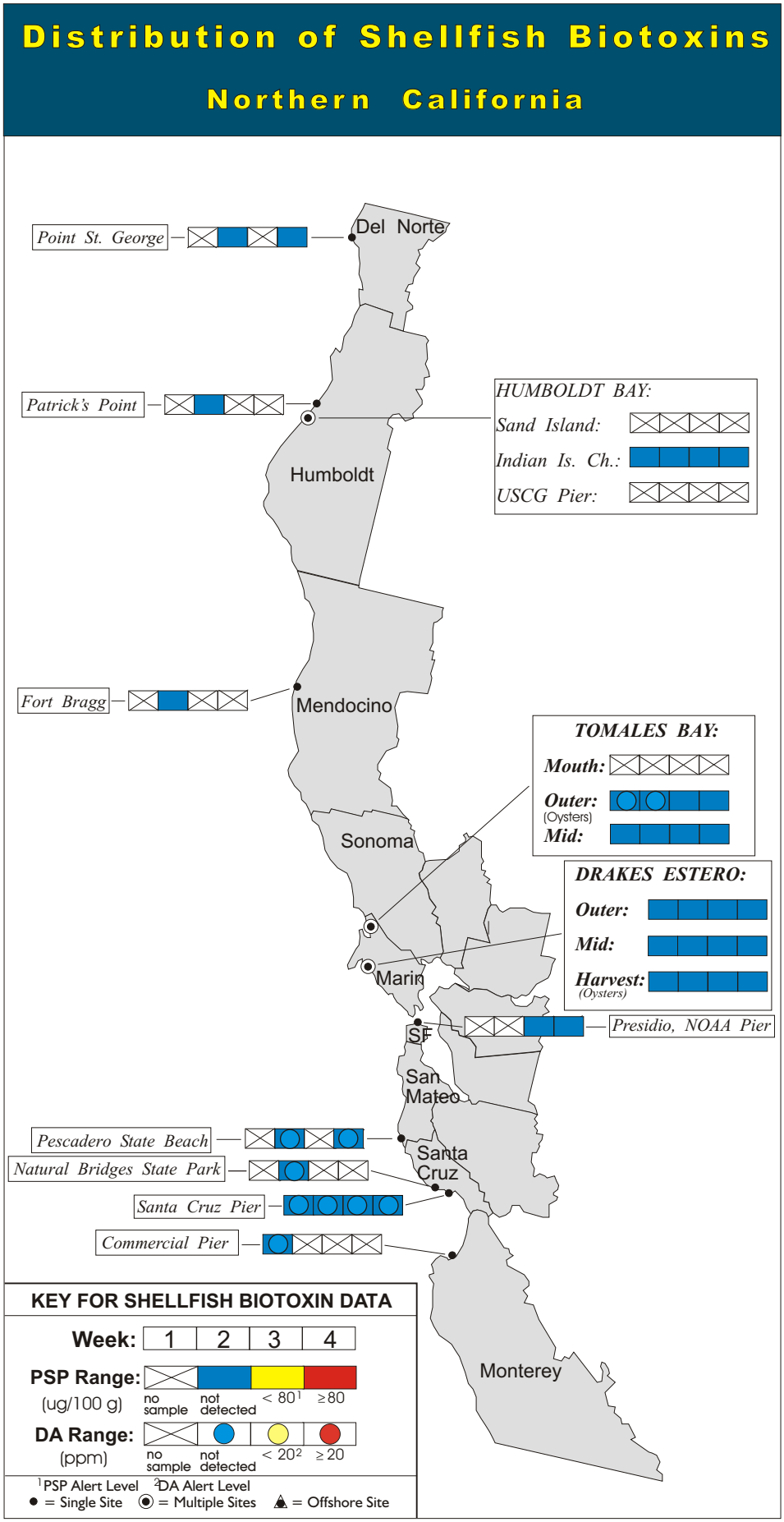
Southern California Summary:

Paralytic Shellfish Poisoning (PSP): PSP toxins were not detected during June.

Domoic Acid (DA):

DA was absent from most mussel samples in June. Only one site, Leo Carillo Beach (Los Angeles County), had a detectable level of DA (2.7 ppm on June3).

In contrast, samples of pelagic red crab from both nearshore and offshore of Los Angeles continued to contain high levels of domoic acid. The highest concentration detected was 240 ppm on June 12 at Cabrillo Beach. A sample of pelagic crabs collected at Royal Palms Beach on June 6 contained 210 ppm of DA. The concentration of DA in pelagic crab from offshore appeared to decrease from May's observations, containing 98 ppm on June 16. A sample of lobster viscera collected from Redondo Beach on June 12 contained 37 ppm of DA. Rock scallops from this same site did not contain DA in either the viscera or adductor muscle.



Northern California Summary:

Paralytic Shellfish Poisoning (PSP):

PSP toxins were not detected in shellfish from northern California sites during June.

Domoic Acid (DA):

DA was not detected in shellfish from northern California sites during June.

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ENVIRONMENTAL MANAGEMENT BRANCH
Marine Biotoxin Monitoring and Control Program

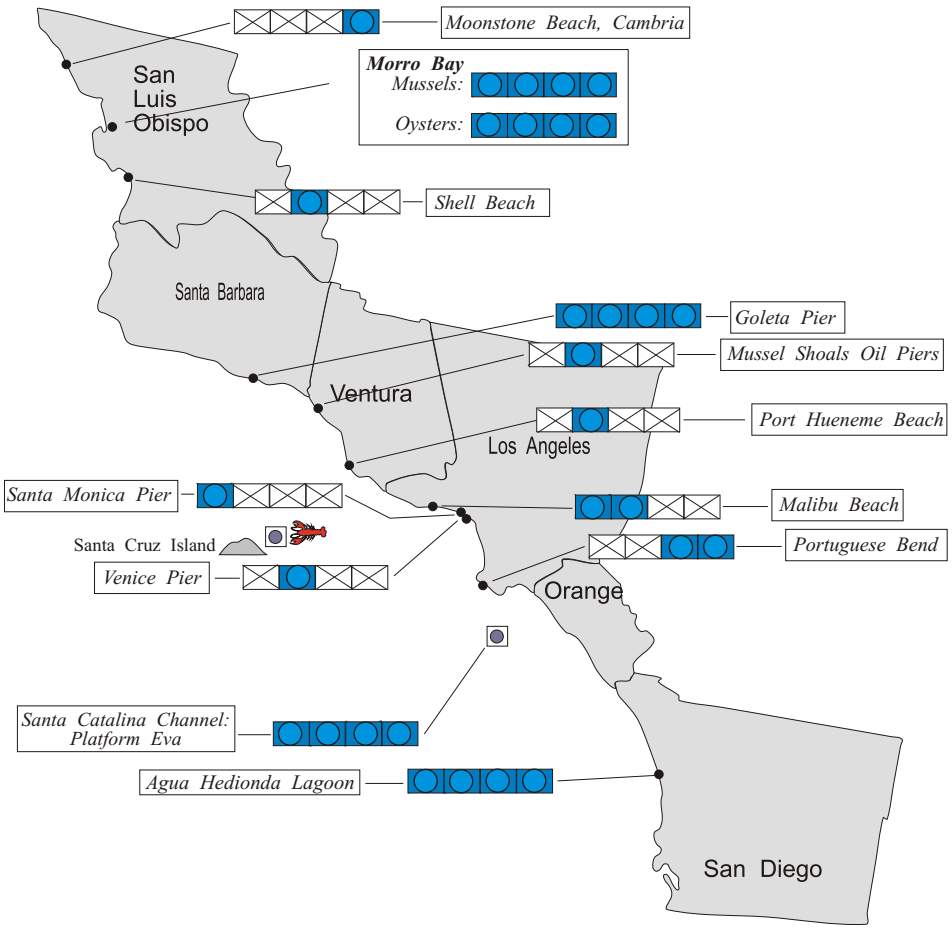
SHELLFISH BIOTOXIN MONTHLY REPORT

July 2002

Technical Report No. 02-24

Distribution of Shellfish Biotoxins

Southern California



KEY FOR SHELLFISH BIOTOXIN DATA

Week: 1 2 3 4

PSP Range: (ug/100 g) — no sample | not detected | < 80[1] | ≥80

DA Range: (ppm) — no sample | not detected | < 20[2] | ≥ 20

[1]PSP Alert Level [2]DA Alert Level
● = Single Site ◉ = Multiple Sites ◉ = Offshore Site

Source: DHS Marine Biotoxin Monitoring and Control Program, July 2002.

INTRODUCTION:

Please note the following conventions: (i) All data are for mussel samples, unless otherwise noted; (ii) All samples are analyzed for PSP toxins; domoic acid (DA) analyses are performed as needed (i.e., on the basis of detected blooms of the diatoms that produce DA). Please refer to the figure key for an explanation of the symbols used for the time of month of sample collection and the toxicity range.

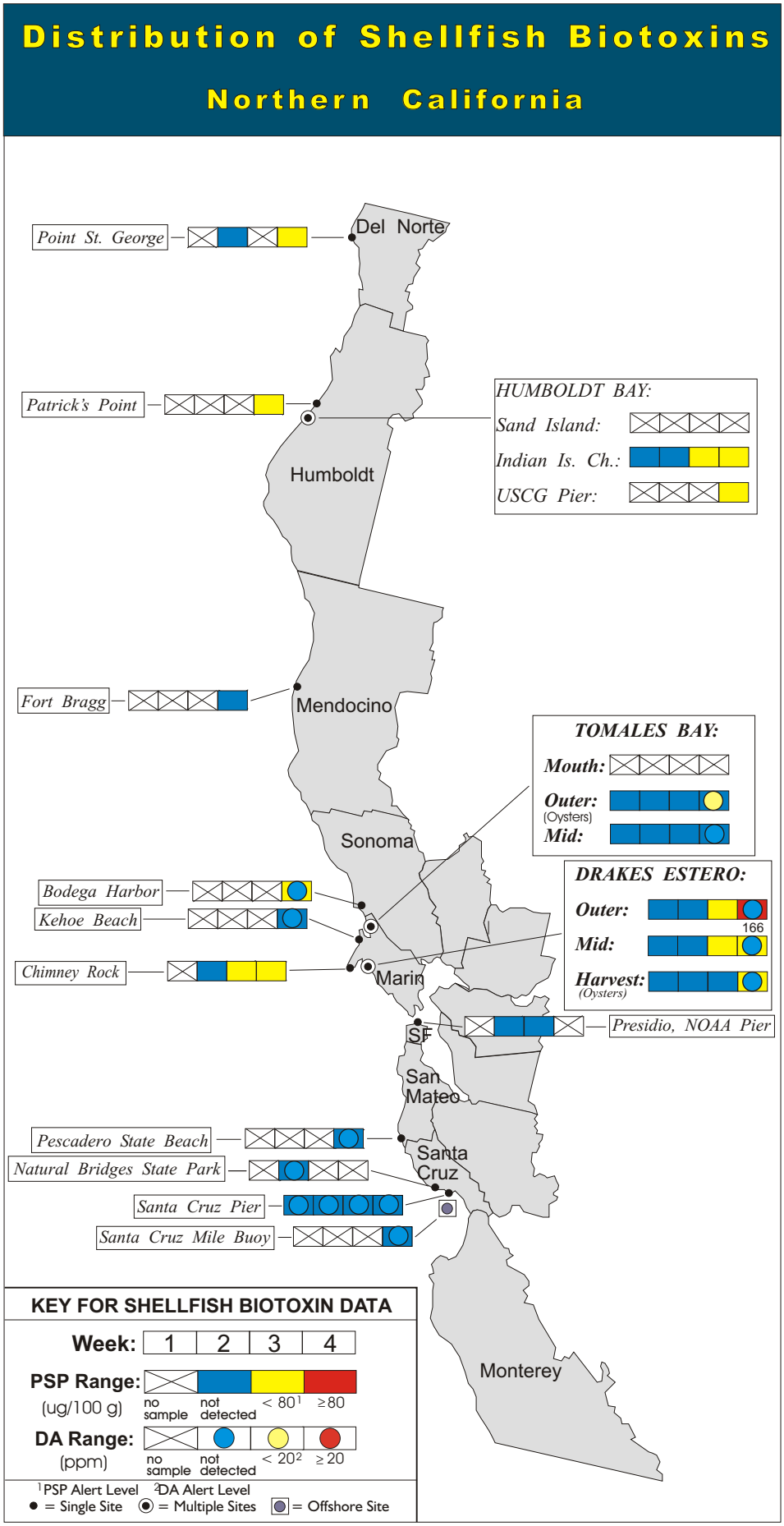
Southern California Summary:

Paralytic Shellfish Poisoning (PSP): PSP toxins were not detected in shellfish samples from southern California locations during July.

Domoic Acid (DA):

DA was not detected in bivalve shellfish samples from southern California locations during July.

Continued high levels of domoic acid were detected in pelagic red crab. A sample of these crustaceans collected offshore near Santa Cruz Island by the Catalina Tall Ship Expeditions contained 120 ppm (July 10).



Northern California Summary:

Paralytic Shellfish Poisoning (PSP):

PSP toxins were detected in shellfish from several northern California sites during July. By July 16 low levels of PSP toxins were detected in mussels from Marin and Humboldt counties. Low levels of toxicity were also detected in samples from Sonoma and Del Norte counties by the end of the month. The low levels of toxin detected along the Marin coast were localized to the Drakes Bay region: the sentinel station at Chimney Rock and inside Drakes Estero. By the last week in July toxin levels increased above the alert level in mussels from the Drakes Estero outer channel sentinel buoy (166 ug). Toxin levels increased to 64 ug in mussels from the mid Estero. Toxin levels remained low at the Chimney Rock sentinel station and were absent at Kehoe Beach, located farther north along the Marin coast.

Domoic Acid (DA):

DA was not detected in shellfish from northern California sites during July.

The Marine Biotoxin Monitoring and Control Program is a state-wide effort involving a consortium of volunteer participants. The shellfish sampling and analysis element of this program is intended to provide an early warning of shellfish toxicity by routinely assessing coastal resources for the presence of paralytic shellfish poisoning (PSP) toxins.

For More Information Please Call:
(510) 540 - 3423

For Recorded Biotoxin Information Call:
(800) 553 - 4133

CALIFORNIA DEPARTMENT OF HEALTH SERVICES
2151 Berkeley Way, Berkeley CA 94704-1011

ENVIRONMENTAL MANAGEMENT BRANCH
Marine Biotoxin Monitoring and Control Program

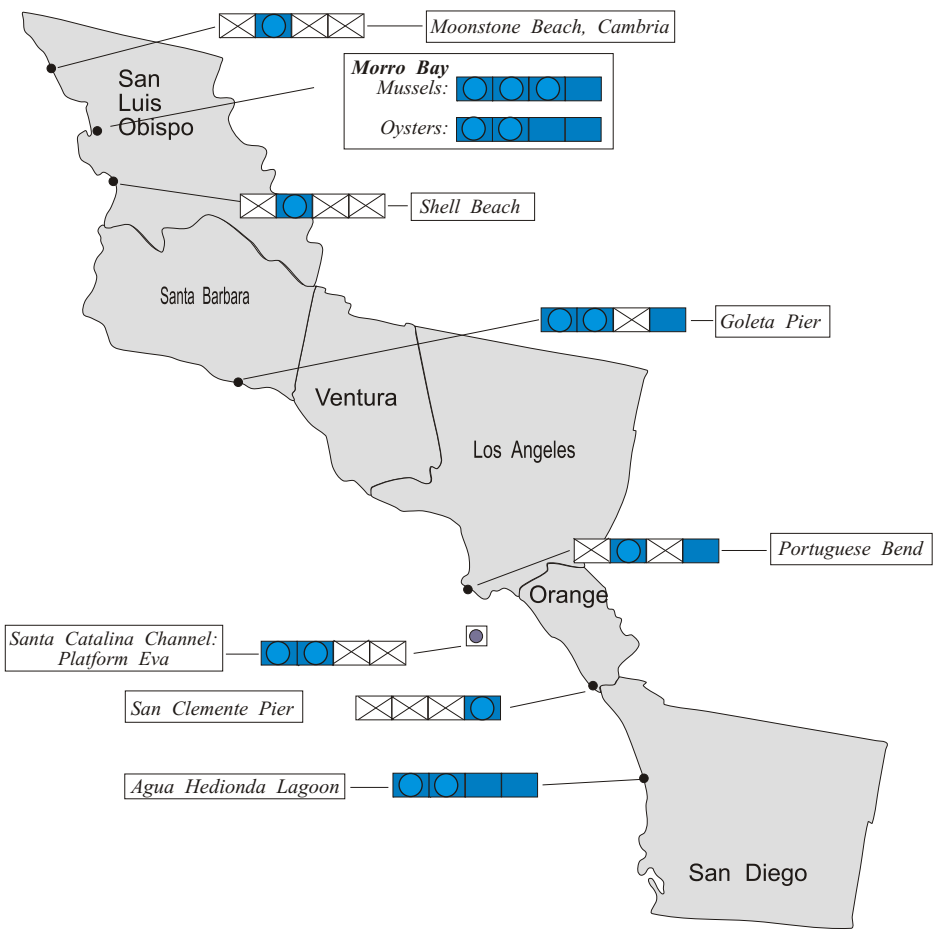
SHELLFISH BIOTOXIN MONTHLY REPORT

August 2002

Technical Report No. 02-26

Distribution of Shellfish Biotoxins

Southern California



KEY FOR SHELLFISH BIOTOXIN DATA

	Week: 1	2	3	4
PSP Range: (ug/100 g)	no sample	not detected	< 80[1]	≥80
DA Range: (ppm)	no sample	not detected	< 20[2]	≥ 20

[1]PSP Alert Level [2]DA Alert Level
● = Single Site ◉ = Multiple Sites ◍ = Offshore Site

Source: DHS Marine Biotoxin Monitoring and Control Program, August 2002.

INTRODUCTION:

Please note the following conventions: (i) All data are for mussel samples, unless otherwise noted; (ii) All samples are analyzed for PSP toxins; domoic acid (DA) analyses are performed as needed (i.e., on the basis of detected blooms of the diatoms that produce DA). Please refer to the figure key for an explanation of the symbols used for the time of month of sample collection and the toxicity range.

Southern California Summary:

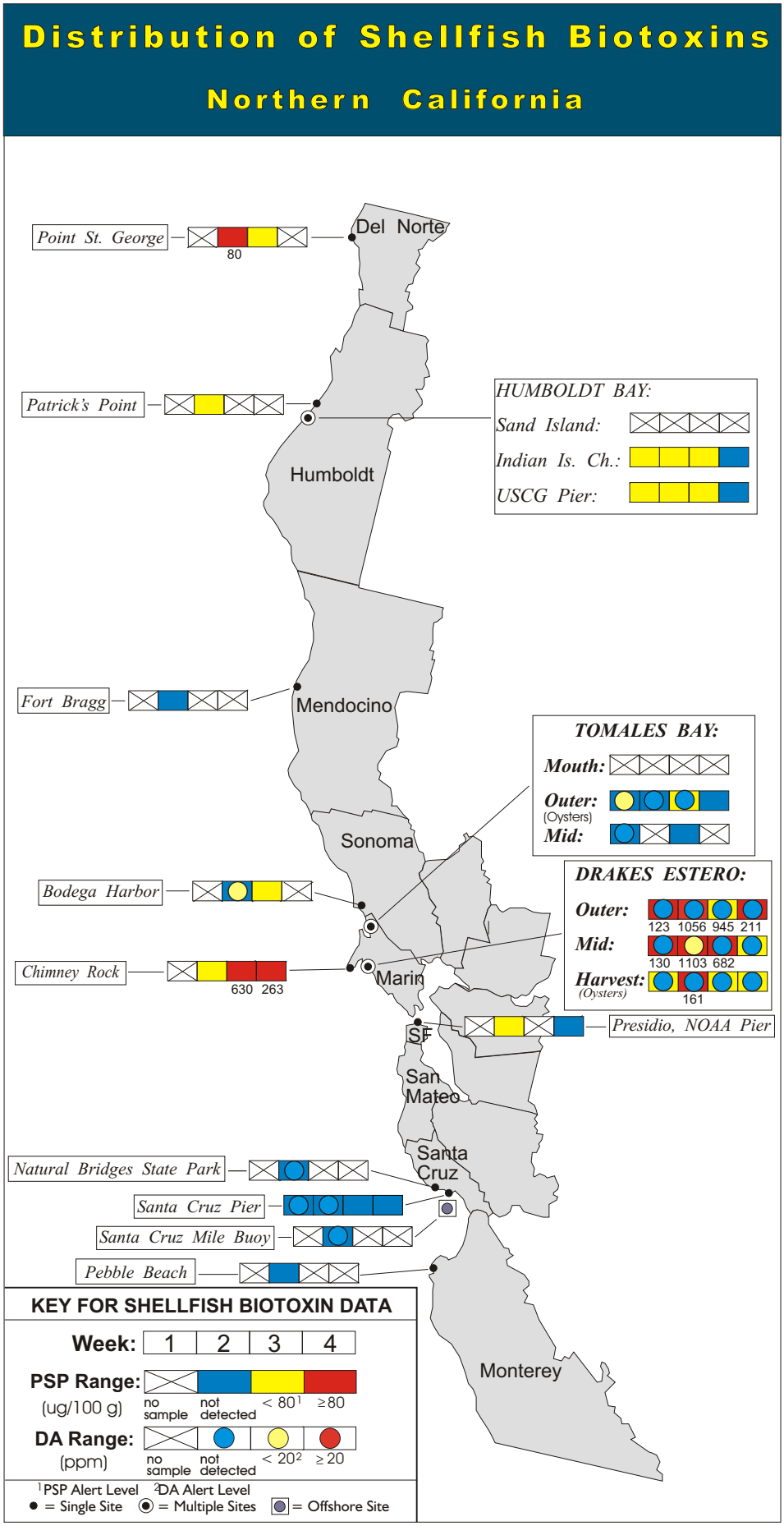
Paralytic Shellfish Poisoning (PSP): PSP toxins were not detected in shellfish samples from southern California locations during August.

Domoic Acid (DA):

DA was not detected in shellfish samples from southern California locations during August.

For Information on our Volunteer Field Sampling Program Please Call:

(510) 540-3423



Northern California Summary:

Paralytic Shellfish Poisoning (PSP):

The low levels of PSP toxins detected in mussels from Humboldt and Del Norte counties at the end of July persisted through most of August. Toxin concentrations increased to 80 ug in mussels from Point Saint George (Del Norte County) by August 9.

The low levels of toxin detected along the Marin coast at the end of July increased above the alert level by the first week of August. By August 13 mussels from Drakes Estero reached 1056 ug and 1103 ug at the outer channel sentinel buoy and in the mid Estero, respectively. These elevated toxin levels began decreasing throughout the remainder of the month but remained above the alert level at the outer Estero sentinel buoy and at the Chimney Rock sentinel station.

Domoic Acid (DA):

Low levels of DA were detected in shellfish from several sites during July. The first positive sample was collected on August 1 from Tomales Bay. Oysters from two different outer bay locations contained 3.9 and 2.7 ppm DA, respectively, and reached 5 ppm by August 6. By the second week in August low levels were also detected in Bodega Harbor (6.9 ppm) and Drakes Estero (1.9 ppm). DA was not detected beyond the second week in August.

The Marine Biotoxin Monitoring and Control Program is a state-wide effort involving a consortium of volunteer participants. The shellfish sampling and analysis element of this program is intended to provide an early warning of shellfish toxicity by routinely assessing coastal resources for the presence of paralytic shellfish poisoning (PSP) toxins.

