

**Inventory and Assessment of Anchialine Pool Habitats in
Kaloko-Honokōhau National Historical Park, 2007-2009**

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ABSTRACT

We documented over 180 pools within Kaloko-Honokōhau National Historical Park federal lands. Pools were documented spatially with GPS, photographed, tagged, and inventoried for ecological parameters. An MS Access database was developed to manage long-term monitoring data. Data collected include pool size, substrate, associated flora and fauna (daytime), and physical parameters of water. Pools with rocky substrate and little to no associated vegetation made up 41% of pool habitat. The remaining pools had sediment substrate, tree canopy, and/or were associated with wetlands. Vegetation (as canopy, emergent, and/or peripheral species) was present at 77% of pools and was predominantly non-native. Endemic anchialine pool fauna including the shrimp *Halocaridina rubra* and *Metabateaus lohena*, the orangeblack Hawaiian damselfly *Megalagrion xanthomelas*, and the mollusk *Theodoxis cariosus* were observed. *H. rubra* was present in 61% of pools and fish were found in 20% of pools, 11% of all pools contained non-native fish. Mean salinity of pools was 15 PSU; individual pool salinity ranged from 8.9 to 29.5 PSU. Pool salinity decreased with distance from shore. Waters were slightly stratified with depth with fresher water on the surface. Surface and bottom salinity varied with tidal stage. Prior studies back to 1972 were examined for data and cross-referenced to compare and contrast the results of research in identifiable pools over time. Salinity has apparently increased in these pools since 1974. The Park may represent one of the few remaining areas on the West Coast of Hawai‘i with intact anchialine pool habitats. Management actions should include continued monitoring of Park pool habitats, working with stakeholders to protect pools within the Park, as well as research to determine species-specific habitat requirements within anchialine ecosystems.

INTRODUCTION

Anchialine pools are brackish pools that have no overland connection to the sea but undergo tidal fluctuations (Holthuis 1973) resulting from hydrologic connection between the groundwater and the ocean. Salinities in pools vary spatially and temporally. For example, on the West Coast of Hawai‘i Island, pools have ranged in salinity from 0.5 to 30 parts per thousand (ppt) (Maciolek and Brock 1974). For reference, freshwater is ≤ 0.5 ppt and seawater is ~ 35 ppt.

Anchialine pool systems are rare worldwide and are restricted to coastal areas with geologically young lava flows, such as Hawai‘i Island, or limestone substrates (Brock and Kam 1997). Within the United States, anchialine pools are only found in Hawai‘i. Results from aerial and ground surveys estimate 680 pools on the Main Hawai‘i Islands in about 148 sites, with 93% of pools located on Hawai‘i Island (TNC 1987). The west coast of Hawai‘i Island contains over 70% of the pools on the island (Maciolek and Brock 1974, Brock 1987, TNC 1987). The Hawai‘i Comprehensive Wildlife Conservation Strategy (Mitchell et al. 2005) estimates 600 to 700 anchialine pools statewide on O‘ahu, Maui, Moloka‘i, and Hawai‘i. These estimates appear to be conservative. For example, our work at Kaloko-Honokōhau National Historical Park (Park) and Keawa Iki on the Ala Kaha Kai National Historical Trail shows that earlier surveys in these areas did not identify many smaller pools and pools that become dry at low tides (personal observation; NPS unpublished data). Certainly the number of pools

on Hawai‘i Island prior to extensive coastal development over the last 30 years was much greater. As of 2009, 182 anchialine pools have been identified in Kaloko-Honokōhau NHP on federally managed lands, and dozens more occur within state and private lands within the Park legislative boundary. Overall, we estimate roughly 27% of the State of Hawai‘i’s existing anchialine pools are located within the National Park legislative boundary.

Pools may be relatively short-lived on a geologic time scale. The steady tectonic subsidence of Hawai‘i Island (from 1.8 mm/yr to more than 3 mm/yr) (Walker 1990) coupled with rising sea levels gives rise to pools in lava depressions and fissures. Once vegetation takes a foothold, pools appear to undergo a process of infilling and senescence. Emergent plants encroach and may eventually change the pools to marshland (Maciolek and Brock, 1974). Introduced plants such as the highly invasive pickleweed (*Batis maritima*) and Christmas berry (*Schinus terebinthifolius*) may accelerate the rate of infilling and pool loss.

Numerous endemic and indigenous arthropods, mollusks and other flora and fauna occur in anchialine pools, including one endangered species and five candidates for protection under the Endangered Species Act (USFWS 2009). Eight of the 12 world-wide hypogeal (underground) caridean shrimps have been documented in Hawai‘i (Holthuis 1973, Brock and Kam 1997, Kensey and Williams 1986). Of these, the most characteristic and recognizable faunal species in the Hawaiian anchialine pool ecosystem are two red-pigmented, caridean shrimp collectively known as ‘*opae‘ula*. Both shrimp are hypogeal, utilizing underground cracks to travel between pools. The smaller (~1.3 cm), endemic atyid ‘*opae‘ula* (*Halocaridina rubra*) are often highly abundant, covering pool bottoms in the hundreds as they graze on algae and diatoms. The larger (~1.7 cm) predatory alpheid ‘*opae‘ula* (*Metabetaeus lohena*), a candidate species, occupies the same habitat but appears to prefer shaded crevices during daytime (personal observation) and may be nocturnal (Sakahara 2011). The endemic *Halocaridina rubra* and two candidate endangered shrimp (*Metabetaeus lohena* and *Palaemonella burnsi*) have been recorded in the Park (Maciolek and Brock 1974). Some other examples of species known to inhabit pools at Kaloko-Honokōhau are the candidate endangered orangeblack Hawaiian damselfly *Megalagrion xanthomelas* (Polhemus 1995), the rare endemic snail *Neritilia hawaiiensis* (Maciolek and Brock 1974), the native prawn *Machrobrachium grandimanus*, and the endemic mollusk *Theodoxis cariosus* (Brock and Kam 1997).

Undisturbed anchialine pool ecosystems usually have clear water and may exhibit a benthic orange crust on the substrate consisting of an assemblage of cyanobacteria, filamentous algae, and diatoms (Bailey-Brock and Brock 1993). Abundant *H. rubra*, hypothesized to be the keystone herbivore in the anchialine pool ecosystem (Brock and Kam 1997), keep the algae in a cropped state, and amphipods and other fauna consume detritus.

Recent studies have examined the genetic structure and evolutionary history of *H. rubra* from across its range throughout the Hawaiian Islands. Mitochondrial gene-sequencing of 573 individuals from 34 sites on Hawai‘i, Maui, and O‘ahu revealed eight genetic lineages that are geographically distinct, restricted to a particular region and island (Santos 2006, Craft et al. 2008). The geographically distinct population structure and demography are thought to be caused by gene flow restrictions due to geologic and

hydrologic barriers. In contrast, *M. lohena* genetics examined from several islands show that genetic populations are not geographically distinct, indicating unrestricted gene flow (Russ et al. 2010). Differences in life history, especially in the larval stage may be the reason for this distinction.

Beyond observations during inventory studies, little is known about habitat requirements for any of the anchialine pool species. Adults of several faunal species inventoried in pool habitats appear tolerant of a wide range of salinities. However, there are few studies completed to date that examine the specific habitat requirements of pool species, and Tango (2010) is one of the first to examine the requirements for different life stages, finding that egg hatch and naiad survival of the orangeblack Hawaiian damselfly have habitat threshold responses. Undoubtedly these requirements vary by species.

Cultural Significance

Kaloko-Honokōhau National Historical Park (hereafter “Park” or “National Park”) was established to preserve, interpret, and perpetuate traditional Hawaiian culture, activities, and land use (Public Law 95-625). The Park encompasses the Honokōhau Settlement National Historic Landmark, about 1200 acres of land and sea that was the site of a thriving Hawaiian community despite harsh living conditions on the arid coastal lava fields of the North Kona district (Figure 1). Availability of freshwater at the coast was perhaps the most critical factor in the decision of the ancient Hawaiians to settle in this seemingly inhospitable area (Honokōhau Study Advisory Commission 1974). Pools were frequently excavated or otherwise modified for specific functions such as sources of drinking water, for bathing, for washing, holding fish, or for irrigating agricultural plots and planters. Pools were strictly managed for sustainability. Beyond functional uses, the pools held spiritual and ritual importance (Honokōhau Study Advisory Commission 1974). Because of the importance of anchialine pools to the Hawaiians who settled along the Kona coastline, preservation of the water quality and quantity supplying the anchialine pool ecosystem is essential to fulfilling the Park’s mission (Honokōhau Study Advisory Commission 1974).

Anchialine pool fauna served several important cultural functions. ‘*Opae‘ula* (*Halocaridina rubra* and *Metabetaeus lohena*) were used specifically for bait in the ‘*opelu* (mackerel scad, *Decapterus pinnulatus*) fishery. ‘*Opelu* fishing continues to be an important economic activity for Hawaiians today, and preservation of the anchialine pools and ‘*opae‘ula* populations are important for the perpetuation of traditional fishing methods. Other anchialine pool fauna, including several snail species: *hapawai* (*Neritina vespertina*) and *pipiwai* (*Theodoxus cariosus*) were collected by ancient Hawaiians for consumption, especially during times of famine (Yamamoto and Tagawa 2000).

Many plants associated with anchialine pool communities were used for a variety of purposes (Abbott 1992, Krauss 2001). Examples include; *hau* (*Hibiscus tiliaceus*), used for outrigger canoe floats, fishnet floats, massage sticks, making twine, and for medicinal purposes; *milo* (*Thespesia populnea*), used to make war canoes and for food storage bowls; *lauhala* (*Pandanus tectorius*), used for thatching, weaving, decoration, rope or twine, and for medicinal uses; *makaloa* (*Cyperus laevigatus*), a sedge used to make sleeping mats for the *ali‘i*; and *moa* (*Psilotum nudum*), for medicinal uses.

Threats to Anchialine Pool Habitats

Hawai‘i’s anchialine pools are threatened by land development, recreational use, non-point source pollution, groundwater withdrawals, and introduced invasive species (Ridgely and Chai 1991, Oki et al. 1999, Hoover and Gold 2005, Mitchell et al. 2005). Climate change and sea level rise are long-term threats that need to be considered as well.

Rapid coastal development along the west coast of Hawai‘i Island in the past 30 years has led to infilling of anchialine pools as coastal areas are graded for golf courses, resorts, and residential areas. The building of resorts on the west coast of Hawai‘i Island destroyed more than 130 pools in 1985 (Brock 1987). Continuing coastal development since then has likely affected more pools. Recent coastal development projects have developed Anchialine Pool Management Plans as part of their Hawai‘i County Special Management Area permit requirements.

Development along the coast has improved access to pools resulting in increased recreational use. People frequently bathe or swim in pools along the coast of West Hawai‘i, introducing chemicals from personal products (e.g., sunscreens, soap, shampoo residue) into pool habitats. Trash and litter are often left behind in and around pools. The frequency of this recreational use is undocumented but commonly observed.

Anchialine pools that are on or near developed areas are likely to be affected by impacts to water-quantity. Enriched irrigation water (i.e., treated wastewater diluted with coastal well water), fertilizers, storm-water runoff, and septic or cesspool leachate can infiltrate to groundwater through porous basalt substrate and flow into anchialine pool systems (Oki et al. 1999, State of Hawaii 2000). Although pools exhibit a range of variability in nutrient concentrations, the upper end of this range is increasing as studies show that pools in proximity to developments have had significant increases in nutrients) after project build out (Brock and Kam 1997, Weigner et al. 2006). For example, measurements of nutrient levels in pools both pre- and post-golf course development show increases in nitrates, phosphates, and ammonium of 98%, 55%, and 135% respectively over pre-development conditions (Jackson and Rosenlieb 1989).

On leeward Hawai‘i Island, where the majority of the state’s anchialine pools are located, the County of Hawaii’s General Plan for Land Use Allocation Guide shows substantial urbanization planned in Kona (County of Hawaii 2007). It is predicted that water demands in the full build-out phase will exceed the sustainable yield capacity by four or five times (Fukunaga & Associates 2010). At the time of this study, 2007-2009, at least nine large-scale development projects are underway or proposed in the vicinity of Kaloko-Honokōhau NHP (Gomes 2010) in addition to the expansion of the Kaloko Industrial Park and planned construction of the West Hawaii Business Park, both located upslope of the Park. The potential cumulative impacts of these developments to groundwater quality and quantity are of significant concern particularly if such changes create conditions unsuitable for native aquatic species to complete their life cycle. These threshold levels have not yet been determined.

Introduced species can alter habitat and ecology of an anchialine pool. Non-native fish have invaded or been introduced to many pools. Unlike native fishes, established non-native fish are able to complete their life cycles in anchialine pools. In particular, topminnows (family Poeciliidae) including mosquitofish (*Gambusia affinis*), guppies

(*Poecilia reticulata*) and mollies (*Poecilia sp.*), and tilapia (usually *Oreochromis mossambicus* or *Sarotherodon melanotheron*) are thought to disturb the pool ecosystem because they prey on herbivorous shrimp (Brock and Kam 1997, Capps et al. 2009). When predation by fish eliminates or reduces *H. rubra* populations, there is a reduction in grazing, which may lead to uncontrolled macro-algae growth. With high fish density and over abundant macro-algae in a pool, it is hypothesized that sediment accumulates quickly; flushing becomes impaired, and water quality declines (Brock and Kam 1997). Bailey-Brock and Brock (1993) documented the decline in native fauna following the introduction of non-native fishes to Kona coast anchialine habitats. Recent estimates by Brock suggest that more than 95% of the Kona coast anchialine ponds are infested by non-native fish (Brock 2002).

Introduced plant species can also greatly alter pool ecosystems and may cause pools to senesce at a much greater rate than they might otherwise. Non-native pickleweed (*Batis maritima*) and non-native canopy species such as kiawe (*Prosopis pallida*) and Christmas berry (*Schinus terebinthifolius*) are aggressive species that can quickly invade a pool's perimeter and/or substrate and change a pool habitat from a rocky pool to one with large amounts of leaf litter, organic sediment, and increased rates of infilling. *Milo* (*Thespesia populnea*) is another canopy species that can rapidly overgrow pool habitats. Botanists do not agree on whether it is indigenous (Abbot 1992) or a Polynesian introduction (Wester 1992).

Various climate change scenarios predict that sea levels will rise between 0.5 to 1.6 m (1.6 to 5.2 ft) by 2100 (review in Vitousek et al. 2010). Sea level rise and changes in storm run up during large surf events will affect anchialine pool habitats and location. Pools located at inundated elevations will cease to exist while those at slightly higher elevations will likely undergo changes in hydrology and water chemistry. New anchialine pools will likely appear at higher elevations inland of new shorelines. Storm surge, which relocates sediment and can wash marine species into pools, will affect pools that are too high in elevation to be impacted at the present time.

Study Objectives

The inventory and protection of anchialine pool resources is a management priority for Kaloko-Honokōhau National Historical Park (NPS 1994). Anchialine pools represent exposed groundwater, and the Park's General Management Plan/EIS (GMP) identifies upslope groundwater withdrawals and contamination by wastewater and polluted runoff as potential threats to the pools and the rare taxa inhabiting them. Extensive light industrial, residential, ocean harbor, and golf course development is underway or planned immediately adjacent to and upslope of the Park. In two cases, the developments are planned within Kaloko-Honokōhau's authorized boundaries on lands not owned by the Park.

Prior to this study, the majority of Park pools have had limited or no data associated with them. Several researchers and educational institutions (e.g., Maciolek and Brock 1974, Chai 1991, NPS (Schuster) 1994 unpublished data, Brock and Kam 1997, NPS 2002 and 2004 unpublished data, Knee 2008, MIT 2008 unpublished data) have conducted inventory studies over the past three decades on various subsets of pools within the Park. However, in most cases, based on the information available, it has been difficult to

identify and relocate the pools that were examined during these studies. A biological inventory of the pools was initiated in the summer of 2004 by the Inventory and Monitoring Program (I&M) and USGS-BRD targeted aquatic insects and other aquatic invertebrates (Foote, 2005; Foote, et al., in prep). Apart from this effort, Kaloko-Honokōhau has not had any systematic, comprehensive inventory or study of all the anchialine pools within its boundaries.

The goals of our study were to:

- 1) Collect Global Position System (GPS) data and standardized photographs at all pools within Kaloko-Honokōhau National Historical Park.
- 2) Place non-destructive pool number identification tags at each pool to standardize pool identification for future research.
- 3) Collect comprehensive physical and biological data at each pool to help assess pool ecosystem condition.
- 4) Create and populate a Microsoft Access anchialine pool database with the data collected, including cross-references to numbering systems from previous studies (Appendix 1).
- 5) Use the database to extract spatial and temporal information that will be useful for management of Park pools, particularly those that contain Candidate Species for listing under the Endangered Species Act.

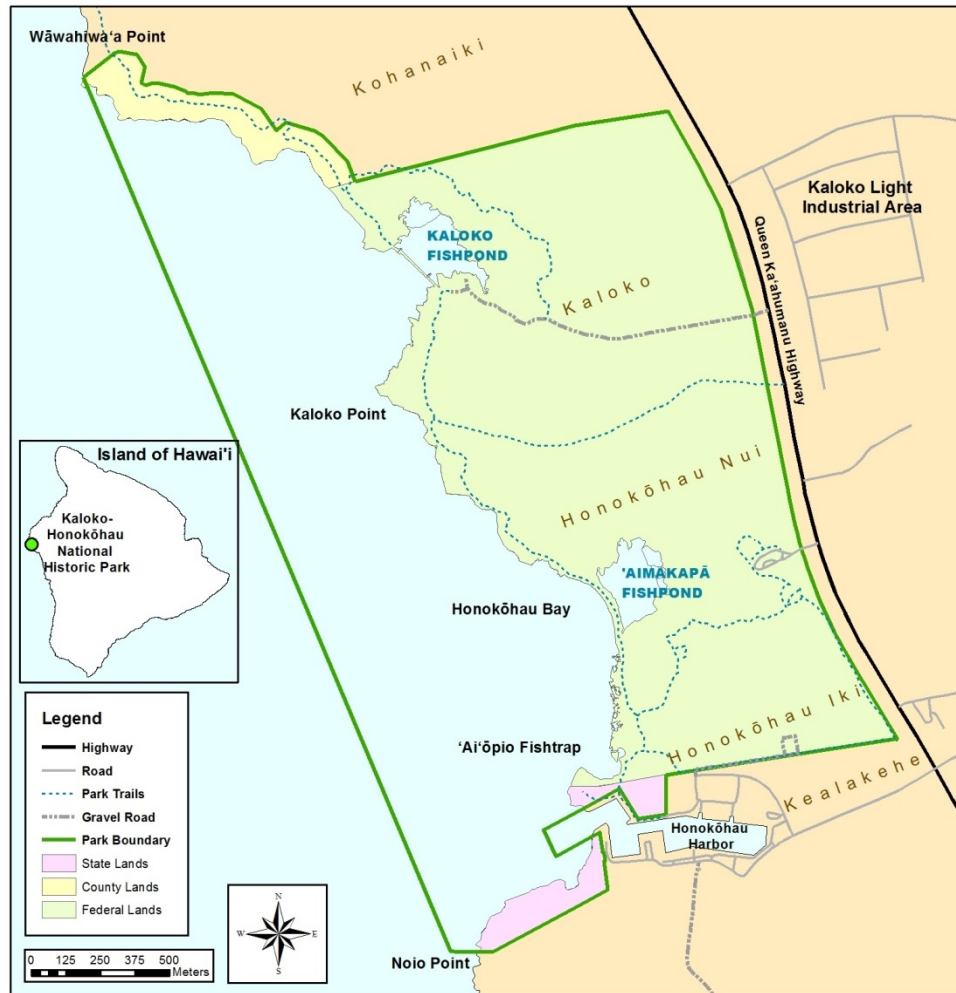


Figure 1. Kaloko-Honokōhau National Historical Park on the west coast of Hawai‘i Island. State-owned (pink) and privately-owned (yellow) lands are within the Park Boundary. The NPS manages the state lands by agreement with the state on the north side of the harbor.

METHODS

Study Area

Kaloko-Honokōhau National Historical Park (Park) is located on the arid west coast of Hawai‘i Island, three miles north of the town of Kailua-Kona (Lat: 19.67°; Long: -156.033°, Figure 1). Average rainfall is 20-30 inches per year. The substrate consists of porous volcanic basalts estimated to be 1500 to 10,000 years old (Wolfe and Morris 1996) overlain with little to no soil.

Within the Park, the groundwater system is composed of brackish water overlying saltwater (Oki et al. 1999). Groundwater levels in the Park range from 0.3 to 0.6 m (1 to 2 ft) above mean sea level and fluctuate daily by 0.2 to 0.5 m (0.5 to 1.5 ft) in response to ocean tides (Oki et al. 1999). Groundwater recharge occurs primarily at higher elevations east of the Park on the slopes of Hualalai volcano. As fresh groundwater flows seaward

and enters lower coastal elevations it mixes with seawater. After flowing under the parklands, through the pools and fishponds, groundwater eventually discharges into nearshore areas (Oki et al. 1999, Johnson et al. 2008). As a result of ongoing urban development, water withdrawal upslope of the Park has increased since 1978, the year the Park was established (Oki et al. 1999, USGS 2010). With water-source development, groundwater flow through the Park is expected to decrease whereas nutrient and contaminant loads in groundwater from upslope commercial and residential areas will increase (Oki et al. 1999).

Anchialine pools are surface expressions of the brackish groundwater. In the Park, pools vary significantly in size between 500 m² to <1.0 m² cracks in the ‘a‘a basalt. Some of the shallower pools may become wet spots in the lava at lower low tides. Individual pools are separated from others at varying tides. In some cases, pools may have surface connection to others at higher high tides (in which case they are referred to as “pool complexes” in this report). Studies since 1991 have shown that subsets of Park pools range in salinity from 4.8 to 20.5 ppt (Chai 1991 unpublished, Brock and Kam 1997, Bienfang 2007).

The tidal stage within pools lags behind ocean tides with greater lag times occurring furthest from shore. In January of 2008, undergraduate students from the Massachusetts Institute of Technology TREX course sampled pool height, salinity, and temperature over a 24-hour period (MIT-TREX 2008, Appendix 2). Measurements at four pools showed that maximum and minimum pool heights lag behind predicted ocean tide heights by 0.5 to 1 hr (Figure 2). Oki et al. (1999) recorded a slightly longer lag at ‘Aimakapā Fishpond.

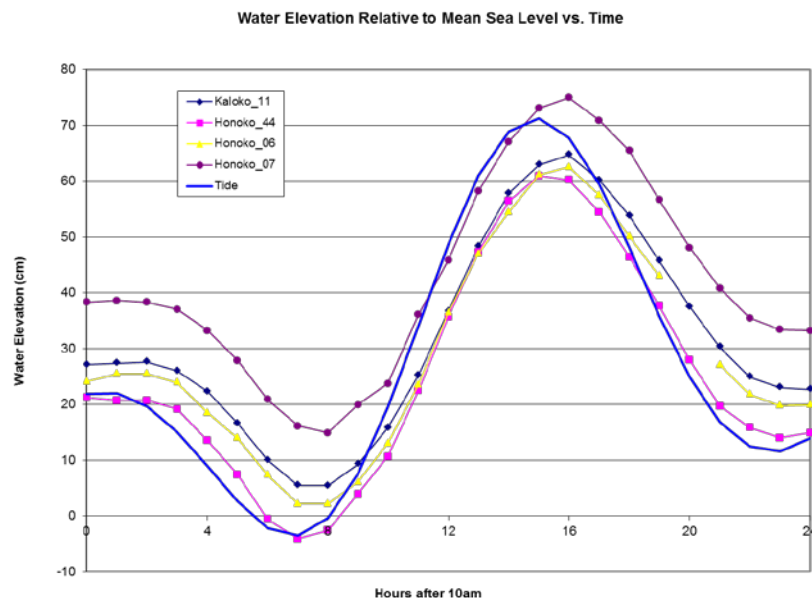


Figure 2. Water elevation relative to mean sea level over a 24-h period in four anchialine pools (MIT-TREX 2008 unpublished data). The X axis represents hours after 10:00 am. Estimated ocean tide heights for Kona were obtained from an online NOAA-based tide prediction program (Pentcheff and Flater 2007-2008).

Habitat Characteristics

Pools were tagged using aluminum tags wired to the substrate with stainless steel wire in an easily located, unmovable position. Tags placed by earlier studies were left in place. If pools were previously tagged using the Park nomenclature, the tags were upgraded or maintained. Pools within a complex (merging at high tides) are numbered as pool “# - A”, “# - B”, “# - C”, etc. NPS Pool nomenclature follows the format: [Island]_[1st 6 letters of Ahupua‘a]_[Pool#][complex, if occurs], e.g., HI_Honoko_35A. No nails were placed in the substrate and the substrate was not altered.

Locations of pools were collected or confirmed using a high-accuracy (sub-meter after differential correction) GPS unit (Trimble GeoXT or GeoExplorer 6000 XH). Positions were differentially corrected in Pathfinder Office using the NPS base station. Maps of pools were created in ArcGIS 9.2. The pools were photographed with Olympus C4040 and C7070 digital cameras from a standard southern aspect for future photo comparisons. North arrows and a slate with the pool number were included in each photo. If the south side of a pool was inaccessible, photos were taken from the most accessible place. Each photo was later labeled with pool number, date, time, and tide state using Adobe Photoshop and was then archived on the Kaloko-Honōkohau NHP server, and linked to the Access Database.

