1. ABSTRACT

In order to assess the ecological health of the San Juan Hydrologic Unit (San Diego, Orange, and Riverside Counties, CA), water chemistry, water and sediment toxicity, fish tissues, benthic macroinvertebrate communities, and physical habitat were assessed at multiple sites. Water chemistry, toxicity, and fish tissues were assessed under SWAMP between 2002 and 2003, and bioassessment samples were collected under other programs between 1998 and 2006.

Most indicators showed evidence of widespread impact, especially in the northern and coastal areas of the watershed. For example, all sites in the Laguna Creek hydrologic subarea, as well as sites in the lower portions of the San Juan Creek watershed exceeded aquatic life thresholds for many (8) water chemistry constituents. Toxicity was moderate at most sites, and not observed at a few sites in the interior of the San Juan Creek watershed. Fish tissue collected from Aliso Creek did not indicate impairment, although no organic constituents were measured, and only one constituent (Selenium) had an applicable threshold. IBIs were poor or very poor at almost every coastal site, as well as at all sites in the Laguna Creek hydrologic subarea, meaning that biological communities characteristic of impairment were found at these sites. Sites with fair, good, or very good IBI scores were located in the interior or southern portions of the watershed. Physical habitat was very degraded at coastal and northern sites, but in moderate to good condition at interior sties. Some designated reference sites (e.g., 901SJMCC2, REF-CS, and 901SJATC2) did not appear to conform to expectations of reference condition. However, other reference sites appeared to be in good ecological health, as were sites that had not been designated as reference (e.g., 901SJBEL2).

Despite limitations of this assessment (e.g., uncertain spatial and temporal variability, low levels of replication, non-probabilistic sampling, and lack of thresholds for several indicators), multiple lines of evidence support the conclusion that parts of the San Juan HU are in poor ecological condition.

I. ABSTRACT

In order to assess the ecological health of the Santa Margarita Hydrologic Unit (San Diego and Riverside Counties, CA), water chemistry, water and sediment toxicity, fish tissues, benthic macroinvertebrate communities, and physical habitat were assessed at multiple sites. Water chemistry, toxicity, and fish tissues were assessed under SWAMP between 2002 and 2003. Bioassessment samples were collected under other programs between 1998 and 2005.

All indicators showed evidence of impact, although for most indicators the impacts were moderate at most sites. Water chemistry constituents at all sites exceeded aquatic life thresholds, ranging from 4 constituents at Deluz Creek and the upstream site on the Santa Margarita River to 9 constituents at the downstream site on the Santa Margarita River. Nutrients were impacted at most sites, except at Deluz and Sandia Creeks. Toxicity was moderate, although samples from all sites were toxic to the freshwater algae *Selenastrum capricornutum* on at least one sampling date. Fish tissues from the downstream Santa Margarita River site showed no evidence of impact. Bioassessment samples indicated that large areas of the watershed are in poor ecological condition, meaning that benthic macroinvertebrate communities at these sites were similar to communities at impaired sites. However, certain areas of the watershed, such as Deluz and Roblar Creeks are in fair or good condition. Physical habitat showed few signs of degradation at any site.

Despite a number of limitations of this assessment (e.g., uncertain spatial and temporal variability, low levels of replication, non-probabilistic sampling, and lack of thresholds for several indicators), multiple lines of evidence support the conclusion that parts of the Santa Margarita HU are in moderate to good ecological condition.

1. ABSTRACT

In order to assess the ecological health of the San Luis Rey Hydrologic Unit (San Diego County, CA), water chemistry, water and sediment toxicity, fish tissues, benthic macroinvertebrate communities, and physical habitat were assessed at multiple sites. Water chemistry, toxicity, and fish tissues were assessed under SWAMP between 2004 and 2006. Bioassessment samples were collected under other programs between 1998 and 2006.