For More Information Please Call:
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For Recorded Biotoxin Information Call:
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2151 Berkeley Way, Berkeley CA 94704-1011

ENVIRONMENTAL MANAGEMENT BRANCH
Marine Biotoxin Monitoring and Control Program

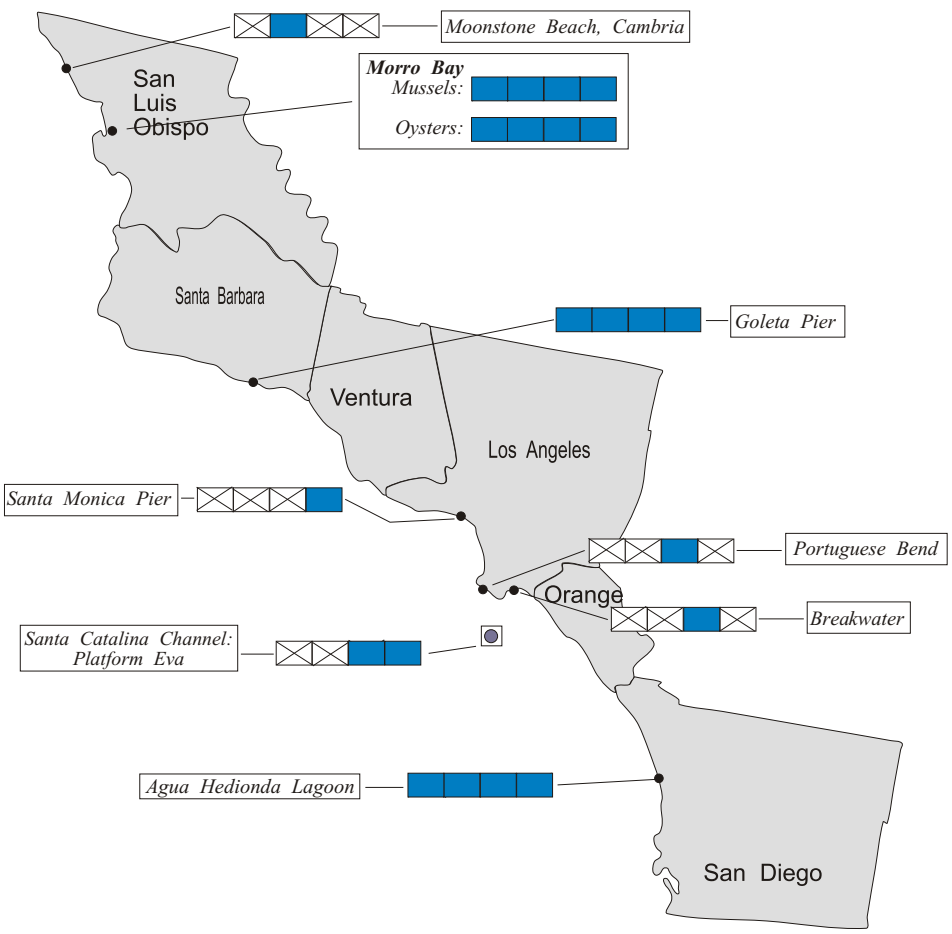
SHELLFISH BIOTOXIN MONTHLY REPORT

September 2002

Technical Report No. 02-28

Distribution of Shellfish Biotoxins

Southern California



KEY FOR SHELLFISH BIOTOXIN DATA

Week:	1	2	3	4
PSP Range: (ug/100 g)	no sample	not detected	< 80[1]	≥80
DA Range: (ppm)	no sample	not detected	< 20[2]	≥ 20

[1]PSP Alert Level [2]DA Alert Level
● = Single Site ◉ = Multiple Sites ◙ = Offshore Site

Source: DHS Marine Biotoxin Monitoring and Control Program, September 2002.

INTRODUCTION:

Please note the following conventions: (i) All data are for mussel samples, unless otherwise noted; (ii) All samples are analyzed for PSP toxins; domoic acid (DA) analyses are performed as needed (i.e., on the basis of detected blooms of the diatoms that produce DA). Please refer to the figure key for an explanation of the symbols used for the time of month of sample collection and the toxicity range.

Southern California Summary:

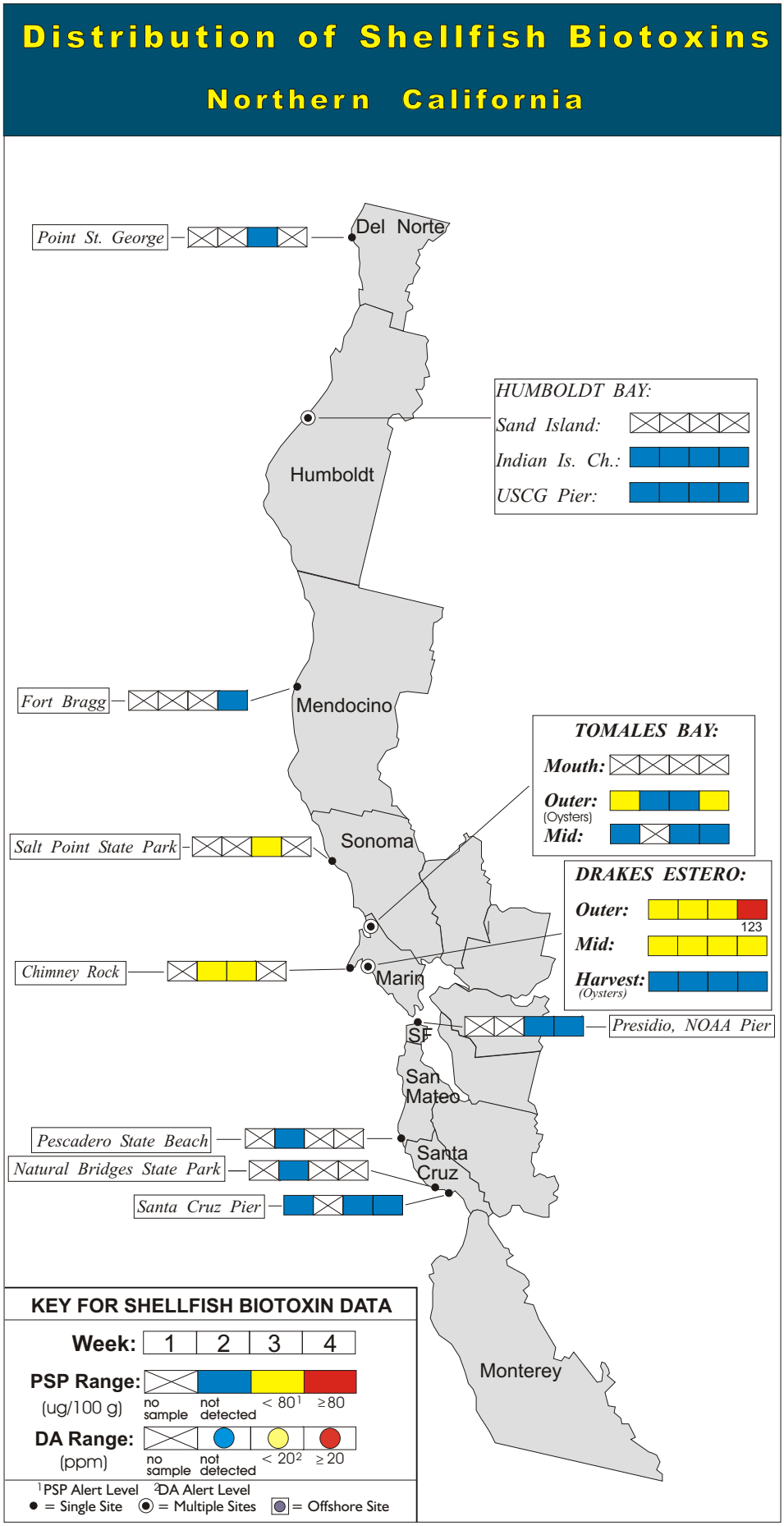
Paralytic Shellfish Poisoning (PSP): PSP toxins were not detected in shellfish samples from southern California locations during September.

Domoic Acid (DA):

DA was not detected in shellfish samples from southern California locations during September.

For Information on our Volunteer Field Sampling Program Please Call:

(510) 540-3423



Northern California Summary:

Paralytic Shellfish Poisoning (PSP):

Levels of PSP toxins continued to decline through September but persisted at several locations in Marin and Sonoma counties for much of the month.

There was a brief resurgence of toxicity in mussels from the outer channel sentinel buoy in Drakes Estero during the last week of September. The PSP toxin concentration increased to 123 ug on August 27 and decreased slightly to 89 ug by August 30.

The Marine Biotoxin Monitoring and Control Program is a state-wide effort involving a consortium of volunteer participants. The shellfish sampling and analysis element of this program is intended to provide an early warning of shellfish toxicity by routinely assessing coastal resources for the presence of paralytic shellfish poisoning (PSP) toxins.

For More Information Please Call:
(510) 540 - 3423

For Recorded Biotoxin Information Call:
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ENVIRONMENTAL MANAGEMENT BRANCH
Marine Biotoxin Monitoring and Control Program

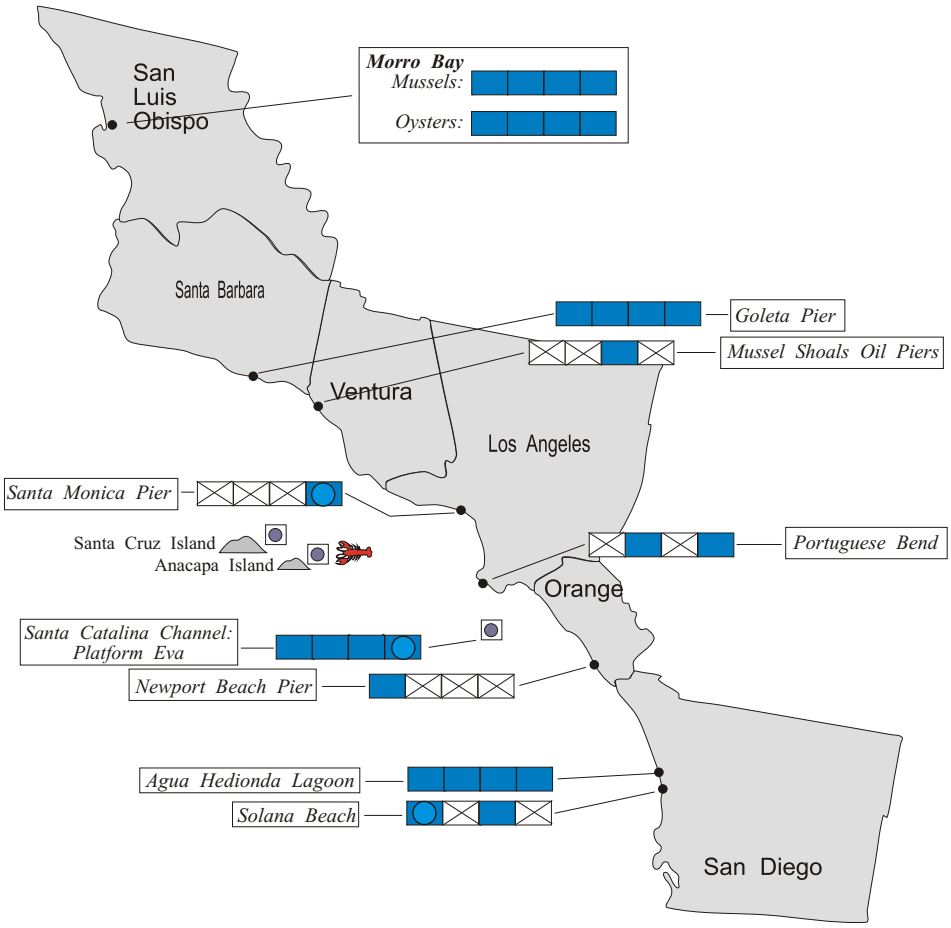
SHELLFISH BIOTOXIN MONTHLY REPORT

October 2002

Technical Report No. 02-30

Distribution of Shellfish Biotoxins

Southern California



KEY FOR SHELLFISH BIOTOXIN DATA

Week:	1	2	3	4

PSP Range: (ug/100 g)

no sample	not detected	< 80[1]	≥80

DA Range: (ppm)

no sample	not detected	< 20[2]	≥ 20

[1]PSP Alert Level [2]DA Alert Level
● = Single Site ◉ = Multiple Sites ▣ = Offshore Site

Source: DHS Marine Biotoxin Monitoring and Control Program, October 2002.

INTRODUCTION:

Please note the following conventions: (i) All data are for mussel samples, unless otherwise noted; (ii) All samples are analyzed for PSP toxins; domoic acid (DA) analyses are performed as needed (i.e., on the basis of detected blooms of the diatoms that produce DA). Please refer to the figure key for an explanation of the symbols used for the time of month of sample collection and the toxicity range.

Southern California Summary:

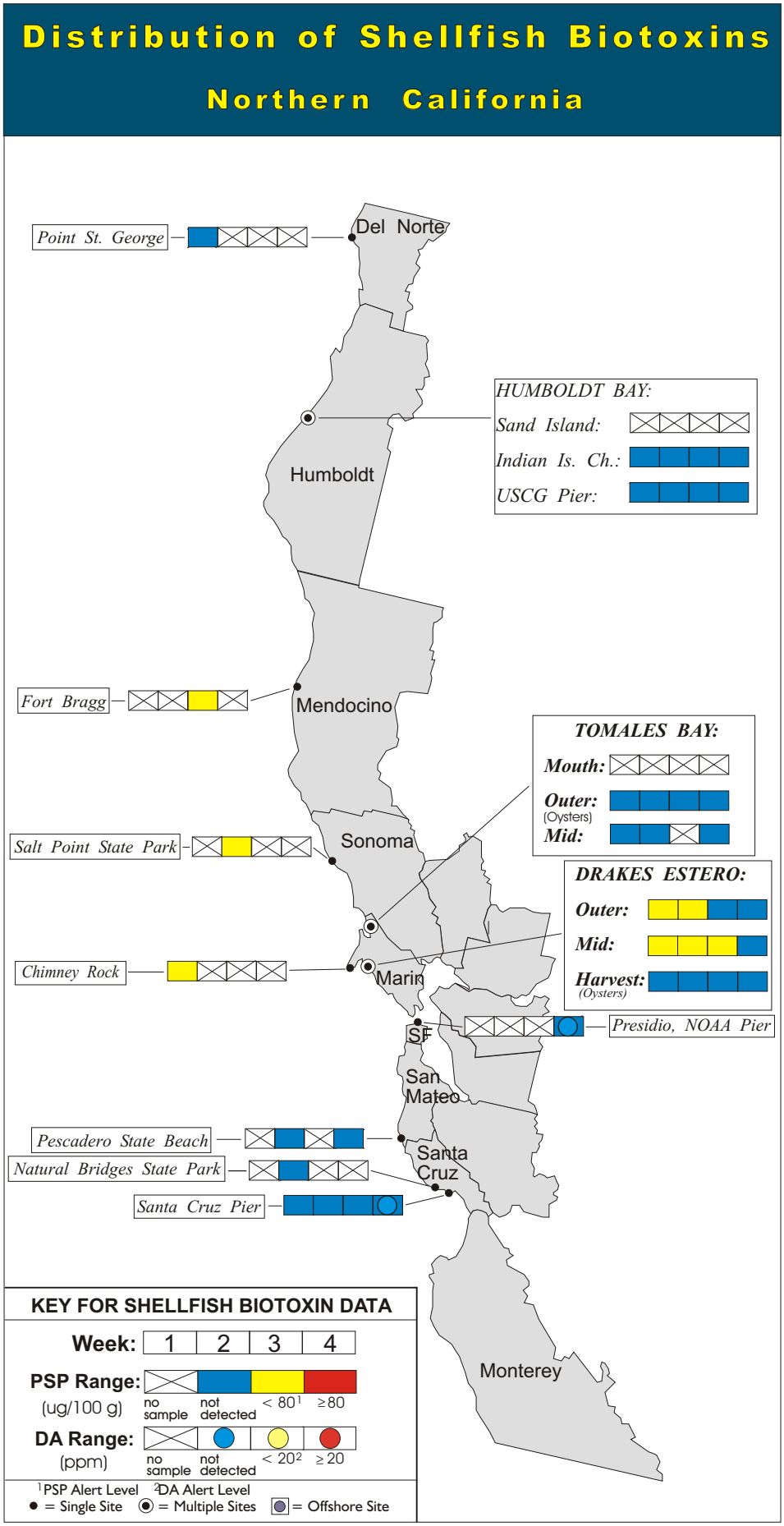
Paralytic Shellfish Poisoning (PSP): PSP toxins were not detected in shellfish samples from southern California locations during October.

Domoic Acid (DA):

DA was not detected in shellfish samples from southern California locations during October. High levels of domoic acid continued to be detected in lobster viscera, however. A sample from Anacapa Island, collected on October 8, contained 150 ppm of domoic acid.

For Information on our Volunteer Field Sampling Program Please Call:

(510) 540-3423



Northern California Summary:

Paralytic Shellfish Poisoning (PSP):

Levels of PSP toxins continued to decline through October but persisted at several locations. Low levels of these toxins were detected in mussels from Fort Bragg (Mendocino County) and Salt Point State Park (Sonoma County). Low levels of PSP toxins were also detected in mussels from our Drakes Bay sentinel station and from Drakes Estero.

Domoic Acid (DA):

DA was not detected in shellfish samples from northern California locations during October.

The Marine Biotoxin Monitoring and Control Program is a state-wide effort involving a consortium of volunteer participants. The shellfish sampling and analysis element of this program is intended to provide an early warning of shellfish toxicity by routinely assessing coastal resources for the presence of paralytic shellfish poisoning (PSP) toxins.

For More Information Please Call:
(510) 540 - 3423

For Recorded Biotoxin Information Call:
(800) 553 - 4133

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ENVIRONMENTAL MANAGEMENT BRANCH
Marine Biotoxin Monitoring and Control Program

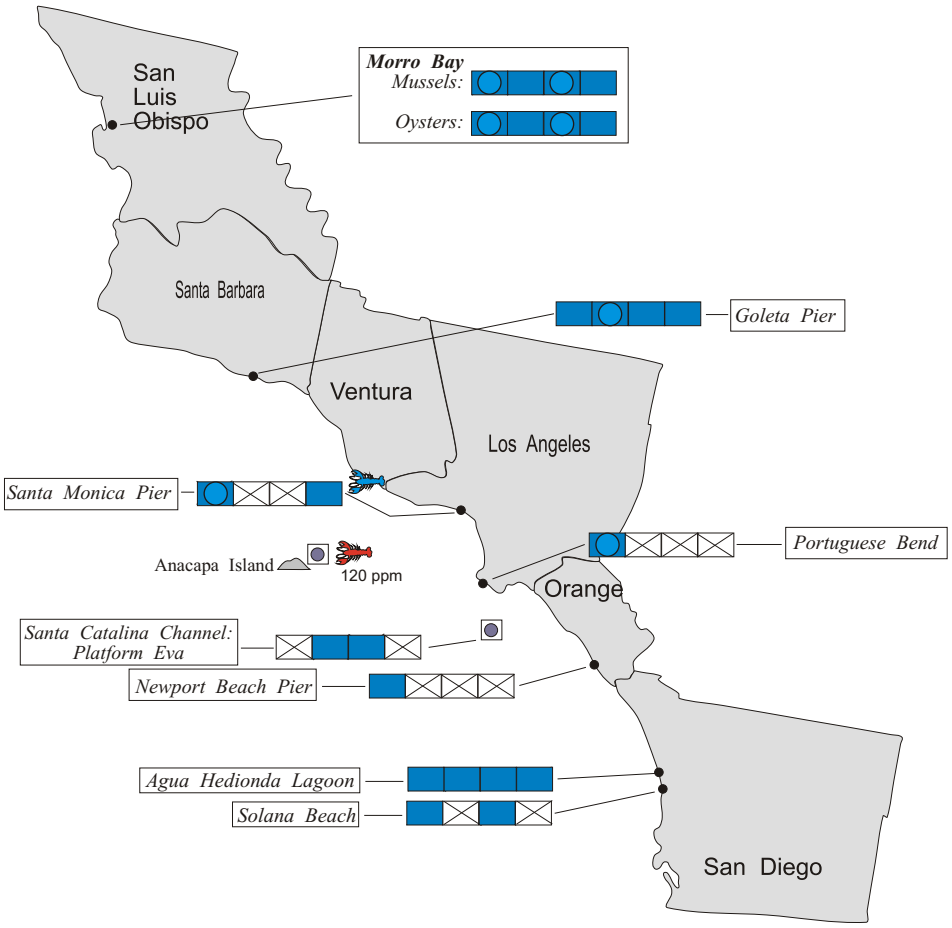
SHELLFISH BIOTOXIN MONTHLY REPORT

November 2002

Technical Report No. 02-32

Distribution of Shellfish Biotoxins

Southern California



KEY FOR SHELLFISH BIOTOXIN DATA

	Week: 1	2	3	4
PSP Range: (ug/100 g)	no sample	not detected	< 80[1]	≥80
DA Range: (ppm)	no sample	not detected	< 20[2]	≥ 20

[1]PSP Alert Level [2]DA Alert Level
● = Single Site ◉ = Multiple Sites ◉ = Offshore Site

Source: DHS Marine Biotoxin Monitoring and Control Program, November 2002.

INTRODUCTION:

Please note the following conventions: (i) All data are for mussel samples, unless otherwise noted; (ii) All samples are analyzed for PSP toxins; domoic acid (DA) analyses are performed as needed (i.e., on the basis of detected blooms of the diatoms that produce DA). Please refer to the figure key for an explanation of the symbols used for the time of month of sample collection and the toxicity range.

Southern California Summary:

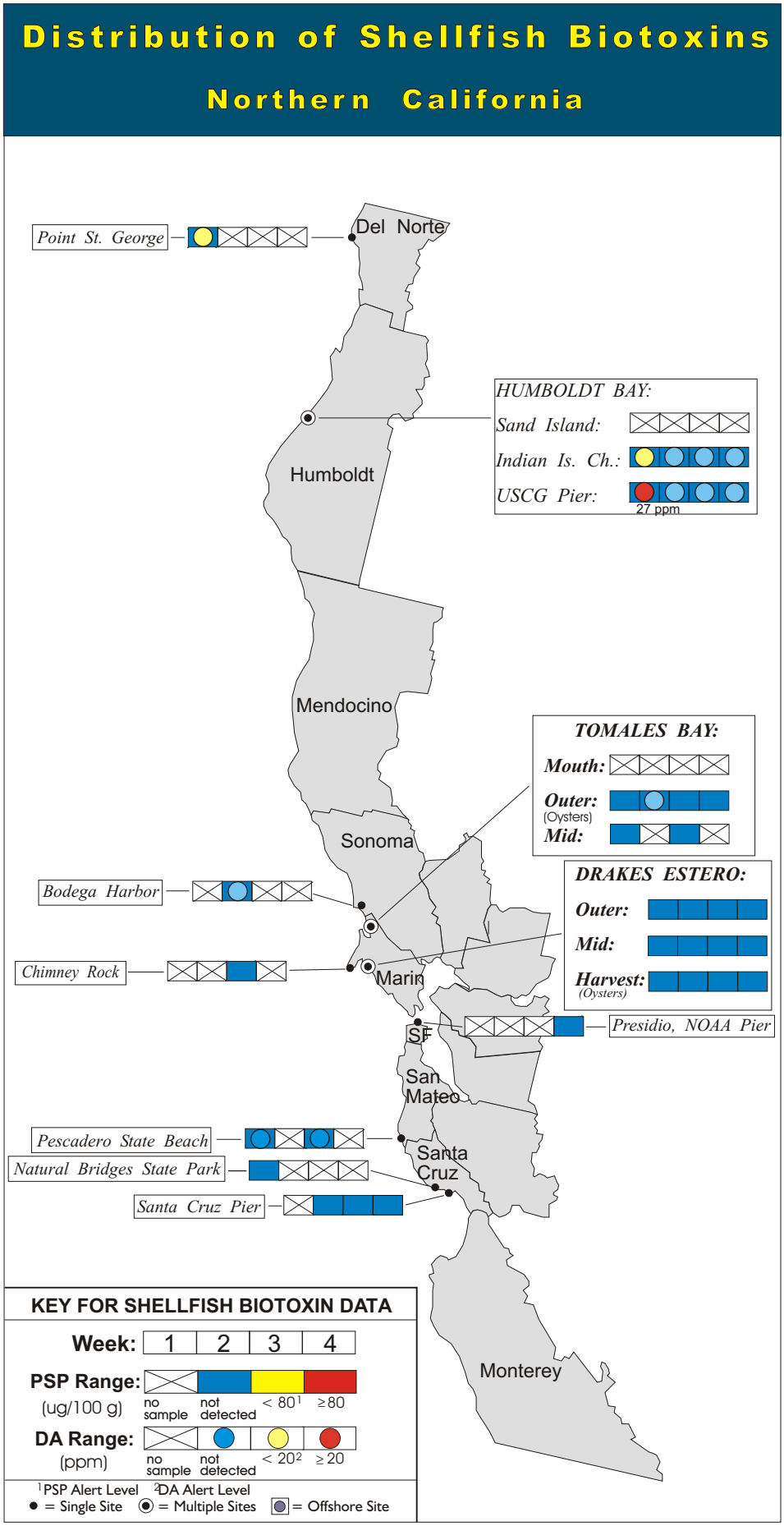
Paralytic Shellfish Poisoning (PSP): PSP toxins were not detected in shellfish samples from southern California locations during November.

Domoic Acid (DA):

DA was not detected in shellfish samples from southern California locations during November. High levels of domoic acid continued to be detected in lobster viscera, however. A sample from Anacapa Island, collected on November 14, contained 120 ppm of domoic acid.

For Information on our Volunteer Field Sampling Program Please Call:

(510) 540-3423



Northern California Summary:

Paralytic Shellfish Poisoning (PSP):

PSP toxins were not detected in shellfish samples from northern California locations during November.

Domoic Acid (DA):

DA was detected in shellfish samples from northern California locations in Del Norte and Humboldt counties during the first week of November. Elevated levels of this toxin (27 ppm) were detected in sentinel mussels from the U. S. Coast Guard pier in Humboldt Bay (November 5). Mussels collected on the same day from farther inside the bay at Indian Island contained 13 ppm. A lower concentration of domoic acid (9.8 ppm) was also detected in mussels collected farther north at Point Saint George (Del Norte County) on November 4 following the observation of a *Pseudo-nitzschia* bloom in this region in late October.

The Marine Biotoxin Monitoring and Control Program is a state-wide effort involving a consortium of volunteer participants. The shellfish sampling and analysis element of this program is intended to provide an early warning of shellfish toxicity by routinely assessing coastal resources for the presence of paralytic shellfish poisoning (PSP) toxins.