Numerous physical and biological parameters were collected at each pool (Table 1). Some of the parameters collected were also included in previous surveys (Maciolek and Brock 1974, Chai 1991 unpublished, Brock and Kam 1997, NPS 2004 unpublished, Bienfang 2007) and others were added for a more comprehensive inventory of pool habitats.

An approximate pool surface area (m²) was estimated by using the equation:

$$\text{Surface Area of an Ellipse} = \pi (L/2)(W/2).$$

Where L and W are the maximum length and width of pools at high tide state (between 0.47 and 2.27 ft).

Deepest depth was also collected at varying tidal heights. Many pool depths were not specifically measured at higher high tides; therefore high-tide depth was estimated by using adjusted bottom sample depths measured with a Hydrolab Quanta sonde. For those pools in which samples were taken at high tide with the sonde vertically suspended just above the bottom, 15 cm were added to recorded depths to account for instrument shape and bottom clearance. In pools where the Hydrolab rested on the bottom horizontally, 5 cm were added. Bottom type was categorized as rocky, organic sediment, sand, or mixed bottom.

Distribution of flora and fauna was recorded at each pool between 2007 and 2008. Vegetation associated with pools was documented including percent canopy cover by species, percent cover of emerging vegetation by species, and percent cover of plants within 0.5 meters of pool periphery by species. The presence or absence of macro-algae was also recorded. Rapid daylight visual surveys of fauna within all Park pools were conducted on multiple occasions throughout the study. Initially observers would examine

the pool for a minimum of 5 minutes for the presence of faunal species. The presence of species within pools were recorded and modified in subsequent visits. If a species was seen on any visit it was considered “present”. This rapid survey should not be considered a comprehensive survey but a first step in recording the presence of endemic and/or introduced species.

Physical characteristic data for pool waters (salinity, pH, dissolved oxygen, temperature, turbidity, and Oxygen Redox Potential ORP) were collected between 6:00 am and 12:00 pm Hawai‘i Standard Time from each pool at 3 high and, if possible, 3 low tides with a calibrated Hydrolab Quanta Sonde (www.hach.com) (Table 2). The sonde was calibrated within 24 h of sampling. Salinity is reported in Practical Salinity Scale units (PSU) throughout this report. Because some pools were dry at lower low tides, they did not have representative “low tide” samples. Estimated ocean tide heights for Kailua Kona were obtained from an online NOAA-based tide prediction program (Pentcheff and Flater 2007-2008). Tidal flow state (e.g., ebb, slack, flood) was also noted. Because pool water depth lags 0.5 to 1 hour after ocean tide heights, sampling at high or low tides occurred 0.0 - 0.5 hrs before predicted slack tides until 2.0 - 2.5 hours after predicted slack tide. Because it was impossible to sample all Park pools during targeted tide heights in a single day, pools were sampled within a two- to five-day period (Table 2).

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Table 1. Pool characteristics sampled in 2007 to 2008 at all documented anchialine pools within Kaloko-Honokōhau National Historical Park.

Pool Characteristic	Description of Measure
Measurement	
Length	Longest length (m). Measured as close to high tide water mark as possible. Accuracy ± 10 cm.
Width	Widest width (m) Measured as close to high tide water mark as possible. Accuracy ± 10 cm.
Depth	Deepest depth (m). Measured at various tide heights with measure tape. Resolution = 1 cm.
Area	Approximate surface area (m^2) = $\pi(\text{length}/2 \cdot \text{width}/2)$
Substrate composition	
Type	Rocky, organic sediment, sand, mixed
Modifications (Archeological site)	
Type	Description recorded: Excavations, water worn stones, walls, etc.
Fauna	
Type	Presence/ Absence
Vegetation	
Canopy	% of each species comprising canopy overhang
Emergent	% of each species emerging from pool substrate
Peripheral	% of each species comprising periphery within 0.5 m of pool edge.
Algal mats	Presence/absence and species of algae
Tide height	
Height	Feet (ft); Estimate [‡] of tide height in ocean at Kailua-Kona, HI.
Tide state	
State	Slack, ebb, flood
Water characteristics	
(Sampled at 3 higher high tides within each pool; 3 lower low tides within pools containing water)	
Temperature	Celsius ($^{\circ}\text{C}$); accuracy ± 0.2 units, resolution = 0.01 $^{\circ}\text{C}$
pH	accuracy ± 0.2 units, resolution 0.01 units
Salinity	Practical Salinity Units (PSU); accuracy ± 1 units, resolution 0.01 PSU
Specific Conductance	milliSiemens/centimeter (mS/cm), accuracy $\pm 1\%$ of reading ± 1 count, resolution = 4 digits
Dissolved Oxygen (DO)	Micrograms/Liter (mg/L) ; accuracy ± 0.6 mg/L , resolution = 0.01 mg/L
Turbidity	Nephelometric Turbidity Units (NTU); accuracy ± 1 NTU
Oxygen Redox Potential (ORP)	millivolts (mV); accuracy ± 25 mV, resolution 0.1 < 100 NT; 1 NTU ≥ 100 NTU
Depth	meters (m), accuracy ± 0.1 m, resolution = 0.1 m

A heavy rain storm during a scheduled sampling event allowed us to evaluate the effect of rain events on pool salinity. High tide water-quality sampling was planned for December 12, 2008, but was postponed due to a heavy rain storm passing over the Park on the day and evening of December 11th. The Park's Remote Automatic Weather Station (RAWS; <http://www.wrcc.dri.edu/cgi-bin/rawMAIN.pl?hiHKAL>) recorded 2.4 inches of rain ending at 1:00 am on Dec 12, 2008. Although regular sampling was postponed, 17 pools were sampled on the morning of December 12th approximately eight hours after the end of the storm. These same pools were sampled again on December 15th and salinities were compared to see what the effect of such a large rain event would be on pool salinity as well as how quickly the pools returned to "normal" salinities.

Table 2. Water sampling event dates for anchialine pools at various tidal heights.

Tide status			
Tide height		Date	Year
Low Tides			
-0.29 to 0.21 ft	(-0.09 to 0.6 m)	April 15, 23, 30; May 2, 3,	2008
0.31 to 0.58 ft	(0.09 to 0.18 m)	January 21, 22, 23,	2009
0.27 to 0.56 ft	(0.08 to 0.17 m)	February 4,5,	2009
High Tides			
1.20 to 2.31 ft	(0.37 to 0.70 m)	September 17, 18, 19, 22,	2008
1.82 to 2.64 ft	(0.55 to 0.80 m)	November 16, 17, 18, 19,	2008
1.91 to 2.54 ft	(0.58 to 0.77 m)	December 15, 16,	
High Tide Rainfall Event			
0.74 to 1.5 ft	(0.23 to 0.46 m)	December 12,	2008

Because the sampling of physical water parameters in this study represents a snapshot in time, A YSI 6600 Multiparameter Sonde (see www.ysi.com for specifications) was deployed continuously from February 6, 2008 to February 21, 2008 at the bottom of pool HI_Kaloko_53C to examine tidal influence on pool salinity and temperature over a two-week period. The sonde was deployed at approximately 0.75 m (2.5 ft) depth (at high tide) and collected data every 15 minutes.

The effects of possible future sea-level rise on present anchialine pools within the Park were examined by analyzing detailed elevation maps with current sea level rise predictions. LiDAR data (Federal Emergency Management Agency Task Order 26, 2006) was used to map various elevation contours in ArcGIS 9.3. Elevation data are horizontally accurate to 1.0 ft (0.3 m) with 68.2% of laser returns. Data are vertically accurate to 0.5 ft (0.2 m) in open terrain and 0.69 ft (0.21 m) in all terrain with a 95% confidence interval. Maps were made overlaying present anchialine pool locations over elevation data.

Published and unpublished reports, field notes, existing tags, and interviews with previous investigators were used to determine identities of pools and to glean useful historical data from earlier studies. Data from previous studies were used to examine temporal trends in water quality and ecosystem condition.

Data Analysis and Management

All maps, photos, and data were computer- and CD-archived at Kaloko-Honokōhau NHP. A Microsoft Access database was developed and populated in consultation with the Pacific Island Network database manager to ensure conformation to national NPS Inventory and Monitoring database standards.

The temporal variability of salinity at anchialine pools was examined in several ways: variability among high tide sampling dates, variability among low tide sampling dates, variability between high vs low tide, and variability between high rainfall (December 12, 2008) and “normal” conditions. For all of these analyses, variability due to water column depth (stratification) was factored out by examining only surface salinities.

Statistical comparisons between high and low tide salinities were made for pools that were sampled three times at high tide and three at low tide in a fairly constrained period (~4 months). Salinity data was log transformed and compared with a two factor ANOVA using location and tide as the factors (n=27 pools). Comparisons of surface salinity at 18 pools directly after the December 12, 2008 high rainfall event and three days later were also made with log transformed data using two factor ANOVA's with location and date as factors. Statistical analyses were performed with JMP 5.0 (SAS Institute 2000).

RESULTS

A total of 182 individual anchialine pools were mapped with GPS and GIS. Of these, 172 were tagged, photographed, and sampled for the parameters described in Table 1 (Figure 3). Ten pools were not sampled or tagged because they were associated with (part of a pool complex) a larger, more accessible pool that was used as the representative sample for that pool complex. Nine of these are located along a narrow, deep fissure (HI_Kaloko_57A-J), and one is located in Kaloko Fishpond wetlands (HI-Kaloko_140A).

Of the individual pools that were mapped, 51 pools comprised fifteen separate pool complexes, defined as two or more pools that connect at a high tide state (Table 3). All but three of the complexes are in low-lying wetland areas associated with Kaloko Fishpond, 'Aimakapā Fishpond, or 'Ai'opiō Fishtrap. Eleven of the complexes consisted of two pools joined at higher high tides whereas two complexes connect three and four pools each. Two complexes were fissures with numerous pools in the geologically young (3000-5000 years Before Present) 'a'a flow that is located in the central region of Kaloko-Honokōhau (Figure 3). The fissures run perpendicular to shore extending inland over 180 m. Groundwater can be seen flowing seaward through the fissures, and although sections are covered by 'a'a, they are clearly interconnected. Fissure 57 was mapped (10 pools) but only sampled at one central pool because the pools were usually too deep and inaccessible for sampling or visible assessments. Fissure 53 is wider and was therefore sampled along its entire visible length of 12 pools.

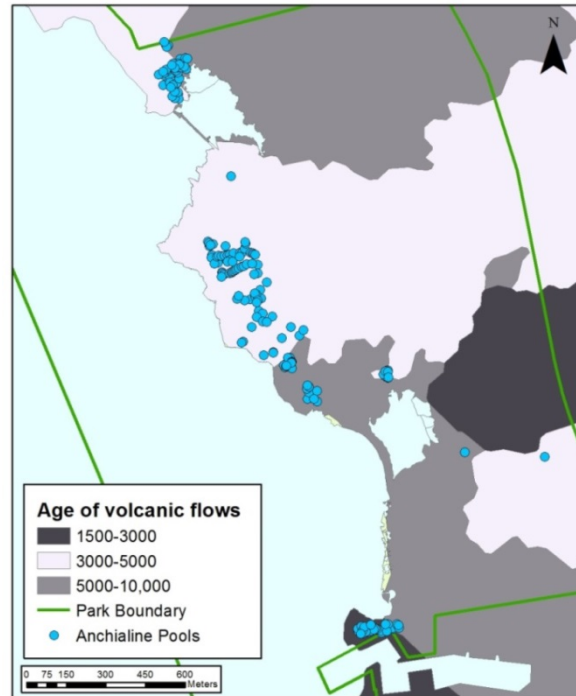


Figure 3. Distribution of anchialine pools within Kaloko-Honokōhau National Historical Park federally managed lands in relationship to age of volcanic flows (years Before Present (BP)).

Table 3. Identity of pool complexes (two or more pools that connect at a high tide state)

Pool Complex Name	# of Pools in Complex	Pool Habitat Type	Area
HI_Kealak_83/a/b/c/	4	Wetland	‘Ai’opiō
HI_Kealak_85a/b	2	Transitional	‘Ai’opiō
HI_Kealak_98a/b	2	Wetland	‘Ai’opiō
HI_Honoko_41/a	2	Wetland	‘Aimakapā
HI_Honoko_038a/b/c	3	Transitional/Rock/Canopy	‘Aimakapā
HI_Honoko_035a/b	2	Transitional/Rock	lava flow (3000-5000 BP)
HI_Kaloko_53a/b/c/d/e/f/g/h/i/j/k/l	12	Rock Fissure	lava flow (3000-5000 BP)
HI_Kaloko_57a/b/c/d/e/f/g/h/i/j/	10	Rock Fissure	lava flow (3000-5000 BP)
HI_Kaloko_118a/b	2	Transitional	Kaloko
HI_Kaloko_132a/b	2	Wetland	Kaloko
HI_Kaloko_133a/b	2	Wetland	Kaloko
HI_Kaloko_134a/b	2	Wetland	Kaloko
HI_Kaloko_136a/b	2	Transitional/Rock	Kaloko
HI_Kaloko_138a/b	2	Rock	Kaloko
HI_Kaloko_140a/b	2	Wetland	Kaloko

Surface Area

The mean surface area of pools in the Park was $15.2 \text{ m}^2 \pm 50.7$ (mean $\pm$ standard deviation). Pool sizes ranged from 0.06 m^2 to 566.9 m^2 , and 57 % of pools are between $1\text{-}10 \text{ m}^2$ in surface area (Figure 4)

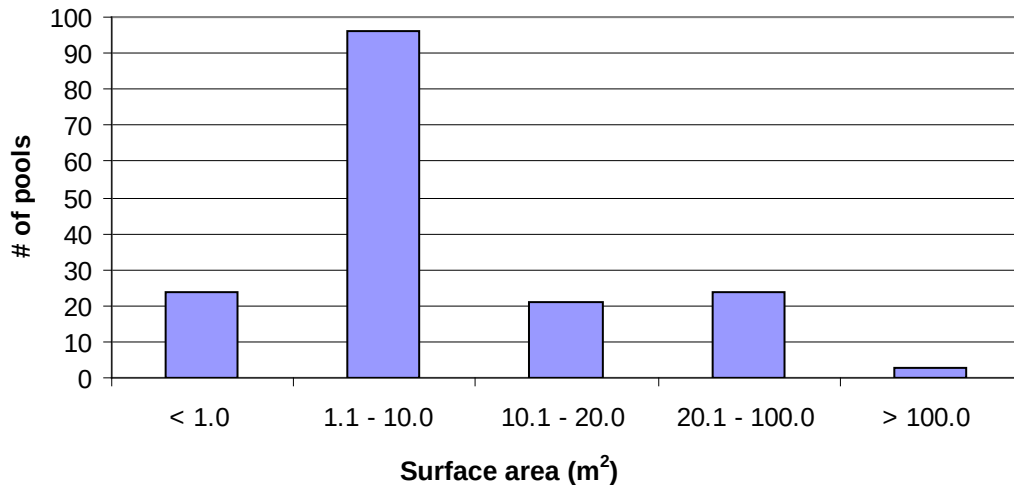


Figure 4. Estimated surface areas of anchialine pools (n=168) within Kaloko-Honokōhau National Historical Park. The area of four pools (30, 32, 66, 53L) was not measured.

Pool Depth

The deepest depths for pools at higher high tides ranged from 0.1 to 1.25 m. The mean deepest depth was $0.5 \pm 0.25 \text{ m}$. At high tide, approximately 9% or 15 pools measured over 1-m deep at the deepest point. The remaining pools were shallower than 1 m at high tide. At lower low tides ($< 0.0 \text{ ft}$) 57% of pools were dry or damp, although in some of the pools water could be seen down in cracks of the rock.

Substrate Composition

Substrate composition within the anchialine pools included ‘a‘a and pāhoehoe basalt rock, fine organic sediment, and, in a few cases, carbonate sand. The dominant bottom types were rock (52%); 33% of pools had sediment bottoms, and 15% were mixed rock/sediment. Of the sediment-substrate pools, several pools contained large components of calcareous beach sand; sediment substrate in several other pools was dominated by fine organic silt.

Cultural Modifications (Archeological sites)

Cultural modifications associated with Park pools commonly include excavation, small walls, and associated trails. In the central area of the Park, many of the pools contain a single water-worn stone placed in the bottom of the pool. The purpose of the stone is unknown.

Associated Vegetation

Pools support a number of indigenous as well as introduced riparian plant species. Vegetation was associated with 77% of pools in the Park as canopy, emergent, or peripheral vegetation. Introduced species dominated all three types of vegetation (Figure 5).

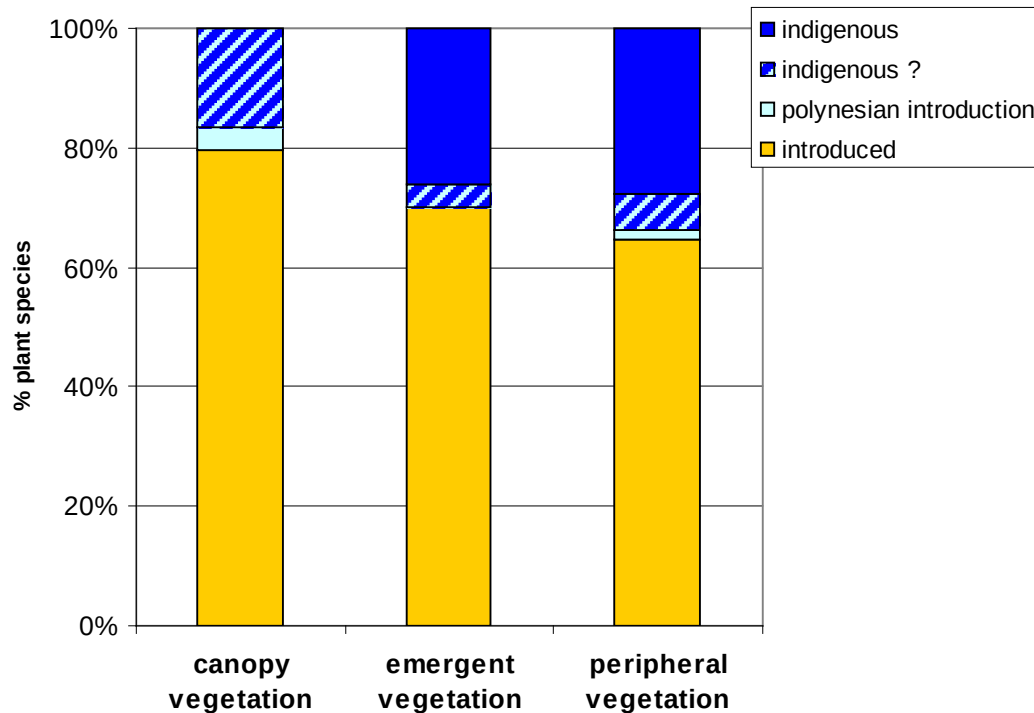


Figure 5. The percent composition of native or introduced plant species in canopy, emergent, and peripheral vegetation at anchialine pools at Kaloko-Honokōhau National Historical Park. The *milo* tree (*Thespesia populnea*) may be a Polynesian introduction and is labeled “indigenous?”.

Canopy

Canopy cover existed at 35% of pools. All canopy species were non-native except *T. populnea*, which may be native (Figure 5). The pools with canopy were distributed throughout the Park (Figure 6a & b, Figure 7). *Prosopis pallida* (kiawe), *Schinus terebinthifolius* (Christmas berry), *Thespesia populnea* (*milo*), and *Tournefortia argentea* (tree heliotrope) were the dominant canopy species (Table 4). *T. populnea*’s status as indigenous has not been confirmed and it may have been introduced by Polynesians (Wester 1992). Most of the pools with *T. populnea* canopy are located in the central portions of the Park (Figure 7).

Table 4. Plants associated with anchialine pools at Kaloko-Honokōhau National Historical Park. The frequency of pools in which each species occurs as canopy, emergent, or peripheral vegetation is included.

Family	Genus	Species	Hawaiian name	Common name	Canopy	Emergent	Periphery	Total
Indigenous								
Aizoaceae	<i>Sesuvium</i>	<i>portulacastrum</i>	<i>‘ākulikuli</i>	shoreline sea purslane		5	40	45
Cyperaceae	<i>Fimbristylis</i>	<i>dichotoma</i>		forked fimbry		1		1
Cyperaceae	<i>Cyperus</i>	<i>laevigatus</i>	<i>makaloa</i>			6	2	8
Goodeniaceae	<i>Scaevola</i>	<i>taccada</i>	<i>naupaka</i>				1	1
Ruppiaceae	<i>Ruppia</i>	<i>maritima</i>		widgeongrass		3		3
Scrophulariaceae	<i>Bacopa</i>	<i>monnieri</i>		water hyssop		2	2	4
Solanaceae	<i>Lycium</i>	<i>sandwicense</i>	<i>ohelo kai</i>			1	13	14
Malvaceae*	<i>Thespesia</i>	<i>populnea</i>	<i>milo</i>		13	3	13	29
Introduced								
Anacardiaceae	<i>Schinus</i>	<i>terebinthifolius</i>	<i>wilelaiki</i>	Christmas berry	24	1	23	48
Asteraceae	<i>Pluchea</i>	<i>carolinensis</i>		sourbush	3		4	7
Bataceae	<i>Batis</i>	<i>maritima</i>		pickleweed		50	59	109
Boraginaceae	<i>Tournefortia</i>	<i>argentea</i>		tree heliotrope	6		4	10
Fabaceae	<i>Prosopis</i>	<i>pallida</i>	<i>kiawe</i>	mesquite	27		15	42
Poaceae	<i>Paspalum</i>	<i>sp.</i>		salt grass		5	6	11
Poaceae	<i>Pennisetum</i>	<i>setaceum</i>		fountain grass			24	24
Rubiaceae**	<i>Morinda</i>	<i>citrifolia</i>	<i>noni</i>	noni	3		3	6

* Thought to be indigenous but not confirmed. May be a Polynesian introduction

** Polynesian introduction

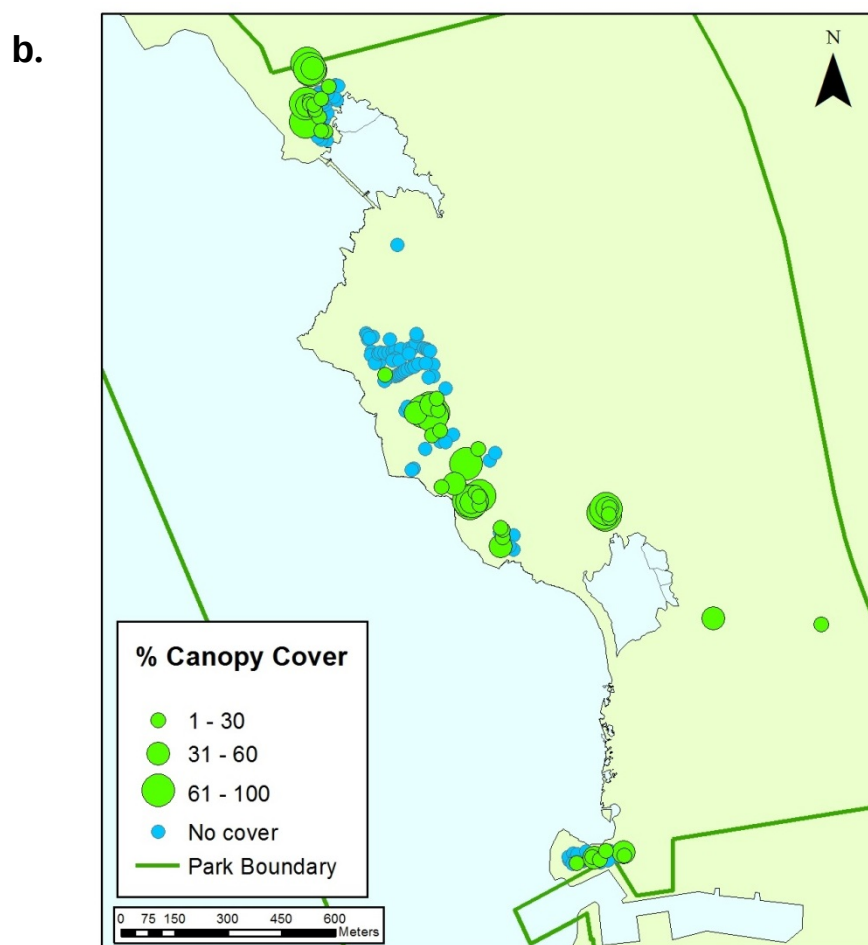
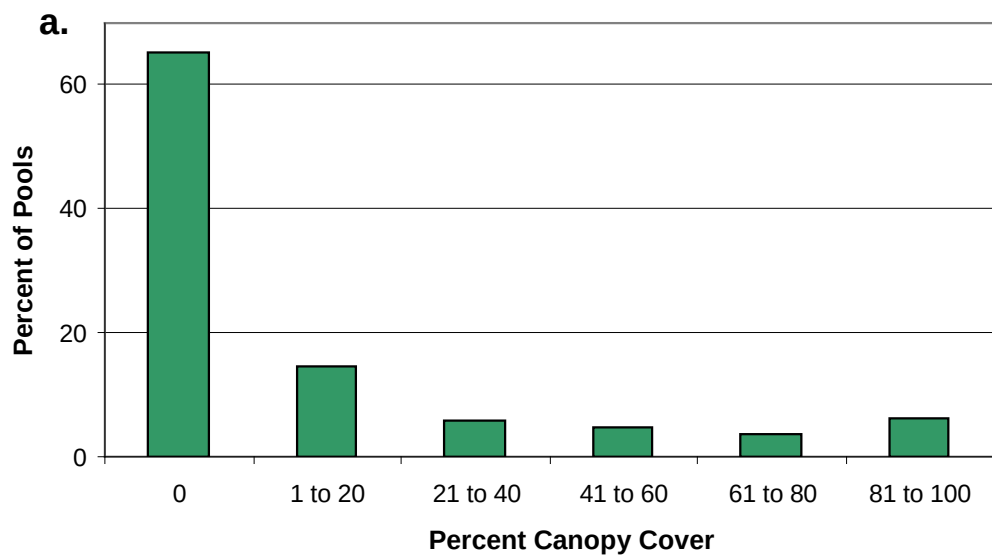


Figure 6. Canopy vegetation associated with anchialine pools: **a)** Canopy cover at Park pools (n=172) **b)** Distribution of canopy cover throughout Kaloko-Honokōhau NHP.