Although potential impacts to human health were also assessed, the primary goal of this monitoring program was to examine impacts to aquatic life in the watershed. Most of these ecological indicators showed evidence of widespread impacts to the watershed. For example, all sites (n = 7) exceeded aquatic life thresholds for several water chemistry constituents (up to 10 at one site). Toxicity was evident at all sites, although frequency varied from moderate (e.g., at Iron Springs Creek) to severe (e.g., at Gird Creek); chronic toxicity was evident at 70% of all samples with *Selenastrum capricornutum* and *Hyallela azteca* being the most sensitive indicators of toxicity. However, acute toxicity to *H. azteca* or *Ceriodaphnia dubia* was not observed. Fish tissue collected at one site did not indicate impairment, although accumulation of PCBs was evident. Bioassessment samples collected at 14 sites ranged from very poor to very good condition. The sites in the best biological condition were located on the eastern slope of Palomar Mountain, where mean IBI scores ranged from 60 to 85. Sites in poor condition were found throughout the watershed. At these sites, benthic assemblages were typical of impacted communities with few sensitive taxa. Physical habitat was in moderate condition at most sites in the watershed, but in good condition at Iron Springs Creek. Embeddedness was a widespread impact on physical habitat, receiving an average score of 5.5 out of 20. Multiple stressors, such as contaminated water and sediment, and alteration of physical habitat, were likely responsible for the poor health of the watershed.

Despite limitations of this assessment (e.g., uncertain spatial and temporal variability, low levels of replication, non-probabilistic sampling, and lack of thresholds for several indicators), multiple lines of evidence support the conclusion that large portions of the San Luis Rey watershed were in poor condition and that conditions are better, though still degraded, for some tributaries, particularly on Palomar Mountain.

1. ABSTRACT

In order to assess the ecological health of the Carlsbad Hydrologic Unit (San Diego County, CA), water chemistry, water and sediment toxicity, fish tissues, benthic macroinvertebrate communities, and physical habitat were assessed at multiple sites. Water chemistry, toxicity, and fish tissues were assessed under SWAMP between 2002 and 2003. Bioassessment samples were collected under other programs between 1998 and 2005.

Although impacts to human health were also assessed, the goal of this monitoring program was to examine impacts to aquatic life in the watershed. Most of these ecological indicators showed evidence of widespread impacts to the watershed. For example, all sites (n = 10) exceeded aquatic life thresholds for several water chemistry constituents (up to eight at one site). Toxicity was evident at all sites, although severity varied from slight (e.g., at Escondido Creek) to moderate (e.g., at San Marcos Creek); chronic indicators of toxicity were evident at 8 to 40% of all samples, with *Selenastrum capricornutum* and *Hyallela azteca* being the most sensitive indicators of toxicity. Fish tissue collected at 2 sites did not indicate impairment, although accumulation of PCBs and pesticides was evident. Bioassessment samples collected at 21 sites (125 samples) were all in poor or very poor condition, with mean annual IBIs ranging from 4.3 to 31.4, meaning that benthic assemblages were typical of impacted communities. Physical habitat varied throughout the watershed, with mean physical habitat scores ranging from 8.3 to 16.5 (both in Escondido Creek). Embeddedness was a widespread and severe impact on physical habitat, receiving at average score of 3.3. Multiple stressors, such as pollution of water and sediment, and alteration of physical habitat, are likely responsible for the poor health of the watershed.

Despite limitations of this assessment (e.g., uncertain spatial and temporal variability, low levels of replication, non-probabilistic sampling, and lack of thresholds for several indicators), multiple lines of evidence support the conclusion that the Carlsbad watershed is in poor ecological condition.

1. ABSTRACT

In order to assess the ecological health of the San Dieguito Hydrologic Unit (San Diego County, CA), water chemistry, water and sediment toxicity, benthic macroinvertebrate communities, and physical habitat were assessed at multiple sites. Water chemistry and toxicity were assessed under SWAMP in 2003, and bioassessment samples were collected under other programs between 1998 and 2005.