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CALIFORNIA DEPARTMENT OF HEALTH SERVICES
2151 Berkeley Way, Berkeley CA 94704-1011

ENVIRONMENTAL MANAGEMENT BRANCH
Marine Biotoxin Monitoring and Control Program

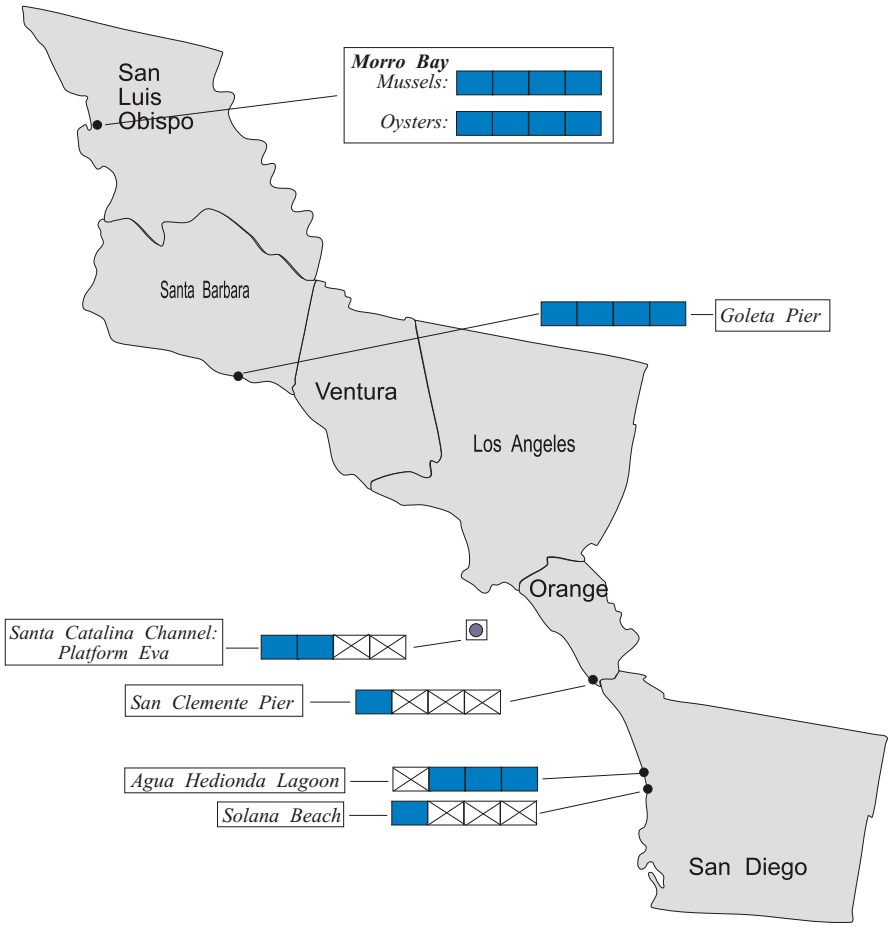
SHELLFISH BIOTOXIN MONTHLY REPORT

December 2002

Technical Report No. 02-34

Distribution of Shellfish Biotoxins

Southern California



KEY FOR SHELLFISH BIOTOXIN DATA

Week:	1	2	3	4
PSP Range: (ug/100 g)	no sample	not detected	< 80[1]	≥80
DA Range: (ppm)	no sample	not detected	< 20[2]	≥ 20

[1]PSP Alert Level [2]DA Alert Level
● = Single Site ◉ = Multiple Sites ◉ = Offshore Site

Source: DHS Marine Biotoxin Monitoring and Control Program, December 2002.

INTRODUCTION:

Please note the following conventions: (i) All data are for mussel samples, unless otherwise noted; (ii) All samples are analyzed for PSP toxins; domoic acid (DA) analyses are performed as needed (i.e., on the basis of detected blooms of the diatoms that produce DA). Please refer to the figure key for an explanation of the symbols used for the time of month of sample collection and the toxicity range.

Southern California Summary:

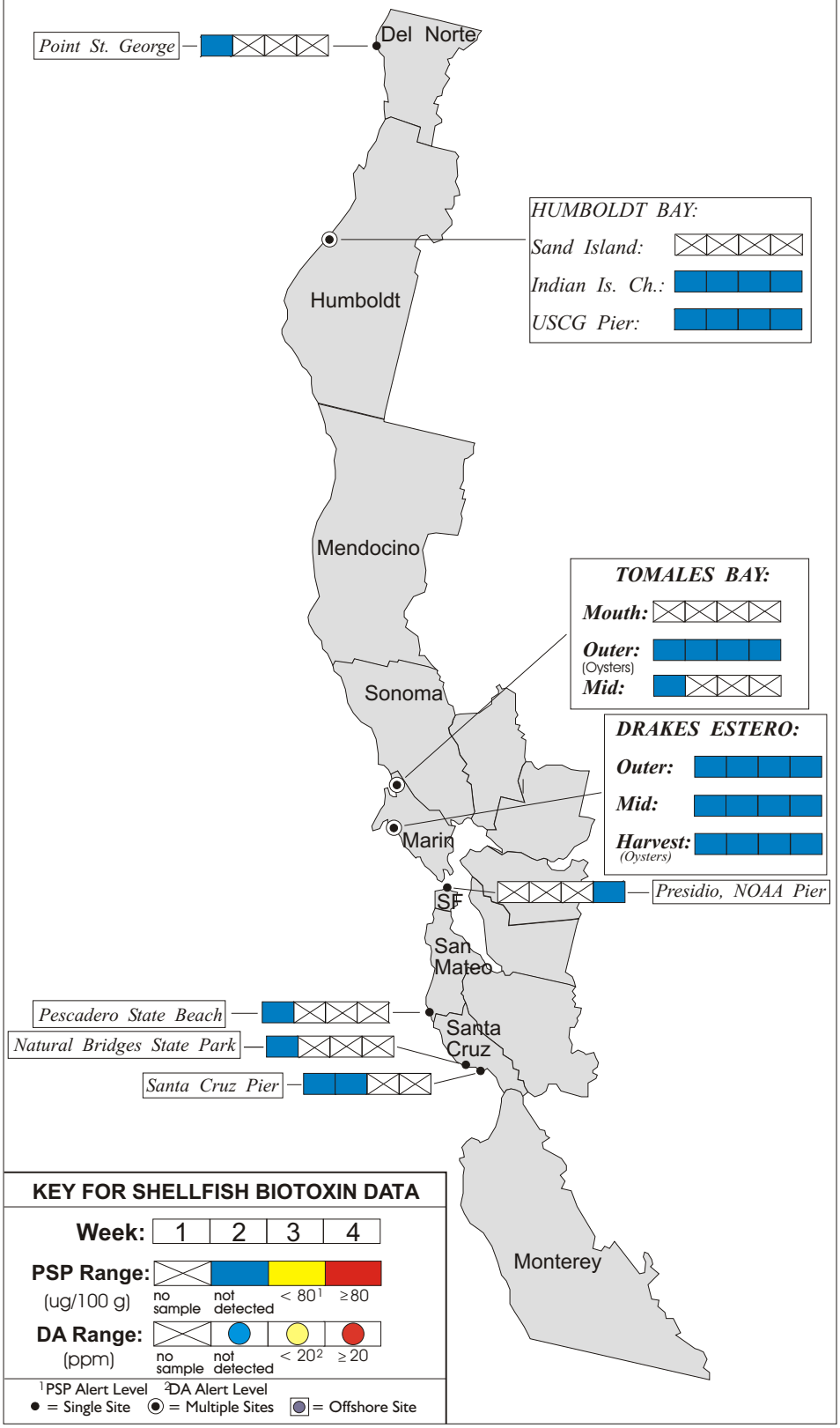
Paralytic Shellfish Poisoning (PSP): PSP toxins were not detected in shellfish samples from southern California locations during December.

For Information on our Volunteer Field Sampling Program Please Call:

(510) 540-3423

Distribution of Shellfish Biotoxins

Northern California



Northern California Summary:

Paralytic Shellfish Poisoning (PSP):

PSP toxins were not detected in shellfish samples from northern California locations during December.

The Marine Biotoxin Monitoring and Control Program is a state-wide effort involving a consortium of volunteer participants. The shellfish sampling and analysis element of this program is intended to provide an early warning of shellfish toxicity by routinely assessing coastal resources for the presence of paralytic shellfish poisoning (PSP) toxins.

For More Information Please Call:
(510) 540 - 3423

For Recorded Biotoxin Information Call:
(800) 553 - 4133

APPENDIX B.

Monthly lists of program participants submitting shellfish samples for PSP toxin assay during 2002.

Appendix B-1. California Marine Biotoxin Monitoring and Control Program participants submitting shellfish samples during January 2002.

COUNTY	AGENCY	SAMPLES
Del Norte	Del Norte County Health Department	1
Humboldt	Coast Seafood Company	5
	Humboldt County Environmental Health Department	5
Mendocino	Mendocino County Environmental Health Department	1
Sonoma	None Submitted	2
Marin	Cove Mussel Company	2
	CDHS Marine Biotoxin Program	1
	Hog Island Oyster Company	3
	Johnson Oyster Company	20
	Marin Oyster Company	5
San Francisco	San Francisco County Health Department	1
San Mateo	San Mateo County Environmental Health Department	2
Santa Cruz	Santa Cruz County Environmental Health Department	1
	U.C. Santa Cruz	1
Monterey	None Submitted	
San Luis Obispo	Williams Shellfish Company	8
Santa Barbara	U.C. Santa Barbara Marine Science Institute	4
Ventura	None Submitted	
Los Angeles	Los Angeles County Health Department	1
Orange	Orange County Health Care Agency	1
	Ecomar, Inc.	4
San Diego	Carlsbad Aquafarms, Inc.	5
	CDHS Volunteer (Paul Sims)	2

Appendix B-2. California Marine Biotoxin Monitoring and Control Program participants submitting shellfish samples during February 2002.

COUNTY	AGENCY	SAMPLES
Del Norte	Del Norte County Health Department	1
Humboldt	Coast Seafood Company	4
Mendocino	None Submitted	
Sonoma	CDHS Volunteer (Tim Callan)	1
Marin	Cove Mussel Company	2
	Hog Island Oyster Company	2
	Johnson Oyster Company	16
	Marin Oyster Company	4
San Francisco	San Francisco County Health Department	1
San Mateo	San Mateo County Environmental Health Department	2
Santa Cruz	U.C. Santa Cruz	2
Monterey	CDHS Volunteer	1
San Luis Obispo	Williams Shellfish Company	8
Santa Barbara	U.C. Santa Barbara Marine Science Institute	4
Ventura	CDHS Volunteer (Bill Weinerth)	2
Los Angeles	Los Angeles County Health Department	1
Orange	Ecomar, Inc.	4
	Orange County Health Care Agency	1
San Diego	Carlsbad Aquafarms, Inc.	4
	CDHS Volunteer (Paul Sims)	1

Appendix B-3. California Marine Biotoxin Monitoring and Control Program participants submitting shellfish samples during March 2002.

COUNTY	AGENCY	SAMPLES
Del Norte	Del Norte County Health Department	1
Humboldt	Coast Seafood Company	4
Mendocino	None Submitted	
Sonoma	None Submitted	
Marin	Cove Mussel Company	4
	Hog Island Oyster Company	4
	Johnson Oyster Company	16
	Marin Oyster Company	6
San Francisco	San Francisco County Health Department	1
San Mateo	San Mateo County Environmental Health Department	2
Santa Cruz	Santa Cruz County Environmental Health Department	4
	U.C. Santa Cruz	3
Monterey	None Submitted	
San Luis Obispo	Williams Shellfish Company	8
Santa Barbara	U.C. Santa Barbara Marine Science Institute	4
Ventura	CDHS Volunteer (Bill Weinerth)	1
Los Angeles	Los Angeles County Health Department	1
Orange	Orange County Health Care Agency	1
	Ecomar, Inc.	4
San Diego	Carlsbad Aquafarms, Inc.	2
	CDHS Volunteer (Paul Sims)	1

Appendix B-4. California Marine Biotoxin Monitoring and Control Program participants submitting shellfish samples during April 2002.

COUNTY	AGENCY	SAMPLES
Del Norte	Del Norte County Health Department	2
Humboldt	Coast Seafood Company	5
	Humboldt County Environmental Health Department	2
Mendocino	Mendocino County Environmental Health Department	1
Sonoma	CDHS Marine Biotoxin Program	1
Marin	Cove Mussel Company	4
	CDHS Marine Biotoxin Program	4
	Hog Island Oyster Company	12
	Johnson Oyster Company	20
	Marin Oyster Company	8
	Point Reyes Oyster Company	2
	Tomales Bay Oyster Company	1
San Francisco	San Francisco County Health Department	1
San Mateo	San Mateo County Environmental Health Department	1
Santa Cruz	U.C. Santa Cruz	4
Monterey	None Submitted	
San Luis Obispo	Williams Shellfish Company	13
	CDHS Marine Biotoxin Program	1
	San Luis Obispo County Environmental Health Department	2
Santa Barbara	U.C. Santa Barbara Marine Science Institute	5
	Vandenberg AFB	1
	California Department of Parks and Recreation	1
Ventura	Ventura County Environmental Health Department	3
Los Angeles	Los Angeles County Health Department	4
Orange	Orange County Health Care Agency	1
	Ecomar, Inc.	4
San Diego	Carlsbad Aquafarms, Inc.	5
	CDHS Volunteer (Paul Sims)	2

Appendix B-5. California Marine Biotoxin Monitoring and Control Program participants submitting shellfish samples during May 2002.

COUNTY	AGENCY	SAMPLES
Del Norte	Del Norte County Health Department	2
Humboldt	Coast Seafood Company	4
	Humboldt County Environmental Health Department	2
Mendocino	Mendocino County Environmental Health Department	1
Sonoma	None Submitted	
Marin	Cove Mussel Company	2
	Hog Island Oyster Company	4
	Johnson Oyster Company	15
	Marin Oyster Company	4
	Point Reyes Oyster Company	2
	CDHS Marine Biotoxin Program	2
San Francisco	San Francisco County Health Department	2
San Mateo	San Mateo County Environmental Health Department	2
Santa Cruz	U.C. Santa Cruz	5
	Santa Cruz County Environmental Health Department	1
Monterey		
San Luis Obispo	Williams Shellfish Company	10
	San Luis Obispo County Environmental Health Department	2
Santa Barbara	U.C. Santa Barbara Marine Science Institute	8
	CDHS Volunteer	1
Ventura	Ventura County Environmental Health Department	4
Los Angeles	Los Angeles County Health Department	16
Orange	Ecomar, Inc.	9
	Orange County Health Care Agency	1
San Diego	Carlsbad Aquafarms, Inc.	3
	CDHS Volunteer (Paul Sims)	2

Appendix B-6. California Marine Biotoxin Monitoring and Control Program participants submitting shellfish samples during June 2002.

COUNTY	AGENCY	SAMPLES
Del Norte	Del Norte County Health Department	2
Humboldt	Coast Seafood Company	4
	Humboldt County Environmental Health Department	1
Mendocino	Mendocino County Environmental Health Department	1
Sonoma	None Submitted	
Marin	Cove Mussel Company	4
	Hog Island Oyster Company	4
	Johnson Oyster Company	16
	Marin Oyster Company	5
San Francisco	San Francisco County Health Department	2
San Mateo	San Mateo County Environmental Health Department	2
Santa Cruz	Santa Cruz County Environmental Health Department	2
	U.C. Santa Cruz	5
Monterey	None Submitted	
San Luis Obispo	Williams Shellfish Company	10
	San Luis Obispo County Environmental Health Department	2
Santa Barbara	U.C. Santa Barbara Marine Science Institute	4
Ventura	CDHS Volunteer	1
Los Angeles	Los Angeles County Health Department	5
Orange	Ecomar, Inc.	2
San Diego	Carlsbad Aquafarms, Inc.	4
	CDHS Volunteer (Paul Sims)	1

Appendix B-7. California Marine Biotoxin Monitoring and Control Program participants submitting shellfish samples during July 2002.

COUNTY	AGENCY	SAMPLES
Del Norte	Del Norte County Health Department	2
Humboldt	Coast Seafood Company	10
	Humboldt County Environmental Health Department	1
Mendocino	Mendocino County Environmental Health Department	1
Sonoma	CDHS Marine Biotoxin Program	1
Marin	Cove Mussel Company	4
	CDHS Marine Biotoxin Program	4
	Hog Island Oyster Company	6
	Johnson Oyster Company	37
	Marin Oyster Company	4
San Francisco	San Francisco County Health Department	2
San Mateo	San Mateo County Environmental Health Department	1
Santa Cruz	U.C. Santa Cruz	4
	Santa Cruz County Environmental Health Department	4
Monterey	None Submitted	
San Luis Obispo	Williams Shellfish Company	8
	San Luis Obispo County Environmental Health Department	2
Santa Barbara	U.C. Santa Barbara Marine Science Institute	5
Ventura	Ventura County Environmental Health Department	2
Los Angeles	Los Angeles County Health Department	6
Orange	Ecomar, Inc.	5
San Diego	Carlsbad Aquafarms, Inc.	5

Appendix B-8. California Marine Biotoxin Monitoring and Control Program participants submitting shellfish samples during August 2002.

COUNTY	AGENCY	SAMPLES
Del Norte	Del Norte County Health Department	2
Humboldt	Coast Seafood Company	12
	Humboldt County Environmental Health Department	1
Mendocino	Mendocino County Environmental Health Department	1
Sonoma	CDHS Marine Biotoxin Program	2
Marin	Cove Mussel Company	2
	Hog Island Oyster Company	9
	Johnson Oyster Company	41
	Marin Oyster Company	6
	Point Reyes Oyster Company	1
	CDHS Marine Biotoxin Program	3
San Francisco	San Francisco County Health Department	2
San Mateo	None Submitted	
Santa Cruz	U.C. Santa Cruz	5
	Santa Cruz County Environmental Health Department	2
Monterey	Monterey County Health Department	1
San Luis Obispo	Williams Shellfish Company	8
	San Luis Obispo County Environmental Health Department	2
Santa Barbara	U.C. Santa Barbara Marine Science Institute	3
Ventura	None Submitted	
Los Angeles	Los Angeles County Health Department	2
Orange	Ecomar, Inc.	2
	Orange County Health Care Agency	1
San Diego	Carlsbad Aquafarms, Inc.	4

Appendix B-9. California Marine Biotoxin Monitoring and Control Program participants submitting shellfish samples during September 2002.

COUNTY	AGENCY	SAMPLES
Del Norte	Del Norte County Health Department	1
Humboldt	Coast Seafood Company	8
Mendocino	Mendocino County Environmental Health Department	1
Sonoma	Sonoma County Public Health Department	1
Marin	Cove Mussel Company	3
	Hog Island Oyster Company	4
	Johnson Oyster Company	32
	Marin Oyster Company	5
	CDHS Marine Biotoxin Program	2
San Francisco	San Francisco County Health Department	2
San Mateo	San Mateo County Environmental Health Department	1
Santa Cruz	U.C. Santa Cruz	3
Monterey	None Submitted	
San Luis Obispo	Williams Shellfish Company	10
	San Luis Obispo County Environmental Health Department	1
Santa Barbara	U.C. Santa Barbara Marine Science Institute	4
Ventura	None Submitted	
Los Angeles	Los Angeles County Health Department	2
	Los Angeles Regional Water Quality Control Board	1
Orange	Ecomar, Inc.	3
San Diego	Carlsbad Aquafarms, Inc.	5

Appendix B-10. California Marine Biotoxin Monitoring and Control Program participants submitting shellfish samples during October 2002.

COUNTY	AGENCY	SAMPLES
Del Norte	Del Norte County Health Department	1
Humboldt	Coast Seafood Company	10
Mendocino	Mendocino County Environmental Health Department	1
Sonoma	Sonoma County Public Health Department	1
Marin	Cove Mussel Company	3
	CDHS Marine Biotoxin Program	1
	Hog Island Oyster Company	5
	Johnson Oyster Company	25
	Marin Oyster Company	5
San Francisco	San Francisco County Health Department	1
San Mateo	San Mateo County Environmental Health Department	2
Santa Cruz	U.C. Santa Cruz	5
	Santa Cruz County Environmental Health Department	2
Monterey	None Submitted	
San Luis Obispo	Williams Shellfish Company	8
Santa Barbara	U.C. Santa Barbara Marine Science Institute	5
Ventura	Ventura County Environmental Health Department	1
Los Angeles	Los Angeles County Health Department	3
Orange	Ecomar, Inc.	4
	Orange County Health Care Agency	1
San Diego	Carlsbad Aquafarms, Inc.	4
	CDHS Volunteer (Paul Sims)	1

Appendix B-11. California Marine Biotoxin Monitoring and Control Program participants submitting shellfish samples during November 2002.

COUNTY	AGENCY	SAMPLES
Del Norte	Del Norte County Health Department	1
Humboldt	Coast Seafood Company	12
Mendocino	None Submitted	
Sonoma	CDHS Marine Biotoxin Program	1
Marin	Cove Mussel Company	2
	Hog Island Oyster Company	2
	Johnson Oyster Company	16
	Marin Oyster Company	4
San Francisco	San Francisco County Health Department	1
San Mateo	San Mateo County Environmental Health Department	2
Santa Cruz	U.C. Santa Cruz	3
	Santa Cruz County Environmental Health Department	1
Monterey	None Submitted	
San Luis Obispo	Williams Shellfish Company	8
Santa Barbara	U.C. Santa Barbara Marine Science Institute	4
Ventura	None Submitted	
Los Angeles	Los Angeles County Health Department	3
Orange	Ecomar, Inc.	2
	Orange County Health Care Agency	1
San Diego	Carlsbad Aquafarms, Inc.	4
	CDHS Volunteer (Paul Sims)	2

Appendix B-12. California Marine Biotoxin Monitoring and Control Program participants submitting shellfish samples during December 2002.

COUNTY	AGENCY	SAMPLES
Del Norte	Del Norte County Health Department	1
Humboldt	Coast Seafood Company	9
Mendocino	None Submitted	
Sonoma	None Submitted	
Marin	Cove Mussel Company	1
	Hog Island Oyster Company	2
	Johnson Oyster Company	20
	Marin Oyster Company	3
San Francisco	San Francisco County Health Department	1
San Mateo	San Mateo County Environmental Health Department	1
Santa Cruz	U.C. Santa Cruz	2
	Santa Cruz County Environmental Health Department	1
Monterey	None Submitted	
San Luis Obispo	Williams Shellfish Company	10
Santa Barbara	U.C. Santa Barbara Marine Science Institute	5
Ventura	None Submitted	
Los Angeles	None Submitted	
Orange	Ecomar, Inc.	2
	Orange County Health Care Agency	1
San Diego	Carlsbad Aquafarms, Inc.	3
	CDHS Volunteer (Paul Sims)	1

APPENDIX C.

Monthly maps of toxic phytoplankton distribution and sampling effort during 2002.

CALIFORNIA DEPARTMENT OF HEALTH SERVICES
2151 Berkeley Way, Berkeley CA 94704-1011

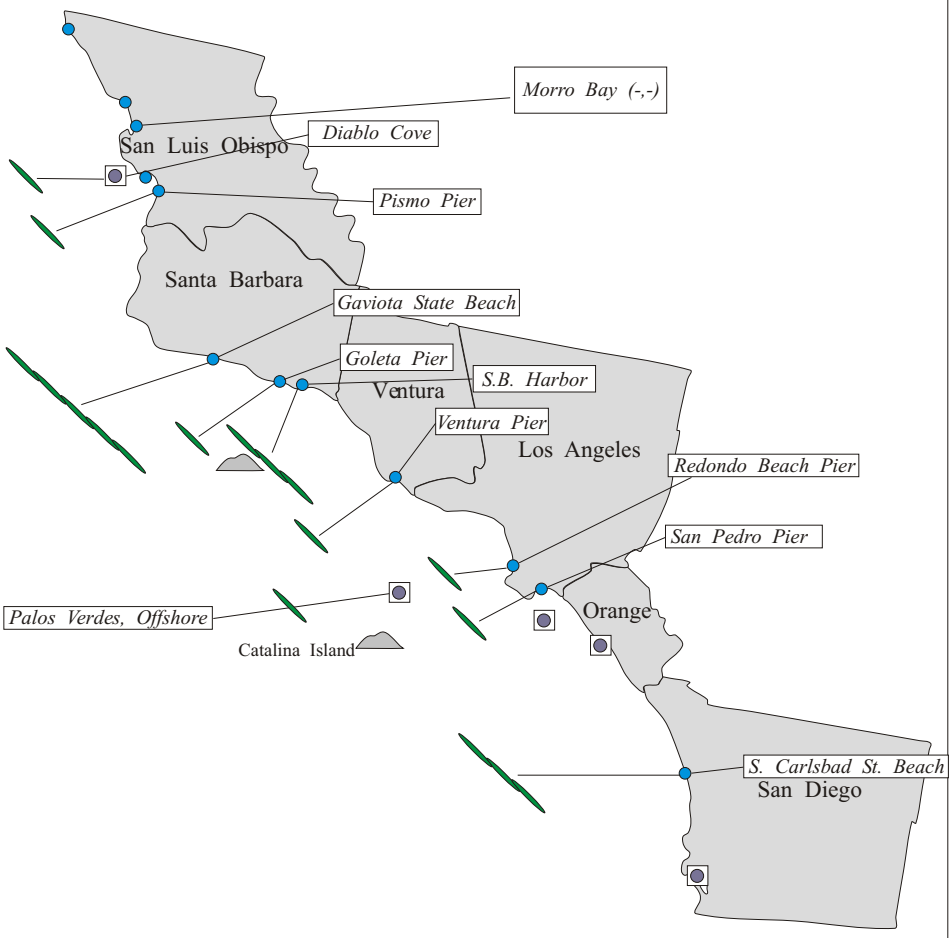
ENVIRONMENTAL MANAGEMENT BRANCH
Phytoplankton Monitoring Program

Phytoplankton Monthly Report

January 2002

Technical Report No. 02-10

Distribution of Toxin-Producing Phytoplankton
Southern California



Relative Abundance of Known Toxin Producers

Alexandrium Species

- Rare (less than 1%)
- Present (between 1% and 10%)
- Common (between 10% and 50%)
- Abundant (greater than 50%)

Pseudo-nitzschia Species

- Present (less than 10%)
- Common (between 10% and 50%)
- Abundant (greater than 50%)

MONTHLY SAMPLING STATIONS:

- Single Sampling Station
- Multiple Sampling Stations
- Offshore Sampling Station

For areas with multiple sampling stations, species abundance at each station is represented as follows:
(a,p) = Abundance for Alexandrium and Pseudo-nitzschia.
e.g., (c,p) = common, present; (a,-) = abundant, not observed

Southern California Summary:

Alexandrium catenella (Dinoflagellate that produces paralytic shellfish poisoning (PSP) toxins). *Alexandrium* was not observed along the southern California coast in January.