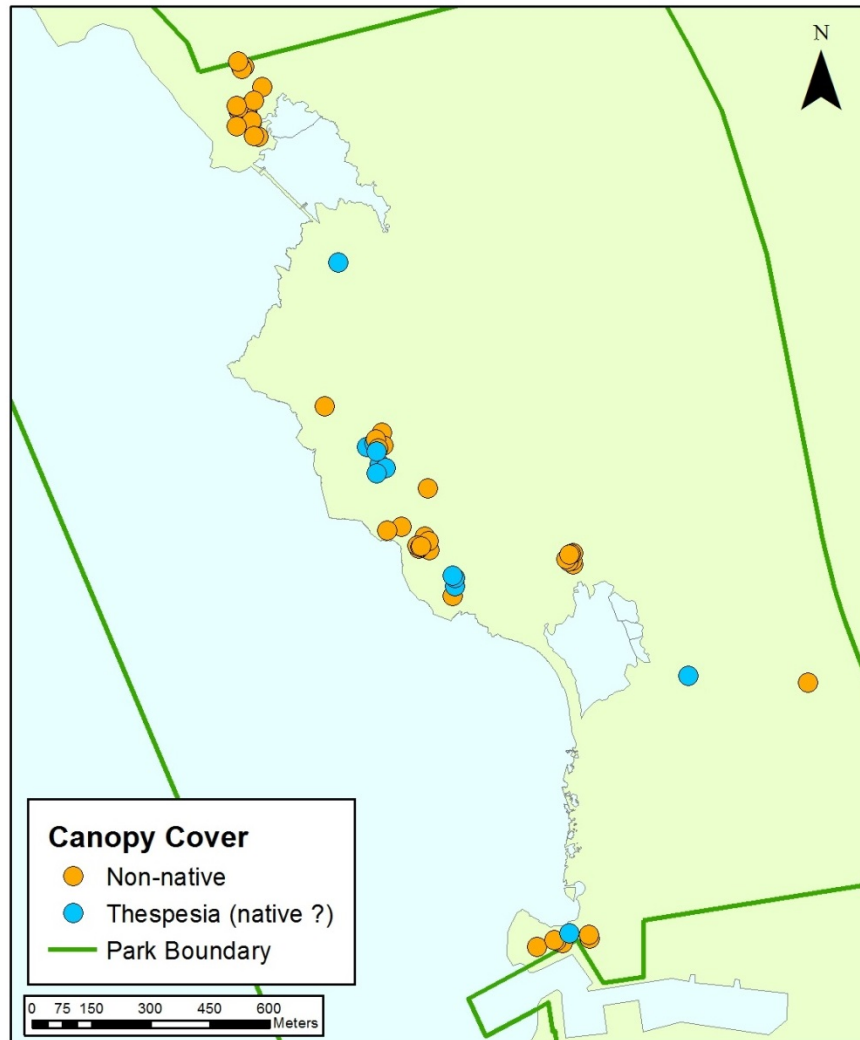


Figure 7. Distribution of milo (*Thespesia populnea*) and non-native canopy species. It has not been confirmed whether *T. populnea* is indigenous or a Polynesian introduction.

Emergent

Emergent vegetation was present in 35% of the pools and included six confirmed indigenous species (Figure 8a, Table 4). The culturally significant *Cyperus laevigatus* (makaloa) was found growing out of six pools; the native sea grass *Ruppia maritima* was in three pools; and the indigenous sedge *Fimbristylis dichotoma* was in one pool.

Peripheral

Peripheral vegetation was present in 72% of the pools and was more frequent than emergent or canopy vegetation (Figure 8b). Peripheral vegetation included many of the same native species that comprise the emergent community. However, a higher diversity and frequency of non-native species existed around the periphery of pools than in the canopy or emergent groups (Table 4). Invasive non-native *Schinus terebinthifolius* (Christmas berry), *Prosopis pallida* (kiawe), and *Pennisetum setaceum* (fountain grass) was commonly found encroaching on pools.

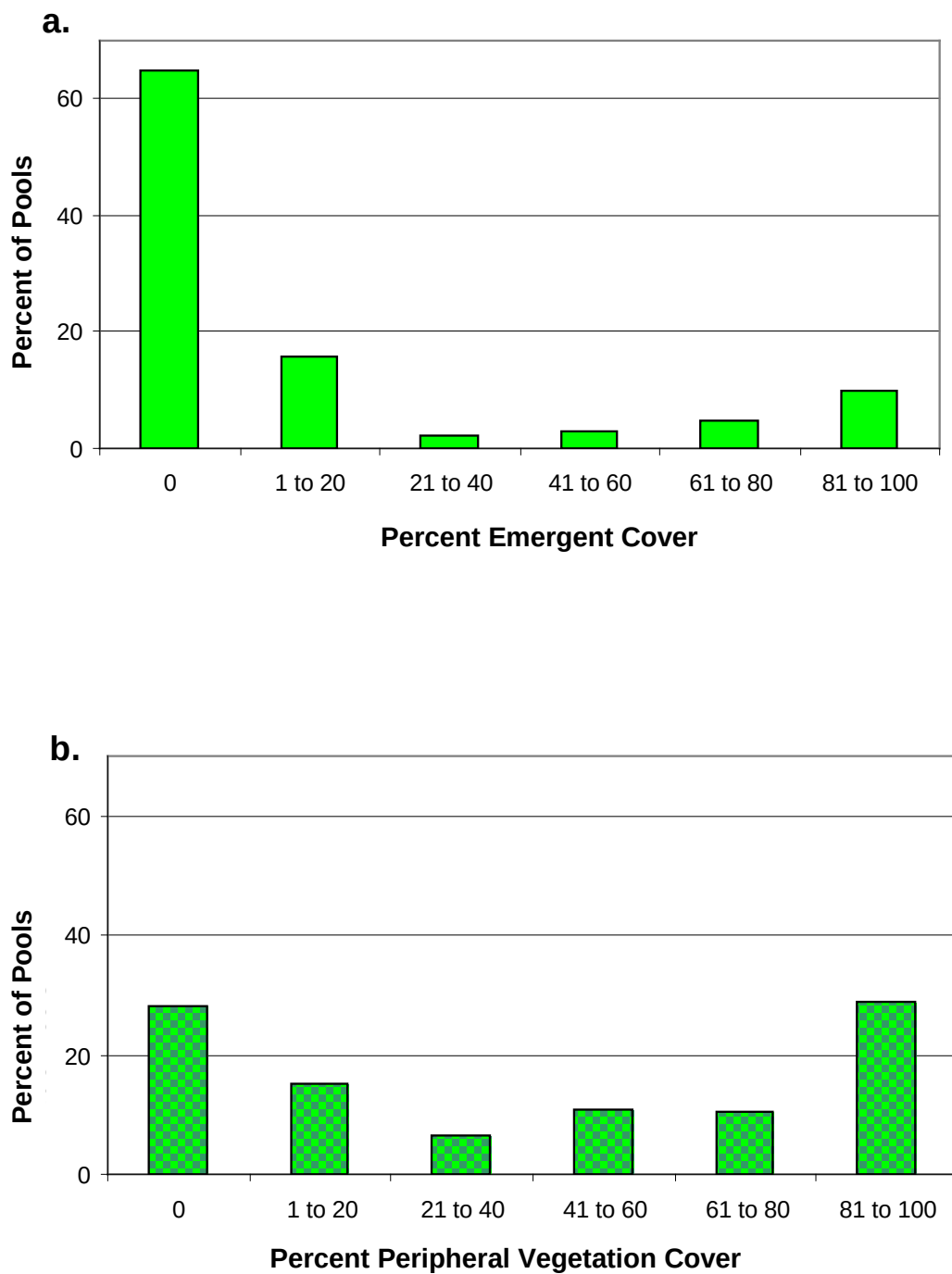


Figure 8. Percent cover of (a) emergent and (b) peripheral vegetation at anchialine pools (n=172).

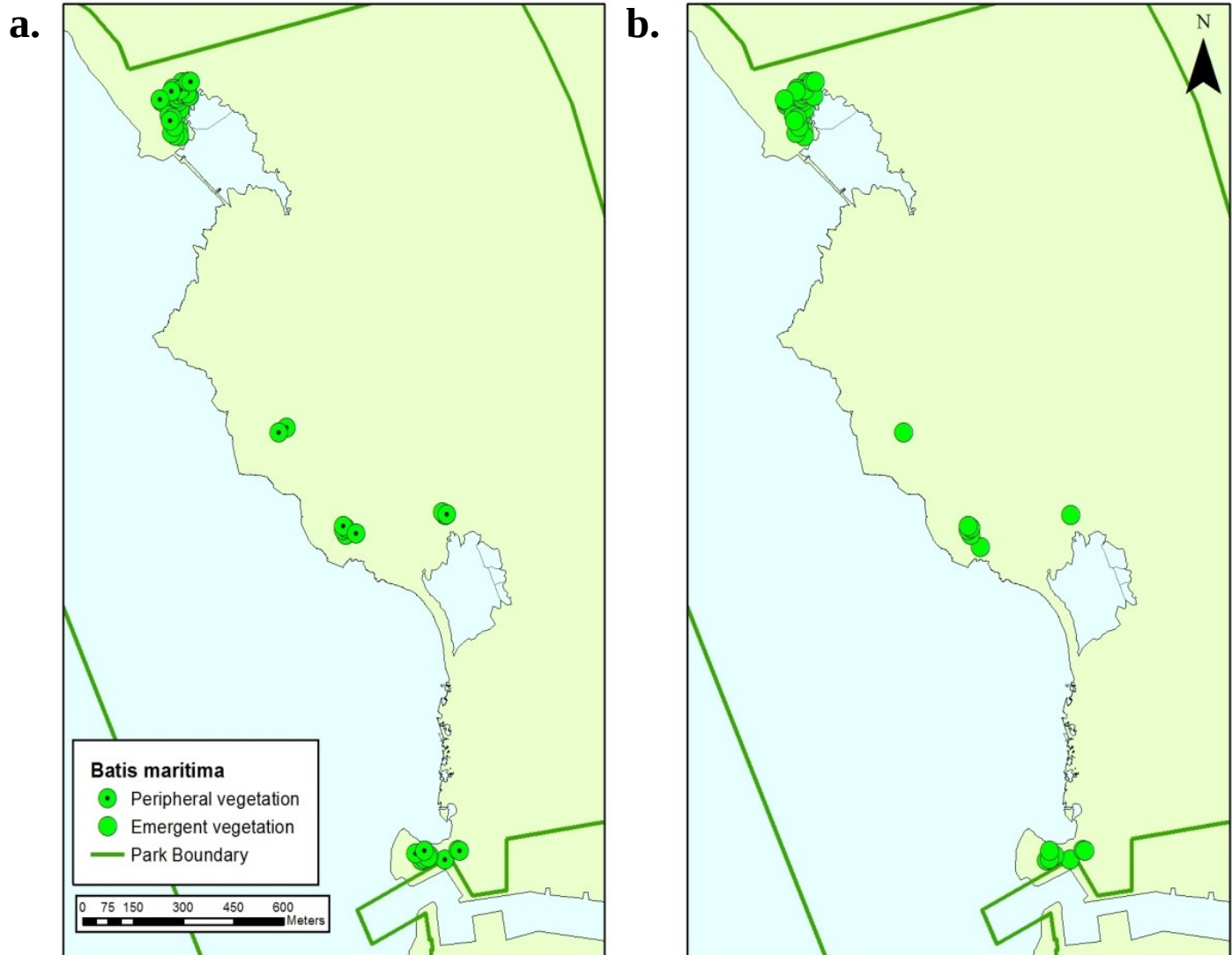


Figure 9. The distribution of invasive *Batis maritima* as (a) peripheral and (b) emergent vegetation at anchialine pools.

The dominant emergent and peripheral species was *Batis maritima* (pickleweed), an invasive, introduced succulent (Table 3). *Batis* was most associated with pools located in low lying wetland type habitat, especially in areas near the fishponds which get inundated at higher high tides (Figure 9).

Marine Algae

Macroalgae were found in 9% of pools (Figure 10). *Cladophora* sp. was in five pools, three of which also had introduced poeciliids (guppies). *Ulva* sp. was in seven pools in the Harbor area along with the native crustacean *Halocaridina rubra*. An unidentified species (possibly *Chaetomorpha*) was found in two pools, one with introduced Poeciliids and one with *H. rubra*.

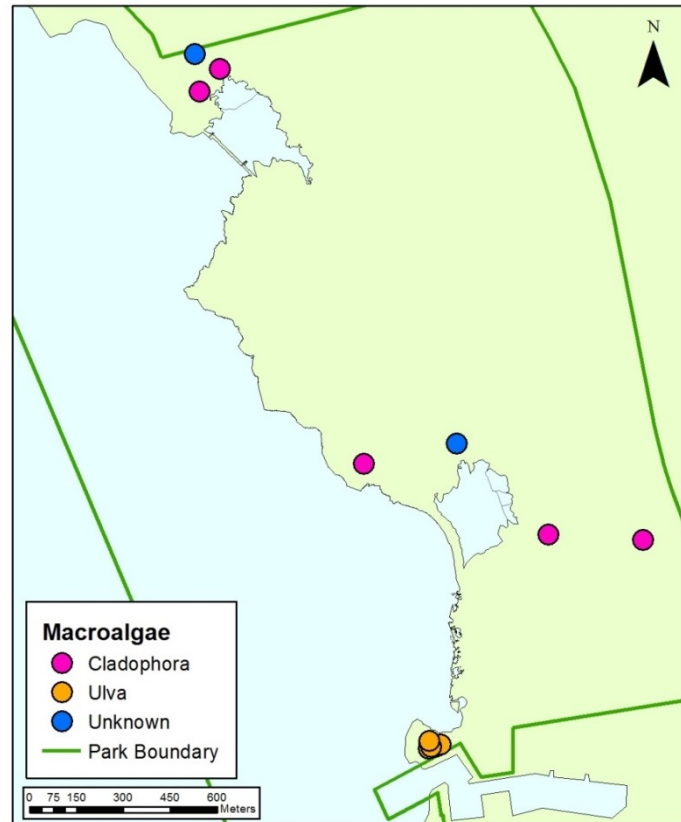


Figure 10. Distribution of macroalgae within anchialine pools at Kaloko-Honokōhau National Historical Park. Each circle represents a single pool.

Pool Habitat Type

Based on substrate and vegetation, we classified pool habitats within Kaloko-Honokōhau National Historical Park into four general categories; Rocky Pools, Canopy Pools, Wetland Pools, and Transitional Pools (Figure 11a). Rocky Pools were the dominant group comprising 40% of Park pools. These pools contain rock substrate with little associated vegetation (Figure 11b). Canopy Pools, dominated by canopy overhang, made up 12% of Park pools. This habitat type often has leaf litter and rocky and/or organic sediment substrate (Figure 11c). Wetland Pools (30% of pools), are associated with wetlands and fishponds. They have thick organic sediment substrate with high percent cover of peripheral and often emergent riparian (Figure 11d). The final group is made up of “transitional” habitats with characteristics from two or three of the other habitat types. The Transitional Pools (17% of pools) have developed from rocky habitat to ones with some sediment, canopy, and/or peripheral vegetation.

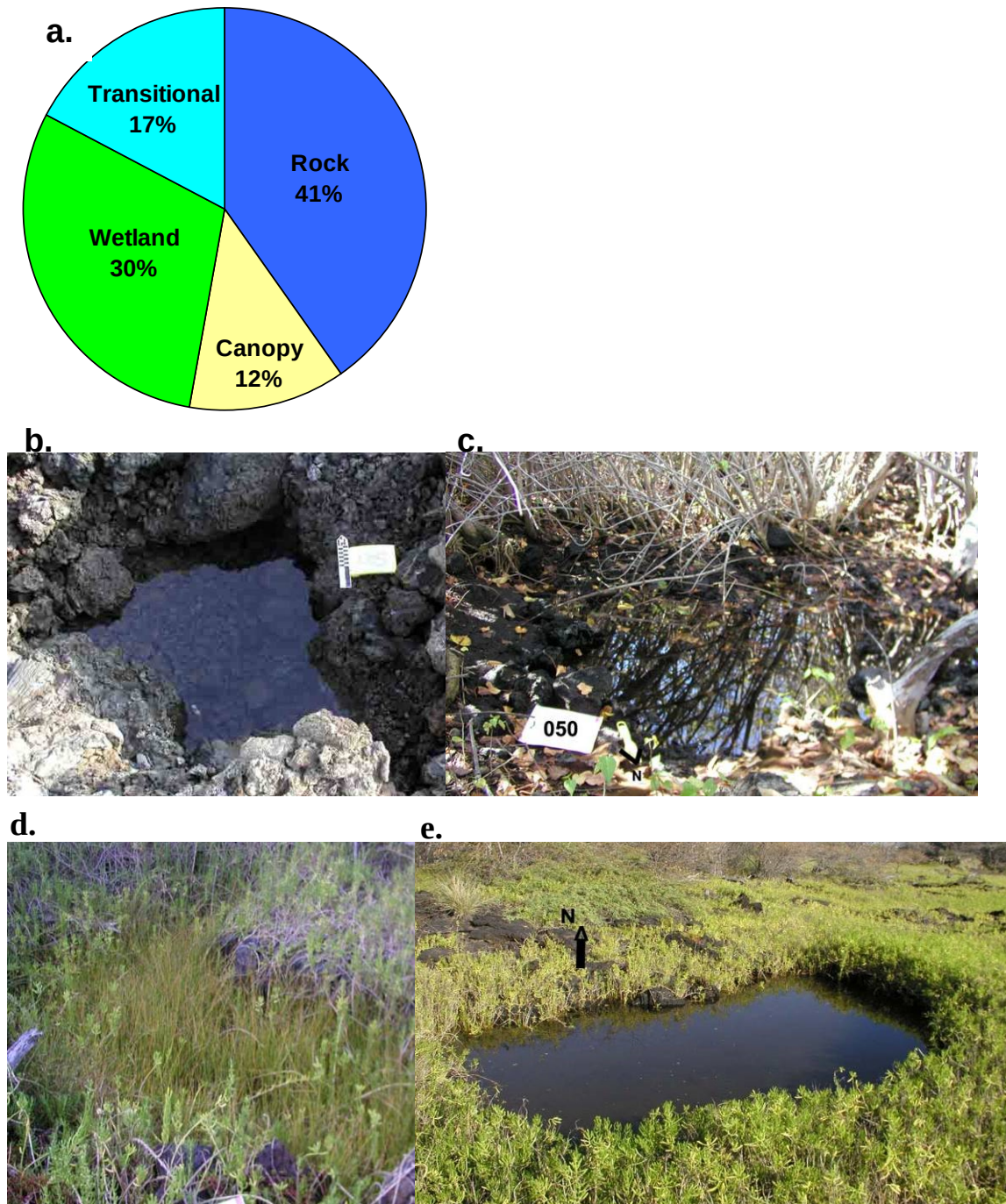


Figure 11. **a)** Anchialine pool habitats at Kaloko-Honokōhau National Historical Park, $n = 172$ pools; **b)** Rocky pool habitat; **c)** Canopy pool habitat; **d)** & **e)** Wetland pool habitats. The wetland pool on the left supports the native *Cyperus laevigatus* (makaloa) as emergent vegetation and the pool on the right is surrounded by the invasive *Batis maritima*.

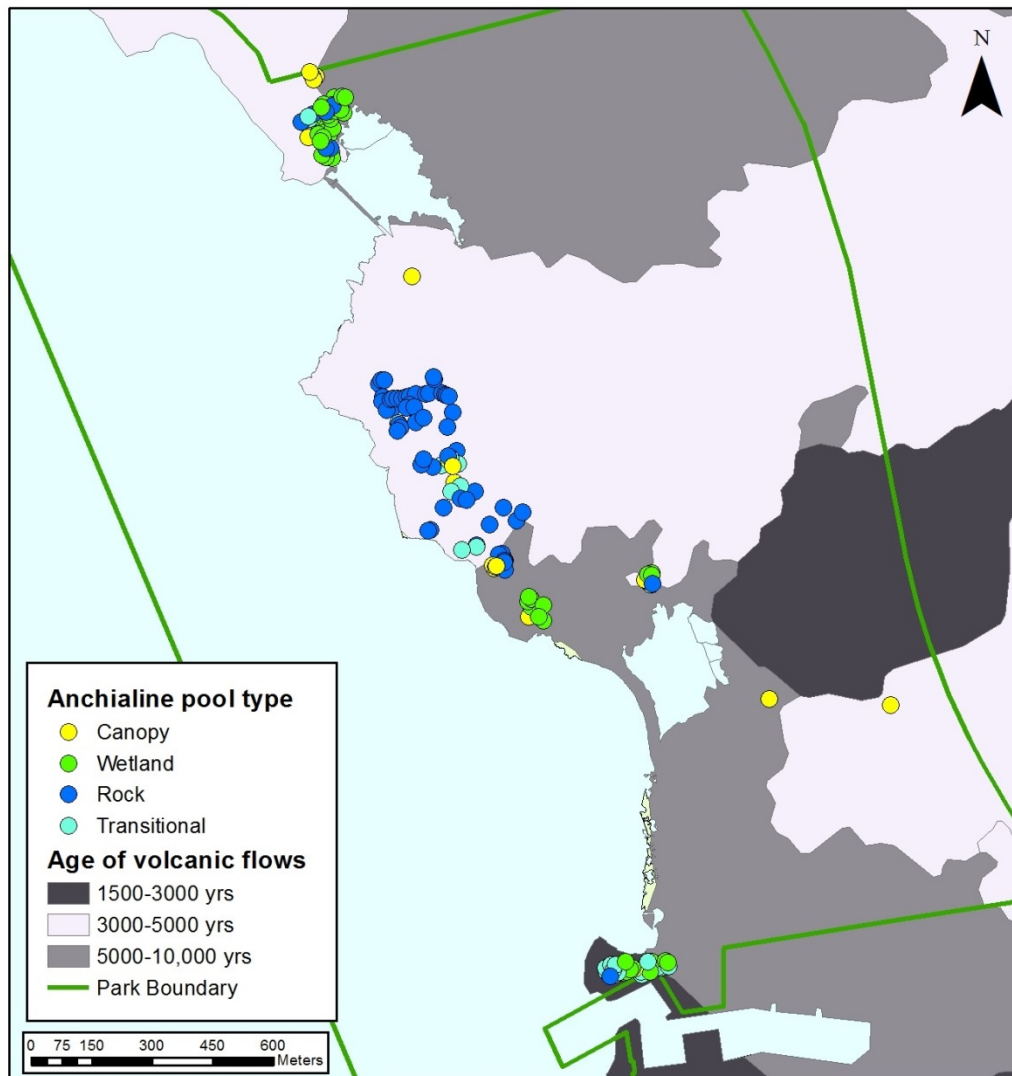


Figure 12. Distribution of anchialine pool types in relation to the age of volcanic flows (years Before Present (BP)) within Kaloko-Honokōhau National Historical Park.

When examined in relation to the age of lava flows within the Park, rocky pools are associated with the more recent, 3,000-5,000 years Before Present (BP) flows and canopy pools are spread throughout the Park in 3,000 -10,000 BP flow areas where trees have gained a foothold (Figure 12). Senescent, wetland pools are located in the two oldest flows (5,000-10,000 BP) in low lying wetlands at edges of the fishponds or near ‘Ai’opiō Fishtrap. The elevation of the most recent flow (1,500-3,000 BP) is too high above mean sea level to support anchialine pools.

Fauna

Rapid daylight visual surveys of all Park pools identified the presence of nine native anchialine pool species at Kaloko-Honokōhau (Yamamoto and Tagawa, 2000; Table 5). Endemic anchialine pool animals observed included the crustaceans *Halocaridina rubra* and *Metabateaus lohena* (Figure 13), the gastropod *Theodoxis cariosus*, and the

damselfly *Megalagrion xanthomelas*. Two other species that were seen were not identified. These include a white amphipod and a small snail (Figure 17). Other species present in some pools include pan-tropical Thiarid snails, non-native guppies and mollies (Poeciliidae). Additionally, several marine fish (*Kuhlia sandvicensis*, *Chanos chanos*, *Abudefduf sordidas*) and one marine snail (*Nerita picea*) were observed.

Table 5. Faunal species found in rapid, daylight visual surveys at anchialine pools (n =172) between 2007 and 2008. [†]The unidentified fish were found in pools connected by water to Kaloko Fishpond at higher high tides and are thought to be juvenile *Mugil cephalus* (native mullet) and/or *Chanos chanos* (native milkfish). Odonates are present but were not surveyed by pool.