Although impacts to human health were also assessed, the goal of this monitoring program was to examine impacts to aquatic life in the watershed. Several indicators showed evidence of widespread impacts to the watershed. For example, all sites (n=5) exceeded aquatic life thresholds for water chemistry constituents (up to eight at one site). The number of exceedances increased along a downstream gradient. Toxicity to *S. capricornutum* was evident at all sites, but toxicity to *C. dubia* was only observed at the mainstem site, and toxicity to *H. azteca* was not observed. Bioassessment samples collected at 9 sites were frequently in poor or very poor condition, with only 3 sites producing samples in fair condition. Mean annual IBI scores ranged from 16.3 at Green Valley Creek to 51.4 at Boden Canyon Creek. Physical habitat was very good at all sites, except for the mainstem site, where the mean physical habitat score was 9.8. At all other sites, the mean physical habitat score was above 15. Multiple stressors, such as pollution of water, are likely responsible for the poor health of the watershed.

Despite limitations of this assessment (e.g., uncertain spatial and temporal variability, low levels of replication, non-probabilistic sampling, and lack of thresholds for several indicators), multiple lines of evidence support the conclusion that the ecological condition of the San Dieguito watershed is moderately impacted.

1. ABSTRACT

In order to assess the ecological health of the Peñasquitos Hydrologic Unit (San Diego County, CA), water chemistry, water and sediment toxicity, crayfish tissues, benthic macroinvertebrate communities, and physical habitat were assessed at multiple sites. Water chemistry, toxicity, and fish tissues were assessed under SWAMP in 2002, and bioassessment samples were collected between 1998 and 2005 under other programs.

Although impacts to human health were also assessed, the goal of this monitoring program was to examine impacts to aquatic life in the watershed. Most of these ecological indicators showed evidence of widespread impacts to the watershed. For example, all 5 sites monitored in 2002 under the Surface Water Ambient Monitoring Program (SWAMP) exceeded aquatic life thresholds for several water chemistry constituents (up to eight at one site). These stressors included pesticides, as well as nutrients. Toxicity to *Selenastrum capricornutum* was also observed at every site; nearly 40% of sediment samples were toxic to *Hyallela azteca*. Bioassessment samples collected from 7 sites in Spring and Fall between 1998 and 2005 indicated widespread degradation, as all samples (n = 59) were in poor or very poor condition (i.e., Index of Biotic Integrity <40). Therefore, benthic macroinvertebrate communities were similar to communities expected at impaired sites. Physical habitat varied among sites, with mean physical habitat scores ranging from 4.8 to 15.4 out of 20. Multiple stressors, such as pollution of water and sediment, and alteration of physical habitat, were likely responsible for the poor health of the watershed.

Despite limitations of this assessment (e.g., uncertain spatial and temporal variability, low levels of replication, non-probabilistic sampling, and lack of thresholds for several indicators), multiple lines of evidence support the conclusion that the Peñasquitos watershed is in poor ecological condition.

1. ABSTRACT

In order to assess the ecological health of the San Diego Hydrologic Unit (San Diego County, CA), water chemistry, water and sediment toxicity, invertebrate tissues, benthic macroinvertebrate communities, and physical habitat were assessed at multiple sites. Water chemistry, toxicity, and invertebrate tissues were assessed under SWAMP in 2005 and 2006. Bioassessment samples were collected under SWAMP and other programs between 1998 and 2005.

Although impacts to human health were also assessed, the goal of this monitoring program was to examine impacts to aquatic life in the watershed. Most of these ecological indicators showed evidence of widespread impacts to the watershed. For example, all sites (n = 7) exceeded aquatic life thresholds for several water chemistry constituents (up to 9 at one site). Toxicity was evident at all sites, although frequency varied from 62% of samples (at San Vicente Creek) to 86% (at Chocolate Creek). The alga *Selenastrum capricornutum* and the crustacean *Hyallela azteca* were the most sensitive indicators of toxicity, showing a toxic response to more than 90% of samples. Invertebrate tissues collected at the mouth of the San Diego River showed evidence of accumulation of PCBs, even exceeding thresholds established by the Office of Environmental Health Hazard Assessment (OEHHA). Bioassessment samples collected at 10 of 13 sites were in poor or very poor condition, with mean annual IBIs as low as 5.5, indicating that benthic assemblages were typical of impacted communities. Samples in good biological condition were observed at only 3 sites, all above El Capitan Reservoir. Physical habitat varied throughout the watershed, with mean physical habitat scores ranging from 6.3 (at Chocolate Creek) to 16.1 (at Boulder Creek) out of 20; only one site had minimal evidence of physical habitat degradation. Embeddedness was a widespread and severe impact on physical habitat, receiving at average score of 5.6 out of 20. Multiple stressors, such as contaminated water and sediment, and alteration of physical habitat, were likely responsible for the poor health of the watershed.