Pseudo-nitzschia species (includes all known potential domoic acid producing diatoms). *Pseudo-nitzschia* numbers increased along the southern California coast towards the end of January. This diatom was abundant in a sample collected from Gaviota Pier (Santa Barbara County) on January 30. Elevated numbers of *Pseudo-nitzschia* were also observed inside Santa Barbara Harbor (January 31) and farther south at South Carlsbad State Beach (January 29).

The Phytoplankton Monitoring Program, managed by the California Department of Health Services, is a state-wide program designed to detect toxin producing species of phytoplankton in ocean water before they impact California's valuable shellfish resources or become a threat to consumer safety.

For More Information Please Call:
(510) 540 - 3423

For Recorded Biotoxin Information Call:
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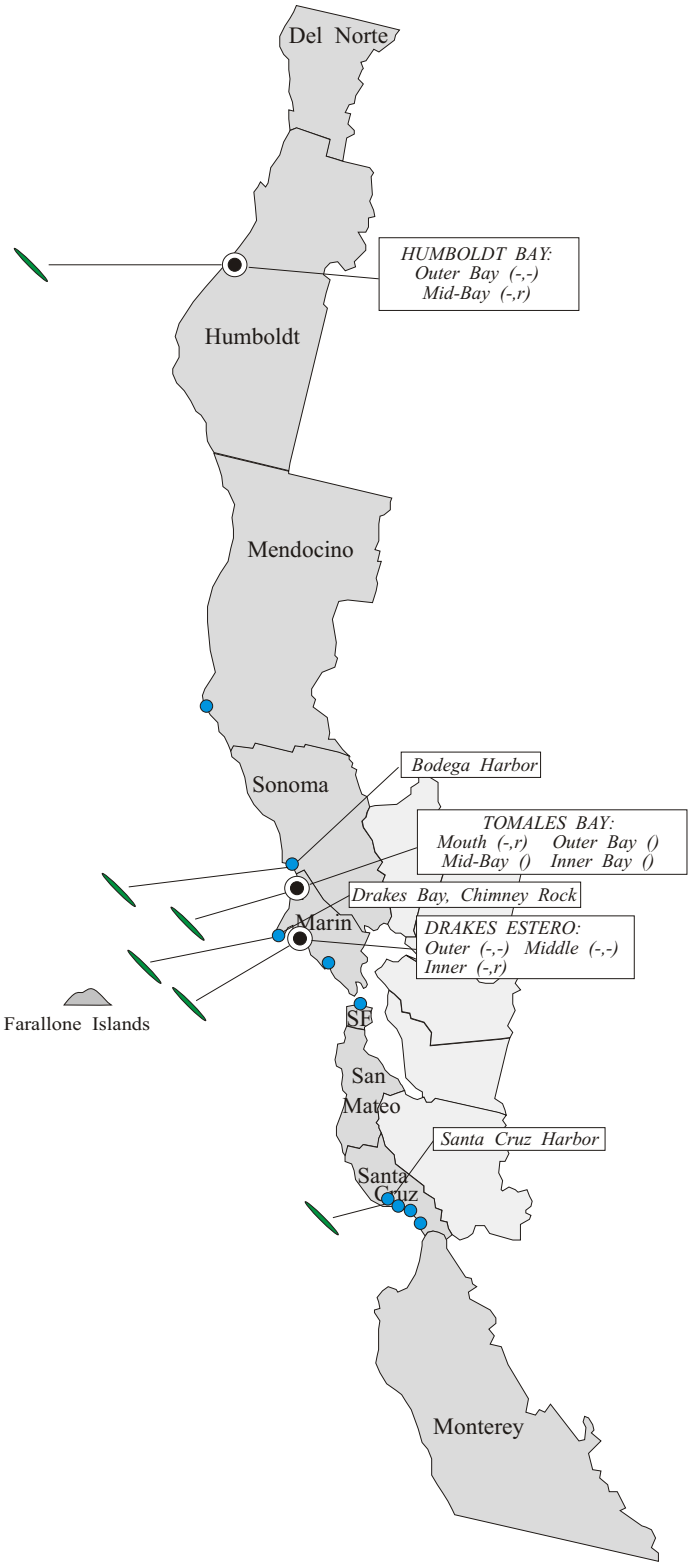
Distribution of Toxin-Producing Phytoplankton Northern California



Northern California Summary:

Alexandrium catenella (Dinoflagellate that produces paralytic shellfish poisoning (PSP) toxins). *Alexandrium* was not observed along the northern California coast in January.

Pseudo-nitzschia species (includes all known potential domoic acid producing diatoms). Very low numbers of *Pseudo-nitzschia* were observed at several sites along the northern California coast in January.

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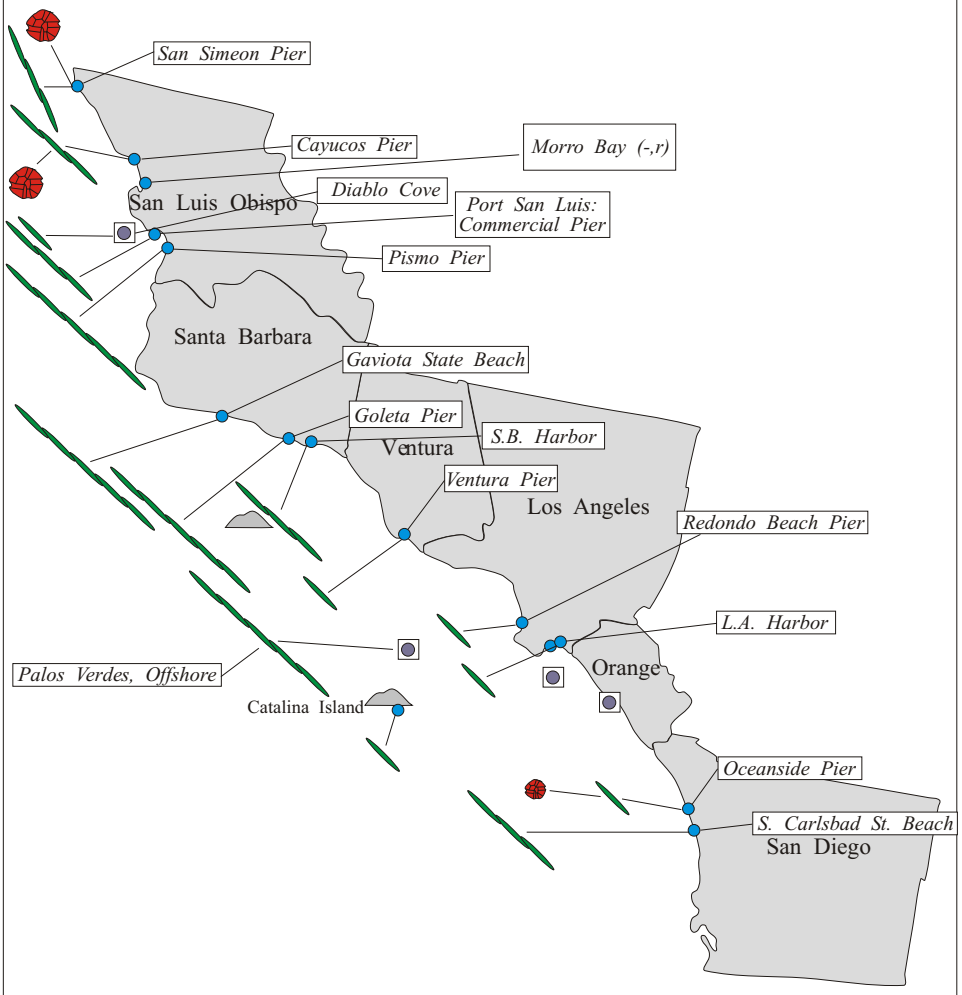
ENVIRONMENTAL MANAGEMENT BRANCH
Phytoplankton Monitoring Program

Phytoplankton Monthly Report

February 2002

Technical Report No. 02-12

Distribution of Toxin-Producing Phytoplankton
Southern California



Relative Abundance of Known Toxin Producers

Alexandrium Species

- Rare (less than 1%)
- Present (between 1% and 10%)
- Common (between 10% and 50%)
- Abundant (greater than 50%)

Pseudo-nitzschia Species

- Present (less than 10%)
- Common (between 10% and 50%)
- Abundant (greater than 50%)

MONTHLY SAMPLING STATIONS:

- Single Sampling Station
- Multiple Sampling Stations
- Offshore Sampling Station

For areas with multiple sampling stations, species abundance at each station is represented as follows:
(a,p) = Abundance for Alexandrium and Pseudo-nitzschia.
e.g., (c,p) = common, present; (a,-) = abundant, not observed

Southern California Summary:

Alexandrium catenella (Dinoflagellate that produces paralytic shellfish poisoning (PSP) toxins). Low numbers of *Alexandrium* were observed at two sites along the San Luis Obispo coast and also at one San Diego site in February.

Pseudo-nitzschia species (includes all known potential domoic acid producing diatoms). *Pseudo-nitzschia* numbers increased along the southern California coast at several locations in February.

This diatom increased in relative abundance at several sites along the San Luis Obispo coast by mid-February, then declined by the end of the month. A similar pattern was observed along the Santa Barbara coast. The increase observed at Gaviota Pier in January continued through the beginning of February. By mid-month this diatom was abundant at Goleta Pier. The relative abundance of this diatom decreased by the end of February at these sites. Elevated numbers of *Pseudo-nitzschia* were also observed offshore of Los Angeles (February 5) and low numbers were observed farther offshore at Catalina Island (February 24).

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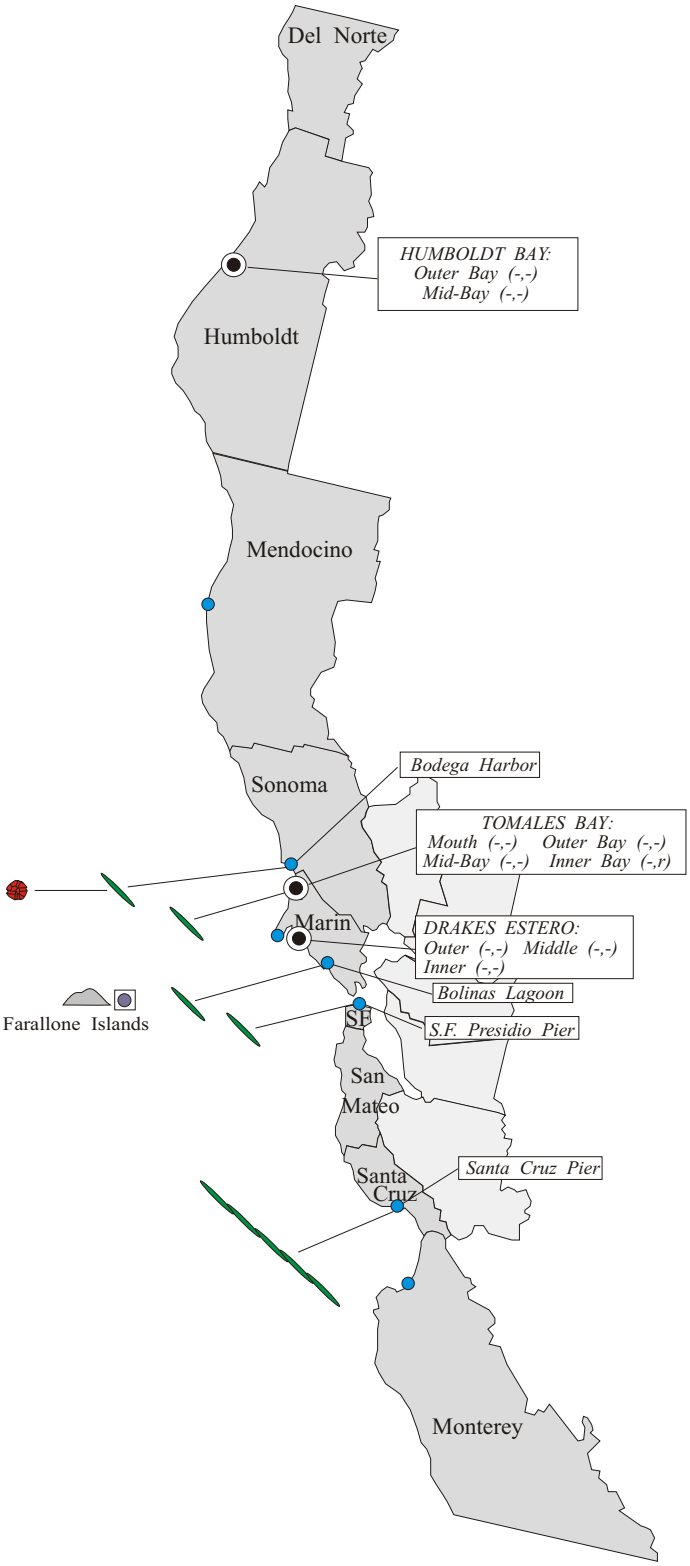
Distribution of Toxin-Producing Phytoplankton Northern California



Northern California Summary:

Alexandrium catenella (Dinoflagellate that produces paralytic shellfish poisoning (PSP) toxins). *Alexandrium* was observed at one location along the northern California coast in February. Low numbers of this dinoflagellate were detected in a sample from Bodega Harbor collected on February 22.

Pseudo-nitzschia species (includes all known potential domoic acid producing diatoms). Very low numbers of *Pseudo-nitzschia* were observed at several sites between San Francisco and Sonoma counties in February. Researchers at the University of California, Santa Cruz (UCSC) reported the onset of a *Pseudo-nitzschia* bloom in late February in the Santa Cruz area of Monterey Bay. Analyses of mussel samples provided by UCSC revealed very high levels of domoic acid (see Technical Report No. 02-11 for shellfish toxicity data) at this site.

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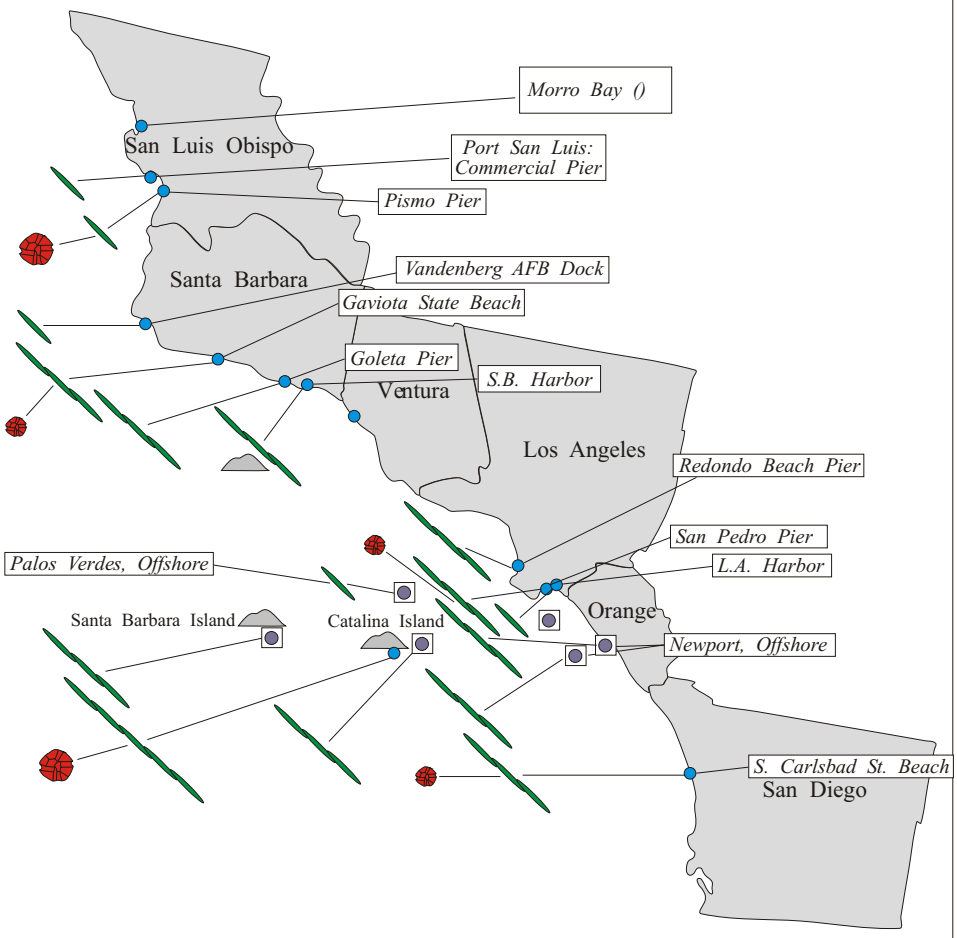
ENVIRONMENTAL MANAGEMENT BRANCH
Phytoplankton Monitoring Program

Phytoplankton Monthly Report

March 2002

Technical Report No. 02-14

Distribution of Toxin-Producing Phytoplankton
Southern California



Relative Abundance of Known Toxin Producers

Alexandrium Species

- Rare (less than 1%)
- Present (between 1% and 10%)
- Common (between 10% and 50%)
- Abundant (greater than 50%)

Pseudo-nitzschia Species

- Present (less than 10%)
- Common (between 10% and 50%)
- Abundant (greater than 50%)

MONTHLY SAMPLING STATIONS:

- Single Sampling Station
- Multiple Sampling Stations
- Offshore Sampling Station

For areas with multiple sampling stations, species abundance at each station is represented as follows:
(a,p) = Abundance for Alexandrium and Pseudo-nitzschia.
e.g., (c,p) = common, present; (a,-) = abundant, not observed

Southern California Summary:

Alexandrium catenella (Dinoflagellate that produces paralytic shellfish poisoning (PSP) toxins). Observations of *Alexandrium* increased slightly along the southern California coast during March.

Pseudo-nitzschia species (includes all known potential domoic acid producing diatoms). *Pseudo-nitzschia* numbers increased along the southern California coast in March at several locations.

This diatom increased in relative abundance at several sites offshore and along the coast of Los Angeles by the end of March. Volunteer observers on Catalina Island (Catalina Island Marine Institute) and offshore of the Island (Catalina Tall Ships Expeditions) reported a bloom of *Pseudo-nitzschia* during the last weekend in March. This coincided with the first reported dolphin stranding on a Los Angeles beach, the first of many such strandings in April and May. A similar pattern was observed along the Santa Barbara coast. A rapid increase in the relative abundance of this diatom was observed at several Santa Barbara sites by the end of March, coinciding with the detection of elevated levels of domoic acid in mussels from this region.

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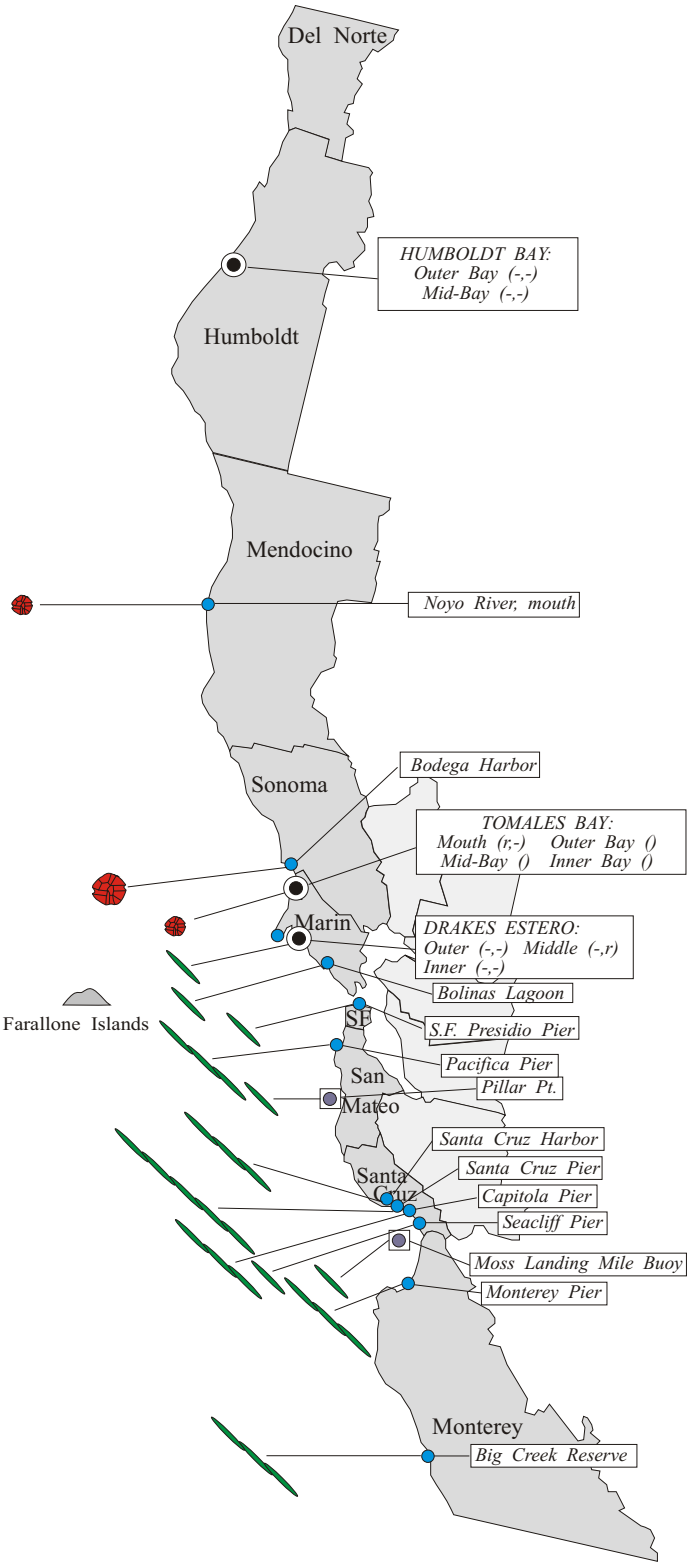
Distribution of Toxin-Producing Phytoplankton Northern California



Northern California Summary:

Alexandrium catenella (Dinoflagellate that produces paralytic shellfish poisoning (PSP) toxins). Low numbers of *Alexandrium* were observed along the northern California coast between Marin and Mendocino counties in March.

Pseudo-nitzschia species (includes all known potential domoic acid producing diatoms). *Pseudo-nitzschia* increased in distribution and relative abundance along the northern California coast between Monterey and San Mateo counties. High densities of this diatom continued to be reported by the University of California, Santa Cruz (UCSC) at the Santa Cruz Pier. Samples from volunteer collectors in this area revealed high relative abundances of *Pseudo-nitzschia* at several sites inside Monterey Bay and southward along the Monterey coast. The relative abundance of this diatom peaked at the beginning of March and began to decline through the month. This pattern was consistent with the observed decline in domoic acid concentrations in mussels from this region (see technical Report No. 02-13 for shellfish toxin data).