Class	Order	Genus	Species	Status	Hawaiian /common name	Total # pools
Crustacea						
	Decapoda	<i>Halocaridina</i>	<i>rubra</i>	endemic	<i>Opae'ula</i>	105
	Decapoda	<i>Metabetaeus</i>	<i>lohena</i>	endemic	<i>Opae'ula</i>	27
	Decapoda	<i>Palaemon</i>	<i>debilis</i>	indigenous	<i>Opae huna</i>	28
	Decapoda	<i>Macrobrachium</i>	<i>grandimanus</i>	indigenous	<i>Opae oeha'a</i>	2
	Decapoda	<i>Metapograpsus</i>	<i>thukuhar</i>	indigenous	<i>A'ama</i>	3
	Amphipoda	<i>Paramoera</i>	<i>paaki</i>	indigenous		common
	Amphipoda	Unidentified white amphipod				2
Gastropoda						
	Gastropoda	<i>Thiarididae</i>		pan-tropical		present
	Gastropoda	<i>Nerita</i>	<i>picea</i>	indigenous	<i>Pipipi</i>	1
	Gastropoda	<i>Theodoxus</i>	<i>cariosus</i>	endemic	<i>Pipiwai</i>	16
	Gastropoda	<i>Laddia lamellata</i> (poss.)				9
Insecta						
	Odonata	<i>Megalagrion</i>	<i>xanthomelas</i>	endemic	<i>pinao'ula</i>	present
Osteichthys						
Family						
	Poeciliidae	<i>Poecilia sp.</i>		non-native, invasive	Guppies	19
	Poeciliidae	<i>Gambusia sp.</i>			mosquitofish	
	Kuhliidae	<i>Kuhlia</i>	<i>sandvicensis</i>	indigenous	<i>Āholehole</i>	2
	Chanidae	<i>Chanos</i>	<i>chanos</i>	indigenous	<i>Awa</i>	4
	Pomacentridae	<i>Abudefduf</i>	<i>sordidus</i>	indigenous	<i>Kūpipi</i>	3
		Unidentified fish [†]				16

Halocaridina rubra were observed in 61% of pools, often numbering in the hundreds (Figure 14a). Fish were observed in 20% of pools and 11% of Park pools contained invasive Poeciliids (Figure 14b). *H. rubra* were typically found in pools without introduced fish. However, four pools contained both introduced poeciliids (guppies) and *H. rubra*. Of the pools containing fish, 75% were wetland-type pools in low lying areas associated with fishponds where fish presumably swam into pools from fishponds during extreme high tides. Sixteen pools that contained unidentified fish were connected by water to Kaloko Fishpond at higher high tides and are thought to be juvenile *Mugil cephalus* (native mullet) and/or *Chanos chanos* (native milkfish). Fish in the nine pools not associated with wetland areas were likely released into pools by people or washed in during high surf events. At low tides (<0.0 ft) 57% of Park pools were dry, however, at higher tides, 2/3rds of these “dry” pools contained *H. rubra* (Figure 15).



Figure 13. *Metabetaeus lohena* and *Halocaridina rubra* in a shaded pool in Kaloko-Honokōhau National Historical Park. Note the large pincers and the larger size of *M. lohena*.

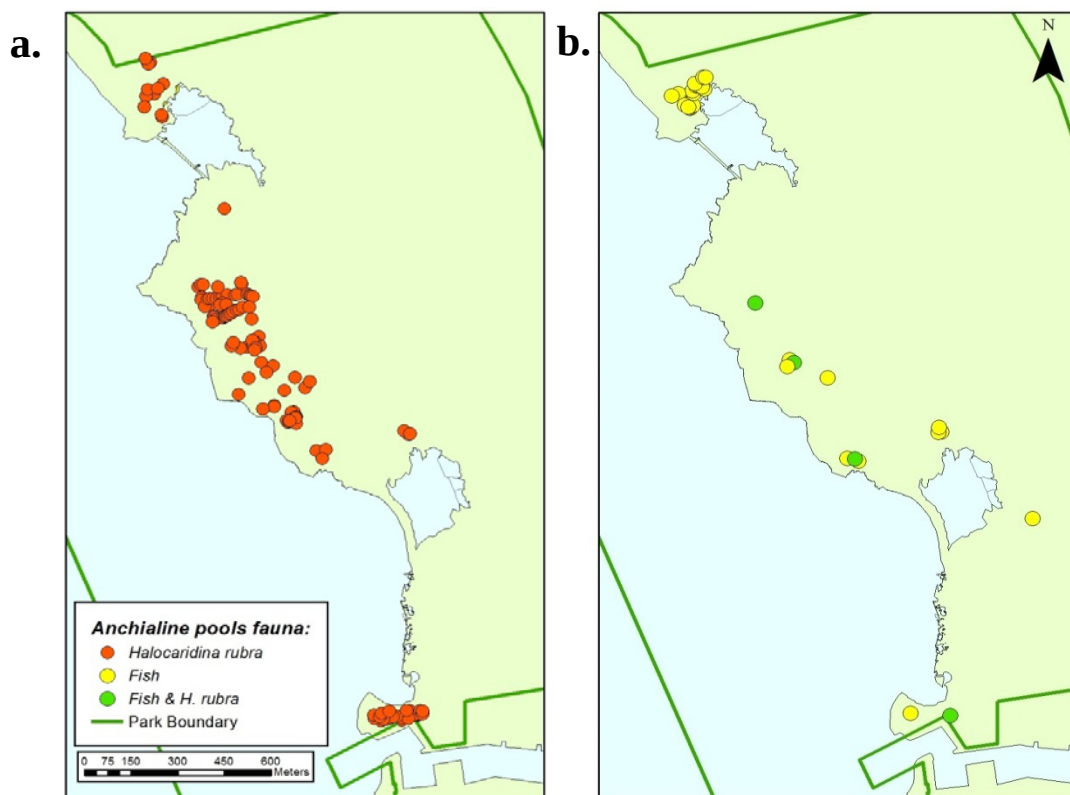


Figure 14. Distribution of a) *Halocaridina rubra* in 105 pools and b) fish in 34 anchialine pools at Kaloko-Honokōhau National Historical Park. Invasive Poeciliid fish were found in 19 pools. Sixteen pools associated with Kaloko Fishpond had unidentified fish species that were thought to be juvenile *Mugil cephalus* and/or *Chanos chanos*.

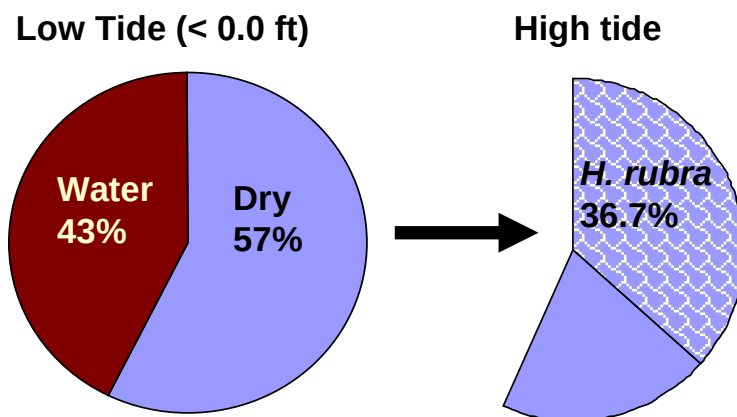


Figure 15. Pie charts showing percent of pools that are dry at low tides, and the percent of the dry at low tide subset that contain *Halocaridina rubra* following watering at high tide states. Percent values are the percent of total Park pools (n=172).

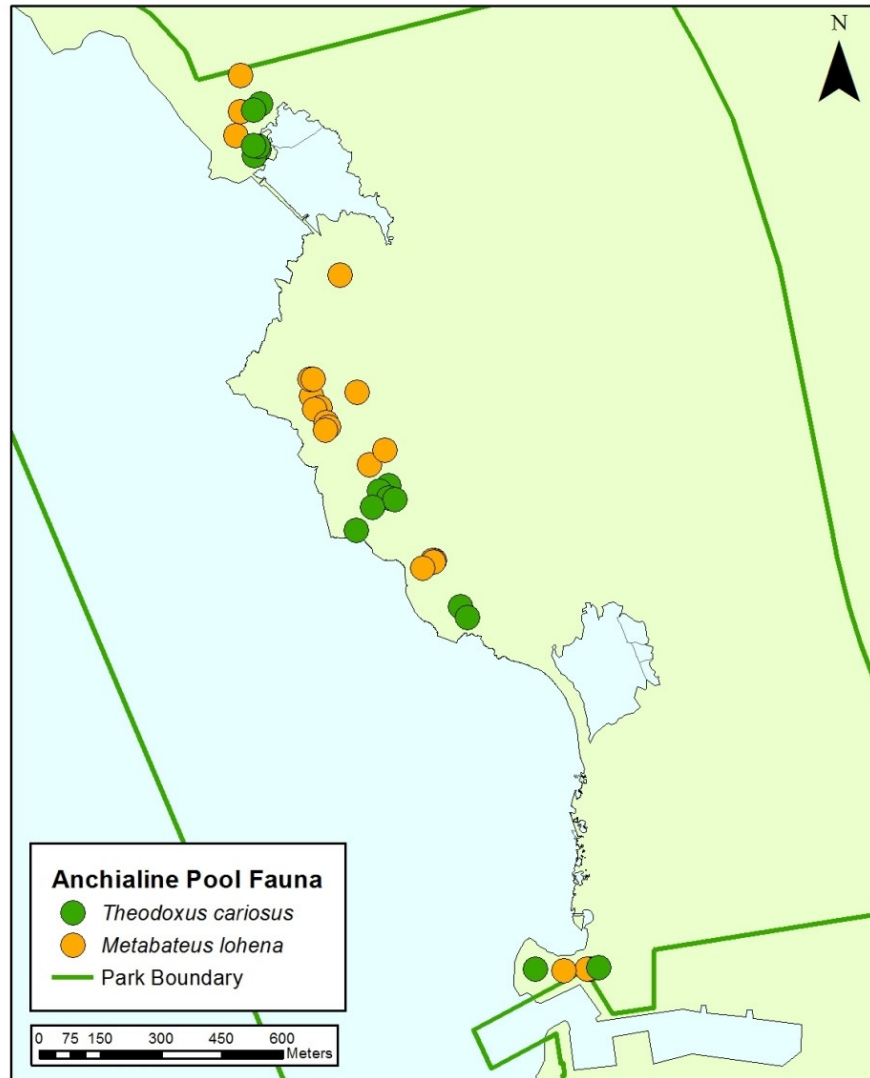


Figure 16. Distribution of *Metabateus lohena* and *Theodoxus cariosus* in anchialine pools at Kaloko-Honokōhau National Historical Park.

The candidate endangered red shrimp species *Metabateus lohena* was found throughout the Park in 16% of pools (Figure 16). The endemic snail *Theodoxus cariosus* was found in 9% of pools also located throughout the Park. The snails numbered in the hundreds in one pool.

Two animals that are unidentified to date were found in the central portion of the Park (Figure 17). The snail has only been described once before from the same area in 1991 (D. Chai 2009, personal communication). When anchialine pool managers and researchers from across the State of Hawai‘i have been asked if they have seen the snail before, all responses have been negative. Initial identification of the snail indicates it is probably *Laddia lamellate* (Kano & Kase 2008), found previously in submarine caves from the Kona Coast (Kano 2009).

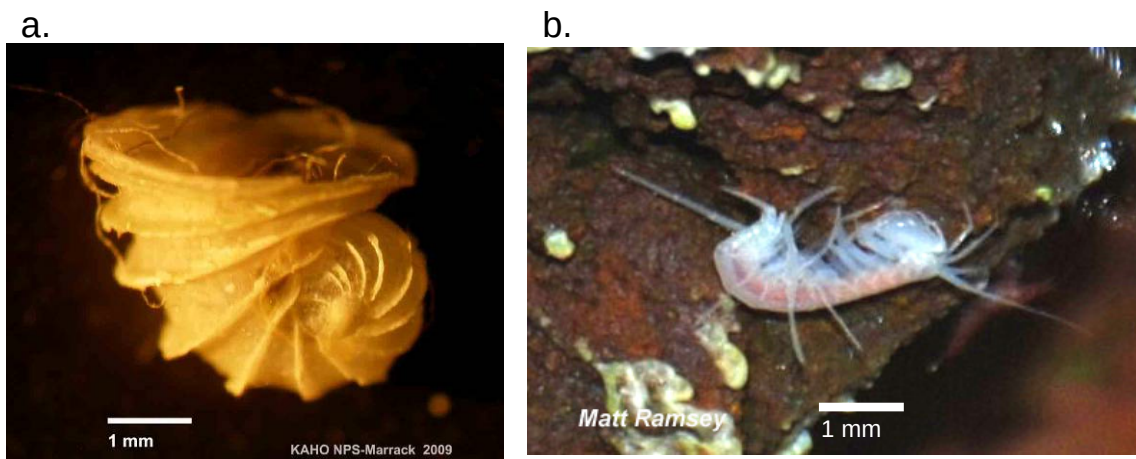


Figure 17. Unidentified anchialine pool species found in 2008 at Kaloko-Honokōhau National Historical Park. a) Mollusk, probably *Laddia lamellate* (Kano & Kase 2008). b) Unidentified amphipod.

Hydrographic Parameters

Hydrographic parameters were sampled at the surface and bottom of 160 pools between April 5, 2008 and February 5, 2009. Pools were sampled up to three times at high tide and three times at low tide, unless tide state made measurements impossible. Some pools were sampled less because they were “discovered” after water quality sampling was initiated. The mean, standard deviation, and minimum and maximum observations for each parameter are listed in Table 6.

Salinity

The mean salinity of anchialine pools was 14.96 ± 3.5 PSU ranging from 8.9 to 29.46 PSU. Overall there was slight stratification of salinity with depth with fresher waters at surface of pools. However, across all sampling events, the average difference between surface and bottom depths (≥ 0.1 m) was 0.9 ± 1.4 PSU. Salinity showed no difference between surface and bottom water during 13% of sampling events, even at 1.0 and 1.2-m depths (Figure 18a & b). In a few wetland associated pools, salinity changed as much as 7 to 11.5 PSU within a 0.3-m depth increase. All salinity differences greater than 1 PSU occurred at high tides (>1.2 -ft ; >0.36 -m) (Figure 18b).

Table 6. Summary of hydrographic parameters sampled at 160 pools between April 5, 2008 and February 5, 2009. All pools were sampled three times at high tide and three at low tide, unless tide state made measurements impossible or pools were located after initiation of sampling. Samples from a December 12, 2008 storm event are reported and discussed separately.

Parameter	Mean	Standard deviation	Minimum	Maximum
Salinity (PSU)	14.96	3.53	8.86	29.46
pH	7.50	0.36	6.03	8.69
Temp (°C)	20.62	1.32	18.72	25.94
DO (mg/L)	5.62	1.87	0.87	16.58
Turbidity (NTU)	0.23	0.90	0.00	8.00
Depth (m)	0.15	0.22	0.00	1.20
Tide height (ft)	1.45	0.91	-0.29	2.64

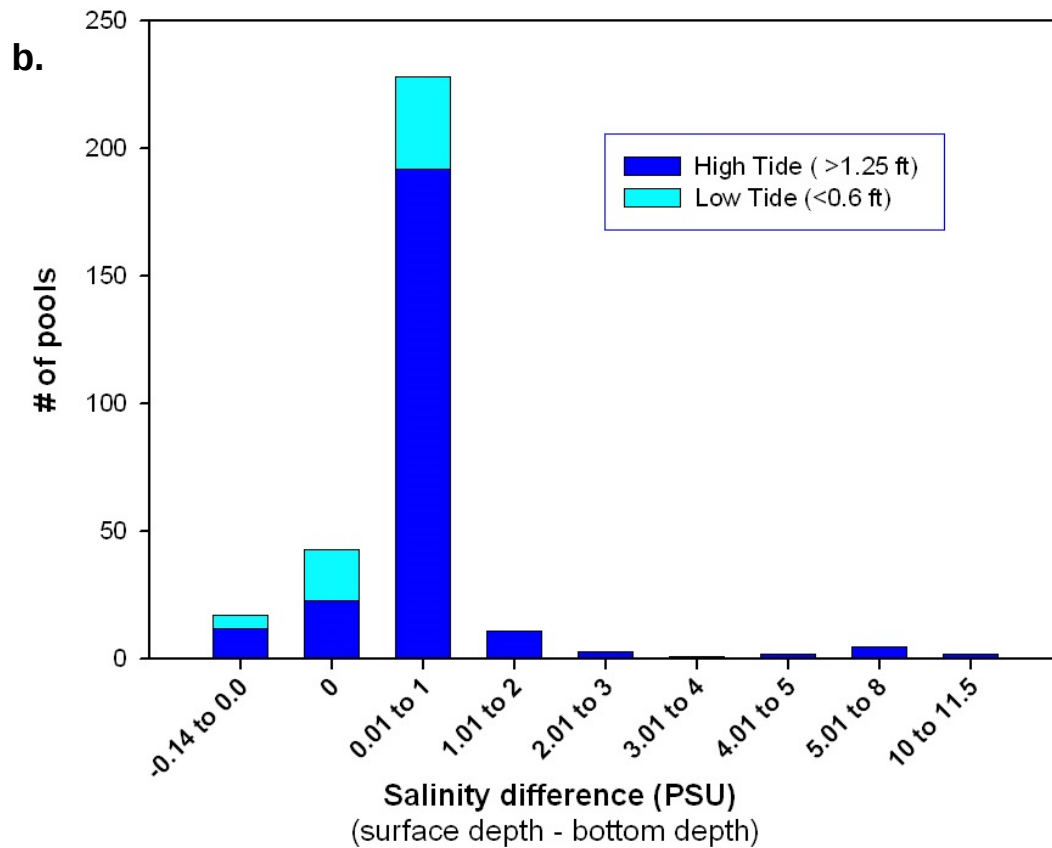
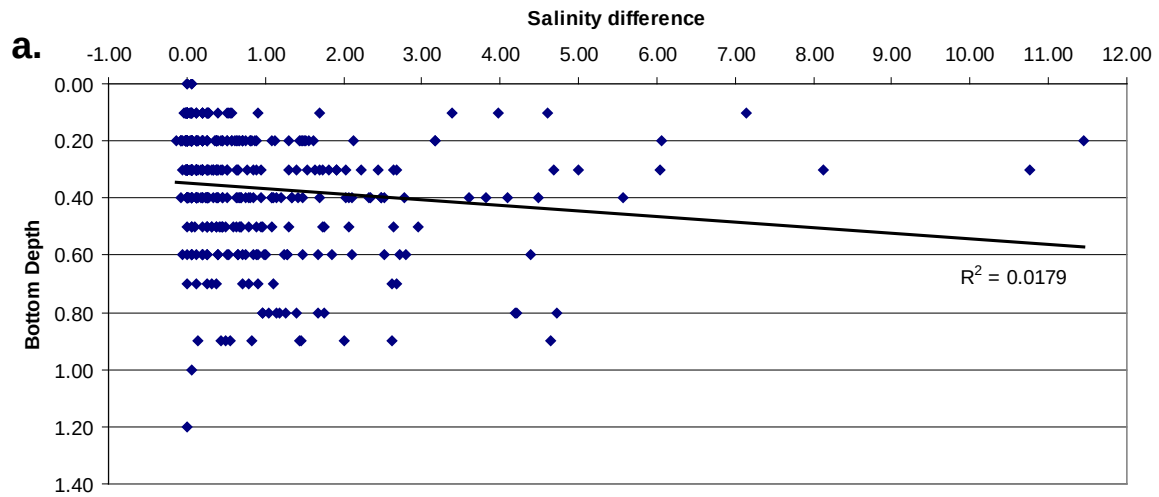


Figure 18. a) Salinity difference between top and bottom of anchialine pools at varying bottom depths. Sampling events (n) =389. Difference in salinity = *surface salinity* – *bottom salinity*. Pools with more saline water at the bottom show a negative salinity difference. Pools with less saline water at bottom show a positive difference. **b)** Salinity difference between surface and bottom of pools as a function of high vs low tide sampling.

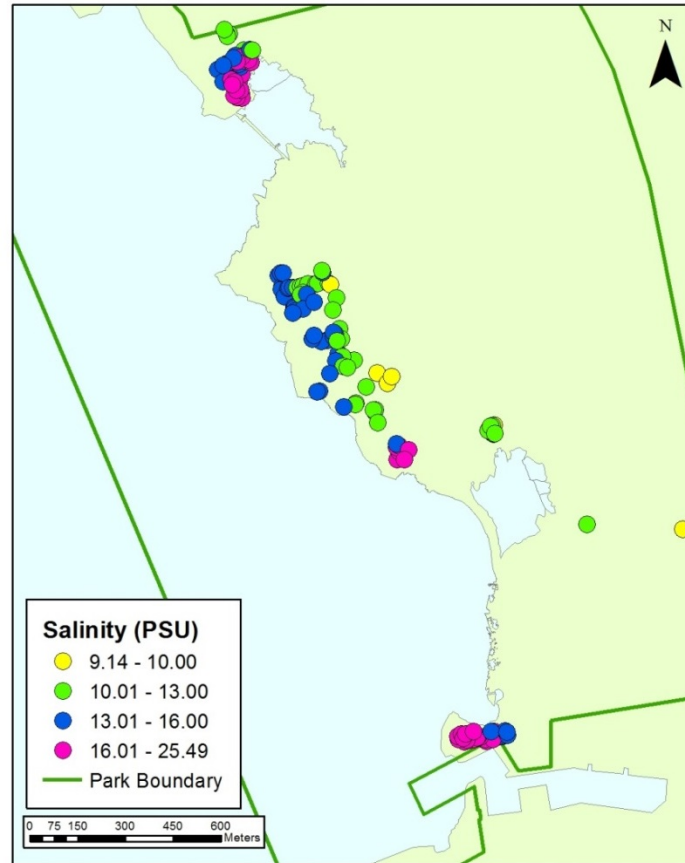


Figure 19. Spatial variation of mean pool salinities. Pools with lowest mean salinities (yellow) are located farthest from shore while the highest mean salinities (pink) are located close to shore in low lying wetland areas.

Spatial variation

Salinity of pools decreases with distance from shore (Figure 19). The pools with the lowest mean salinities (9.14 to 10.0 PSU) were the farthest inland. The pools with the highest mean salinities (16.01 to 25.49 PSU) were closest to shore in low lying wetland areas associated with fishponds or ‘Ai‘opiō Fishtrap (Figure 19).

Temporal variation

When the mean surface salinity of all Park pools was compared between six “normal” sampling periods (three high tides and three low tides) values ranged from 14.2 to 15.5 PSU. Variability of salinity measurements within each sampling period was high due to differences between individual pools; however values were of a similar range (Figure 21). During the three high tide sampling periods (September 2008, November 2008, and December 2008), the mean salinities of all sampled pools were 14.9 (n=136), 15.2 (n=138), and 15.5 (n=78) PSU respectively. Mean low tide surface salinities from April 2008 (n=52), January 2009 (n=74), and February 2009 (n=73) sampling periods ranged between 14.2 to 14.5 PSU (Figure 20). Mean salinity following the December 12, 2008

storm event was 10.2 PSU, but is not directly comparable to means from other events because samples were taken in 18 pools in the central portion of the Park where salinities are usually lower than northern and southern pools.

The extent of change in observed in surface-salinity varied by individual pool. Within 27 individual pools located throughout the Park, the mean difference between maximum and minimum surface salinity measurements over the six sampling periods was 2.64 PSU (7.91 PSU max difference, 0.75 PSU minimum difference).

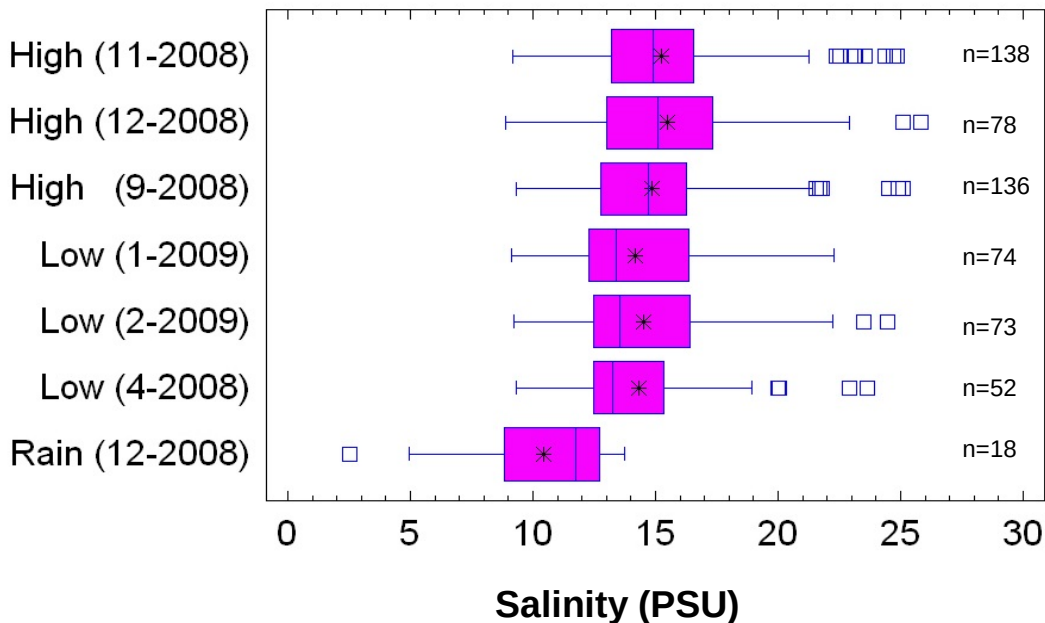


Figure 20. Anchialine pool surface salinities for seven sampling periods. Sampling occurred at three high tide and three low tide events as well as one high rainfall event. A black asterisk represents mean value. The n equals the number of pools sampled during each sampling period. Blue bars represent the median, quartiles and extremes of the data. Blue boxes represent data outliers.