Despite limitations of this assessment (e.g., uncertain spatial and temporal variability, low levels of replication, non-probabilistic sampling, and lack of thresholds for several indicators), multiple lines of evidence support the conclusion that portions of the San Diego watershed are in poor ecological condition.

1. ABSTRACT

In order to assess the ecological health of the Pueblo San Diego Hydrologic Unit (San Diego County, CA), water chemistry, water and sediment toxicity, and benthic macroinvertebrate communities were assessed at multiple sites on Chollas and Paradise Creeks. Water chemistry, toxicity, and bioassessment samples were assessed under SWAMP between 2005 and 2006. Bioassessment samples were also collected under other programs between 2003 and 2005.

Although impacts to human health were assessed, the goal of this monitoring program was to examine impacts to aquatic life in the watershed. Most of these ecological indicators showed evidence of widespread impacts to the watershed. For example, water chemistry constituents at both sites exceeded aquatic life thresholds. Toxicity was evident at both sites, with the alga *Selenastrum capricornutum* indicating toxicity at both Paradise and Chollas Creeks. Bioassessment samples collected at 2 sites on Chollas Creek were all in poor or very poor condition. Mean annual IBIs ranged from 10.0 at the downstream site to 19.5 at the upstream site, indicating that benthic assemblages were typical of impacted communities. Multiple stressors, including contaminated water, were likely responsible for the poor health of the watershed.

Despite limitations of this assessment (e.g., uncertain spatial and temporal variability, low levels of replication, non-probabilistic sampling, and lack of thresholds for several indicators), multiple lines of evidence support the conclusion that these sites in the Pueblo San Diego HU are in poor ecological condition.

1. ABSTRACT

In order to assess the ecological health of the Sweetwater Hydrologic Unit (San Diego County, CA), water chemistry, water and sediment toxicity, and benthic macroinvertebrate communities were assessed at multiple sites. Water chemistry and toxicity were assessed under SWAMP in 2005 and 2006. Bioassessment samples were collected under other programs between 1998 and 2005.

Although potential impacts to human health were also assessed, the primary goal of this monitoring program was to examine impacts to aquatic life in the watershed. Most of the ecological indicators showed evidence of widespread impacts to the watershed. For example, all sites (n = 4) exceeded aquatic life thresholds for several water chemistry constituents (up to nine at one site). Toxicity was evident at all sites. Bioassessment samples collected at 10 sites were all in poor or very poor condition with mean annual IBIs ranging from 2.9 to 57.6, indicating that benthic assemblages were typical of impacted communities. However, some samples from three sites in the upper watershed were in fair, good, or very good condition. In general, sites in urban areas were in worse condition than those in the central or upper parts of the hydrologic unit. Multiple stressors, such as contaminated water and sediment, and alteration of physical habitat, are likely responsible for the poor health of the watershed.

Despite limitations of this assessment (e.g., uncertain spatial and temporal variability, low levels of replication, non-probabilistic sampling, and lack of thresholds for several indicators), multiple lines of evidence support the conclusion that the lower Sweetwater watershed is in poor ecological condition.

1. ABSTRACT

In order to assess the ecological health of the Otay Hydrologic Unit (San Diego County, CA), water chemistry, water and sediment toxicity, benthic macroinvertebrate communities, and physical habitat were assessed at two sites—Poggi Creek and Jamul Creek. Water chemistry and toxicity were assessed by SWAMP multiple times in 2003, and bioassessment samples were collected between 2000 and 2001 under other programs.