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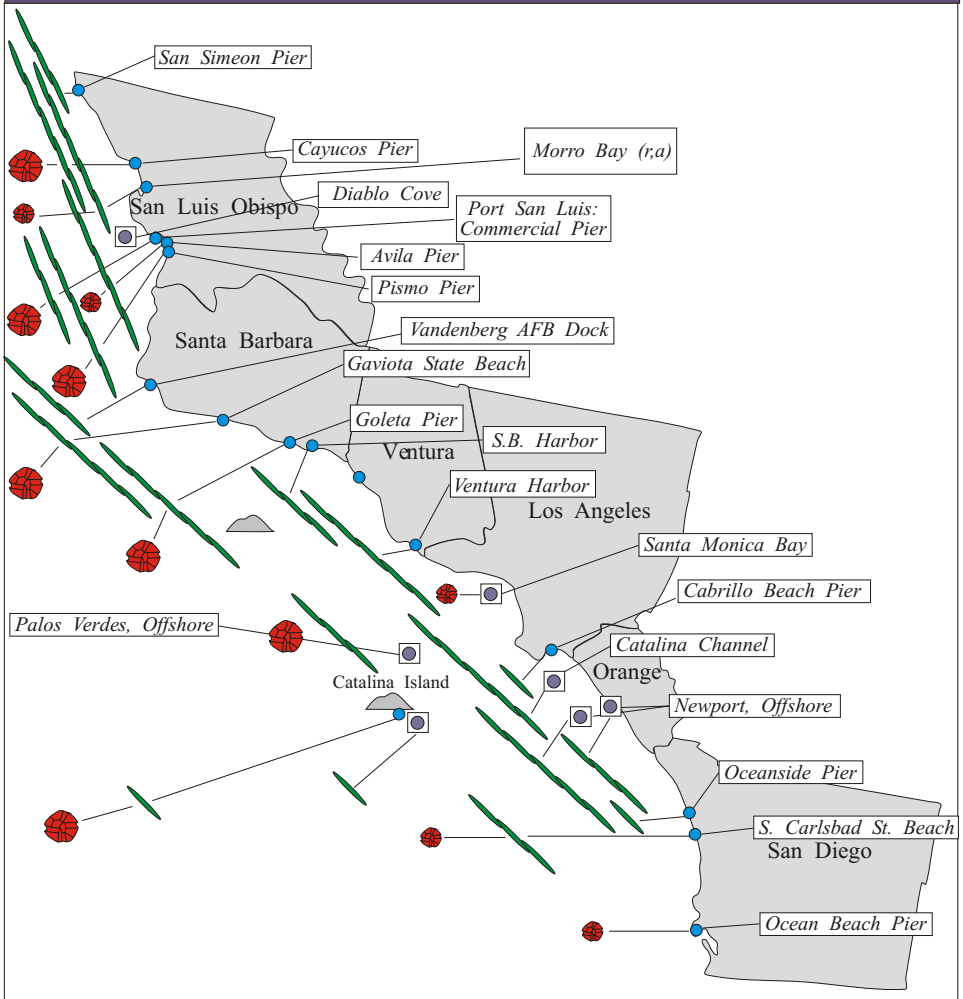
ENVIRONMENTAL MANAGEMENT BRANCH
Phytoplankton Monitoring Program

Phytoplankton Monthly Report

April 2002

Technical Report No. 02-16

Distribution of Toxin-Producing Phytoplankton
Southern California



Relative Abundance of Known Toxin Producers

Alexandrium Species

- Rare (less than 1%)
- Present (between 1% and 10%)
- Common (between 10% and 50%)
- Abundant (greater than 50%)

Pseudo-nitzschia Species

- Present (less than 10%)
- Common (between 10% and 50%)
- Abundant (greater than 50%)

MONTHLY SAMPLING STATIONS:

- Single Sampling Station
- Multiple Sampling Stations
- Offshore Sampling Station

For areas with multiple sampling stations, species abundance at each station is represented as follows:
(a,p) = Abundance for Alexandrium and Pseudo-nitzschia.
e.g., (c,p) = common, present; (a,-) = abundant, not observed

Southern California Summary:

Alexandrium catenella (Dinoflagellate that produces paralytic shellfish poisoning (PSP) toxins). The distribution and relative abundance of *Alexandrium* increased significantly along the entire southern California coast during April.

Pseudo-nitzschia species (includes all known potential domoic acid producing diatoms). *Pseudo-nitzschia* numbers increased dramatically along the entire southern California coast in April.

There appeared to be a southward progression to this toxic bloom over time for the nearshore stations. The greatest relative abundances of this diatom along the San Luis Obispo coast (90%) occurred within the first week of April, declining to low levels by the end of the month. In contrast, the numbers of *Pseudo-nitzschia* along the Santa Barbara coast were low at the beginning of the month but steadily increased to high abundances by the end of April. Although this diatom was present in low numbers in the nearshore Los Angeles area as well as farther offshore at Catalina Island, it was observed in high numbers in the middle of Catalina Channel (L.A. and Orange counties) at the end of April.

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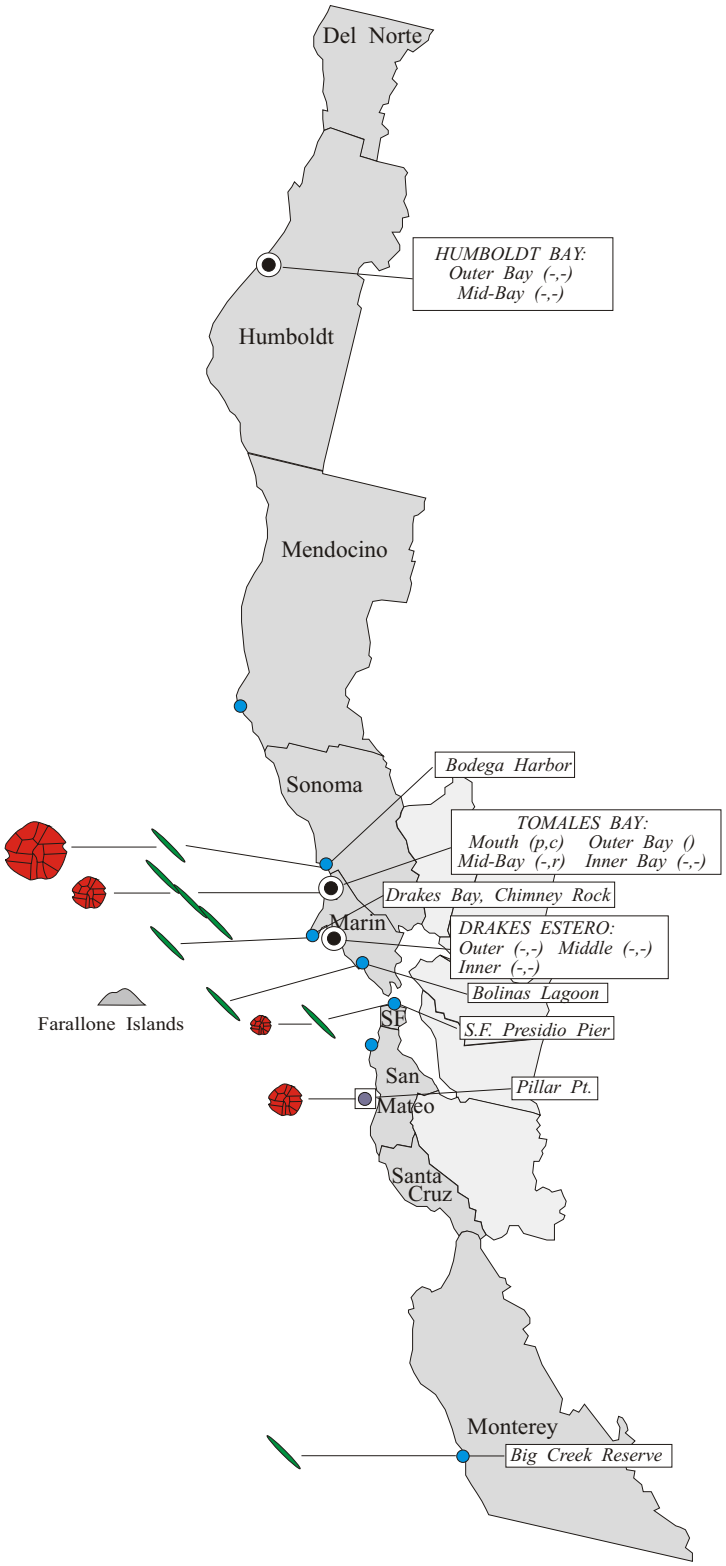
Distribution of Toxin-Producing Phytoplankton Northern California



Northern California Summary:

Alexandrium catenella (Dinoflagellate that produces paralytic shellfish poisoning (PSP) toxins). There was a noticeable increase in the relative abundance of *Alexandrium* in April, particularly in the northern California coastal area between San Mateo and Sonoma counties. Although the relative abundance of this dinoflagellate was greatest in Bodega Harbor, the cell mass was low as reflected in the low concentration of PSP toxins in mussels from this area (see technical Report #02-15).

Pseudo-nitzschia species (includes all known potential domoic acid producing diatoms). *Pseudo-nitzschia* decreased in distribution and relative abundance along the northern California coast between Monterey and Marin counties. Observations of this overall decline were consistent with the significant decrease in domoic acid concentrations in mussels from the Monterey Bay region (see technical Report No. 02-11 for shellfish toxin data).

The highest relative abundance of *Pseudo-nitzschia* in northern California was observed just inside Tomales Bay during the last week of April. These observations led to the analysis of shellfish samples from farther inside the Bay, which were found to contain low levels of domoic acid.

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CALIFORNIA DEPARTMENT OF HEALTH SERVICES
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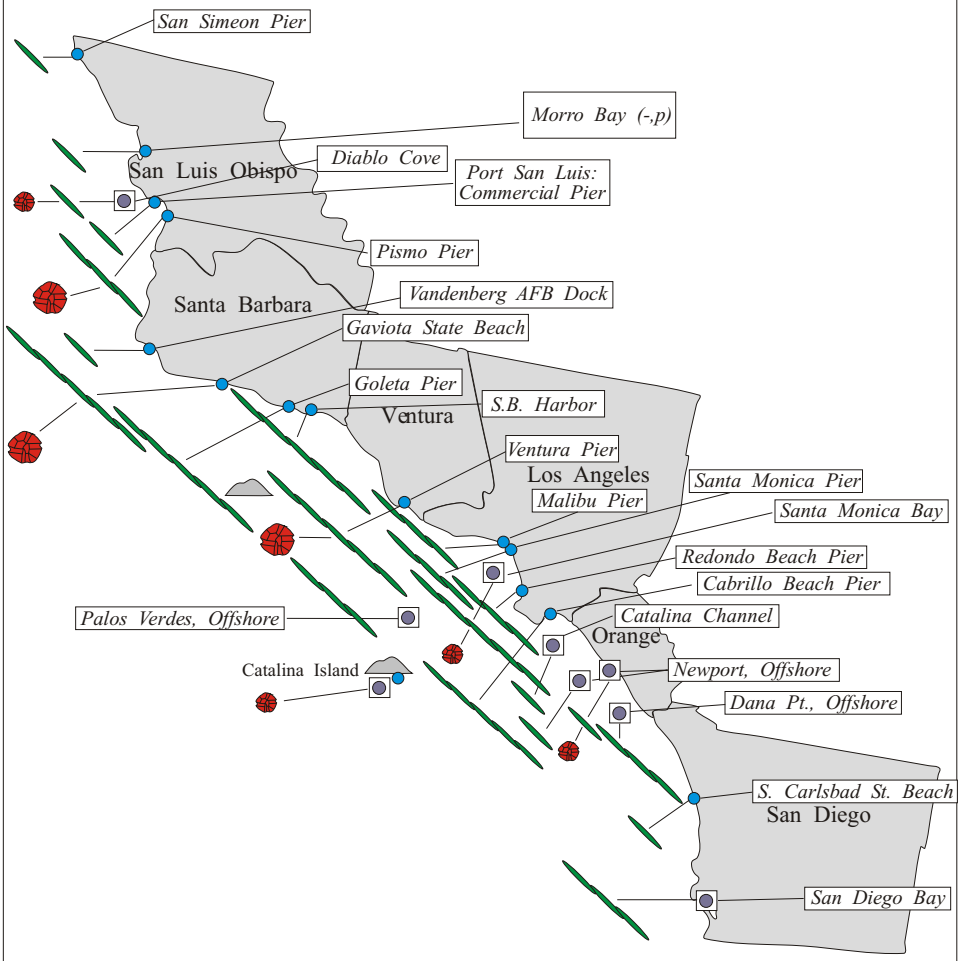
ENVIRONMENTAL MANAGEMENT BRANCH
Phytoplankton Monitoring Program

Phytoplankton Monthly Report

May 2002

Technical Report No. 02-18

Distribution of Toxin-Producing Phytoplankton
Southern California



Relative Abundance of Known Toxin Producers

Alexandrium Species

- Rare (less than 1%)
- Present (between 1% and 10%)
- Common (between 10% and 50%)
- Abundant (greater than 50%)

Pseudo-nitzschia Species

- Present (less than 10%)
- Common (between 10% and 50%)
- Abundant (greater than 50%)

MONTHLY SAMPLING STATIONS:

- Single Sampling Station
- Multiple Sampling Stations
- Offshore Sampling Station

For areas with multiple sampling stations, species abundance at each station is represented as follows:
(a,p) = Abundance for Alexandrium and Pseudo-nitzschia.
e.g., (c,p) = common, present; (a,-) = abundant, not observed

Southern California Summary:

Alexandrium catenella (Dinoflagellate that produces paralytic shellfish poisoning (PSP) toxins). The distribution and relative abundance of *Alexandrium* decreased slightly along the southern California coast in May.

Pseudo-nitzschia species (includes all known potential domoic acid producing diatoms). *Pseudo-nitzschia* numbers remained high along the southern California coast in May.

The southward progression of this toxic bloom continued into May, with a significant decline in relative abundances along the San Luis Obispo coast and a continued increase in numbers south of Point Conception. The high abundances of *Pseudo-nitzschia* observed in April along the Santa Barbara coast continued throughout most of the month. Elevated numbers of this diatom continued to be observed just offshore of Los Angeles and Orange counties during the first week of May, gradually declining through the end of the month at most sites. Farther offshore at Catalina Island *Pseudo-nitzschia* was no longer observed, with dinoflagellates appearing as a principle component of the phytoplankton as is more typical for the season.

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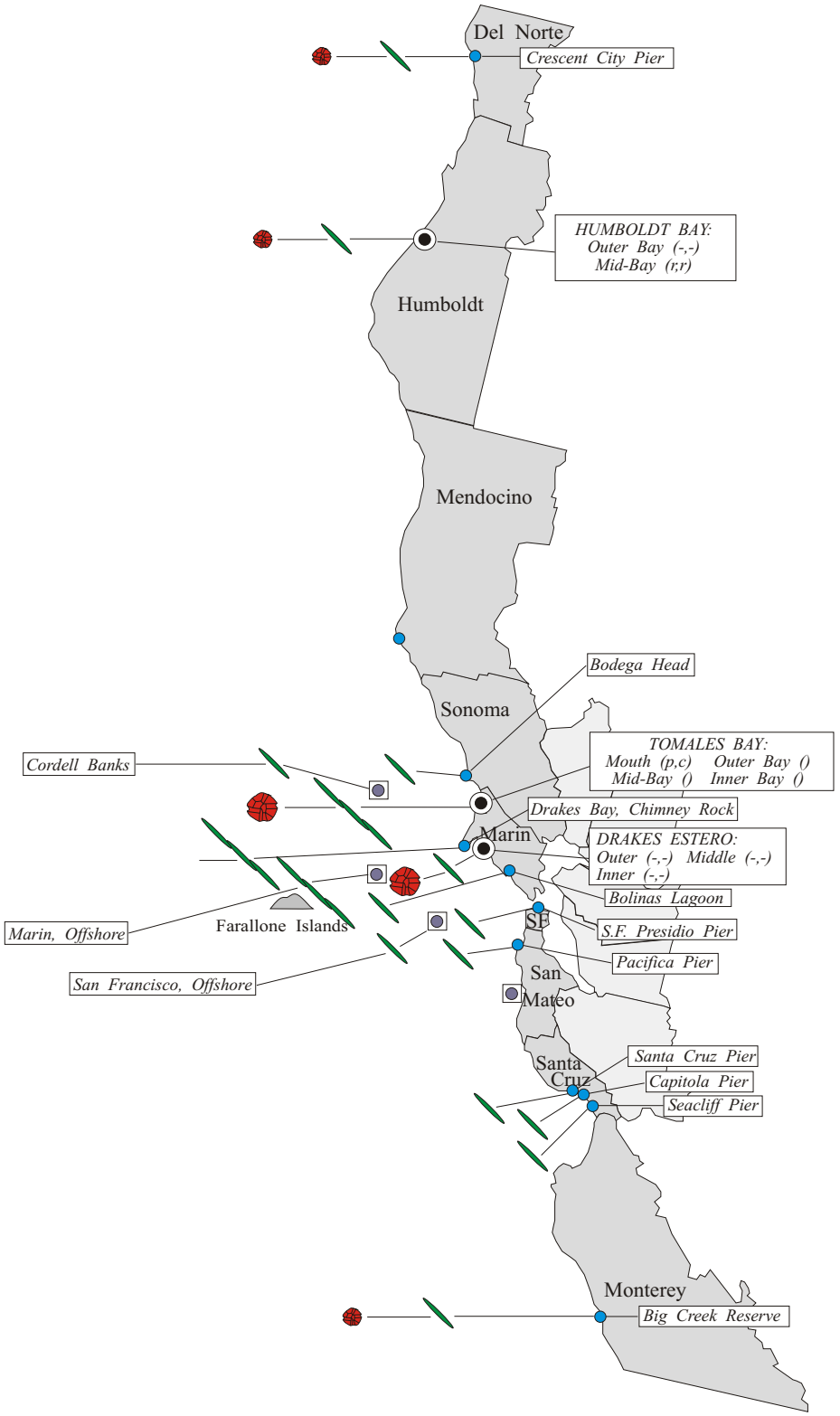
For More Information Please Call:
(510) 540 - 3423

For Recorded Biotoxin Information Call:
(800) 553 - 4133

Distribution of Toxin-Producing Phytoplankton Northern California



Northern California Summary:

Alexandrium catenella (Dinoflagellate that produces paralytic shellfish poisoning (PSP) toxins). There was an increase in the distribution of *Alexandrium* in May, however relative abundances were lower than observed in April.

Pseudo-nitzschia species (includes all known potential domoic acid producing diatoms). *Pseudo-nitzschia* increased in distribution along the northern California coast, although relative abundances were low in most areas. As observed in April, the highest relative abundance of *Pseudo-nitzschia* was observed just inside Tomales Bay. Shellfish samples from farther inside the Bay continued to contain low levels of domoic acid. *Pseudo-nitzschia* was also common at other Marin sites, including an offshore location sampled by the Gulf of the Farallones Marine Sanctuary.

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2151 Berkeley Way, Berkeley CA 94704-1011

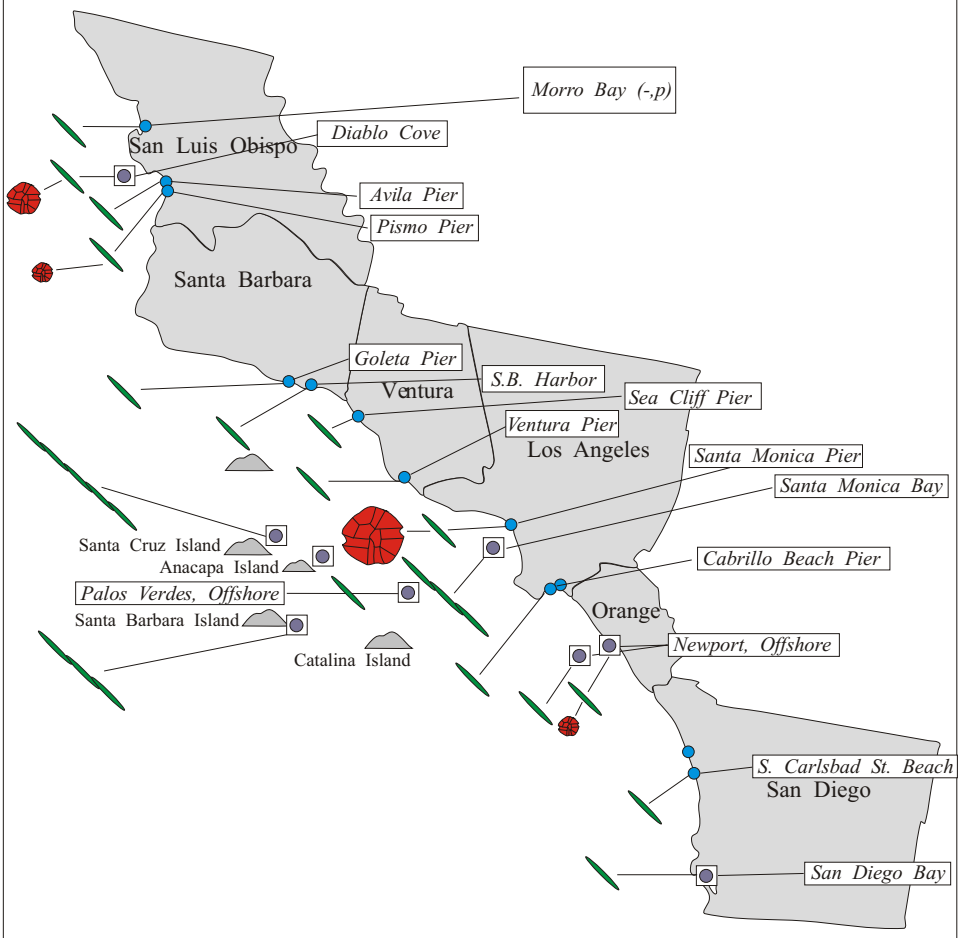
ENVIRONMENTAL MANAGEMENT BRANCH
Phytoplankton Monitoring Program

Phytoplankton Monthly Report

June 2002

Technical Report No. 02-20

Distribution of Toxin-Producing Phytoplankton
Southern California



Relative Abundance of Known Toxin Producers

Alexandrium Species

- Rare (less than 1%)
- Present (between 1% and 10%)
- Common (between 10% and 50%)
- Abundant (greater than 50%)

Pseudo-nitzschia Species

- Present (less than 10%)
- Common (between 10% and 50%)
- Abundant (greater than 50%)

MONTHLY SAMPLING STATIONS:

- Single Sampling Station
- Multiple Sampling Stations
- Offshore Sampling Station

For areas with multiple sampling stations, species abundance at each station is represented as follows:
(a,p) = Abundance for Alexandrium and Pseudo-nitzschia.
e.g., (c,p) = common, present; (a,-) = abundant, not observed

Southern California Summary:

Alexandrium catenella (Dinoflagellate that produces paralytic shellfish poisoning (PSP) toxins). The distribution and relative abundance of *Alexandrium* along the southern California coast in June was equivalent to May's observations. One exception was a sample collected on June 13 at Santa Monica Pier (Los Angeles County) that contained significant numbers of *Alexandrium*. PSP toxins were not detected in mussels collected farther upcoast and downcoast from this site.

Pseudo-nitzschia species (includes all known potential domoic acid producing diatoms). The distribution of *Pseudo-nitzschia* along the southern California coast in June was similar to previous observations, however there was a dramatic decrease in relative abundances throughout this region.

The decline in this diatom was mirrored in the shellfish analytical results, which showed that domoic acid was nondetectable at most sites. Interestingly, elevated numbers of *Pseudo-nitzschia* were detected offshore near Santa Cruz Island. Corresponding high domoic acid concentrations continued to be detected in pelagic red crab as reported in technical Report #02-19.

The Phytoplankton Monitoring Program, managed by the California Department of Health Services, is a state-wide program designed to detect toxin producing species of phytoplankton in ocean water before they impact California's valuable shellfish resources or become a threat to consumer safety.

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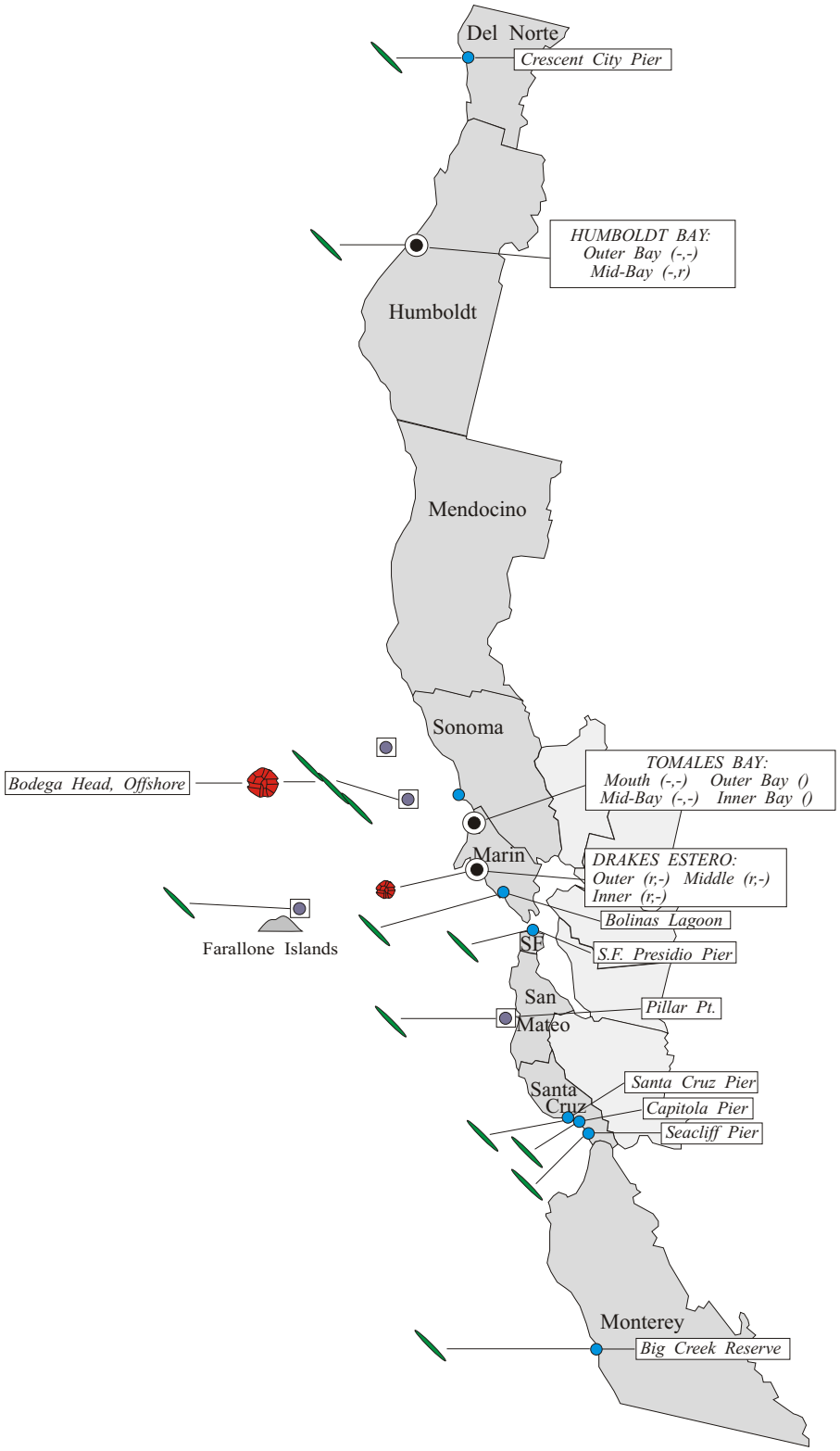
Distribution of Toxin-Producing Phytoplankton Northern California



Northern California Summary:

Alexandrium catenella (Dinoflagellate that produces paralytic shellfish poisoning (PSP) toxins). There was a decrease in the distribution and abundance of *Alexandrium* in June compared to observations in May.