On December 12, 2008, a storm passed over Kaloko-Honokōhau dropping 2.4 inches of rain (NPS RAWs station). Salinity measurements taken at 18 pools eight hours after this high-rainfall event were significantly lower than in the same pools three days later (December 15, 2008) ($F_{1,17} = 8.53$; $p=0.0095$) (Figure 21). Immediately after the rainfall event, salinities ranged from 2.5 to 13.7 PSU at high tide. Three days later, within the same pools, they ranged from 10.4 to 15.1 PSU at high tide. The pools with lowest salinities after the storm were 2.5 PSU and 5 PSU at the surface. After three days the surface salinities in these pools were 13.2 PSU and 11.9 PSU respectively, similar to the salinities in these pools collected in September, November, and December 2008.

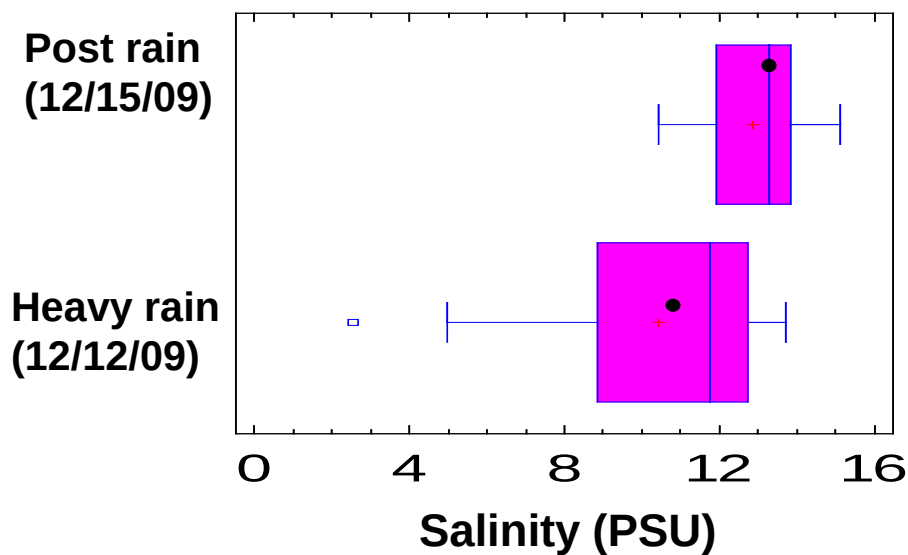


Figure 21. Mean anchialine pool surface salinities for 18 pools eight hours after a high rainfall event (2.4 inches) at high tide and three days later at high tide. Blue bars represent the median, quartiles and extremes of the data. Blue boxes represent data outliers.

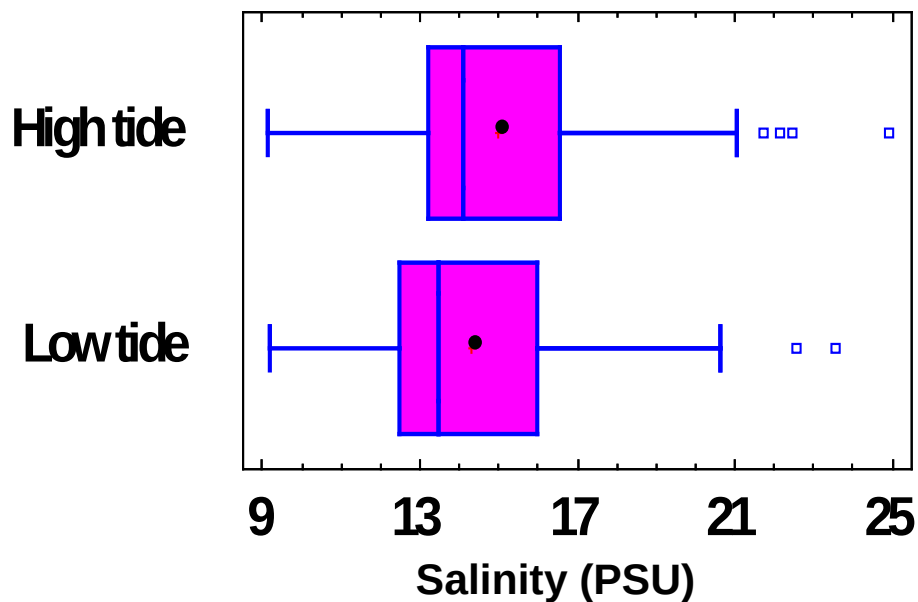


Figure 22. Mean anchialine pool surface salinities for 72 pools at high tide and low tide events. Each pool was sampled two times at high tide and 2 to 3 times at low tide. Black dots are mean values. Blue bars represent the median, quartiles and extremes of the data. Blue boxes represent data outliers.

Within the 72 pools that were deep enough to be sampled at both high and low tides, the mean high-tide surface salinities were slightly more saline by 0.7 ± 0.8 PSU than low tide measurements (Figure 22). A total of 27 pools located throughout the Park were sampled at three high and three low tides and were compared with a two-factor ANOVA. Within these pools, surface salinities measured at high tide were significantly different than at low tide ($F_{1,26} = 30.9$; $p < 0.0001$).

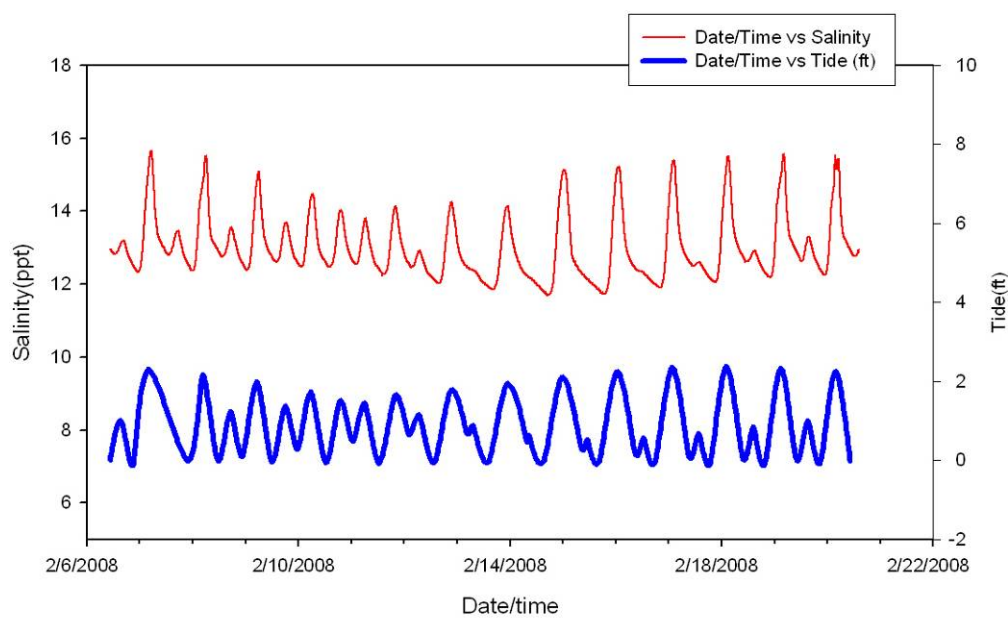


Figure 23. Salinity variation at the bottom of pool HI_Kaloko_53C with tidal change from February 6, 2008 to February 21, 2008. Estimated ocean tide heights for Kona were obtained from a NOAA-based tide prediction program (Pentcheff and Flater 2007-2008). The salinity data were measured with a YSI 6600 sonde.

The February 6, 2008 to February 21, 2008 YSI 6600 Sonde data from pool HI_Kaloko_53C recorded salinity at the bottom of the pool varied as much as 3.3 parts per thousand (11.82 to 15.12 ppt) in 8 hrs. Salinity had a positive relation with tidal height. As tides rose, the bottom of the pool became more saline as the saltwater lens pushed inland (Figure 23).

Temperature

The mean temperature of pools was 20.62 ± 1.3 °C ranging from 18.7 to 25.9 °C across all sampling events. Data were collected between 6:00 am and 12:00 pm. When surface and bottom water were compared, the mean difference was 0.2 °C cooler at the bottom of pools. However, variation was high with some pools cooler at the bottom and some warmer. During one sampling event at one pool, temperatures were 2.9 °C warmer at 0.3 m depths than at the surface. In another pool, temperatures were 4.4 °C cooler at 0.2 m depths than at the surface. The greatest increase of temperature with depth occurred at wetland pools during high tide. Continuous temperature data from the YSI sonde deployed in pool HI_Kaloko_53C showed that, unlike salinity, temperature at the bottom of the pool was inversely related to tides, becoming cooler with higher tides by

as much as 0.5°C (Figure 24). During three separate sampling events bottom temperatures were slightly cooler by 0.1°C than surface temperatures within this pool as well as other pools within this fissure complex.

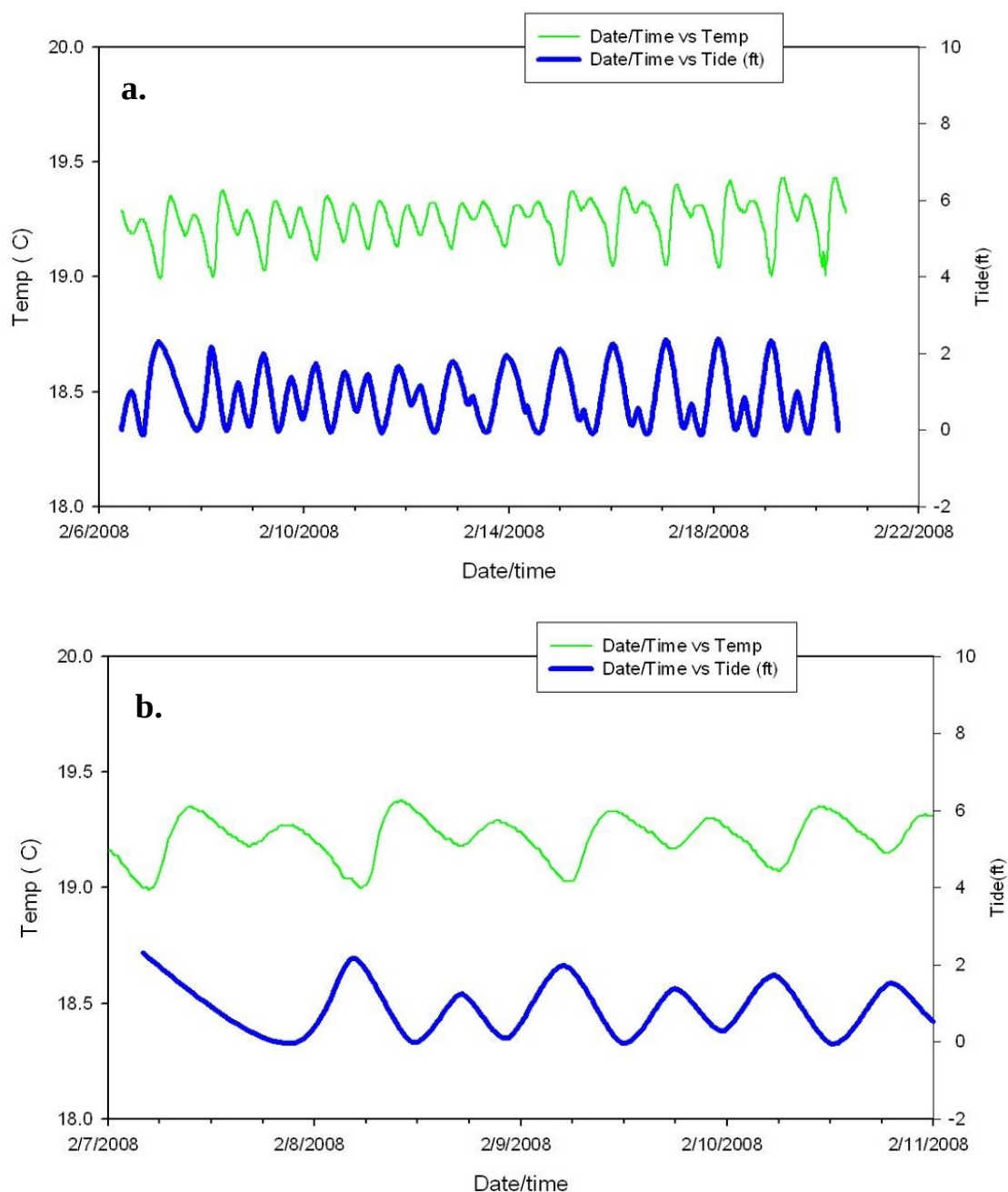


Figure 24. a) Temperature ($^{\circ}\text{C}$) variation at the bottom of pool HI_Kaloko_53C with tidal change deployed from February 6 to 21, 2008. **b)** Close up of February 7 to 11, 2008 data. Date labels are positioned on 00:00 hrs. Estimated ocean tide heights for Kona were obtained from a NOAA-based tide prediction program (Pentcheff and Flater 2007-2008).

Climate Change

The melting of polar ice caps and the expansion of ocean water due to climate change, and the steady tectonic subsidence of Hawai‘i Island are predicted drivers of sea level rise at along the West Coast of Hawai‘i Island. Based on current predictions for 2100, sea level rise scenarios include probable rise (0.48 m/1.6 ft) to extreme (1.55 m/5.1 ft) (Table 7; Vitousek et al 2010). Using Federal Emergency Management Agency LiDAR data from 2006, 2-ft (0.6-m) elevation contours (± 0.5 -ft; 0.15-m accuracy) were mapped within the Park to examine the effects of projected sea level rise on anchialine pools. Maps were made overlaying present anchialine pool locations over elevation data (Figure 25, Figure 26)

Table 7. Mean sea-level rise scenarios at Kaloko-Honokōhau National Historical Park based on various recent models (e.g., Intergovernmental Panel on Climate Change 2007, Rahmstorf 2007) (adapted from Vitousek et al. 2010). Increase in meters (m) & feet (ft) relative to present (2008).

<i>Scenario</i>	<i>Rate [mm/yr]</i>	<i>Acceleration [mm/yr²]</i>	<i>2025</i>	<i>2050</i>	<i>2100</i>
Modest	3.5 mm/yr; 0.13in/y	0	0.06m; 0.19 ft	0.15m; 0.49 ft	0.32m; 1.1 ft
Probable	4 mm/yr; 0.16in/yr	0.013 mm/yr ² ; 0.0005 in/yr ²	0.07m; 0.22 ft	0.19m; 0.62 ft	0.48m; 1.6 ft
Extreme	4 mm/yr; 0.16in/yr	0.14 mm/yr ² ; 0.0005 in/yr ²	0.11m; 0.33 ft	0.41m; 1.3 ft	1.55m; 5.1 ft

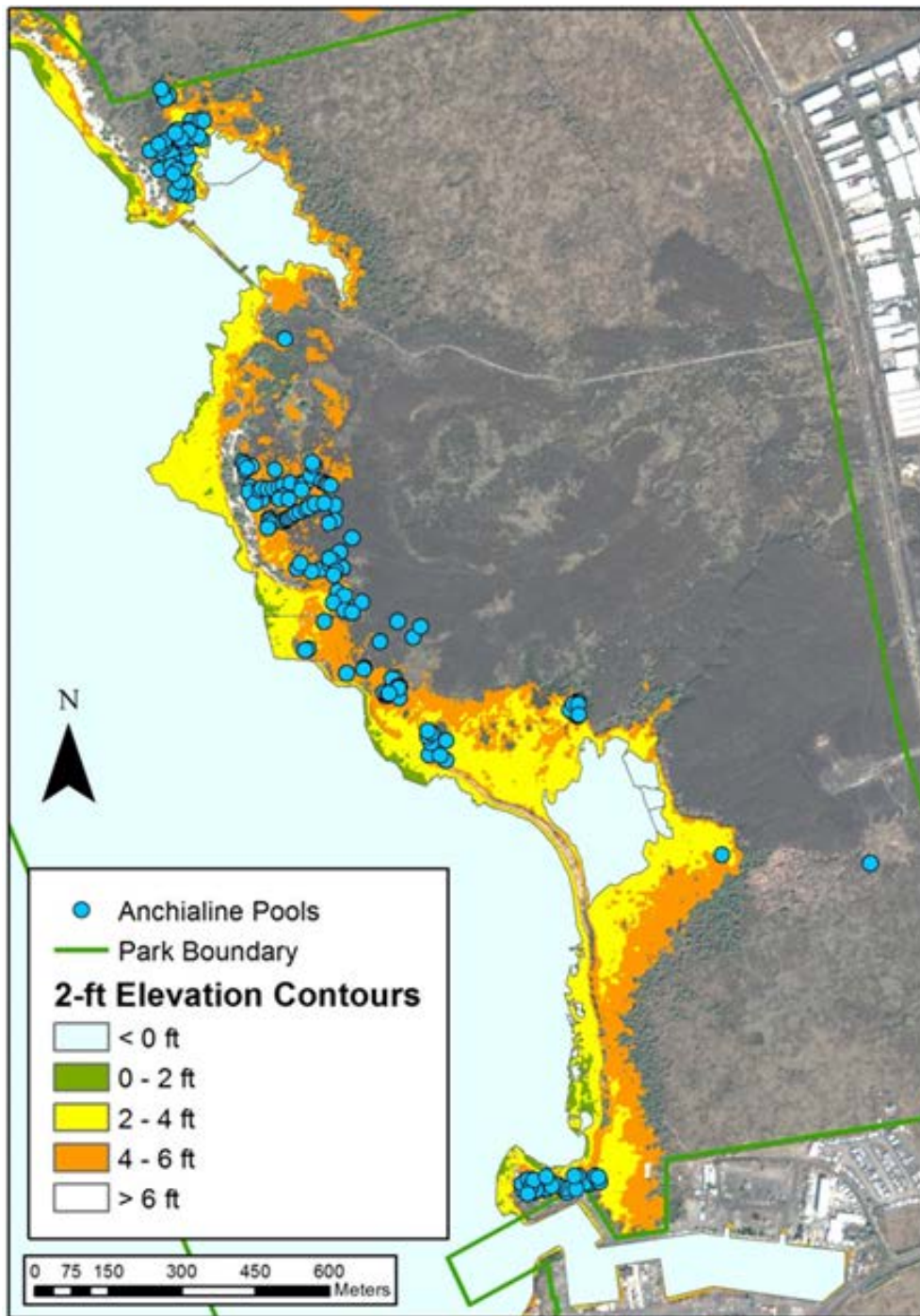


Figure 25. Anchialine pool locations in relation to mean sea level and 2-ft (0.6-m) elevation contour lines (yellow). Elevation data are derived from 2006 Federal Emergency Management Agency LiDAR data. Aerial photo is 2006.

Of the 182 pools mapped within the Park, two pools lay below the park's 2-ft (0.6-m) elevation contour and 83 % lay below the 5.1-ft (1.6-m) contour (Figure 25). These pools will be inundated if the sea-level rise occurs to these extents (Figure 26a). However, this analysis does not take the tidal cycle into account. Because tides along the West Coast of Hawai'i can rise as much as three feet over mean sea level, some pools attached to fishpond and wetland areas are presently inundated at higher high tides. Projected sea-level rise in conjunction with higher high tides will affect many more pools (Figure 26b). At neap tides, native and introduced fish will undoubtedly migrate into pools that have not contained them before. Additionally, even pools that are not inundated will be affected by changes in hydrology. As the marine-water lens pushes inland, many pools will become higher in salinity and may become deeper. Also, storm surge run-up is more likely to deliver marine species and sediment into pools. New pools would presumably form inland, within areas of slightly higher elevation, as sea level rise forces the brackish water lens landward.

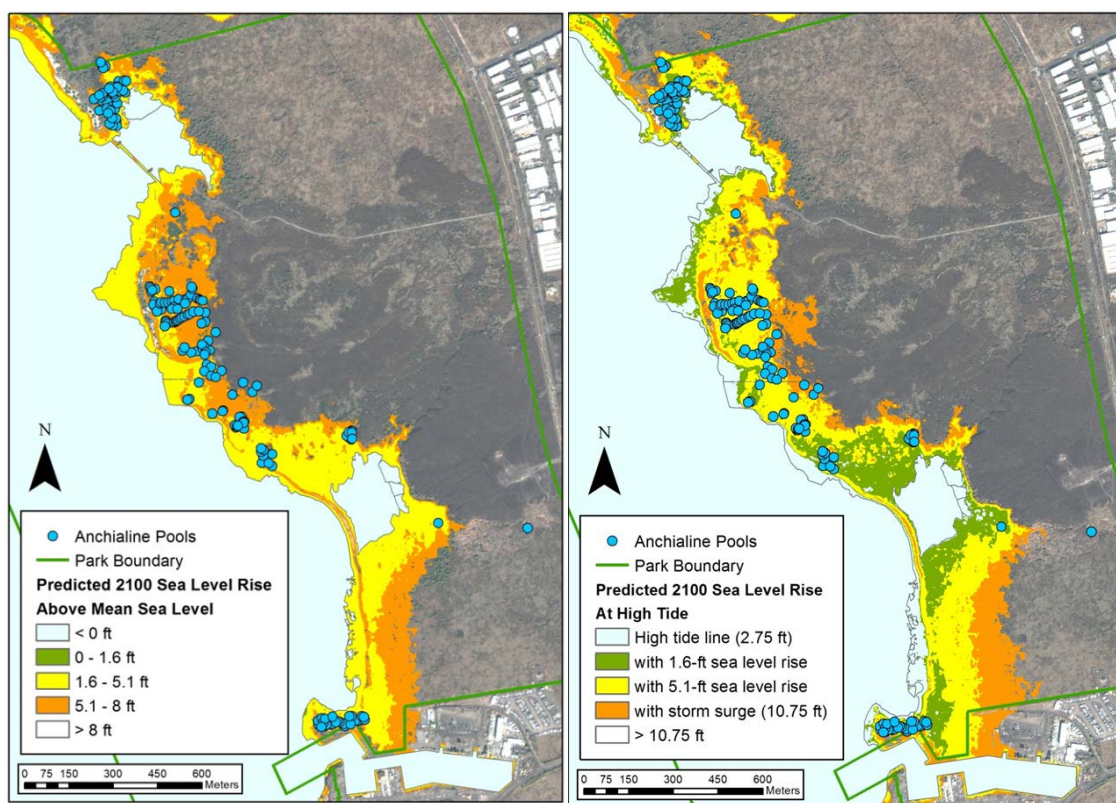


Figure 26. a) Anchialine pool locations in relation to projected sea-level rise in year 2100 at medium (up to 1.6 ft; 0.5 m) and extreme (up to 5.1 ft; 1.6 m) forecasts, **b)** Anchialine pool locations in relation to the projected sea-level rise at higher-high tide states (2.75 ft; 0.84 m) for the same forecast conditions as Figure 27a. Elevation data are derived from 2006 Federal Emergency Management Agency LiDAR data. Sea level forecasts are from Vitousek et al. (2010)

DISCUSSION/MANAGEMENT RECOMMENDATIONS

A total of 182 pools were located and mapped with GPS and GIS. Of these, 172 were tagged, photographed, and sampled for ecological parameters. *H. rubra* were observed in 61% of pools and were primarily associated with rocky and canopy type pools without sediment or fish. Several wetland pools without fish did contain *H. rubra*, especially north of 'Aimakapā Fishpond and in the 'Ai'opiō area.

The habitat types identified in this study coincide with stages of senescence described in Brock and Kam (1997). Rocky pools typify young pools with low sedimentation and associated vegetation; whereas wetland pools, full of organic sediment and surrounded by riparian plants, are becoming senescent. Because wetland pools are often connected to fishponds at higher high tides and/or are at low elevations in proximity to marine environments, non-native fish eradication in these pools would be difficult; potentially impossible without simultaneous action in the fishpond. Wetland pools in the Park are also predominantly surrounded by the invasive non-native pickleweed *Batis maritima*, which is difficult to eradicate and requires consistent treatment for successful control (Schuster 1996).

Eradication of invasive fish should focus on the nine pools not associated with wetlands. In particular, fish should be removed as soon as possible from pool HI_Kaloko_054 located in the central park area to protect against infestation to surrounding pools. This rocky pool is located near numerous pristine pools that contain endemic shrimp and the unidentified mollusk and amphipod discussed above.

Removal of vegetation during restoration should be done cautiously, especially at canopy pools. Observations by David Foote (2005, and pers. comm.) show that *Megalagrion xanthomelas*, the candidate endangered orangeblack Hawaiian damselfly, is most often associated with pools covered in *Thespesia populnea* (milo) canopy. Until habitat requirements for this and other species are better understood, removal of canopy should be limited.

During this study, 57% of pools were observed to go dry at lower low tides. Because fish may be unable to survive in these “dry” pools, the pools can act as important refuges for hypogeal species such as *Halocaridina rubra* that may otherwise be out-competed by non-native fish species. Additionally, as sea level rises and inundates pools at lower elevations, these “dry” pools will become deeper and may be a place where pool fauna unable to survive in marine water conditions will migrate to.

Comparison with past studies

A number of past studies have examined faunal composition and/or water quality in various sub-sets of anchialine pools within Kaloko-Honokōhau National Historical Park (Table 8). When possible, pools were cross-referenced so that historical data could be compared to recent observations.