Although impacts to human health were also assessed, the goal of this monitoring program was to examine impacts to aquatic life in the watershed. Most of these ecological indicators showed evidence of impacts, although impacts were more severe at Poggi Creek than at Jamul Creek. For example, both sites exceeded aquatic life thresholds for several water chemistry constituents, but there were more exceedances at Poggi Creek (4) than Jamul (3), and more pesticides were detected at Poggi (5) than at Jamul (2). Nutrients, Selenium, and specific conductivity frequently exceeded thresholds at both sites. Toxicity was also evident at both sites. At Poggi Creek, 50% of tests for chronic toxicity were positive, but only 33% were positive at Jamul Creek. Bioassessment samples were only collected at sites near Jamul Creek, prior to sampling under SWAMP, but these bioassessment samples were in fair to poor condition. IBI scores ranged from 11 to 46, indicating that benthic macroinvertebrate communities were similar to communities at impaired sites. Physical habitat was degraded at Poggi Creek, where most components of physical habitat showed signs of major alterations. In contrast, Jamul Creek was moderately degraded, with only two components of physical habitat (embeddedness and channel flow) showing signs of severe alteration. At Poggi Creek, altered water chemistry, toxicity in the water column and sediments, and degraded physical habitat suggest that this site was impacted. At Jamul Creek, these same impacts appeared to be less severe, although bioassessment samples collected here suggested that benthic macroinvertebrate communities were also impacted.

Despite limitations of this assessment (e.g., uncertain spatial and temporal variability, low levels of replication, non-probabilistic sampling, and lack of thresholds for several indicators), multiple lines of evidence support the conclusion that these sites in the Otay watershed were in poor ecological condition.

1. ABSTRACT

In order to assess the ecological health of the Tijuana Hydrologic Unit (San Diego County, CA), water chemistry, water and sediment toxicity, benthic macroinvertebrate communities, and physical habitat were assessed at multiple sites. Water chemistry and toxicity were assessed under SWAMP between 2005 and 2006. Bioassessment samples were collected under SWAMP and other programs between 1999 and 2006. Physical habitat was assessed under SWAMP in 2007.

Although impacts to human health were also assessed, the goal of this monitoring program was to examine impacts to aquatic life in the watershed. Most of these ecological indicators showed evidence of widespread impacts to the watershed, although severity was greater at sites receiving drainage from Mexico (i.e., Tijuana River mainstem and Tecate Creek). For example, all sites ($n = 4$) exceeded aquatic life thresholds for several water chemistry constituents, but the number and persistence of exceedances was lower at sites within the United States. Nutrients and physical constituents of water quality (e.g., pH, conductivity) were impacted at sites throughout the watershed, and anthropogenic organic constituents affected sites on streams entering from Mexico. Toxicity was evident at all sites, although severity was greater at the Tijuana River and Tecate Creek sites, where sediment samples increased mortality to *Hyalella azteca.* Sub-lethal toxicity to *Hyalella* was evident in all samples from all sites. Bioassessment samples collected at 15 sites (72 samples) ranged from very poor condition to good, with mean annual IBIs ranging from 8.6 to 70.0. Sites with high IBIs had benthic macroinvertebrate communities similar to those found in reference condition, and were clustered in the northern interior portions of the watershed, such as the upper parts of Cottonwood Creek. Physical habitat at La Posta Creek showed signs of moderate degradation, with a mean physical habitat score of 13 out of 20. Embeddedness, velocity-depth regime, and sediment deposition were the most degraded components of physical habitat. Multiple stressors, such as contaminated water and sediment, industrial and urban discharges, and alteration of physical habitat, were likely responsible for the poor health of the southern portions of the watershed.

Despite limitations of this assessment (e.g., uncertain spatial and temporal variability, low levels of replication, non-probabilistic sampling, and lack of thresholds for several indicators), multiple lines of evidence support the conclusion that portions of the Tijuana watershed receiving drainage from Mexico are in poor ecological condition, and that the northern interior of the watershed is in moderate to good ecological condition.