Pseudo-nitzschia species (includes all known potential domoic acid producing diatoms). The distribution of *Pseudo-nitzschia* along the northern California coast in June remained similar to May's observations, although relative abundances decreased somewhat. The elevated relative abundance of *Pseudo-nitzschia* observed just inside Tomales Bay in April and May had disappeared by June. This observation was supported by analytical results of shellfish samples from farther inside the Bay, which no longer contained detectable levels of domoic acid.

The Phytoplankton Monitoring Program, managed by the California Department of Health Services, is a state-wide program designed to detect toxin producing species of phytoplankton in ocean water before they impact California's valuable shellfish resources or become a threat to consumer safety.

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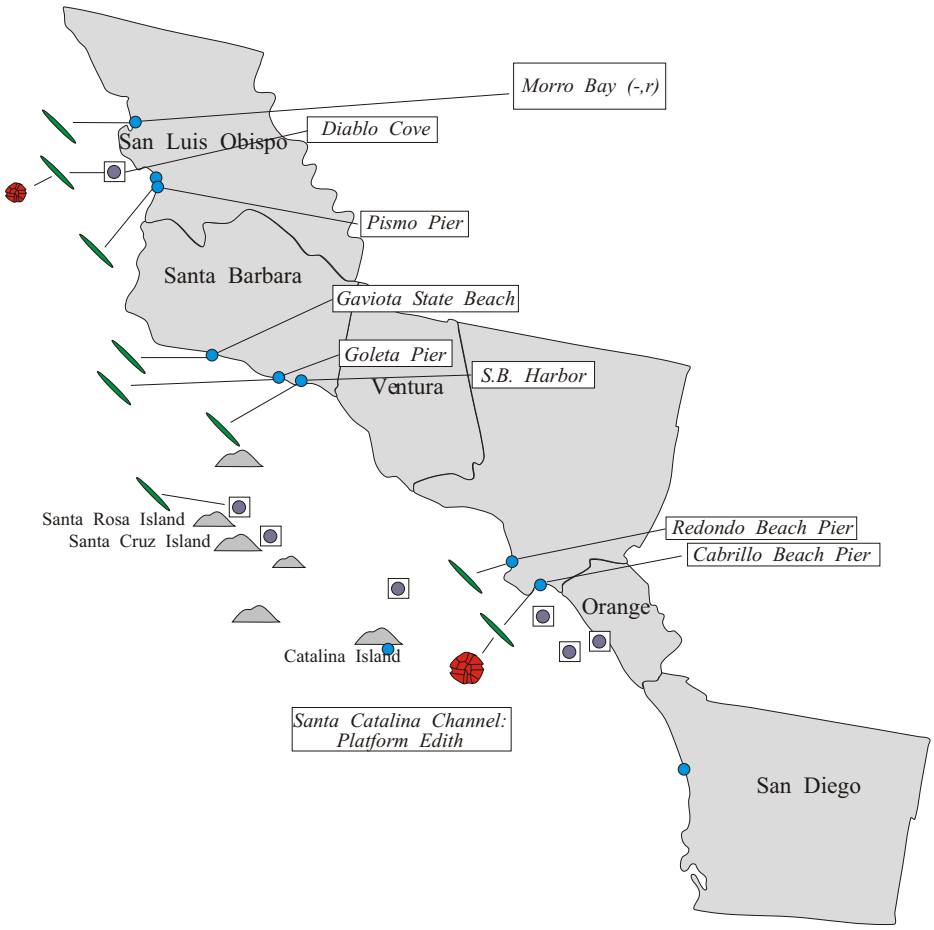
ENVIRONMENTAL MANAGEMENT BRANCH
Phytoplankton Monitoring Program

Phytoplankton Monthly Report

July 2002

Technical Report No. 02-25

Distribution of Toxin-Producing Phytoplankton
Southern California



Relative Abundance of Known Toxin Producers

Alexandrium Species

- Rare (less than 1%)
- Present (between 1% and 10%)
- Common (between 10% and 50%)
- Abundant (greater than 50%)

Pseudo-nitzschia Species

- Present (less than 10%)
- Common (between 10% and 50%)
- Abundant (greater than 50%)

MONTHLY SAMPLING STATIONS:

- Single Sampling Station
- Multiple Sampling Stations
- Offshore Sampling Station

For areas with multiple sampling stations, species abundance at each station is represented as follows:
(a,p) = Abundance for Alexandrium and Pseudo-nitzschia.
e.g., (c,p) = common, present; (a,-) = abundant, not observed

Southern California Summary:

Alexandrium catenella (Dinoflagellate that produces paralytic shellfish poisoning (PSP) toxins). The distribution and relative abundance of *Alexandrium* along the southern California coast in July declined from June's observations. Low numbers of this dinoflagellate were observed offshore of the San Luis Obispo coast and much farther south at Cabrillo Pier (Los Angeles County).

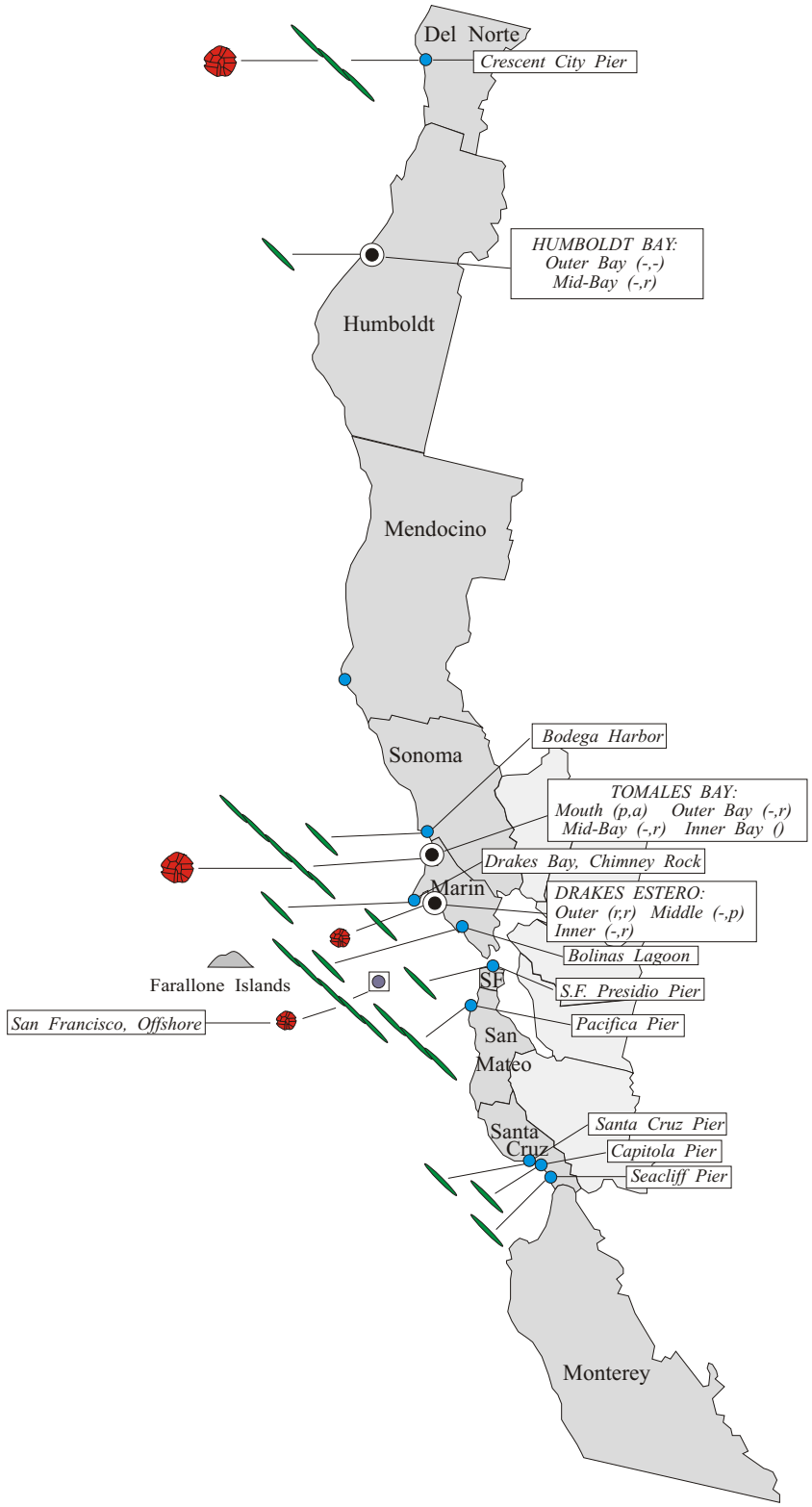
Pseudo-nitzschia species (includes all known potential domoic acid producing diatoms). The distribution of *Pseudo-nitzschia* along the southern California coast decreased dramatically in distribution and relative abundance in July compared to observations in June. However, low numbers of this diatom did persist along the coast and offshore near Santa Cruz and Santa Rosa islands throughout most of July.

The Phytoplankton Monitoring Program, managed by the California Department of Health Services, is a state-wide program designed to detect toxin producing species of phytoplankton in ocean water before they impact California's valuable shellfish resources or become a threat to consumer safety.

For More Information Please Call:
(510) 540 - 3423

For Recorded Biotoxin Information Call:
(800) 553 - 4133

Distribution of Toxin-Producing Phytoplankton Northern California



Northern California Summary:

Alexandrium catenella (Dinoflagellate that produces paralytic shellfish poisoning (PSP) toxins). There was a slight increase in the distribution and abundance of *Alexandrium* in July compared to observations in June. Low numbers of this dinoflagellate were observed offshore of San Francisco, as well as along the coast of Marin and Del Norte counties.

Pseudo-nitzschia species (includes all known potential domoic acid producing diatoms). The distribution of *Pseudo-nitzschia* along the northern California coast in July remained similar to June's observations. However, the relative abundance of this diatom increased between San Mateo and Sonoma counties. Low numbers of *Pseudo-nitzschia* were observed in outer Tomales Bay at the beginning of July, becoming abundant by the end of the month (July 29). As a result of these volunteer efforts we were alerted to the bloom and increased shellfish monitoring in this area. Low levels of domoic acid were detected in oysters farther inside the bay on July 30. *Pseudo-nitzschia* was also abundant offshore of San Francisco by July 30.

The Phytoplankton Monitoring Program, managed by the California Department of Health Services, is a state-wide program designed to detect toxin producing species of phytoplankton in ocean water before they impact California's valuable shellfish resources or become a threat to consumer safety.

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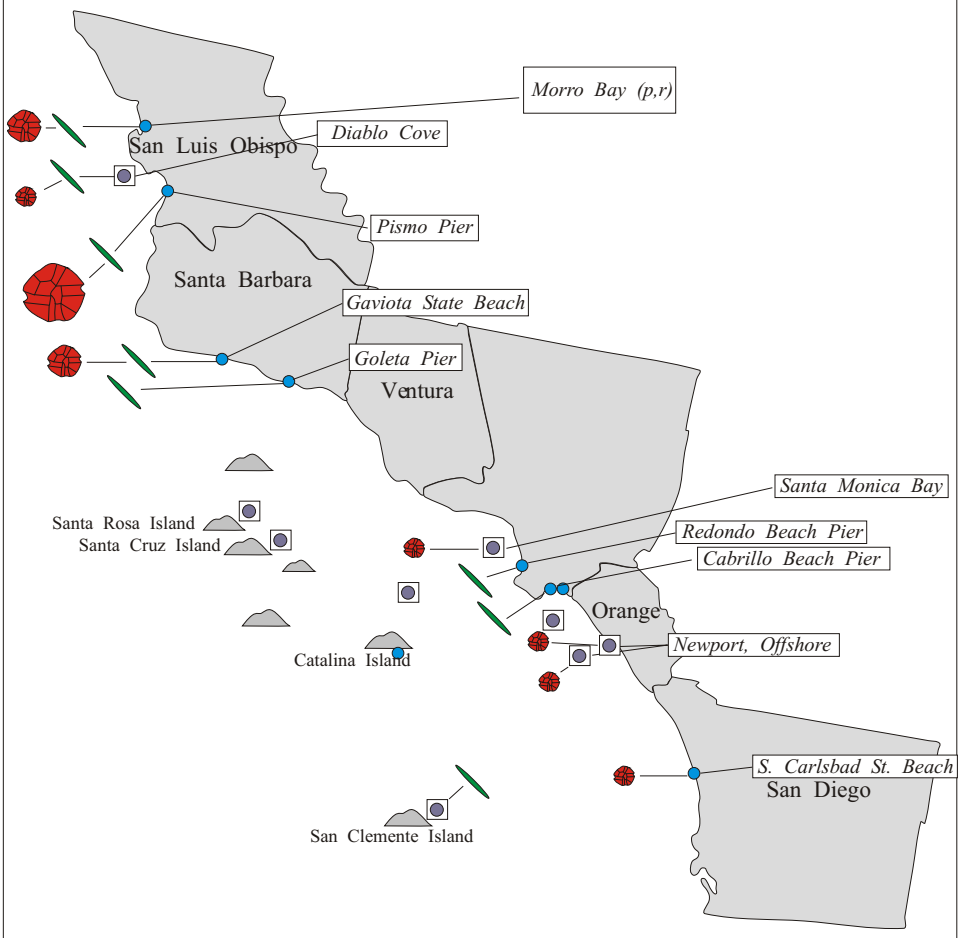
ENVIRONMENTAL MANAGEMENT BRANCH
Phytoplankton Monitoring Program

Phytoplankton Monthly Report

August 2002

Technical Report No. 02-27

Distribution of Toxin-Producing Phytoplankton
Southern California



Relative Abundance of Known Toxin Producers

Alexandrium Species

- Rare (less than 1%)
- Present (between 1% and 10%)
- Common (between 10% and 50%)
- Abundant (greater than 50%)

Pseudo-nitzschia Species

- Present (less than 10%)
- Common (between 10% and 50%)
- Abundant (greater than 50%)

MONTHLY SAMPLING STATIONS:

- Single Sampling Station
- Multiple Sampling Stations
- Offshore Sampling Station

For areas with multiple sampling stations, species abundance at each station is represented as follows:
(a,p) = Abundance for Alexandrium and Pseudo-nitzschia.
e.g., (c,p) = common, present; (a,-) = abundant, not observed

Southern California Summary:

Alexandrium catenella (Dinoflagellate that produces paralytic shellfish poisoning (PSP) toxins). There was a noticeable increase in the distribution and relative abundance of *Alexandrium* along the southern California coast in August. Low numbers of this dinoflagellate were observed at numerous sites between San Diego and San Luis Obispo counties. The greatest relative abundances were observed between Santa Barbara and San Luis Obispo counties. The overall density of cells was still quite low compared to observations at several northern California sites.

Pseudo-nitzschia species (includes all known potential domoic acid producing diatoms). The distribution of *Pseudo-nitzschia* along the southern California coast continued to decrease in August. Low numbers of this diatom persisted along much of the coast, however, as well as offshore near San Clemente Island.

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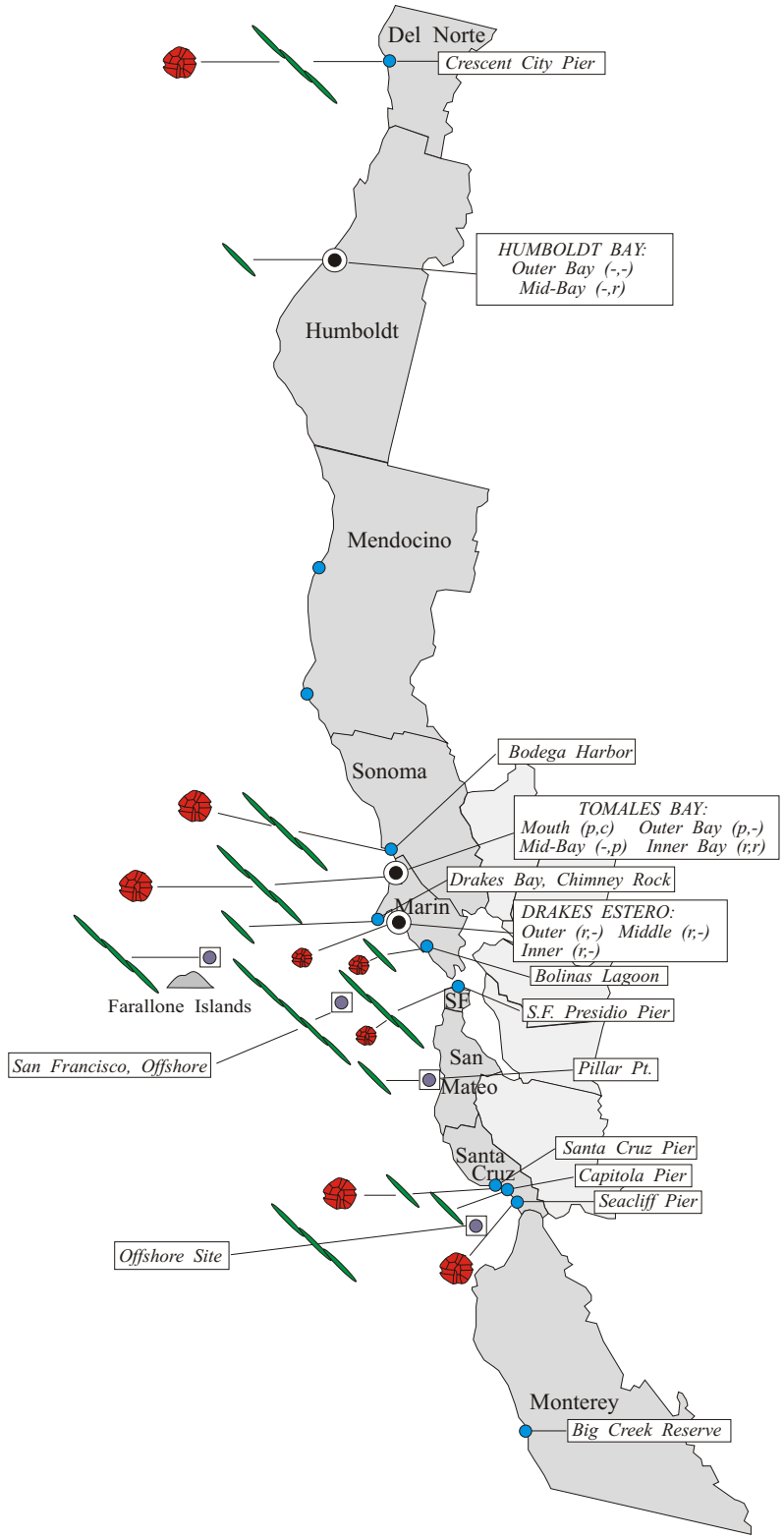
Distribution of Toxin-Producing Phytoplankton Northern California



Northern California Summary:

Alexandrium catenella (Dinoflagellate that produces paralytic shellfish poisoning (PSP) toxins). There was a noticeable increase in the distribution and abundance of *Alexandrium* in August compared to observations in July. Moderate numbers of this dinoflagellate were observed at sites in Santa Cruz, Marin, Sonoma, and Del Norte counties. Many of these observations were associated with varying levels of PSP toxicity in shellfish from nearby areas. The efforts of volunteer samplers near the mouth of Tomales Bay led to the detection of *Alexandrium* during the first week of August. By the third week of the month low levels of PSP toxins were detected in shellfish from the outer bay. Low numbers of this dinoflagellate were observed throughout the month in various locations within Tomales Bay and Drakes Estero.

Pseudo-nitzschia species (includes all known potential domoic acid producing diatoms). The distribution of *Pseudo-nitzschia* along the northern California coast in August remained similar to July's observations. This diatom remained abundant offshore of San Francisco and was common near the Farallone Islands, approximately 20 mile offshore of San Francisco.

The Phytoplankton Monitoring Program, managed by the California Department of Health Services, is a state-wide program designed to detect toxin producing species of phytoplankton in ocean water before they impact California's valuable shellfish resources or become a threat to consumer safety.

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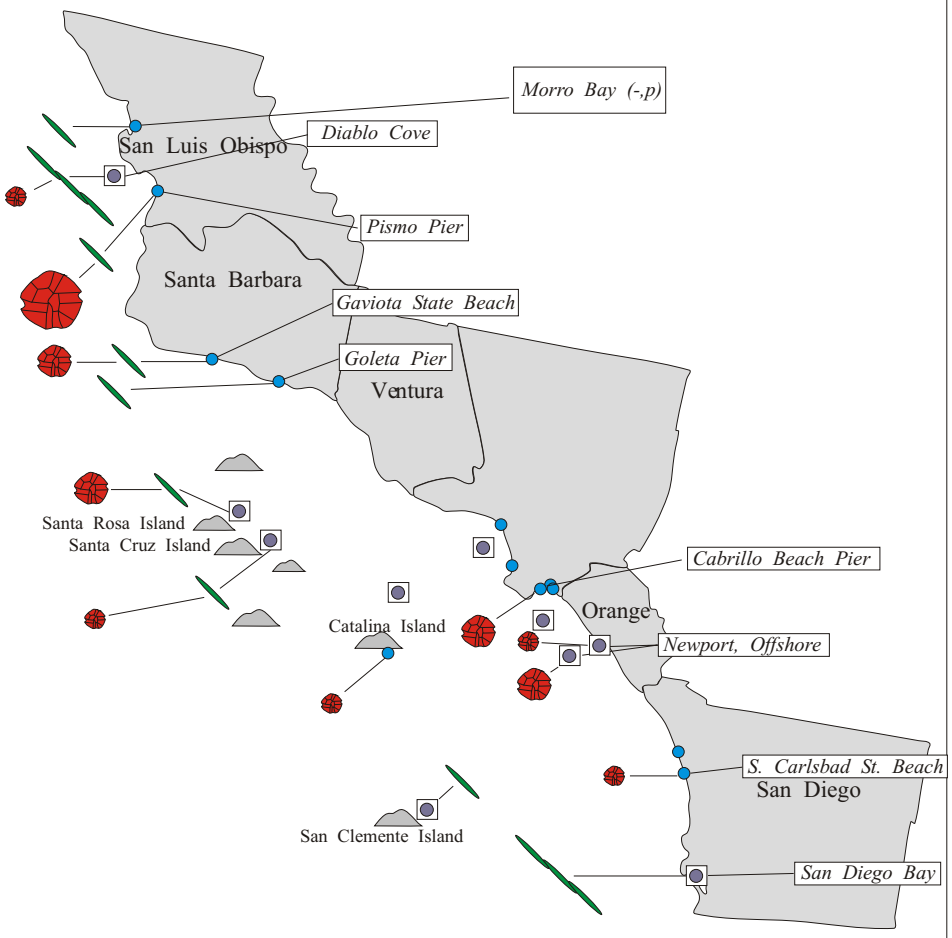
ENVIRONMENTAL MANAGEMENT BRANCH
Phytoplankton Monitoring Program

Phytoplankton Monthly Report

September 2002

Technical Report No. 02-29

Distribution of Toxin-Producing Phytoplankton
Southern California



Relative Abundance of Known Toxin Producers

Alexandrium Species

- Rare (less than 1%)
- Present (between 1% and 10%)
- Common (between 10% and 50%)
- Abundant (greater than 50%)

Pseudo-nitzschia Species

- Present (less than 10%)
- Common (between 10% and 50%)
- Abundant (greater than 50%)

MONTHLY SAMPLING STATIONS:

- Single Sampling Station
- Multiple Sampling Stations
- Offshore Sampling Station

For areas with multiple sampling stations, species abundance at each station is represented as follows:
(a,p) = Abundance for Alexandrium and Pseudo-nitzschia.
e.g., (c,p) = common, present; (a,-) = abundant, not observed

Southern California Summary:

Alexandrium catenella (Dinoflagellate that produces paralytic shellfish poisoning (PSP) toxins). The distribution and relative abundance of *Alexandrium* along the southern California coast in September were similar to observations in August. Low numbers of this dinoflagellate were observed at numerous sites between San Diego and San Luis Obispo counties. The greatest relative abundances were observed at Pismo Pier (San Luis Obispo) and Gaviota Pier (Santa Barbara).