Table 8. Summary of anchialine pool studies at Kaloko-Honokōhau National Historical Park. “x” indicates data were collected.

Reference	# of Park Pools Sampled	Data Sampled			
		GPS Location	Flora/Fauna	Salinity	Nutrients
Maciolek & Brock (1974)	~20		x	x	
Chai (1991, unpublished)	10		x	x	
NPS Schuster (1994 unpublished data)	32	x	some		
Brock and Kam (1997)	64	some	x	(16 pools)	(16 pools)
Oki et al. (1999)	2			x	
Bienfang (2007)	8	x		x	x
NPS (2004 unpublished data)	126	x		x	
USGS-BRD and I&M (2004, unpublished)	Not avail	Not avail	x		
Knee et al. (2008)	13	some		x	x (also Ra/Rn)
MIT (2008, unpublished data)	4			x	
I&M (initiated 2008 & ongoing)	Quarterly:4 permanent/4 random	x		x	x
This study (2007-2009)	182	x	x	x	

Fauna

Surveys of 64 Park pools in 1997 by Brock and Kam show that only 33% of pools (21 pools) they surveyed contained *H. rubra*. Additionally, they noted that over the course of their study, some of the pools with abundant and diverse anchialine pool communities in early 1994 had changed by 1996 to contain guppies but not anchialine crustaceans. Brock and Kam (1997) hypothesized that spring tides may have allowed fish to migrate from ‘Aimakapā Fishpond into some of these pools, located in low lying areas north of the fishpond.

Brock and Kam (1997) suggest over 95% of anchialine pools in West Hawai‘i, have been contaminated by the invasion of alien fish, primarily in a 20-year period. Extensive field work is needed to confirm this estimate across the region, however, the majority of pools (80%) at Kaloko-Honokōhau National Historical Park are not yet

invaded by introduced fish, which suggests that the Park may represent one of the few remaining areas on the West Coast of Hawai‘i with intact anchialine pool habitats.

Thirty seven percent of the Park’s total anchialine pools that become dry at low tides (57% of pools in the Park) offer viable habitat for *Halocaridina rubra* at high tides. Because fish may not be able to survive in these “dry” pools, the pools can act as refuges for hypogeal species that are otherwise out-competed by non-native fish species. Depending on the nature of the interstitial spacing in the underlying rock, some fish species may not be able to live in these pools because they cannot survive in the low tide, dry state, but the hypogeal shrimp can move into them with ease.

Observations at 182 pool locations from this survey show that at least 105 have *H. rubra*. These pools are likely to contain other anchialine pool crustaceans and mollusks not observed in this survey. Because the visual faunal surveys were rapid and conducted during the daytime, rarer species, especially nocturnal species were likely to be under represented or missed. For example, *Metabateus lohena* is rarely seen in direct sunlight so nighttime surveys might show them to be present in many more pools. The limited visual sampling may be why rarer anchialine pool crustaceans previously seen in the Park were missed. The Pacific Island Network Inventory and Monitoring program is presently designing sampling protocols for anchialine pool fauna and will inventory and monitor pools in the Hawaiian National Parks in the future (Brasher and Weijerman 2008, personal communication).

Hydrographic Parameters

Historical hydrographic data for numerous pools within and around Kaloko-Honokōhau are available in Maciolek and Brock (1974), Chai (1991 unpublished study), Brock and Kam (1997), NPS (2004 unpublished data) and Bienfang (2007). However, studies focus on different areas of the Park and pool identification among studies is not consistent, therefore it is difficult to examine long-term temporal changes in water quality within specific pools. Salinity is the only parameter measured in all of the studies, and more recent studies do include nutrient data. Salinity in past studies was reported in parts per thousand (ppt), while other studies since 2007 report salinity in Practical Salinity Units (PSU). Because ppt and PSU are numerically similar, they will be treated as the same unit for comparison purposes.

Two pools (HI_Kaloko_015 and HI_Honoko_123) were identified from salinity sampling in prior studies. Salinity in Kahinihini‘ula (queen’s bath, HI_Kaloko_015) appears to have increased from 4.0 ppt in 1974 to 8.0 ppt in 1991 where it has remained in all later studies (Figure 27). Salinity in pool 123 appears to have increase from 6 ppt to 12 ppt. This apparent doubling of salinity should be examined cautiously because the 1974 data were collected using different methodology, there are no other data from this time period, and rainfall data during this time is unknown. However, oral history from Hawaiians who lived in or frequently visited the lands that now make up the Park, say that they and their ancestors used pools as sources of drinking water (Honokōhau Study Advisory Commission 1974, Roy and Nahele 1975, Wyban 1996, Peter Keka 2008, pers. comm.). Freshwater is considered to be less than 0.5 ppt salinity. The human taste threshold for sodium in water is between 0.03 and 0.46 ppt (USEPA 2003). People can drink waters of 1.5 ppt for short periods of time and may be able to become

habituated to as high as 1.8 ppt (Anderson and Cummings 1999). Even with this ability, the Hawaiians that drank from pools throughout the Park would not have been able to drink water of 8.0 ppt (PSU) on a regular basis. Except for immediately after large rainfall events, this salinity is the lowest measured in any Park pools at the time of this study.

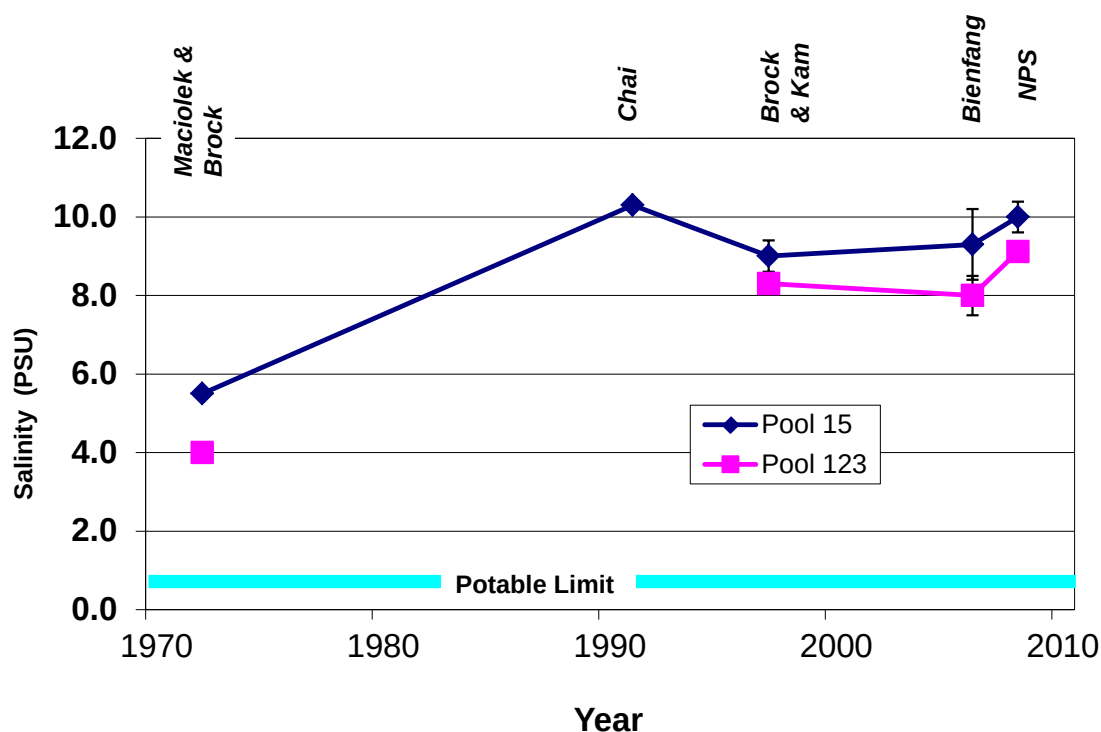


Figure 27. Apparent salinity changes within two anchialine pools at Kaloko-Honokōhau National Historical Park. Researchers responsible for salinity measurements are listed at the top of the graph. It should be noted that methods used in 1974 were not as precise as instruments used after 1990. The blue line is the upper limit of salinity for potable water

Nutrients and Pollutants

Nutrients were not measured during this project; however, past studies have examined nutrients in Park monitoring wells and some anchialine pools (e.g., Brock and Kam 1997, Bienfang 2007). Bienfang (2007) collected nutrient data from eight rocky pools monthly from January 12, 2004 to August 8, 2006 then bimonthly until November 7, 2007 at a subset of these pools (Table 9). These pools, located in the central portion of the Park, include one canopy pool and seven rocky pools. Two of the pools contain fish and seven contain endemic anchialine pool species including *H. rubra*, the endemic mollusk *Theodoxus cariosus*, and *Megalagrion xanthomelas* (at several pools with canopy (*Thespesia populnea*) nearby).

Table 9. Summary of water quality data collected by Bienfang (2007) at eight anchialine pools within Kaloko-Honokōhau National Historical Park from January 2005 to November 2007 on a monthly and bimonthly schedule (n=23 sampling events).

	Temp °C	Sal ppt	Tide ft	pH	DO mg/L	DO %sat	NO ³ μM	PO ⁴ μM	NH ⁴ μM	SiO ² μM	TDON μM	TDOP μM
Pools												
Mean	20.89	9.97	0.83	7.93	7.76	92.45	89.01	3.76	3.13	553.56	97.73	0.34
Min	18.95	4.8	0.26	6.12	4.63	54.2	35.6	2.15	0.04	338.96	2.65	0
Max	27.14	15.68	2.23	9.11	14.87	186.6	183	5.28	14.17	643	397.74	3.56
Wells												
Mean	21.12	7.91	0.9	7.78	7.4	86.52	81.04	4.27	1.19	672.71	111.94	4.37
Min	19.74	0.01	-0.08	7.06	3.75	46.9	41.1	1.89	0.04	376.8	1.97	0
Max	26.66	12.65	2.27	8.91	12.62	146.5	160.6	5.55	8.57	920.4	383.92	378.96

The present nutrient levels in Park pools do appear to be impacted by anthropogenic inputs. A review of nutrient data in Hoover and Gold (2005) shows that by 1996, wells in the Park appear to be affected by nutrients compared to high-level aquifer wells upslope of the Park. Furthermore, data from 2004 and 2005 show that groundwater nutrient levels have increased significantly since then. Without water quality data for anchialine pools prior to this time, the well data suggest that nutrients are elevated in 1994-1996 anchialine pool samples (Brock and Kam 1997) and that water quality has continued to decline since then (Hoover and Gold 2005).

The observations above are supported by observations elsewhere on the West Coast of Hawai'i Island. For example, at the nearby Waikoloa resort, anchialine pools seaward (*makai*) from development are elevated in inorganic nutrients compared to groundwater wells upslope (*mauka*) of the development, indicating that groundwater flowing into development is becoming nutrient enriched due to land use practices at the development (Brock and Kam 1997).

Although limited work has been done to look at anthropogenic pollutants in anchialine pools, increasing septic systems and storm runoff upslope may cause increase in such compounds. In 1997 and 1998 water was collected from four groundwater wells in the Park and analyzed for trace metals and organic contaminants. All analytes were below detection levels except low concentrations of chromium and copper as well as phenol (Oki et al. 1999). Pentachloroanisole was also detected in one well in 2002 (Tribble 2003). Similar studies have not been done at anchialine pools, but presumably groundwater-fed pools habitats also receive such contaminants. The USGS is conducting a study that will examine baseline anthropogenic inputs to Park groundwater using stable isotopes and pharmaceutical tracers and will include four anchialine pools and three wells in sample locations.

Sea Level Rise

Although it is difficult to predict sea level rise rates and extent, it is clear that resource managers at Kaloko-Honokōhau National Historical Park should be aware that areas of slightly higher elevation could be the sites of new pools in the future. Coastal

subsidence coupled with storm surge, and resulting erosion and/or infilling will alter pool habitats. Protection of these new areas will be essential for the preservation of anchialine pool organisms, which will need new habitat to migrate to as their old habitats transition to marine environments.

Future Management Actions

1) Park monitoring of pools and their flora, fauna, and water quality should continue. The Pacific Island Network of the NPS Inventory and Monitoring (I&M) program is developing a protocol for monitoring of selected anchialine pool fauna. That protocol, along with the recently initiated water quality protocol in eight pools on a quarterly basis (Jones et al. 2008) will complement park monitoring efforts. Future pool investigations should coordinate with I&M program efforts to ensure proper sampling for specific research questions.

2) Studies investigating optimal ranges and thresholds of environmental parameters for pool organisms should be supported. For example, how much freshwater do anchialine pools need for ecosystem functions? What ranges of temperature and salinity are necessary for successful reproduction of species? What level(s) of nutrients is associated with macroalgae in pool communities? Brock and Kam (1997) hypothesized that anchialine pool organisms are adapted to highly variable conditions. Although pool species are found in a variety of salinities, temperatures, and nutrient regimes, requirements for species-specific lifecycle stage requirements are not yet well studied (Tango 2010). Thresholds are most likely species specific, or even life-stage specific and may even conflict between species. For example, inventory work by the US Geological Survey shows that *Megalagrion xanthomelas* is found primarily at pools with canopy cover (David Foote, 2008, personal communication) and Tango (2010) found differences in life-stage habitat requirements.

Tides, daily irradiance patterns, and seasonal precipitation create an environment in which salinity, temperature, and other parameters may fluctuate on an hourly basis. A more fine-scale examination of water level, temperature, depth stratification, and changes with tide would be helpful to define what ranges of temperature and salinity are experienced by pool organisms. It is unclear if organisms utilize sub-habitats within pools, migrating to areas of optimal conditions as needed.

The synergistic effects of increased nutrients, increased salinity, and introduction of non-native species on individual pool species as well as the overall habitat need to be better understood. Responsible for declines on coral reefs worldwide, the combination of increased nutrients as well as exclusion of keystone herbivores may well be the reason for macroalgal dominance and pool degradation seen along the Kona coast. Invasive fish are most likely not the sole reason for the widespread decline in anchialine pool habitat seen in the past 20 years. Nineteen pools within Kaloko-Honokōhau National Historical Park contain non-native Poeciliids, yet *H. rubra* are present and macroalgae are absent. Ability to coexist may depend on the Poeciliid species. Elsewhere on the west coast of Hawai'i Island, in an area with little to no development, tilapia and Poeciliids are highly abundant in pools that also contain large amounts of the microbial crust associated with healthy anchialine community structure (Marrack, personal observation).

- 3) Restoration techniques, especially fish and invasive plant eradication, should be developed and applied. The use of various trapping and netting techniques, rotenone, 'akia (*Wikstroemia* sp., an endemic plant traditionally used to stun fish) (Bishop Museum, 2010), native piscivores, and/or electrofishing to eradicate invasive fish need to be tested. Tilapia, problematic for anchialine pools at Pu'uhonua o Honaunau National Historical Park, are not present in Kaloko-Honokōhau pools to date. However, they have recently been reported in 'Aimakapā Fishpond (Rich Mackenzie 2008, pers. comm.). They should be contained and eliminated if at all possible.
- 4) Continue to support studies by the US Geological Survey and other research organizations to investigate regional hydrology. Determining the timing and magnitude of water level and salinity changes within Park pools due to water withdrawals on nearby properties will be helpful as the Park works with surrounding landowners and planning agencies to set protective limits for anchialine pool habitats.
- 5) Continue to work with neighboring landowners, as well as county and state agencies to facilitate sustainable planning, wise water use, and best land-use practices.
- 6) Protect areas where new pools are predicted to form as sea level rises. The young 'a'a flow in the central region of the Park is particularly important because of the high number of pristine pools, the lack of vegetation, and the high occurrence of endemic pool species observed in them.
- 7) Continue to collaborate with state and federal agencies, universities, NGOs, and others to share information and combine efforts on pool conservation. Information sharing has been valuable for conservation efforts statewide as different entities work towards similar goals.
- 8) Develop educational materials and programs to highlight this unique ecosystem and its threats.

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Appendix 1. National Park Service Anchialine Pool Database

The National Park Service (NPS) Pacific Island Network anchialine pool database is accessible to the public at <https://irma.nps.gov/App/Reference/Profile/2192748>. Multiple anchialine pool research projects by the NPS, USGS, and researchers from other institutions contribute to this database. Historical data will be added to the database in the future. The database is maintained by the Pacific Island Network of the NPS Inventory and Monitoring Program.

Appendix 2. MIT TREX 2008 Twenty Four-Hour Data.

These data were collected and provided by undergraduates from Massachusetts Institute of Technology, and are considered anecdotal. Water depths were collected via fixed meter sticks for the duration of the sampling period.

Time	Water Level	Salinity (Refractometer)			Hydrolab Sonde					Corrected Water Level
		Top	Middle	Bottom	Salinity	Dissolved O2	pH	Sp. Cond.	Temperature	
Hr	cm	ppt	ppt	ppt	pss	mg/L		uS/cm	°C	cm
HI_Honkoko_011										
10:00	41.3	10	12	ND	ND	7.71	7.44	21864	19.74	27.1
11:00	41.6	8	11	ND	ND	7.4	7.49	21550	20	27.4
12:00	41.8	8	12	ND	ND	8.1	7.42	21764	20.21	27.6
13:00	40.2	9	11	ND	ND	8.32	7.39	21387	20.38	26.0
14:00	36.5	8	11	ND	ND	8.2	7.41	21256	20.48	22.3
15:00	30.8	9	12	ND	ND	8.21	7.54	21329	20.18	16.6
16:00	24.2	12	14	ND	ND	8	7.63	21330	20.18	10.0
17:00	19.7	12	13	ND	ND	8.05	7.62	21392	20.12	5.5
18:00	19.6	13	13	ND	ND	7.62	7.74	21358	20.02	5.4
19:00	23.5	11	13	ND	ND	7.09	7.72	21446	19.85	9.3
20:00	30.0	11	12	ND	ND	7.1	7.7	21260	19.46	15.8
21:00	39.4	11	12	ND	ND	6.6	7.66	21530	19.41	25.2
22:00	50.9	10	13	ND	ND	6.07	7.64	21702	19.33	36.7
23:00	62.5	10	13	ND	ND	5.85	7.63	22341	19.26	48.3
0:00	72.0	12	14	ND	ND	5.87	7.67	22762	19.14	57.8
1:00	77.1	10.5	13	ND	ND	5.55	7.6	22550	19.18	62.9
2:00	78.9	10	12	ND	ND	5.6	7.55	22018	19.12	64.7
3:00	74.4	10	12	ND	ND	5.83	7.58	21760	19.05	60.2
4:00	68.0	11	13	ND	ND	5.92	7.62	21413	18.93	53.8
5:00	59.9	10	11.5	ND	ND	6	7.62	21070	18.8	45.7
6:00	51.7	10	12	ND	ND	6.05	7.6	21254	18.84	37.5
7:00	44.5	10.5	12	ND	ND	5.98	7.61	21502	18.86	30.3
8:00	39.1	10	12	ND	ND	5.99	7.59	21930	19.11	24.9
9:00	37.2	12	13	ND	ND	6.23	7.55	22263	19.26	23.0
10:00	36.9	13	13	ND	ND	6.5	7.4	22318	19.5	22.7
HI_Honoko_044										
10:00	46.3	15	15	ND	ND	8.32	7.47	21969	19.56	21.3
11:00	45.8	12	14	ND	ND	8.69	7.43	21955	19.62	20.8
12:00	45.8	12	13	ND	ND	8.28	7.46	21867	19.65	20.8
13:00	44.2	12	12	ND	ND	8.26	7.48	21862	19.7	19.2
14:00	38.6	12	13	ND	ND	8.32	7.57	21743	19.72	13.6
15:00	32.5	13	14	ND	ND	8.01	7.43	21696	19.69	7.4
16:00	24.5	15	15	ND	ND	8.29	7.52	21640	19.6	-0.6
17:00	21.0	15	15	ND	ND	7.95	7.54	21585	19.57	-4.1
18:00	22.5	15	15	ND	ND	7.7	7.60	21496	19.52	-2.6
19:00	29.0	15	16	ND	ND	7.92	7.66	21442	19.48	3.9
20:00	35.7	15	15	ND	ND	7.82	7.67	21466	19.47	10.7

Time	Water Level	Salinity (Refractometer)			Hydrolab Sonde					Corrected Water Level
		Top	Middle	Bottom	Salinity	Dissolved O2	pH	Sp. Cond.	Temperature	
Hr	cm	ppt	ppt	ppt	pss	mg/L		uS/cm	°C	cm
21:00	47.5	16	17	ND	ND	7.7	7.71	21714	19.47	22.5
22:00	60.8	15	16	ND	ND	7.33	7.73	22090	19.46	35.7
23:00	72.4	16	16	ND	ND	7.54	7.72	22366	19.41	47.4
0:00	81.5	15	15	ND	ND	7.42	7.70	23019	19.44	56.5
1:00	86.0	15	16	ND	ND	7.32	7.73	23772	19.48	61.0
2:00	85.3	15	16	ND	ND	7.01	7.75	24662	19.5	60.3
3:00	79.5	15	17	ND	ND	8.28	7.75	24097	19.48	54.5
4:00	71.5	15	16	ND	ND	9.08	7.82	23084	19.41	46.5
5:00	62.7	15	15	ND	ND	8.52	7.84	22846	19.42	37.7
6:00	53.0	15	15	ND	ND	8.5	7.84	22686	19.44	28.0
7:00	44.8	15	15	ND	ND	7.52	7.83	22500	19.44	19.8
8:00	40.9	15	16	ND	ND	8.24	7.79	22287	19.48	15.9
9:00	39.1	15	15	ND	ND	7.98	7.78	22152	19.5	14.1
10:00	40.0	15	15	ND	ND	8.23	7.59	22079	19.57	15.0
HI_Honoko_006										
10:00	24.0	13	13	14	13.97	7.91	7.99	0	19.33	24.1
11:00	25.4	13	13	14	14.19		8.21	0	20.17	25.5
12:00	25.4	13	14	15	14.13	8.9	8.55	0	20.44	25.5
13:00	23.8	12	13	14	13.86	8.75	8.23	0	20.14	23.9
14:00	18.4	12	15	15	13.83	8.37	8.12	0	20.42	18.5
15:00	13.9	13	14	14	13.79	8.39	7.95	0	19.93	14.0
16:00	7.3	13	14	15	13.68	8.46	8.09	0	21.68	7.4
17:00	2.1	14	ND	15	13.69	8.88	8.29	0	21.52	2.2
18:00	2.1	13	ND	14	13.85	8.21	8.22	0	19.75	2.2
19:00	6.0	13	ND	14	13.84	8.98	8.13	0	19.22	6.1
20:00	12.9	14	14	15	13.89	7.84	7.79	0	18.31	13.0
21:00	23.4	12	13	13	13.96	7.59	7.86	0	18.28	23.5
22:00	36.4	13	14	15	14.29	6.94	8.02	0	18.7	36.5
23:00	46.9	14	14	16	14.69	7.26	7.92	0	19.14	47.0
0:00	54.4	13	14	14	14.63	7.63	7.89	0	19.24	54.5
1:00	61.2	14	15	15	14.63	7.18	7.95	0	19.26	61.1
2:00	62.4	11	11	11	14.56	7.54	7.94	0	19.26	62.5
3:00	57.4	13	14	14	14.63	7.65	7.94	0	19.09	57.5
4:00	50.0	14	14	15	14.62	7.62	7.94	0	19.01	50.1
5:00	42.9	14	13	13	14.59	7.76	7.94	0	18.89	43.0
6:00	ND	13	13	15	14.42	7.8	8.02	0	18.84	ND
7:00	27.0	13	13	13	14.29	7.57	7.96	0	18.81	27.1
8:00	21.7	13	13	13	14.16	7.79	7.98	0	18.87	21.8
9:00	19.7	13	14	14	14.1	7.72	7.88	0	18.97	19.8
10:00	19.8	13	13	14	14.31	9.88	7.99	0	19.6	19.9
HI_Honoko_007										
10:00	18.7	12	13	14	13.39	7.87	7.75	0	19.75	38.3
11:00	19.0	11	13	15	13.34	7.81	7.72	0	20.5	38.6
12:00	18.7	11	11	14	13.35	8.87	7.87	0	21.23	38.3

Time	Water Level	Salinity (Refractometer)			Hydrolab Sonde					Corrected Water Level
		Top	Middle	Bottom	Salinity	Dissolved O2	pH	Sp. Cond.	Temperature	
Hr	cm	ppt	ppt	ppt	pss	mg/L		uS/cm	°C	cm
13:00	17.5	11	12	14	13.25	9.48	7.95	0	21.5	37.0
14:00	13.7	12	14	14	13.17	9.34	7.97	0	21.77	33.2
15:00	8.3	10	11	13	13.17	9.14	7.96	0	22.15	27.9
16:00	1.3	11	12	12	13.11	8.07	7.82	0	22.04	20.9
17:00	-3.4	11	12	13	13.17	6.77	7.62	0	21.92	16.2
18:00	-4.7	12	12	12	13.16	6.92	7.73	0	21.2	14.9
19:00	0.4	11	ND	13	13.21	6.32	7.73	0	20.63	20.0
20:00	4.2	13	13	13	13.27	6.97	7.83	0	20.37	23.8
21:00	16.5	12	13	14	13.27	7.5	7.79	0	20.14	36.1
22:00	26.3	12	12	12	13.34	7.63	7.77	0	20.11	45.9
23:00	38.6	13	13	14	13.47	7.75	7.8	0	20.1	58.2
0:00	47.5	13	14	15	13.46	10.4	7.81	0	19.77	67.1
1:00	53.5	13	14	14	13.39	8.38	7.85	0	19.57	73.1
2:00	55.4	12	14	14	13.39	10.95	7.83	0	19.35	75.0
3:00	51.3	11	13	13	13.52	10.53	7.79	0	19.45	70.9
4:00	45.9	12	13	13	13.45	15.1	7.78	0	19	65.5
5:00	37.1	13	13	13	13.58	10.5	7.67	0	19.5	56.6
6:00	28.5	12	13	12	13.65	9.83	7.58	0	19.47	48.1
7:00	21.3	12	12	12	13.45	6.4	7.53	0	19.3	40.8
8:00	15.9	11	12	12	13.52	6.9	7.53	0	19.2	35.5
9:00	13.8	12	13	14	13.55	9.15	7.59	0	19.53	33.4
10:00	13.7	12	13	14	13.46	9.6	7.71	0	20	33.2

Appendix 3. Continuous Data HI_Kaloko_053.

YSI 6600 sonde data for Fissure/Pool 53 (western end) at Kaloko Honokōhau NHP. Data were collected in 15-minute intervals from 2/6/08 to 2/20/08. Ocean tide heights for Kailua-Kona were obtained from a NOAA-based tide prediction program (Pentcheff and Flater 2007-2008).

Date M/D/Y	Time hh:mm:ss	Temp C	SpCond mS/cm	pH	Chlorophyll ug/L	Turbidity+ NTU	DO (%)	Salinity ppt	Tide ft
2/6/2008	10:46:09	19.29	21.527	7.72	-0.1	-1.4	83.45	12.97	0.12
2/6/2008	11:01:10	19.28	21.488	7.74	0.5	-1.4	83.48	12.94	0.14
2/6/2008	11:16:10	19.28	21.437	7.74	0.2	-1.3	83.6	12.91	
2/6/2008	11:31:09	19.27	21.406	7.75	0.8	-1.4	83.4	12.89	
2/6/2008	11:46:09	19.26	21.376	7.76	0.5	-1.4	83.39	12.87	
2/6/2008	12:01:09	19.25	21.358	7.77	0.6	-1.3	83.35	12.86	
2/6/2008	12:16:10	19.24	21.339	7.77	0.4	-1.3	83.21	12.84	
2/6/2008	12:31:09	19.23	21.322	7.78	0.9	-1.3	83.06	12.83	
2/6/2008	12:46:09	19.23	21.319	7.78	0.3	-1.3	82.88	12.83	
2/6/2008	13:01:10	19.22	21.33	7.78	0	-1.4	82.83	12.84	
2/6/2008	13:16:10	19.21	21.355	7.78	0.4	-1.3	82.64	12.85	
2/6/2008	13:31:10	19.21	21.387	7.78	0	-1.4	82.56	12.88	
2/6/2008	13:46:09	19.2	21.43	7.78	0.3	-1.3	82.38	12.9	
2/6/2008	14:01:09	19.2	21.453	7.79	0.4	-1.3	82.26	12.92	
2/6/2008	14:16:09	19.2	21.492	7.79	0.4	-1.4	82.13	12.94	
2/6/2008	14:31:09	19.2	21.543	7.79	0.5	-1.3	81.83	12.98	
2/6/2008	14:46:09	19.19	21.586	7.78	0	-1.3	81.51	13.01	
2/6/2008	15:01:09	19.19	21.654	7.78	0.5	-1.3	81.41	13.05	
2/6/2008	15:16:09	19.19	21.738	7.79	0.4	-1.3	81.26	13.11	
2/6/2008	15:31:10	19.19	21.775	7.79	0.1	-1.3	81.2	13.13	1
2/6/2008	15:46:10	19.19	21.817	7.79	0.5	-1.3	81.11	13.16	
2/6/2008	16:01:09	19.19	21.855	7.79	0.2	-1.3	81.09	13.18	
2/6/2008	16:16:09	19.19	21.879	7.79	0.2	-1.3	80.99	13.2	
2/6/2008	16:31:09	19.19	21.881	7.79	0.5	-1.3	81.16	13.2	
2/6/2008	16:46:10	19.2	21.865	7.78	0.6	-1.3	81.05	13.19	
2/6/2008	17:01:10	19.2	21.824	7.78	0.6	-1.4	81.06	13.16	
2/6/2008	17:16:10	19.21	21.757	7.79	0.6	-1.3	81.35	13.12	
2/6/2008	17:31:10	19.21	21.676	7.79	0	-1.4	81.63	13.07	
2/6/2008	17:46:09	19.22	21.603	7.79	-0.2	-1.3	81.94	13.02	
2/6/2008	18:01:10	19.22	21.517	7.79	0.1	-1.3	82.31	12.96	
2/6/2008	18:16:10	19.23	21.429	7.79	0	-1.3	82.64	12.9	
2/6/2008	18:31:10	19.24	21.339	7.79	0.5	-1.4	82.95	12.84	
2/6/2008	18:46:10	19.24	21.277	7.79	0.6	-1.4	83.12	12.8	
2/6/2008	19:01:10	19.24	21.208	7.79	0.8	-1.3	83.51	12.76	
2/6/2008	19:16:10	19.25	21.166	7.79	0.7	-1.3	83.61	12.73	
2/6/2008	19:31:10	19.25	21.095	7.8	0.2	-1.4	83.91	12.68	

Date M/D/Y	Time hh:mm:ss	Temp C	SpCond mS/cm	pH	Chlorophyll ug/L	Turbidity+ NTU	DO (%)	Salinity ppt	Tide ft
2/6/2008	19:46:10	19.25	21.047	7.8	-0.3	-1.3	84.03	12.65	
2/6/2008	20:01:10	19.25	21.009	7.8	0.3	-1.3	84.23	12.63	
2/6/2008	20:16:10	19.25	20.961	7.8	0.9	-1.4	84.29	12.6	
2/6/2008	20:31:09	19.25	20.908	7.8	0.5	-1.4	84.35	12.56	
2/6/2008	20:46:09	19.25	20.867	7.81	0.6	-1.3	84.54	12.53	
2/6/2008	21:01:09	19.24	20.826	7.81	0.4	-1.3	84.55	12.51	-0.1
2/6/2008	21:16:10	19.24	20.781	7.81	0.1	-1.4	84.71	12.48	
2/6/2008	21:31:10	19.24	20.737	7.82	0.3	-1.4	84.79	12.45	
2/6/2008	21:46:09	19.23	20.709	7.82	0.5	-1.3	84.71	12.43	
2/6/2008	22:01:09	19.23	20.682	7.83	0.4	-1.3	84.82	12.41	
2/6/2008	22:16:09	19.22	20.643	7.83	0	-1.3	84.76	12.39	
2/6/2008	22:31:10	19.21	20.616	7.83	0.4	-1.3	84.67	12.37	
2/6/2008	22:46:10	19.2	20.602	7.84	0.7	-1.3	84.55	12.36	
2/6/2008	23:01:10	19.2	20.564	7.84	0	-1.3	84.45	12.34	
2/6/2008	23:16:10	19.19	20.57	7.85	0.5	-1.3	84.37	12.34	
2/6/2008	23:31:10	19.18	20.575	7.86	0.4	-1.4	84.16	12.34	
2/6/2008	23:46:10	19.17	20.597	7.86	-0.1	-1.3	83.79	12.36	
2/7/2008	0:01:10	19.16	20.638	7.87	0.4	-1.3	83.75	12.39	
2/7/2008	0:16:10	19.16	20.695	7.87	0.9	-1.3	83.56	12.42	
2/7/2008	0:31:09	19.15	20.837	7.87	0.1	-1.4	83.09	12.52	
2/7/2008	0:46:09	19.14	21.012	7.87	0.3	-1.3	82.66	12.63	
2/7/2008	1:01:09	19.14	21.172	7.87	0.8	-1.3	82.19	12.74	
2/7/2008	1:16:10	19.13	21.438	7.87	0.5	-1.4	81.52	12.91	
2/7/2008	1:31:09	19.11	21.764	7.87	0.2	-1.4	80.39	13.12	
2/7/2008	1:46:10	19.1	22.128	7.87	0.1	-1.3	79.5	13.36	
2/7/2008	2:01:10	19.09	22.493	7.86	0.4	-1.3	78.6	13.6	
2/7/2008	2:16:10	19.08	22.86	7.86	-0.4	-1.3	77.64	13.85	
2/7/2008	2:31:10	19.06	23.218	7.86	0.7	-1.3	76.59	14.08	
2/7/2008	2:46:10	19.05	23.547	7.86	0.4	-1.3	75.59	14.3	
2/7/2008	3:01:09	19.04	23.858	7.85	0.8	-1.3	74.63	14.51	
2/7/2008	3:16:09	19.03	24.142	7.85	0.4	-1.3	73.84	14.69	
2/7/2008	3:31:10	19.02	24.404	7.85	-0.1	-1.3	73.19	14.87	
2/7/2008	3:46:10	19.01	24.649	7.85	0.4	-1.4	72.53	15.03	
2/7/2008	4:01:10	19	24.872	7.85	-0.2	-1.3	72.04	15.18	2.31
2/7/2008	4:16:10	19	25.121	7.86	-0.1	-1.3	71.43	15.35	
2/7/2008	4:31:09	19	25.367	7.85	0.1	-1.3	70.94	15.51	
2/7/2008	4:46:09	18.99	25.518	7.85	0.1	-1.4	70.6	15.61	
2/7/2008	5:01:10	19	25.595	7.86	-0.2	-1.3	70.47	15.66	
2/7/2008	5:16:10	19	25.567	7.86	0.2	-1.3	70.69	15.65	
2/7/2008	5:31:10	19.02	25.419	7.86	0.1	-1.3	71.11	15.55	
2/7/2008	5:46:10	19.04	25.202	7.87	0.9	-1.3	71.75	15.4	
2/7/2008	6:01:09	19.07	24.802	7.88	0.4	-1.3	72.89	15.13	

Date M/D/Y	Time hh:mm:ss	Temp C	SpCond mS/cm	pH	Chlorophyll ug/L	Turbidity+ NTU	DO (%)	Salinity ppt	Tide ft
2/7/2008	6:16:10	19.1	24.417	7.88	0.7	-1.3	73.94	14.88	
2/7/2008	6:31:10	19.13	23.981	7.89	0.1	-1.4	75.1	14.59	
2/7/2008	6:46:09	19.17	23.552	7.89	0.2	-1.3	76.58	14.3	
2/7/2008	7:01:09	19.21	23.115	7.9	0.5	-1.3	78.09	14.01	
2/7/2008	7:16:10	19.23	22.861	7.91	0.2	-1.4	79.08	13.85	
2/7/2008	7:31:09	19.25	22.676	7.91	1.3	-1.3	79.8	13.72	
2/7/2008	7:46:09	19.27	22.433	7.91	0.5	-1.3	81	13.56	
2/7/2008	8:01:09	19.29	22.237	7.92	0.5	-1.4	82	13.43	
2/7/2008	8:16:10	19.31	22.117	7.92	-0.2	-1.4	82.68	13.35	
2/7/2008	8:31:10	19.32	22.036	7.93	0	-1.3	83.33	13.3	
2/7/2008	8:46:09	19.33	21.967	7.93	1	-1.4	83.74	13.26	
2/7/2008	9:01:09	19.34	21.898	7.93	0.2	-1.4	84.29	13.21	
2/7/2008	9:16:10	19.35	21.853	7.94	-0.3	-1.4	84.74	13.18	
2/7/2008	9:31:10	19.35	21.819	7.94	0.2	-1.3	84.94	13.16	
2/7/2008	9:46:10	19.35	21.769	7.94	0.6	-1.3	85.06	13.13	
2/7/2008	10:01:09	19.34	21.705	7.94	0.4	-1.3	85.2	13.08	
2/7/2008	10:16:09	19.34	21.662	7.94	0.9	-1.4	85.13	13.05	
2/7/2008	10:31:09	19.33	21.621	7.94	0.3	-1.3	85.22	13.03	
2/7/2008	10:46:10	19.33	21.59	7.94	0.2	-1.3	85.21	13.01	
2/7/2008	11:01:10	19.33	21.557	7.94	0.5	-1.3	85.29	12.99	
2/7/2008	11:16:10	19.32	21.522	7.95	0	-1.3	85.3	12.96	
2/7/2008	11:31:09	19.31	21.462	7.94	1.5	-1.3	85.14	12.92	
2/7/2008	11:46:10	19.3	21.412	7.94	0.5	-1.3	84.86	12.89	
2/7/2008	12:01:09	19.3	21.382	7.95	0.5	-1.3	84.76	12.87	
2/7/2008	12:16:10	19.29	21.346	7.95	0.2	-1.3	84.69	12.85	
2/7/2008	12:31:10	19.28	21.3	7.95	0.6	-1.3	84.42	12.82	
2/7/2008	12:46:10	19.27	21.295	7.95	0.9	-1.4	84.49	12.81	
2/7/2008	13:01:10	19.26	21.263	7.95	-0.3	-1.4	84.35	12.79	
2/7/2008	13:16:09	19.26	21.294	7.95	0.2	-1.4	83.98	12.81	
2/7/2008	13:31:10	19.25	21.306	7.95	0.2	-1.3	83.78	12.82	
2/7/2008	13:46:10	19.24	21.332	7.95	1.2	-1.4	83.61	12.84	
2/7/2008	14:01:10	19.23	21.4	7.96	0.8	-1.4	83.22	12.88	
2/7/2008	14:16:10	19.23	21.424	7.96	0.3	-1.3	83	12.9	
2/7/2008	14:31:10	19.22	21.47	7.96	0.3	-1.3	82.71	12.93	
2/7/2008	14:46:09	19.22	21.57	7.96	0.6	-1.4	82.52	13	
2/7/2008	15:01:09	19.21	21.627	7.96	0.6	-1.4	82.1	13.03	
2/7/2008	15:16:10	19.2	21.723	7.96	0.9	-1.3	81.91	13.1	
2/7/2008	15:31:10	19.2	21.863	7.96	-0.4	-1.3	81.33	13.19	
2/7/2008	15:46:09	19.19	21.952	7.96	1.2	-1.4	81.03	13.25	
2/7/2008	16:01:09	19.19	22.041	7.96	0.2	-1.4	80.55	13.3	
2/7/2008	16:16:09	19.18	22.139	7.96	0.1	-1.4	80.58	13.37	
2/7/2008	16:31:09	19.18	22.204	7.96	0.4	-1.3	80.21	13.41	

Date M/D/Y	Time hh:mm:ss	Temp C	SpCond mS/cm	pH	Chlorophyll ug/L	Turbidity+ NTU	DO (%)	Salinity ppt	Tide ft
2/7/2008	16:46:10	19.19	22.237	7.96	-0.2	-1.3	80.03	13.43	
2/7/2008	17:01:09	19.19	22.27	7.96	0.4	-1.3	80.03	13.46	
2/7/2008	17:16:10	19.19	22.28	7.96	0.4	-1.3	80.23	13.46	
2/7/2008	17:31:10	19.2	22.245	7.96	-0.1	-1.4	80.14	13.44	
2/7/2008	17:46:09	19.2	22.189	7.97	0.9	-1.3	80.21	13.4	
2/7/2008	18:01:09	19.21	22.082	7.97	1.2	-1.3	80.63	13.33	
2/7/2008	18:16:09	19.22	21.963	7.97	-0.5	-1.3	81	13.25	
2/7/2008	18:31:10	19.23	21.845	7.97	1.1	-1.4	81.34	13.18	
2/7/2008	18:46:09	19.24	21.744	7.97	0.4	-1.4	81.78	13.11	
2/7/2008	19:01:10	19.24	21.665	7.97	-0.1	-1.3	82.1	13.06	
2/7/2008	19:16:10	19.25	21.554	7.96	0.8	-1.4	82.52	12.98	
2/7/2008	19:31:10	19.25	21.463	7.96	-0.5	-1.3	82.97	12.92	
2/7/2008	19:46:09	19.26	21.359	7.97	0.9	-1.3	83.19	12.86	
2/7/2008	20:01:09	19.27	21.266	7.98	0.9	-1.4	83.7	12.8	
2/7/2008	20:16:09	19.27	21.208	7.95	0	-1.3	83.92	12.76	
2/7/2008	20:31:09	19.27	21.154	7.96	0.8	-1.3	84.27	12.72	
2/7/2008	20:46:10	19.27	21.106	7.96	0.3	-1.3	84.43	12.69	
2/7/2008	21:01:10	19.27	21.053	7.98	0.1	-1.3	84.45	12.66	
2/7/2008	21:16:10	19.27	21.002	7.98	0.8	-1.3	84.75	12.62	
2/7/2008	21:31:09	19.27	20.958	7.98	0.5	-1.3	84.8	12.59	
2/7/2008	21:46:10	19.26	20.927	7.98	-0.4	-1.3	84.85	12.57	- 0.021 063
2/7/2008	22:01:10	19.26	20.86	7.98	-0.3	-1.3	84.84	12.53	
2/7/2008	22:16:10	19.25	20.844	7.98	0.1	-1.3	85.07	12.52	
2/7/2008	22:31:09	19.25	20.805	7.98	0.7	-1.3	84.94	12.49	
2/7/2008	22:46:09	19.24	20.717	7.98	0	-1.3	85.02	12.44	
2/7/2008	23:01:10	19.23	20.691	7.98	0.8	-1.4	84.96	12.42	
2/7/2008	23:16:09	19.23	20.643	7.98	-0.1	-1.4	85.06	12.39	
2/7/2008	23:31:09	19.22	20.625	7.98	0.4	-1.4	84.96	12.38	
2/7/2008	23:46:09	19.21	20.61	7.98	-0.1	-1.3	84.65	12.37	
2/8/2008	0:01:09	19.2	20.616	7.98	0.9	-1.3	84.54	12.37	
2/8/2008	0:16:09	19.19	20.618	7.98	0.4	-1.4	84.44	12.37	
2/8/2008	0:31:10	19.19	20.643	7.98	0.5	-1.4	84.24	12.39	
2/8/2008	0:46:09	19.18	20.738	7.98	0.5	-1.3	84.02	12.45	
2/8/2008	1:01:10	19.17	20.846	7.99	0.5	-1.4	83.51	12.52	
2/8/2008	1:16:09	19.16	20.973	7.99	0.5	-1.4	83.11	12.6	
2/8/2008	1:31:10	19.15	21.151	7.98	-0.2	-1.4	82.56	12.72	
2/8/2008	1:46:09	19.14	21.43	7.98	0.4	-1.3	81.72	12.9	
2/8/2008	2:01:09	19.13	21.748	7.98	0.4	-1.4	80.93	13.11	
2/8/2008	2:16:10	19.11	22.104	7.98	0.7	-1.3	79.84	13.35	
2/8/2008	2:31:10	19.1	22.431	7.98	1.1	-1.3	78.87	13.56	
2/8/2008	2:46:09	19.09	22.769	7.97	0.5	-1.3	78.08	13.79	

Date M/D/Y	Time hh:mm:ss	Temp C	SpCond mS/cm	pH	Chlorophyll ug/L	Turbidity+ NTU	DO (%)	Salinity ppt	Tide ft
2/8/2008	3:01:09	19.07	23.187	7.97	-0.2	-1.3	76.84	14.06	
2/8/2008	3:16:10	19.05	23.439	7.97	1	-1.3	75.97	14.23	
2/8/2008	3:31:10	19.04	23.659	7.96	0.6	-1.3	75.05	14.37	
2/8/2008	3:46:10	19.04	23.778	7.96	-0.3	-1.3	74.79	14.45	
2/8/2008	4:01:10	19.04	23.898	7.96	0.7	-1.3	74.4	14.53	
2/8/2008	4:16:09	19.04	24.048	7.96	0.2	-1.3	74.13	14.63	
2/8/2008	4:31:09	19.03	24.221	7.96	1.2	-1.4	73.55	14.75	2.18
2/8/2008	4:46:09	19.02	24.323	7.96	-0.2	-1.2	73.36	14.82	
2/8/2008	5:01:10	19.01	24.469	7.96	0.1	-1.3	72.89	14.91	
2/8/2008	5:16:10	19	24.798	7.96	0	-1.3	72.09	15.13	
2/8/2008	5:31:09	19	25.134	7.96	0.4	-1.4	71.34	15.36	
2/8/2008	5:46:09	19.01	25.344	7.95	0.3	-1.3	70.91	15.5	
2/8/2008	6:01:09	19.01	25.387	7.95	0.7	-1.3	70.76	15.53	
2/8/2008	6:16:09	19.03	25.291	7.96	0.1	-1.4	71.49	15.46	
2/8/2008	6:31:10	19.05	25.016	7.96	0.4	-1.3	72.07	15.28	
2/8/2008	6:46:10	19.08	24.61	7.97	0.2	-1.4	73.39	15.01	
2/8/2008	7:01:09	19.13	23.927	7.98	0.7	-1.3	75.15	14.55	
2/8/2008	7:16:09	19.18	23.344	7.98	0.8	-1.4	77.01	14.16	
2/8/2008	7:31:09	19.23	22.901	7.99	0.1	-1.4	78.51	13.87	
2/8/2008	7:46:09	19.26	22.589	7.99	0.5	-1.4	79.84	13.67	
2/8/2008	8:01:09	19.29	22.325	8	0.4	-1.3	81.04	13.49	
2/8/2008	8:16:09	19.31	22.116	8	-0.3	-1.3	82.1	13.35	
2/8/2008	8:31:09	19.33	21.981	8.01	0.4	-1.3	83.07	13.26	
2/8/2008	8:46:09	19.35	21.911	8.01	0	-1.4	83.74	13.22	
2/8/2008	9:01:09	19.36	21.871	8.01	1.2	-1.3	84.23	13.19	
2/8/2008	9:16:10	19.37	21.844	8.01	0.1	-1.3	84.47	13.17	
2/8/2008	9:31:09	19.37	21.783	7.97	0.3	-1.4	84.81	13.13	
2/8/2008	9:46:10	19.37	21.765	8.01	0.5	-1.4	85.25	13.12	
2/8/2008	10:01:09	19.38	21.727	8.01	-0.4	-1.4	85.33	13.1	
2/8/2008	10:16:09	19.37	21.666	8.01	-0.4	-1.4	85.55	13.06	
2/8/2008	10:31:09	19.37	21.633	8.01	1.1	-1.4	85.63	13.04	
2/8/2008	10:46:09	19.36	21.59	8.01	-0.1	-1.4	85.8	13.01	
2/8/2008	11:01:09	19.36	21.543	8	0.5	-1.3	85.72	12.98	
2/8/2008	11:16:10	19.35	21.515	8	0.4	-1.3	85.72	12.96	0
2/8/2008	11:31:10	19.34	21.463	8	0.8	-1.3	85.59	12.92	
2/8/2008	11:46:09	19.33	21.423	8	0.2	-1.3	85.52	12.9	
2/8/2008	12:01:09	19.32	21.383	8	0.3	-1.4	85.14	12.87	
2/8/2008	12:16:10	19.32	21.318	8	1.2	-1.4	85.33	12.83	
2/8/2008	12:31:10	19.31	21.289	8	0.3	-1.4	85.23	12.81	
2/8/2008	12:46:10	19.3	21.26	8	0.5	-1.3	84.97	12.79	
2/8/2008	13:01:09	19.29	21.232	8	0.6	-1.4	84.92	12.77	
2/8/2008	13:16:10	19.28	21.203	8	0.9	-1.3	84.92	12.75	