Pseudo-nitzschia species (includes all known potential domoic acid producing diatoms). The distribution and abundance of *Pseudo-nitzschia* along the southern California coast in September were similar to observations in August. Low numbers of this diatom persisted along much of the coast, as well as offshore near Santa Rosa, Santa Cruz, Catalina, and San Clemente islands.

The Phytoplankton Monitoring Program, managed by the California Department of Health Services, is a state-wide program designed to detect toxin producing species of phytoplankton in ocean water before they impact California's valuable shellfish resources or become a threat to consumer safety.

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For Recorded Biotoxin Information Call:
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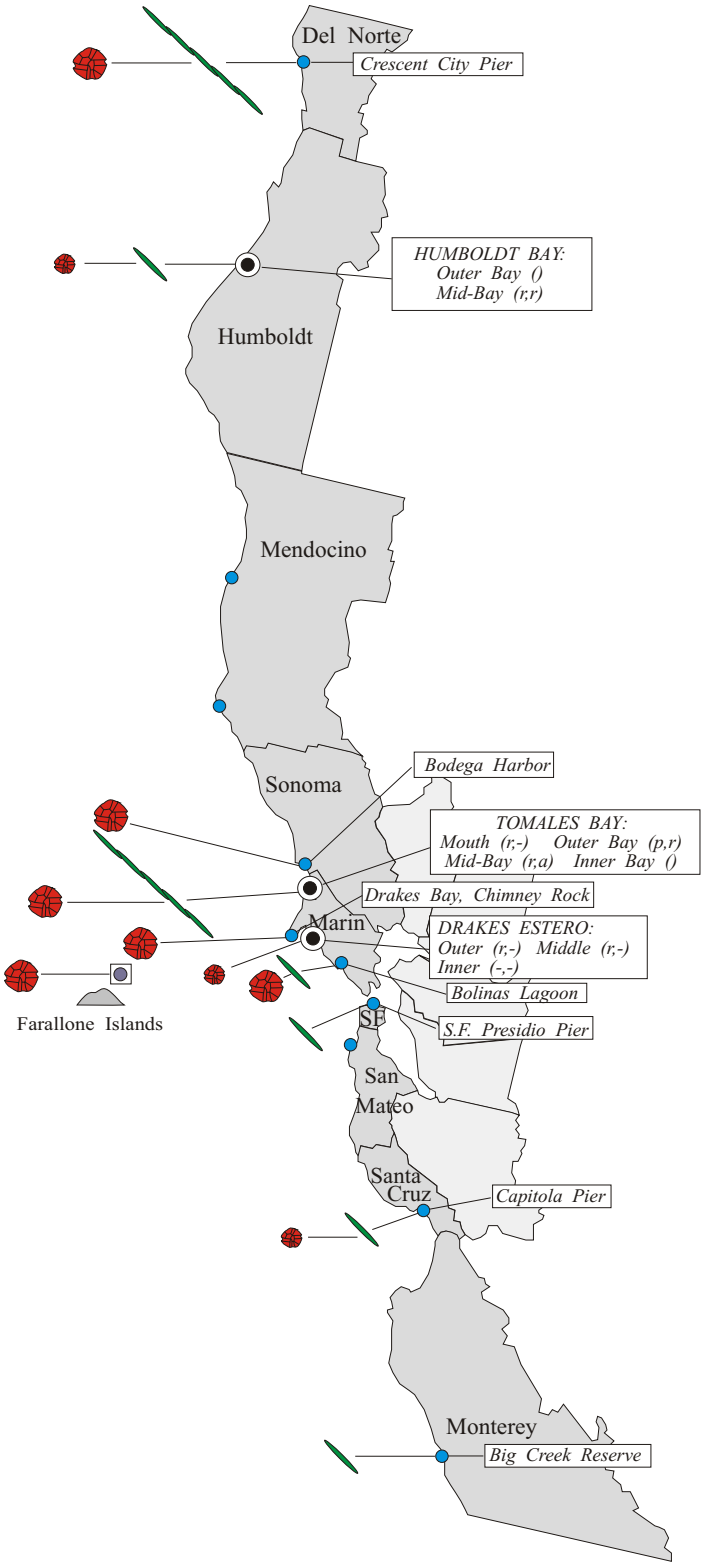
Distribution of Toxin-Producing Phytoplankton Northern California



Northern California Summary:

Alexandrium catenella (Dinoflagellate that produces paralytic shellfish poisoning (PSP) toxins). The distribution and abundance of *Alexandrium* in September was similar to observations in August. Moderate numbers of this dinoflagellate were observed at sites in Marin, Sonoma, and Del Norte counties. *Alexandrium* was also observed in moderate numbers offshore near the Farallone Islands during the last week of September. The highest relative abundances of this dinoflagellate were observed inside Bodega Harbor, inside Tomales Bay, at Chimney Rock, and near the Farallone Islands. Shellfish samples were available for the Tomales Bay and Chimney Rock sites and contained low levels of PSP toxins.

Pseudo-nitzschia species (includes all known potential domoic acid producing diatoms). In general the distribution and abundance of *Pseudo-nitzschia* along the northern California coast in September declined somewhat from July's observations. However increases in relative abundance were observed inside Tomales Bay and farther north at Crescent City.

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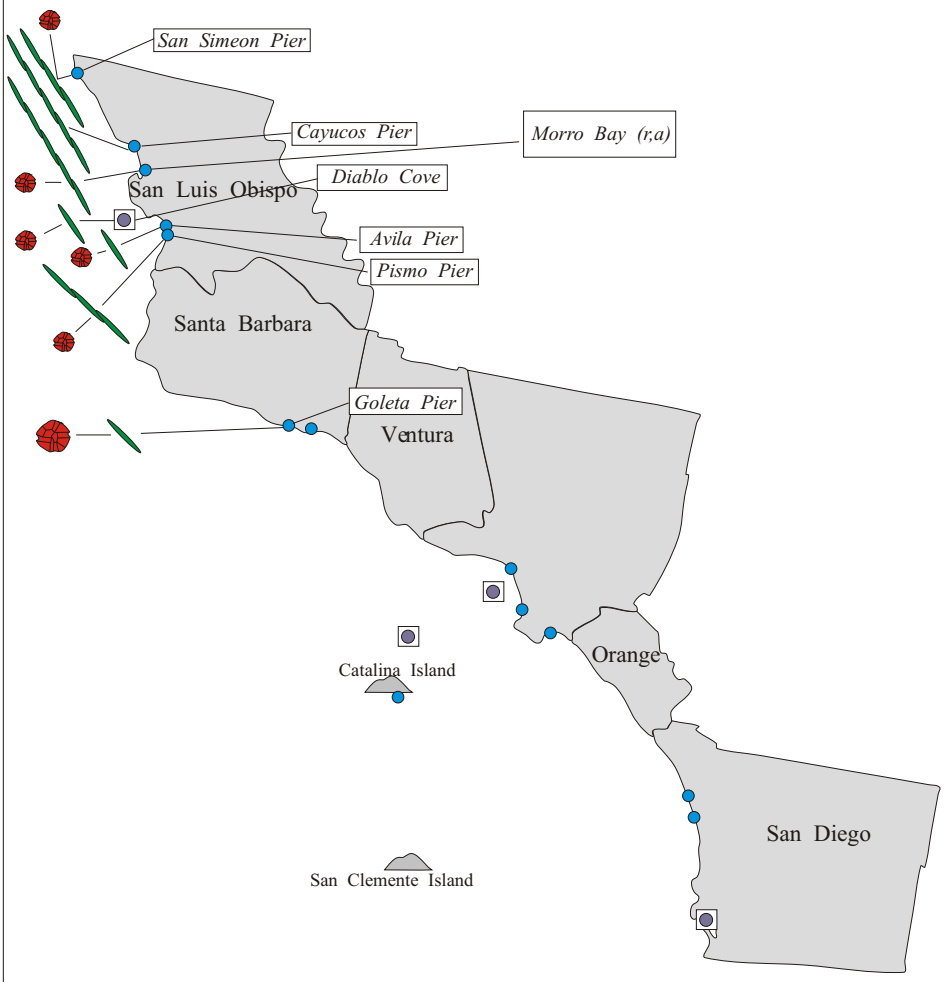
ENVIRONMENTAL MANAGEMENT BRANCH
Phytoplankton Monitoring Program

Phytoplankton Monthly Report

October 2002

Technical Report No. 02-31

Distribution of Toxin-Producing Phytoplankton
Southern California



Relative Abundance of Known Toxin Producers

Alexandrium Species

- Rare (less than 1%)
- Present (between 1% and 10%)
- Common (between 10% and 50%)
- Abundant (greater than 50%)

Pseudo-nitzschia Species

- Present (less than 10%)
- Common (between 10% and 50%)
- Abundant (greater than 50%)

MONTHLY SAMPLING STATIONS:

- Single Sampling Station
- Multiple Sampling Stations
- Offshore Sampling Station

For areas with multiple sampling stations, species abundance at each station is represented as follows:
(a,p) = Abundance for Alexandrium and Pseudo-nitzschia.
e.g., (c,p) = common, present; (a,-) = abundant, not observed

Southern California Summary:

Alexandrium catenella (Dinoflagellate that produces paralytic shellfish poisoning (PSP) toxins). The distribution and relative abundance of *Alexandrium* along the southern California coast in October declined from observations in September. Low numbers of this dinoflagellate were observed at sites between Santa Barbara and San Luis Obispo counties.

Pseudo-nitzschia species (includes all known potential domoic acid producing diatoms). The distribution of *Pseudo-nitzschia* along the southern California coast declined in October compared to observations in September. However the relative abundance of this diatom increased along the San Luis Obispo coast, particularly towards the end of the month.

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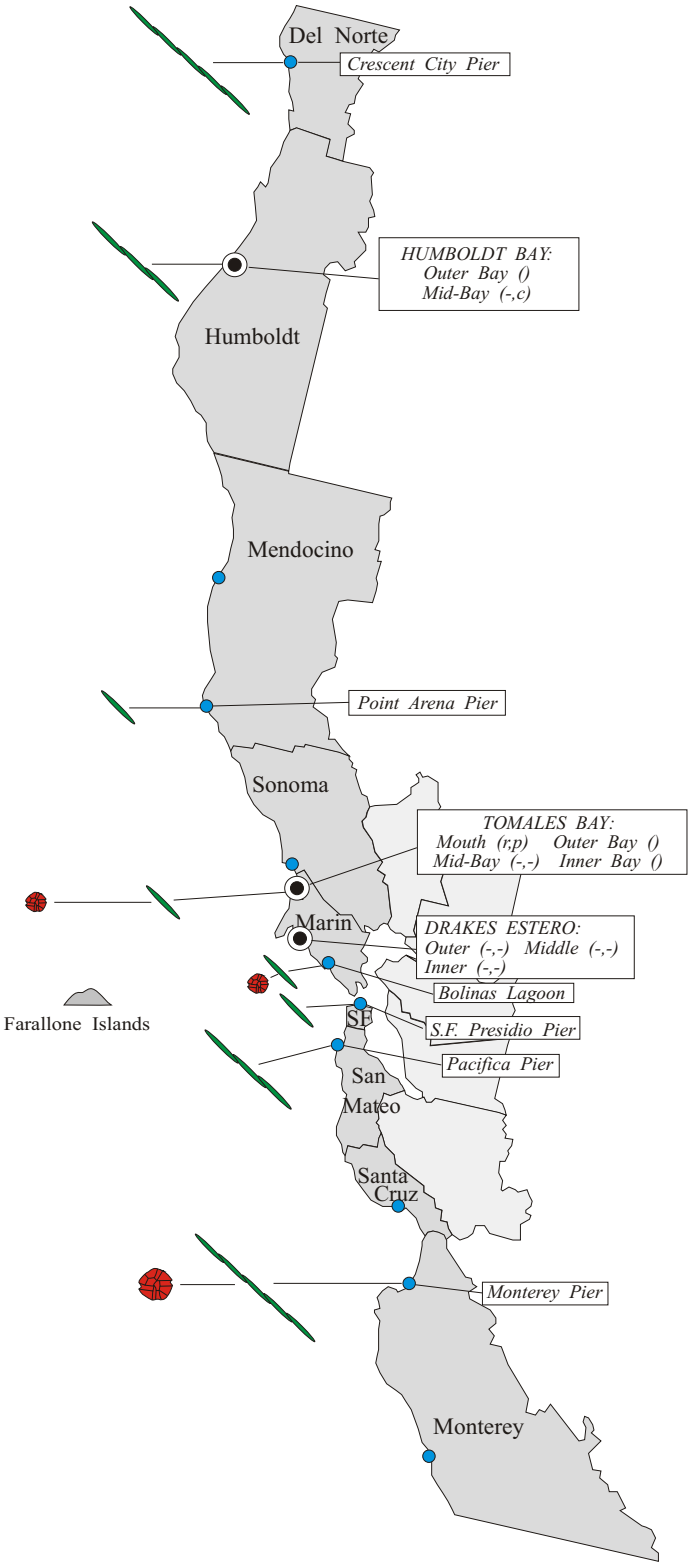
(800) 553 - 4133

Distribution of Toxin-Producing Phytoplankton Northern California



Northern California Summary:

Alexandrium catenella (Dinoflagellate that produces paralytic shellfish poisoning (PSP) toxins). The distribution and abundance of *Alexandrium* in October was reduced from observations in September. Low numbers of this dinoflagellate were observed at sites in Marin and Monterey counties. Cell densities were low in all cases.

Pseudo-nitzschia species (includes all known potential domoic acid producing diatoms). In general the distribution and abundance of *Pseudo-nitzschia* along the northern California coast in October increased somewhat from September's observations. This diatom was abundant in Crescent City (Del Norte County) and at the commercial pier in Monterey. Elevated numbers were also observed inside Humboldt Bay and along the San Mateo coast at Pacifica.

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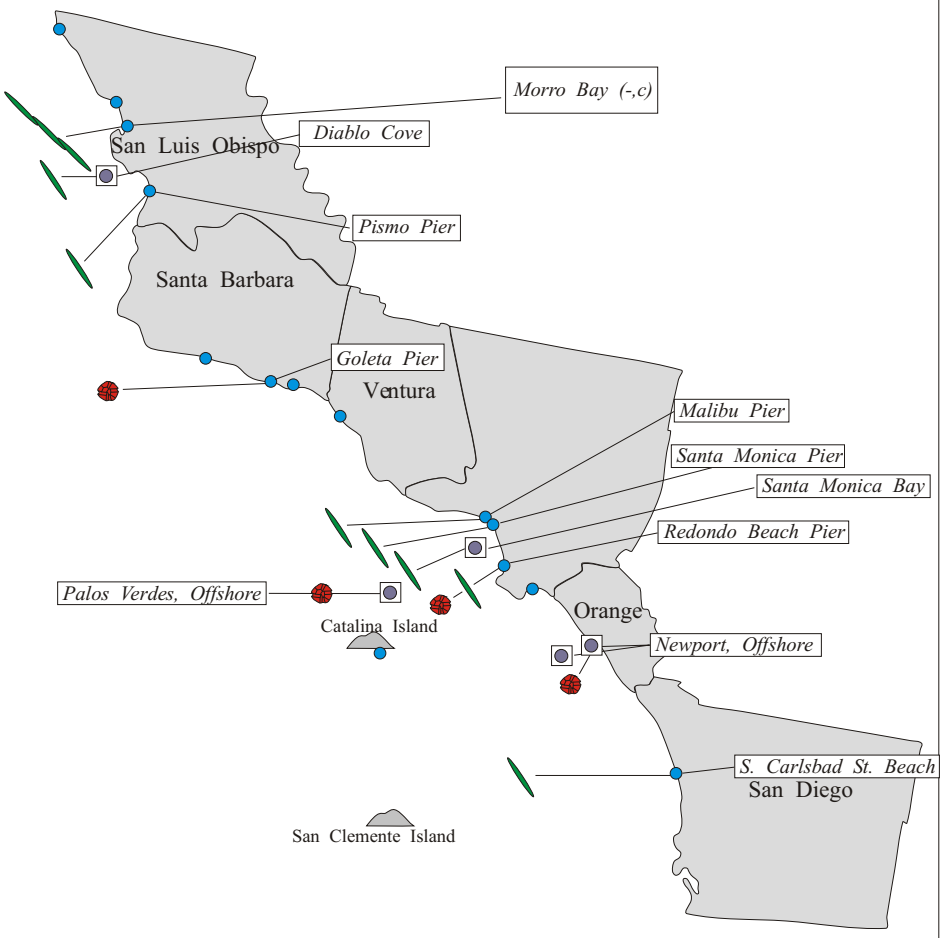
ENVIRONMENTAL MANAGEMENT BRANCH
Phytoplankton Monitoring Program

Phytoplankton Monthly Report

November 2002

Technical Report No. 02-33

Distribution of Toxin-Producing Phytoplankton
Southern California



Relative Abundance of Known Toxin Producers

Alexandrium Species

- Rare (less than 1%)
- Present (between 1% and 10%)
- Common (between 10% and 50%)
- Abundant (greater than 50%)

Pseudo-nitzschia Species

- Present (less than 10%)
- Common (between 10% and 50%)
- Abundant (greater than 50%)

MONTHLY SAMPLING STATIONS:

- Single Sampling Station
- Multiple Sampling Stations
- Offshore Sampling Station

For areas with multiple sampling stations, species abundance at each station is represented as follows:
(a,p) = Abundance for Alexandrium and Pseudo-nitzschia.
e.g., (c,p) = common, present; (a,-) = abundant, not observed

Southern California Summary:

Alexandrium catenella (Dinoflagellate that produces paralytic shellfish poisoning (PSP) toxins). *Alexandrium* was detected at several sites along the southern California coast in November. Low numbers of this dinoflagellate were observed at sites between Santa Barbara and Orange counties.

Pseudo-nitzschia species (includes all known potential domoic acid producing diatoms). The distribution of *Pseudo-nitzschia* along the southern California coast increased in November compared to observations in October, with the range extending from San Luis Obispo through San Diego. The relative abundance of this diatom was low at most sites.

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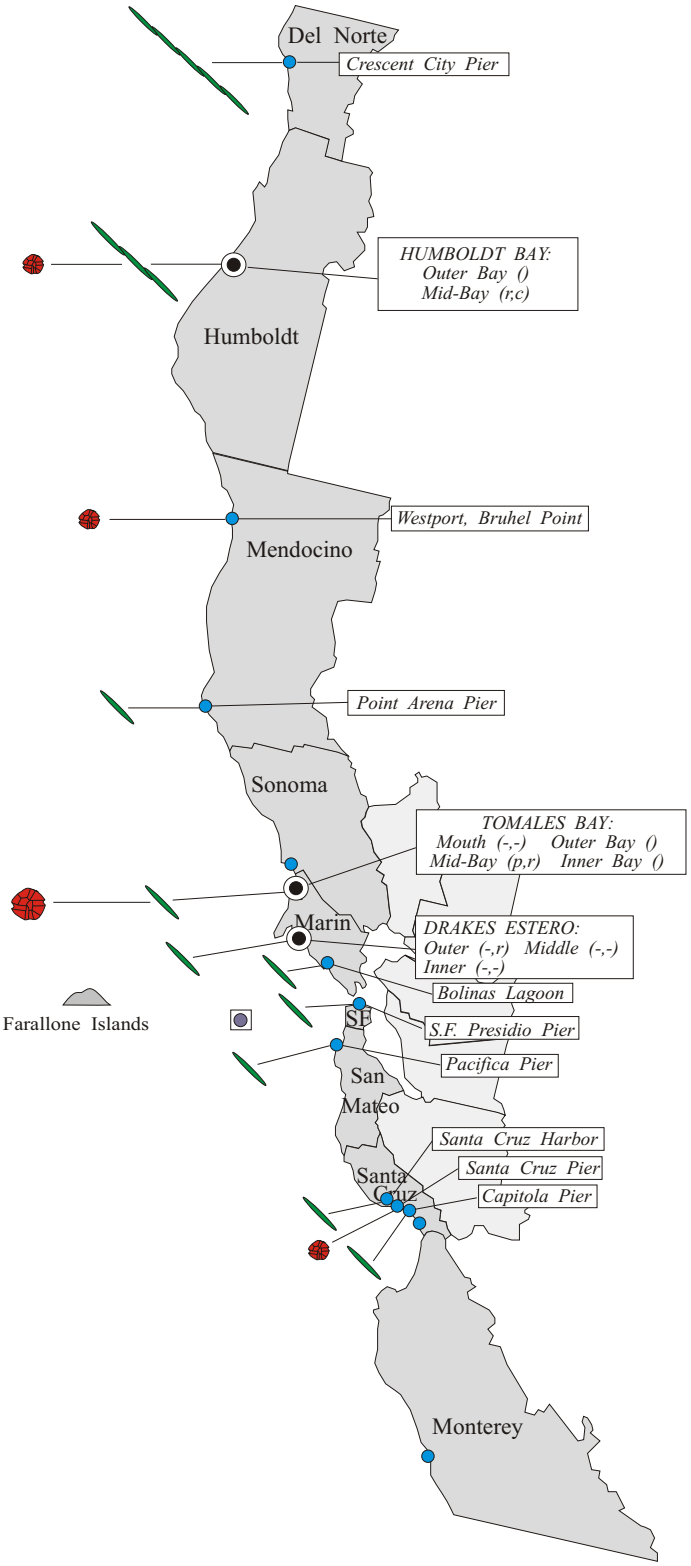
Distribution of Toxin-Producing Phytoplankton Northern California



Northern California Summary:

Alexandrium catenella (Dinoflagellate that produces paralytic shellfish poisoning (PSP) toxins). The distribution and abundance of *Alexandrium* in November increased slightly from observations in October. Low numbers of this dinoflagellate were observed at sites in Santa Cruz, Marin, Mendocino and Humboldt counties counties. Cell densities were low in all cases.

Pseudo-nitzschia species (includes all known potential domoic acid producing diatoms). In general the distribution and abundance of *Pseudo-nitzschia* along the northern California coast in November was similar to October's observations. This diatom remained abundant in Crescent City (Del Norte County) and was also at elevated levels inside Humboldt Bay. Similar observations in October led to the analysis of shellfish for domoic acid, which revealed elevated levels of this toxin at both locations.

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(800) 553 - 4133

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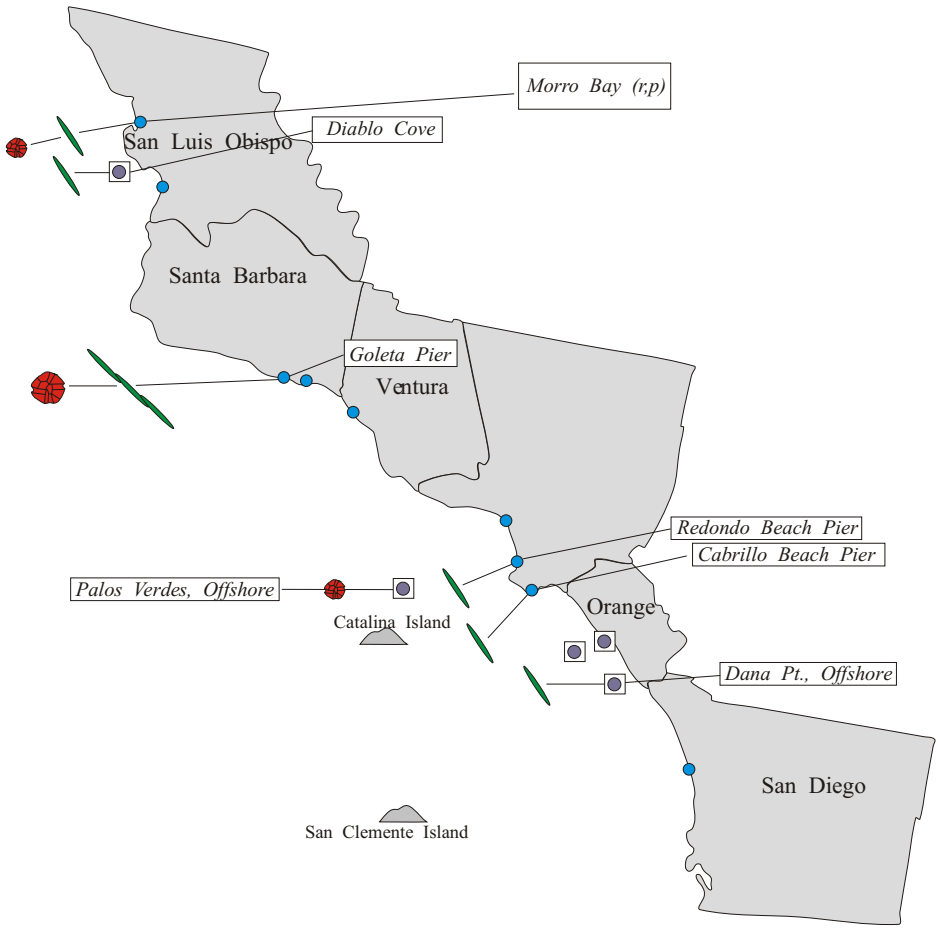
ENVIRONMENTAL MANAGEMENT BRANCH
Phytoplankton Monitoring Program

Phytoplankton Monthly Report

December 2002

Technical Report No. 02-35

Distribution of Toxin-Producing Phytoplankton
Southern California



Relative Abundance of Known Toxin Producers

Alexandrium Species

- Rare (less than 1%)
- Present (between 1% and 10%)
- Common (between 10% and 50%)
- Abundant (greater than 50%)

Pseudo-nitzschia Species

- Present (less than 10%)
- Common (between 10% and 50%)
- Abundant (greater than 50%)

MONTHLY SAMPLING STATIONS:

- Single Sampling Station
- Multiple Sampling Stations
- Offshore Sampling Station

For areas with multiple sampling stations, species abundance at each station is represented as follows:
(a,p) = Abundance for Alexandrium and Pseudo-nitzschia.
e.g., (c,p) = common, present; (a,-) = abundant, not observed

Southern California Summary:

Alexandrium catenella (Dinoflagellate that produces paralytic shellfish poisoning (PSP) toxins). *Alexandrium* was detected at several sites along the southern California coast in December. The greatest relative abundance was observed at Goleta Pier (Santa Barbara County), however cell numbers were low.

Pseudo-nitzschia species (includes all known potential domoic acid producing diatoms). The distribution of *Pseudo-nitzschia* along the southern California coast was similar to November's observations. The relative abundance of this diatom was low at most sites, although there was a noticeable increase at Goleta Pier (Santa Barbara County) at the beginning of December.

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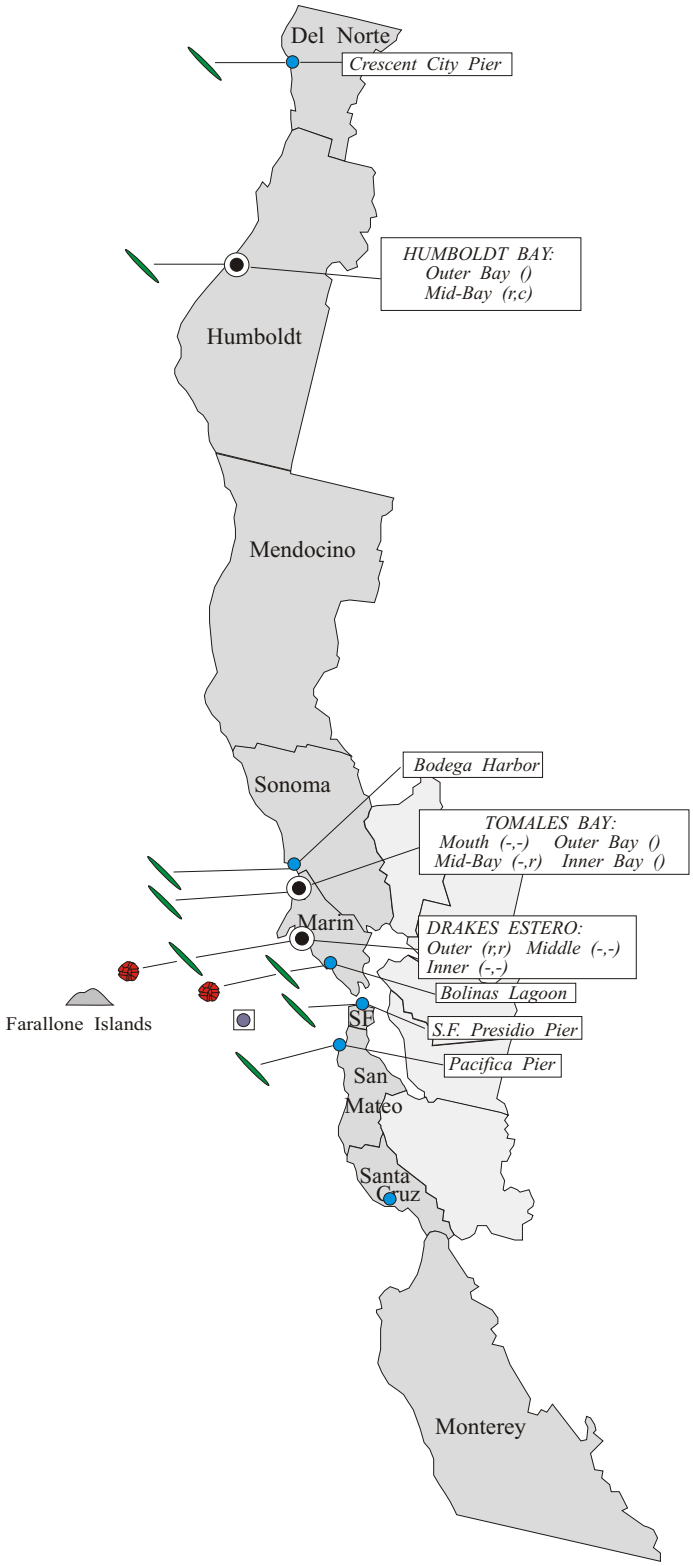
Distribution of Toxin-Producing Phytoplankton Northern California



Northern California Summary:

Alexandrium catenella (Dinoflagellate that produces paralytic shellfish poisoning (PSP) toxins). The distribution and abundance of *Alexandrium* in December decreased from observations in November. Low numbers of this dinoflagellate were observed at sites along the Marin coast.

Pseudo-nitzschia species (includes all known potential domoic acid producing diatoms). In general the distribution and abundance of *Pseudo-nitzschia* along the northern California coast in December decreased compared to November's observations. There was a dramatic decline in the numbers of this diatom along the Del Norte and Humboldt coast, which had experienced high cell densities and elevated levels of domoic acid in early November.

The Phytoplankton Monitoring Program, managed by the California Department of Health Services, is a state-wide program designed to detect toxin producing species of phytoplankton in ocean water before they impact California's valuable shellfish resources or become a threat to consumer safety.

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APPENDIX D.

Monthly lists of agencies and organizations participating in marine phytoplankton sample collection in California during 2002.

Appendix D-1. Agencies and organizations participating in marine phytoplankton sample collection in California during January 2002.

COUNTY	AGENCY	SAMPLES
Del Norte	None Submitted	
Humboldt	Coast Seafood Company	5
	Arcata High School	5
Mendocino	CDHS Volunteer (Jim Wesley)	1
Sonoma	Bodega Marine Lab	2
	CDHS Volunteer (Cathleen Cannon)	1
Marin	CDHS Volunteer (Brent Anderson, Cal Strobel)	2
	CDHS Marine Biotoxin Program	1
	Johnson Oyster Company	20
Alameda	None Submitted	
San Francisco	CDHS Volunteer (Eugenia McNaughton)	4
San Mateo	None Submitted	
Santa Cruz	Santa Cruz County Environmental Health Department	3
	San Lorenzo Valley High School	3
Monterey	None Submitted	
San Luis Obispo	CDHS Volunteer (Judy and Whit Whitmire, Renee and Auburn Atkins, Jim and Nancy Hale)	6
	Morro Bay National Estuary Program	1
	Tenera Environmental	4
Santa Barbara	U.C. Santa Barbara Marine Sciences	5
	California Department of Parks and Recreation	1
	Santa Barbara City College	1
Ventura	CDHS Volunteer (Jeff Kermode)	1
Los Angeles	Los Angeles County Sanitation District	2
	Los Angeles County Health Department	2
Orange	Ecomar, Inc.	3
San Diego	CDHS Volunteers (Randy and Bill Dick)	1
	San Diego County Environmental Health Department	3

Appendix D-2. Agencies and organizations participating in marine phytoplankton sample collection in California during February 2002.

COUNTY	AGENCY	SAMPLES
Del Norte	None Submitted	
Humboldt	Coast Seafood Company	4
	Arcata High School	3
Mendocino	CDHS Volunteer (Amy Johnson)	1
Sonoma	Bodega Marine Laboratory	3
Marin	CDHS Volunteer (Brent Anderson, Richard Plant)	4
	California Department of Fish and Game	3
	Johnson Oyster Company	16
Alameda	None Submitted	
San Francisco	CDHS Volunteer (Eugenia McNaughton)	3
	Gulf of the Farallones National Marine Sanctuary	1
San Mateo	None Submitted	
Santa Cruz	None Submitted	
Monterey	CDHS Volunteer (Whit and Judy Whitmire)	1
San Luis Obispo	CDHS Volunteer (Whit and Judy Whitmire, Renee and Auburn Atkins)	11
	Tenera Environmental	2
Santa Barbara	U.C. Santa Barbara Marine Sciences	4
	California Department of Parks and Recreation	2
	Santa Barbara City College	2
Ventura	None Submitted	
Los Angeles	Los Angeles County Sanitation District	1
	Los Angeles County Health Department	2
	Catalina Island Marine Institute	4
	Catalina Tall Ships Expeditions	4
Orange	None Submitted	
San Diego	CDHS Volunteer (Jeff Kermode)	1
	San Diego County Environmental Health Department	4

Appendix D-3. Agencies and organizations participating in marine phytoplankton sample collection in California during March 2002.

COUNTY	AGENCY	SAMPLES
Del Norte	None Submitted	
Humboldt	Coast Seafood Company	2
	Arcata High School	2
Mendocino	CDHS Volunteer (Amy Johnson)	1
Sonoma	Bodega Marine Lab	5
Marin	CDHS Volunteer (Brent Anderson, Cal Strobel)	5
	Johnson Oyster Company	16
Alameda	None Submitted	
San Francisco	CDHS Volunteer (Eugenia McNaughton)	4
San Mateo	San Mateo County Environmental Health Department	1
	CDHS Volunteer (Sandy Emerson)	1
Santa Cruz	Santa Cruz County Environmental Health Department	4
	San Lorenzo Valley High School	1
	CDHS Marine Biotoxin Program	4
Monterey	U.C. Reserve System	1
	Pacific Cetacean Group	1
	CDHS Marine Biotoxin Program	1
San Luis Obispo	CDHS Volunteer (Whit and Judy Whitmire, Renee and Auburn Atkins)	5
	Tenera Environmental	3
Santa Barbara	California Department of Parks and Recreation	1
	U.C. Santa Barbara Marine Sciences	4
	Santa Barbara City College	1
Ventura	California Department of Parks and Recreation	1
Los Angeles	Los Angeles County Sanitation District	2
	Los Angeles County Health Department	4
	Catalina Tall Ships Expeditions	2
	Catalina Island Marine Institute	6
Orange	Orange County Sanitation District	1
	Ecomar, Inc.	1
	Orange County Sanitation District	2
San Diego	San Diego County Environmental Health Department	4

Appendix D-4. Agencies and organizations participating in marine phytoplankton sample collection in California during April 2002.

COUNTY	AGENCY	SAMPLES
Del Norte	None Submitted	
Humboldt	Coast Seafood Company	5
	Arcata High School	5
Mendocino	CDHS Volunteers (Jim Wesley, Amy Johnson)	2
Sonoma	Bodega Marine Lab	4
	CDHS Volunteer (Cathleen Cannon)	1
Marin	CDHS Volunteer (Brent Anderson, Cal Strobel, Richard Plant)	11
	CDHS Marine Biotoxin Program	2
	Johnson Oyster Company	16
Alameda	None Submitted	
San Francisco	CDHS Volunteer (Eugenia McNaughton)	2
San Mateo	San Mateo County Environmental Health Department	1
	CDHS Volunteer (Sandy Emerson)	2
Santa Cruz	None Submitted	
Monterey	U.C. Reserve System	1
San Luis Obispo	CDHS Volunteer (Judy and Whit Whitmire, Renee and Auburn Atkins, Connie Marangi, Bill Schwebel)	12
	Morro Bay National Estuary Program	2
	Tenera Environmental	4
	Port San Luis Marine Institute	2
	CDHS Marine Biotoxin Program	12
Santa Barbara	U.C. Santa Barbara Marine Sciences	5
	California Department of Parks and Recreation	2
	Santa Barbara City College	2
	Vandenberg AFB	4
Ventura	Catalina Tall Ships Expeditions	1
Los Angeles	Los Angeles County Sanitation District	4
	Los Angeles County Health Department	4
	Catalina Island Marine Institute	3
	Catalina Tall Ships Expeditions	4
Orange	Orange County Sanitation District	5
San Diego	CDHS Volunteers (Randy and Bill Dick, Jeff Kermode, Paul Sims, Rachel Woodfield)	5
	San Diego County Environmental Health Department	5

Appendix D-5. Agencies and organizations participating in marine phytoplankton sample collection in California during May 2002.

COUNTY	AGENCY	SAMPLES
Del Norte	Del Norte County Health Department	2
Humboldt	Coast Seafood Company	4
Mendocino	CDHS Volunteer (Amy Johnson)	1
Sonoma	Bodega Marine Laboratory	3
	Cordell Banks Marine Sanctuary	1
Marin	CDHS Volunteer (Brent Anderson, Cal Strobel)	5
	CDHS Marine Biotoxin Program	2
	Johnson Oyster Company	16
	Cordell Banks Marine Sanctuary	1
Alameda	None Submitted	
San Francisco	CDHS Volunteer (Eugenia McNaughton)	4
	Gulf of the Farallones National Marine Sanctuary	1
San Mateo	San Mateo County Environmental Health Department	1
	CDHS Volunteer (Sandy Emerson)	1
Santa Cruz	Aptos High School	1
	Santa Cruz County Environmental Health Department	4
Monterey	U.C. Reserve System	1
San Luis Obispo	CDHS Volunteer (Whit and Judy Whitmire, Renee and Auburn Atkins, Bill Schwebel)	8
	Tenera Environmental	4
	Morro Bay National Estuary Program	4
	Port San Luis Marine Institute	1
Santa Barbara	U.C. Santa Barbara Marine Sciences	4
	California Department of Parks and Recreation	3
	Santa Barbara City College	2
	Vandenberg AFB	1
Ventura	California Department of Parks and Recreation	4
Los Angeles	Los Angeles County Sanitation District	6
	Los Angeles County Health Department	18
	Catalina Island Marine Institute	3
	Catalina Tall Ships Expeditions	5
Orange	Orange County Sanitation District	4
	Ocean Institute	1
San Diego	CDHS Volunteer (Randy and Bill Dick)	2
	San Diego County Environmental Health Department	2

Appendix D-6. Agencies and organizations participating in marine phytoplankton sample collection in California during June 2002.

COUNTY	AGENCY	SAMPLES
Del Norte	Del Norte County Environmental Health Department	3
Humboldt	Coast Seafood Company	4
Mendocino	None Submitted	
Sonoma	Bodega Marine Lab	3
	Gulf of the Farallones Marine Sanctuary	4
Marin	CDHS Volunteer (Brent Anderson, Richard Plant)	6
	Johnson Oyster Company	16
	Gulf of the Farallones Marine Sanctuary	1
Alameda	None Submitted	
San Francisco	CDHS Volunteer (Eugenia McNaughton)	3
	Cordell Banks Marine Sanctuary	2
San Mateo	CDHS Volunteer (Sandy Emerson)	1
Santa Cruz	Santa Cruz County Environmental Health Department	3
Monterey	U.C. Reserve System	1
San Luis Obispo	CDHS Volunteer (Renee and Auburn Atkins, Bill Schwebel)	5
	Tenera Environmental	4
	Morro Bay National Estuary Program	2
	Port San Luis Marine Institute	1
Santa Barbara	U.C. Santa Barbara Marine Sciences	3
	Santa Barbara City College	1
Ventura	California Department of Parks and Recreation	1
	Catalina Tall Ships Expeditions	4
Los Angeles	Los Angeles County Sanitation District	3
	Los Angeles County Health Department	3
	City of Los Angeles Environmental Management	2
Orange	Orange County Sanitation District	6
San Diego	San Diego County Environmental Health Department	4
	CDHS Volunteer (Paul Sims)	1

Appendix D-7. Agencies and organizations participating in marine phytoplankton sample collection in California during July 2002.

COUNTY	AGENCY	SAMPLES
Del Norte	Del Norte County Health Department	5
Humboldt	Coast Seafood Company	8
Mendocino	CDHS Volunteer (Amy Johnson)	1
Sonoma	Bodega Marine Lab	4
	CDHS Volunteer (Cathleen Cannon)	1
Marin	CDHS Volunteers (Brent Anderson, Cal Strobel, Richard Plant)	17
	CDHS Marine Biotoxin Program	2
	Johnson Oyster Company	24
Alameda	None Submitted	
San Francisco	CDHS Volunteer (Eugenia McNaughton)	3
	Gulf of the Farallones National Marine Sanctuary	2
San Mateo	San Mateo County Environmental Health Department	1
Santa Cruz	Santa Cruz County Environmental Health Department	4
Monterey	None Submitted	
San Luis Obispo	CDHS Volunteers (Renee and Auburn Atkins, Connie Marangi, Bill Schwebel)	6
	Morro Bay National Estuary Program	1
	Tenera Environmental	4
Santa Barbara	U.C. Santa Barbara Marine Sciences	5
	California Department of Parks and Recreation	4
	Santa Barbara City College	2
	Catalina Tall Ships Expeditions	2
Ventura	None Submitted	
Los Angeles	Los Angeles County Sanitation District	2
	Los Angeles County Health Department	4
	Catalina Island Marine Institute	1
Orange	Orange County Sanitation District	2
	Ecomar, Inc.	1
San Diego	San Diego County Environmental Health Department	5

Appendix D-8. Agencies and organizations participating in marine phytoplankton sample collection in California during August 2002.

COUNTY	AGENCY	SAMPLES
Del Norte	Del Norte County Health Department	3
Humboldt	Coast Seafood Company	6
Mendocino	California Department of Parks and Recreation	2
Sonoma	Bodega Marine Laboratory	3
	CDHS Marine Biotoxin Program	3
Marin	CDHS Volunteers (Brent Anderson, Cal Strobel, Richard Plant)	11
	CDHS Marine Biotoxin Program	1
	Johnson Oyster Company	20
	California Department of Fish and Game	2
Alameda	None Submitted	
San Francisco	CDHS Volunteer (Eugenia McNaughton)	4
	Gulf of the Farallones National Marine Sanctuary	3
San Mateo	CDHS Volunteer (Sandy Emerson)	1
Santa Cruz	Pacific Cetacean Group	1
	Santa Cruz County Environmental Health Department	3
Monterey	U.C. Reserve System	1
San Luis Obispo	CDHS Volunteers (Renee and Auburn Atkins, Bill Schwebel)	5
	Tenera Environmental	1
	Morro Bay National Estuary Program	1
Santa Barbara	U.C. Santa Barbara Marine Sciences	3
	California Department of Parks and Recreation	2
Ventura	None Submitted	
Los Angeles	Los Angeles County Sanitation District	3
	Los Angeles County Health Department	4
	City of Los Angeles Environmental Monitoring Division	3
	Catalina Tall Ships Expeditions	1
Orange	Orange County Sanitation District	6
	Ecomar, Inc.	1
San Diego	San Diego County Environmental Health Department	4
	Catalina Island Marine Institute	1

Appendix D-9. Agencies and organizations participating in marine phytoplankton sample collection in California during September 2002.

COUNTY	AGENCY	SAMPLES
Del Norte	Del Norte County Environmental Health Department	3
Humboldt	Coast Seafood Company	6
Mendocino	California Department of Parks and Recreation	2
Sonoma	Bodega Marine Lab	1
	California Department of Fish and Game	3
	CDHS Volunteer (Cathleen Cannon)	1
Marin	CDHS Volunteers (Brent Anderson, Richard Plant)	8
	Johnson Oyster Company	16
	California Department of Fish and Game	1
	CDHS Marine Biotoxin Program	2
Alameda	None Submitted	
San Francisco	CDHS Volunteer (Eugenia McNaughton)	4
	Gulf of the Farallones Marine Sanctuary	3
San Mateo	San Mateo County Environmental Health Department	2
Santa Cruz	Santa Cruz County Environmental Health Department	3
	Pacific Cetacean Group	1
Monterey	U.C. Reserve System	1
San Luis Obispo	CDHS Volunteers (Renee and Auburn Atkins, Connie Marangi)	3
	Tenera Environmental	2
	Morro Bay National Estuary Program	2
Santa Barbara	U.C. Santa Barbara Marine Sciences	3
	Catalina Tall Ships Expeditions	1
Ventura	Catalina Tall Ships Expeditions	1
Los Angeles	Los Angeles County Sanitation District	2
	Los Angeles County Health Department	2
	City of Los Angeles Environmental Monitoring Division	2
	Los Angeles Regional Water Quality Control Board	1
	Catalina Tall Ships Expeditions	1
	Catalina Island Marine Institute	3
Orange	Orange County Sanitation District	6
	Ecomar, Inc.	1
San Diego	San Diego County Environmental Health Department	5
	CDHS Volunteers (Paul Sims, Randy and Bill Dick)	2

Appendix D-10. Agencies and organizations participating in marine phytoplankton sample collection in California during October 2002.

COUNTY	AGENCY	SAMPLES
Del Norte	Del Norte County Health Department	2
Humboldt	Coast Seafood Company	3
Mendocino	CDHS Volunteers (Amy Johnson, Jim Wesley)	2
Sonoma	Bodega Marine Lab	2
Marin	CDHS Volunteers (Brent Anderson, Cal Strobel, Richard Plant)	7
	Johnson Oyster Company	4
Alameda	None Submitted	
San Francisco	CDHS Volunteer (Eugenia McNaughton)	2
San Mateo	San Mateo County Environmental Health Department	2
Santa Cruz	San Lorenzo Valley High School	1
	CDHS Marine Biotoxin Program	1
Monterey	CDHS Volunteer (Whit and Judy Whitmire)	1
	U.C. Reserve System	1
San Luis Obispo	CDHS Volunteers (Whit and Judy Whitmire, Renee and Auburn Atkins)	7
	Morro Bay National Estuary Program	2
	Tenera Environmental	3
Santa Barbara	U.C. Santa Barbara Marine Sciences	4
	Santa Barbara City College	1
Ventura	None Submitted	
Los Angeles	Los Angeles County Sanitation District	1
	Los Angeles County Health Department	3
	City of Los Angeles Environmental Monitoring Division	1
	Los Angeles Regional Water Quality Control Board	1
	Catalina Island Marine Institute	2
	Catalina Tall Ships Expeditions	2
Orange	None Submitted	
San Diego	San Diego County Environmental Health Department	2
	CDHS Volunteer (Paul Sims)	1

Appendix D-11. Agencies and organizations participating in marine phytoplankton sample collection in California during November 2002.

COUNTY	AGENCY	SAMPLES
Del Norte	Del Norte County Health Department	2
Humboldt	Coast Seafood Company	4
Mendocino	CDHS Volunteers (Amy Johnson, Jim Wesley)	2
Sonoma	None Submitted	3
Marin	CDHS Volunteers (Brent Anderson, Richard Plant)	7
	Johnson Oyster Company	16
	California Department of Fish and Game	2
Alameda	None Submitted	
San Francisco	CDHS Volunteer (Eugenia McNaughton)	1
	Gulf of the Farallones National Marine Sanctuary	1
San Mateo	San Mateo County Environmental Health Department	1
Santa Cruz	San Lorenzo Valley High School	1
	Santa Cruz County Environmental Health Department	5
Monterey	None Submitted	
San Luis Obispo	CDHS Volunteers (Renee and Auburn Atkins)	3
	Tenera Environmental	1
	Morro Bay National Estuary Program	4
	CDHS Marine Biotoxin Program	1
Santa Barbara	U.C. Santa Barbara Marine Sciences	3
	Santa Barbara City College	1
	CDHS Marine Biotoxin Program	2
Ventura	CDHS Marine Biotoxin Program	1
Los Angeles	Los Angeles County Sanitation District	2
	Los Angeles County Health Department	2
	City of Los Angeles Environmental Monitoring Division	2
	Catalina Tall Ships Expeditions	1
	Los Angeles Regional Water Quality Control Board	1
Orange	Orange County Sanitation District	5
San Diego	San Diego County Environmental Health Department	2

Appendix D-12. Agencies and organizations participating in marine phytoplankton sample collection in California during December 2002.

COUNTY	AGENCY	SAMPLES
Del Norte	Del Norte County Environmental Health Department	2
Humboldt	Coast Seafood Company	5
Mendocino	None Submitted	
Sonoma	CDHS Volunteer (Cathleen Cannon)	1
Marin	CDHS Volunteers (Brent Anderson, Richard Plant, Cal Strobel)	7
	Johnson Oyster Company	20
Alameda	None Submitted	
San Francisco	CDHS Volunteer (Eugenia McNaughton)	3
San Mateo	San Mateo County Environmental Health Department	2
Santa Cruz	San Lorenzo Valley High School	1
Monterey	None Submitted	
San Luis Obispo	CDHS Volunteers (Renee and Auburn Atkins, Bill Schwebel)	3
	Tenera Environmental	2
	Morro Bay National Estuary Program	3
Santa Barbara	U.C. Santa Barbara Marine Sciences	5
	Santa Barbara City College	1
Ventura	None Submitted	
Los Angeles	Los Angeles County Sanitation District	3
	Los Angeles County Health Department	2
	Los Angeles Regional Water Quality Control Board	1
Orange	Orange County Sanitation District	2
	Ocean Institute	1
San Diego	San Diego County Environmental Health Department	1