Date M/D/Y	Time hh:mm:ss	Temp C	SpCond mS/cm	pH	Chlorophyll ug/L	Turbidity+ NTU	DO (%)	Salinity ppt	Tide ft
2/8/2008	13:31:09	19.27	21.204	8	0.2	-1.3	84.69	12.76	
2/8/2008	13:46:09	19.26	21.205	8	0.3	-1.4	84.35	12.76	
2/8/2008	14:01:10	19.25	21.243	8	1.1	-1.3	84.02	12.78	
2/8/2008	14:16:10	19.24	21.285	8	0.5	-1.3	83.92	12.81	
2/8/2008	14:31:10	19.24	21.322	8	0.6	-1.3	83.55	12.83	
2/8/2008	14:46:09	19.23	21.36	8	0.5	-1.4	83.34	12.86	
2/8/2008	15:01:09	19.22	21.428	8	0	-1.4	83.02	12.9	
2/8/2008	15:16:10	19.21	21.5	8	0.6	-1.4	82.71	12.95	
2/8/2008	15:31:09	19.21	21.576	8	0.2	-1.3	82.24	13	
2/8/2008	15:46:09	19.21	21.677	8	0.3	-1.3	82	13.07	
2/8/2008	16:01:09	19.2	21.788	8	-0.3	-1.4	81.63	13.14	
2/8/2008	16:16:09	19.19	21.935	8	0.5	-1.4	81.08	13.23	
2/8/2008	16:31:09	19.19	22.091	8	0.3	-1.4	80.58	13.34	
2/8/2008	16:46:09	19.18	22.218	8	0.1	-1.3	80.37	13.42	
2/8/2008	17:01:09	19.18	22.347	8	0.1	-1.4	79.79	13.51	1.25
2/8/2008	17:16:09	19.18	22.424	8	0.4	-1.3	79.49	13.56	
2/8/2008	17:31:09	19.19	22.396	8	0.1	-1.4	79.53	13.54	
2/8/2008	17:46:09	19.19	22.381	8	0	-1.3	79.5	13.53	
2/8/2008	18:01:09	19.2	22.328	8	1.3	-1.3	79.81	13.49	
2/8/2008	18:16:09	19.21	22.255	8	0.6	-1.3	79.93	13.45	
2/8/2008	18:31:09	19.22	22.168	8	0.1	-1.4	80.31	13.39	
2/8/2008	18:46:09	19.23	22.073	8	0.3	-1.4	80.59	13.33	
2/8/2008	19:01:10	19.24	21.918	8	-0.2	-1.4	81.14	13.22	
2/8/2008	19:16:10	19.25	21.868	8	0	-1.4	81.42	13.19	
2/8/2008	19:31:09	19.25	21.775	8	-0.1	-1.4	81.68	13.13	
2/8/2008	19:46:09	19.26	21.664	8	0.1	-1.3	82.19	13.06	
2/8/2008	20:01:09	19.27	21.561	8.01	-0.1	-1.4	82.85	12.99	
2/8/2008	20:16:09	19.28	21.485	8.01	0.3	-1.3	83.09	12.94	
2/8/2008	20:31:10	19.28	21.392	8.01	0.4	-1.4	83.52	12.88	
2/8/2008	20:46:10	19.28	21.295	8.01	1	-1.3	83.77	12.81	
2/8/2008	21:01:09	19.29	21.224	8.01	0.2	-1.4	84.19	12.77	
2/8/2008	21:16:10	19.29	21.162	8.01	0.3	-1.4	84.09	12.73	
2/8/2008	21:31:10	19.29	21.101	8.01	0.9	-1.4	84.5	12.69	
2/8/2008	21:46:09	19.28	21.066	8.01	0.6	-1.4	84.71	12.66	
2/8/2008	22:01:09	19.28	21.036	8.01	0.9	-1.3	84.83	12.64	
2/8/2008	22:16:10	19.28	20.986	8.01	0.7	-1.3	84.92	12.61	
2/8/2008	22:31:09	19.27	20.954	8.01	0.3	-1.4	85.02	12.59	0.1
2/8/2008	22:46:09	19.27	20.9	8.01	-0.3	-1.3	85.03	12.56	
2/8/2008	23:01:09	19.26	20.864	8.01	0.4	-1.3	85	12.53	
2/8/2008	23:16:09	19.26	20.81	8.01	0.4	-1.3	84.99	12.5	
2/8/2008	23:31:10	19.25	20.775	8.01	-0.2	-1.4	85.09	12.47	
2/8/2008	23:46:10	19.24	20.738	8.01	0.5	-1.4	85.05	12.45	

Date M/D/Y	Time hh:mm:ss	Temp C	SpCond mS/cm	pH	Chlorophyll ug/L	Turbidity+ NTU	DO (%)	Salinity ppt	Tide ft
2/9/2008	0:01:10	19.24	20.708	8.01	0.7	-1.3	84.78	12.43	
2/9/2008	0:16:10	19.23	20.672	8.01	0.6	-1.3	84.81	12.41	
2/9/2008	0:31:10	19.22	20.644	8.01	0.2	-1.3	84.62	12.39	
2/9/2008	0:46:10	19.21	20.649	8.01	-0.3	-1.4	84.46	12.39	
2/9/2008	1:01:10	19.2	20.678	8.01	0.5	-1.3	84.39	12.41	
2/9/2008	1:16:09	19.19	20.737	8.01	0	-1.3	83.96	12.45	
2/9/2008	1:31:09	19.18	20.781	8.01	0.4	-1.4	83.75	12.48	
2/9/2008	1:46:10	19.17	20.862	8.01	0.5	-1.4	83.61	12.53	
2/9/2008	2:01:10	19.17	20.966	8.01	0.4	-1.3	83.34	12.6	
2/9/2008	2:16:10	19.16	21.122	8.01	0.2	-1.4	82.72	12.7	
2/9/2008	2:31:09	19.14	21.362	8.01	1.3	-1.4	81.92	12.86	
2/9/2008	2:46:09	19.13	21.615	8.01	0.4	-1.3	81.26	13.03	
2/9/2008	3:01:09	19.12	21.925	8.01	-0.1	-1.4	80.27	13.23	
2/9/2008	3:16:09	19.11	22.277	8	1.3	-1.3	79.28	13.46	
2/9/2008	3:31:09	19.09	22.608	8	-0.3	-1.4	78.45	13.68	
2/9/2008	3:46:10	19.08	22.904	8	0.6	-1.4	77.8	13.87	
2/9/2008	4:01:09	19.07	23.188	8	-0.3	-1.3	76.93	14.06	
2/9/2008	4:16:10	19.06	23.493	7.99	0.7	-1.3	75.94	14.26	
2/9/2008	4:31:10	19.05	23.781	7.99	0.4	-1.4	75.09	14.45	
2/9/2008	4:46:09	19.04	24.035	7.99	-0.5	-1.4	74.32	14.62	
2/9/2008	5:01:10	19.03	24.252	7.99	0	-1.4	73.77	14.77	1.99
2/9/2008	5:16:09	19.03	24.421	7.99	0.1	-1.3	73.3	14.88	
2/9/2008	5:31:10	19.03	24.549	7.99	1	-1.3	72.98	14.97	
2/9/2008	5:46:10	19.03	24.689	7.99	0.9	-1.5	72.7	15.06	
2/9/2008	6:01:10	19.03	24.733	7.99	-0.1	-1.4	72.77	15.09	
2/9/2008	6:16:10	19.04	24.632	7.99	0.4	-1.4	73.03	15.02	
2/9/2008	6:31:09	19.06	24.28	7.99	0.5	-1.3	74.04	14.79	
2/9/2008	6:46:10	19.08	23.889	8	0.8	-1.4	75.04	14.53	
2/9/2008	7:01:09	19.11	23.566	8	0.1	-1.4	76.08	14.31	
2/9/2008	7:16:10	19.14	23.24	8.01	0.7	-1.3	77.2	14.1	
2/9/2008	7:31:10	19.17	22.913	8.01	-0.1	-1.4	78.18	13.88	
2/9/2008	7:46:09	19.2	22.638	8.01	-0.3	-1.3	79.32	13.7	
2/9/2008	8:01:09	19.22	22.413	8.02	0.2	-1.4	80.19	13.55	
2/9/2008	8:16:09	19.24	22.219	8.02	0.7	-1.4	80.96	13.42	
2/9/2008	8:31:10	19.26	22.051	8.02	0.3	-1.3	81.91	13.31	
2/9/2008	8:46:10	19.27	21.945	8.03	0.8	-1.3	82.57	13.24	
2/9/2008	9:01:10	19.29	21.848	8.03	0.4	-1.3	83.2	13.18	
2/9/2008	9:16:09	19.3	21.762	8.03	0.1	-1.4	83.72	13.12	
2/9/2008	9:31:09	19.31	21.664	8.03	1.2	-1.4	84.13	13.06	
2/9/2008	9:46:09	19.32	21.603	8.03	0.6	-1.4	84.55	13.02	
2/9/2008	10:01:09	19.33	21.542	8.03	0.4	-1.3	84.97	12.98	
2/9/2008	10:16:10	19.33	21.479	8.03	0.6	-1.3	85.14	12.93	

Date M/D/Y	Time hh:mm:ss	Temp C	SpCond mS/cm	pH	Chlorophyll ug/L	Turbidity+ NTU	DO (%)	Salinity ppt	Tide ft
2/9/2008	10:31:10	19.33	21.433	8.03	0	-1.3	85.54	12.9	
2/9/2008	10:46:10	19.33	21.392	8.03	-0.1	-1.3	85.45	12.88	
2/9/2008	11:01:10	19.33	21.347	8.03	0.5	-1.4	85.66	12.85	
2/9/2008	11:16:09	19.33	21.321	8.03	0.4	-1.4	85.64	12.83	
2/9/2008	11:31:09	19.32	21.296	8.03	0.3	-1.4	85.63	12.82	
2/9/2008	11:46:10	19.32	21.257	8.03	-0.5	-1.4	85.54	12.79	-0.04
2/9/2008	12:01:10	19.31	21.211	8.03	0	-1.4	85.49	12.76	
2/9/2008	12:16:09	19.31	21.16	8.03	0.7	-1.3	85.29	12.73	
2/9/2008	12:31:09	19.3	21.113	8.03	0.7	-1.4	85.13	12.69	
2/9/2008	12:46:10	19.29	21.064	8.03	0.5	-1.4	85.15	12.66	
2/9/2008	13:01:10	19.29	21.048	8.03	-0.2	-1.3	84.92	12.65	
2/9/2008	13:16:10	19.28	21.014	8.03	0.9	-1.4	84.82	12.63	
2/9/2008	13:31:09	19.27	21.014	8.03	0.4	-1.3	84.8	12.63	
2/9/2008	13:46:09	19.27	20.992	8.03	-0.3	-1.4	84.44	12.62	
2/9/2008	14:01:10	19.26	20.987	8.03	0.4	-1.4	84.4	12.61	
2/9/2008	14:16:09	19.26	20.996	8.03	0.1	-1.4	84.29	12.62	
2/9/2008	14:31:09	19.25	21.015	8.03	0.3	-1.4	84.04	12.63	
2/9/2008	14:46:10	19.24	21.066	8.03	0.5	-1.4	83.83	12.66	
2/9/2008	15:01:10	19.24	21.098	8.03	0.7	-1.3	83.62	12.69	
2/9/2008	15:16:09	19.24	21.139	8.03	0.5	-1.3	83.45	12.71	
2/9/2008	15:31:09	19.23	21.209	8.03	0	-1.4	83.04	12.76	
2/9/2008	15:46:09	19.22	21.338	8.03	0.1	-1.4	82.56	12.84	
2/9/2008	16:01:10	19.21	21.516	8.03	0	-1.4	82.14	12.96	
2/9/2008	16:16:10	19.2	21.665	8.03	0.7	-1.4	81.7	13.06	
2/9/2008	16:31:09	19.19	21.848	8.03	0.7	-1.3	81.13	13.18	
2/9/2008	16:46:09	19.19	22.001	8.03	0.6	-1.3	80.5	13.28	
2/9/2008	17:01:09	19.18	22.176	8.02	0.8	-1.4	79.92	13.39	
2/9/2008	17:16:10	19.17	22.356	8.02	0.6	-1.3	79.46	13.51	
2/9/2008	17:31:09	19.17	22.491	8.02	0.1	-1.3	79.02	13.6	
2/9/2008	17:46:09	19.17	22.594	8.02	-0.5	-1.3	78.76	13.67	1.39
2/9/2008	18:01:09	19.17	22.647	8.02	-0.2	-1.4	78.65	13.7	
2/9/2008	18:16:09	19.18	22.639	8.02	0.5	-1.3	78.57	13.7	
2/9/2008	18:31:09	19.18	22.642	8.02	0.1	-1.4	78.61	13.7	
2/9/2008	18:46:09	19.19	22.6	8.02	0.5	-1.4	78.83	13.67	
2/9/2008	19:01:09	19.2	22.531	8.02	0.7	-1.4	78.98	13.63	
2/9/2008	19:16:09	19.21	22.429	8.02	0.5	-1.4	79.28	13.56	
2/9/2008	19:31:10	19.22	22.313	8.03	-0.1	-1.4	79.64	13.48	
2/9/2008	19:46:09	19.23	22.158	8.03	0.3	-1.3	80.06	13.38	
2/9/2008	20:01:09	19.24	22.033	8.03	1.1	-1.4	80.71	13.3	
2/9/2008	20:16:10	19.25	21.91	8.03	0.4	-1.4	81.32	13.22	
2/9/2008	20:31:09	19.26	21.79	8.03	0.9	-1.4	81.58	13.14	
2/9/2008	20:46:10	19.27	21.682	8.03	1	-1.4	82.18	13.07	

Date M/D/Y	Time hh:mm:ss	Temp C	SpCond mS/cm	pH	Chlorophyll ug/L	Turbidity+ NTU	DO (%)	Salinity ppt	Tide ft
2/9/2008	21:01:10	19.28	21.579	8.03	1.3	-1.4	82.7	13	
2/9/2008	21:16:10	19.29	21.483	8.04	-0.2	-1.3	83.08	12.94	
2/9/2008	21:31:10	19.3	21.379	8.04	0.4	-1.3	83.4	12.87	
2/9/2008	21:46:09	19.3	21.291	8.04	0.5	-1.4	83.82	12.81	
2/9/2008	22:01:10	19.3	21.212	8.04	0.7	-1.3	84.23	12.76	
2/9/2008	22:16:10	19.3	21.154	8.04	0.7	-1.4	84.39	12.72	
2/9/2008	22:31:09	19.3	21.101	8.04	0.3	-1.3	84.48	12.69	
2/9/2008	22:46:09	19.29	21.077	8.04	0	-1.4	84.61	12.67	
2/9/2008	23:01:09	19.29	21.037	8.04	0.3	-1.4	84.61	12.65	
2/9/2008	23:16:10	19.28	20.996	8.04	0.5	-1.4	84.71	12.62	
2/9/2008	23:31:10	19.27	20.949	8.04	1.1	-1.3	84.62	12.59	0.28
2/9/2008	23:46:09	19.26	20.927	8.04	0.8	-1.4	84.56	12.57	
2/10/2008	0:01:09	19.26	20.888	8.04	0.1	-1.3	84.44	12.55	
2/10/2008	0:16:10	19.25	20.844	8.03	0.5	-1.4	84.31	12.52	
2/10/2008	0:31:09	19.24	20.824	8.04	0.1	-1.4	84.24	12.51	
2/10/2008	0:46:09	19.23	20.807	8.04	0.5	-1.4	84.3	12.5	
2/10/2008	1:01:09	19.23	20.782	8.03	0.6	-1.3	84.14	12.48	
2/10/2008	1:16:09	19.22	20.782	8.04	0	-1.3	84.14	12.48	
2/10/2008	1:31:10	19.22	20.774	8.04	1.1	-1.3	83.95	12.47	
2/10/2008	1:46:10	19.21	20.802	8.04	0.4	-1.4	83.89	12.49	
2/10/2008	2:01:10	19.2	20.825	8.04	-0.1	-1.3	83.64	12.51	
2/10/2008	2:16:10	19.2	20.852	8.04	1.1	-1.3	83.37	12.53	
2/10/2008	2:31:09	19.19	20.984	8.04	0.7	-1.3	83.1	12.61	
2/10/2008	2:46:10	19.18	21.128	8.04	0.4	-1.4	82.6	12.71	
2/10/2008	3:01:10	19.16	21.386	8.04	0.9	-1.4	81.98	12.88	
2/10/2008	3:16:09	19.16	21.552	8.03	0.2	-1.4	81.37	12.98	
2/10/2008	3:31:10	19.14	21.787	8.03	-0.2	-1.3	80.48	13.14	
2/10/2008	3:46:09	19.13	22.085	8.03	0.6	-1.3	79.76	13.33	
2/10/2008	4:01:09	19.12	22.347	8.03	0.2	-1.3	78.91	13.51	
2/10/2008	4:16:09	19.11	22.618	8.03	-0.6	-1.3	78.28	13.69	
2/10/2008	4:31:10	19.1	22.884	8.02	-0.3	-1.4	77.61	13.86	
2/10/2008	4:46:10	19.09	23.054	8.02	0.3	-1.3	77.06	13.97	
2/10/2008	5:01:10	19.09	23.224	8.02	0.7	-1.3	76.42	14.09	
2/10/2008	5:16:09	19.08	23.471	8.02	-0.1	-1.3	75.91	14.25	
2/10/2008	5:31:10	19.08	23.584	8.02	-0.4	-1.4	75.66	14.32	1.74
2/10/2008	5:46:10	19.08	23.689	8.02	0.4	-1.4	75.42	14.39	
2/10/2008	6:01:09	19.07	23.798	8.02	0.6	-1.3	75.14	14.47	
2/10/2008	6:16:09	19.08	23.81	8.02	-0.1	-1.4	75.05	14.47	
2/10/2008	6:31:09	19.09	23.781	8.02	-0.1	-1.4	75.37	14.45	
2/10/2008	6:46:10	19.1	23.725	8.02	0.8	-1.3	75.52	14.42	
2/10/2008	7:01:09	19.11	23.636	8.02	0.5	-1.4	75.83	14.36	
2/10/2008	7:16:09	19.13	23.442	8.03	0.8	-1.3	76.2	14.23	

Date M/D/Y	Time hh:mm:ss	Temp C	SpCond mS/cm	pH	Chlorophyll ug/L	Turbidity+ NTU	DO (%)	Salinity ppt	Tide ft
2/10/2008	7:31:10	19.15	23.157	8.03	0	-1.3	77.01	14.04	
2/10/2008	7:46:10	19.17	22.878	8.03	-0.7	-1.4	77.92	13.86	
2/10/2008	8:01:10	19.2	22.598	8.04	0.3	-1.4	78.78	13.67	
2/10/2008	8:16:10	19.22	22.326	8.04	-0.3	-1.4	79.83	13.49	
2/10/2008	8:31:09	19.24	22.053	8.04	0.4	-1.4	80.76	13.31	
2/10/2008	8:46:09	19.26	21.915	8.04	0.6	-1.4	81.49	13.22	
2/10/2008	9:01:10	19.28	21.742	8.05	0.4	-1.4	82.24	13.11	
2/10/2008	9:16:09	19.3	21.605	8.05	-0.6	-1.5	82.9	13.02	
2/10/2008	9:31:09	19.31	21.508	8.05	0.7	-1.3	83.46	12.95	
2/10/2008	9:46:09	19.33	21.41	8.05	-0.3	-1.3	84.01	12.89	
2/10/2008	10:01:09	19.34	21.363	8.05	0.7	-1.4	84.48	12.86	
2/10/2008	10:16:09	19.34	21.305	8.05	-0.2	-1.4	84.73	12.82	
2/10/2008	10:31:09	19.35	21.232	8.05	0.2	-1.4	84.86	12.77	
2/10/2008	10:46:10	19.35	21.177	8.05	0.4	-1.4	85.31	12.74	
2/10/2008	11:01:10	19.35	21.14	8.05	0.1	-1.3	85.39	12.71	
2/10/2008	11:16:09	19.35	21.106	8.05	0.2	-1.4	85.69	12.69	
2/10/2008	11:31:10	19.34	21.09	8.05	0.4	-1.4	85.65	12.68	
2/10/2008	11:46:10	19.34	21.062	8.05	0.2	-1.4	85.43	12.66	
2/10/2008	12:01:10	19.34	21.021	8.05	0.8	-1.5	85.52	12.63	
2/10/2008	12:16:10	19.33	20.981	8.05	0.1	-1.4	85.55	12.61	-0.06
2/10/2008	12:31:09	19.33	20.934	8.05	0.1	-1.4	85.49	12.58	
2/10/2008	12:46:09	19.32	20.899	8.05	0.9	-1.3	85.47	12.56	
2/10/2008	13:01:09	19.32	20.855	8.05	0.6	-1.4	85.42	12.53	
2/10/2008	13:16:09	19.31	20.819	8.05	0.6	-1.4	85.29	12.5	
2/10/2008	13:31:10	19.3	20.796	8.05	0.8	-1.4	85.18	12.49	
2/10/2008	13:46:10	19.3	20.786	8.05	0.7	-1.3	85	12.48	
2/10/2008	14:01:10	19.29	20.768	8.05	0.5	-1.4	85.05	12.47	
2/10/2008	14:16:09	19.28	20.768	8.05	0.3	-1.4	84.85	12.47	
2/10/2008	14:31:09	19.27	20.787	8.05	0.8	-1.4	84.65	12.48	
2/10/2008	14:46:09	19.26	20.837	8.05	0.4	-1.4	84.37	12.51	
2/10/2008	15:01:10	19.25	20.862	8.05	0.1	-1.3	84.02	12.53	
2/10/2008	15:16:10	19.24	20.909	8.05	1	-1.4	83.97	12.56	
2/10/2008	15:31:10	19.24	20.935	8.05	-0.3	-1.4	83.68	12.58	
2/10/2008	15:46:10	19.23	21.022	8.05	0.3	-1.3	83.5	12.64	
2/10/2008	16:01:09	19.23	21.122	8.05	0	-1.4	83.11	12.7	
2/10/2008	16:16:09	19.22	21.248	8.05	0	-1.4	82.53	12.78	
2/10/2008	16:31:09	19.21	21.375	8.05	0.2	-1.4	81.99	12.87	
2/10/2008	16:46:10	19.21	21.578	8.05	0.3	-1.4	81.65	13	
2/10/2008	17:01:09	19.2	21.756	8.05	1.1	-1.4	81.06	13.12	
2/10/2008	17:16:09	19.19	22.013	8.05	0.7	-1.4	80.22	13.29	
2/10/2008	17:31:10	19.18	22.254	8.04	0.6	-1.4	79.53	13.45	
2/10/2008	17:46:10	19.17	22.498	8.04	0.6	-1.3	78.83	13.61	

Date M/D/Y	Time hh:mm:ss	Temp C	SpCond mS/cm	pH	Chlorophyll ug/L	Turbidity+ NTU	DO (%)	Salinity ppt	Tide ft
2/10/2008	18:01:09	19.16	22.68	8.04	0.1	-1.3	78.52	13.73	1.52
2/10/2008	18:16:09	19.15	22.863	8.04	0.2	-1.3	77.71	13.85	
2/10/2008	18:31:09	19.15	23.033	8.04	0.7	-1.3	77.27	13.96	
2/10/2008	18:46:10	19.15	23.115	8.04	0.3	-1.4	77.04	14.01	
2/10/2008	19:01:10	19.16	23.136	8.04	-0.2	-1.4	77.17	14.03	
2/10/2008	19:16:10	19.16	23.124	8.04	0.1	-1.4	77.09	14.02	
2/10/2008	19:31:09	19.17	23.1	8.04	0.8	-1.4	77.32	14	
2/10/2008	19:46:09	19.18	23.051	8.04	0.6	-1.4	77.42	13.97	
2/10/2008	20:01:10	19.19	22.934	8.04	0.3	-1.4	77.82	13.89	
2/10/2008	20:16:09	19.2	22.793	8.05	0.8	-1.4	78.16	13.8	
2/10/2008	20:31:10	19.22	22.626	8.05	0.1	-1.3	78.5	13.69	0.48
2/10/2008	20:46:09	19.24	22.433	8.05	1	-1.4	79.46	13.56	
2/10/2008	21:01:10	19.25	22.262	8.05	0.4	-1.4	79.87	13.45	
2/10/2008	21:16:09	19.26	22.106	8.05	0.7	-1.4	80.49	13.35	
2/10/2008	21:31:09	19.28	21.954	8.06	0.1	-1.4	81.05	13.25	
2/10/2008	21:46:09	19.29	21.821	8.06	0.4	-1.4	81.76	13.16	
2/10/2008	22:01:09	19.3	21.71	8.06	0.2	-1.3	82.24	13.09	
2/10/2008	22:16:09	19.31	21.623	8.06	0.2	-1.3	82.55	13.03	
2/10/2008	22:31:10	19.31	21.553	8.06	0.3	-1.3	83.04	12.98	
2/10/2008	22:46:10	19.31	21.474	8.06	0.6	-1.4	83.35	12.93	
2/10/2008	23:01:09	19.32	21.389	8.06	0.2	-1.3	83.61	12.88	0.48
2/10/2008	23:16:09	19.31	21.311	8.06	0.6	-1.3	83.88	12.83	
2/10/2008	23:31:09	19.31	21.225	8.06	-0.1	-1.4	83.98	12.77	
2/10/2008	23:46:09	19.31	21.166	8.06	0.2	-1.4	84.37	12.73	
2/11/2008	0:01:09	19.31	21.112	8.06	0.8	-1.3	84.54	12.69	
2/11/2008	0:16:09	19.31	21.071	8.06	0.3	-1.4	84.45	12.67	
2/11/2008	0:31:09	19.3	21.033	8.06	0.5	-1.3	84.55	12.64	
2/11/2008	0:46:10	19.29	20.992	8.06	0	-1.4	84.63	12.62	
2/11/2008	1:01:09	19.29	20.963	8.06	0	-1.4	84.62	12.6	
2/11/2008	1:16:10	19.28	20.935	8.06	0.9	-1.3	84.52	12.58	
2/11/2008	1:31:09	19.28	20.905	8.06	0.1	-1.4	84.55	12.56	0.48
2/11/2008	1:46:10	19.27	20.894	8.06	0.3	-1.4	84.53	12.55	
2/11/2008	2:01:09	19.26	20.893	8.06	0.4	-1.4	84.24	12.55	
2/11/2008	2:16:10	19.24	20.888	8.06	0	-1.4	83.99	12.55	
2/11/2008	2:31:09	19.23	20.896	8.06	0.2	-1.4	83.94	12.55	
2/11/2008	2:46:10	19.22	20.931	8.06	0.9	-1.4	83.56	12.58	
2/11/2008	3:01:09	19.21	20.986	8.06	0.7	-1.4	83.47	12.61	
2/11/2008	3:16:10	19.21	21.05	8.06	0.4	-1.4	83.11	12.65	
2/11/2008	3:31:09	19.2	21.167	8.06	-0.3	-1.4	82.71	12.73	
2/11/2008	3:46:09	19.19	21.328	8.06	0.1	-1.4	82.26	12.84	
2/11/2008	4:01:09	19.18	21.484	8.06	-0.1	-1.4	81.79	12.94	0.48
2/11/2008	4:16:10	19.17	21.623	8.06	0.4	-1.3	81.29	13.03	

Date M/D/Y	Time hh:mm:ss	Temp C	SpCond mS/cm	pH	Chlorophyll ug/L	Turbidity+ NTU	DO (%)	Salinity ppt	Tide ft
2/11/2008	4:31:10	19.16	21.76	8.06	-0.2	-1.5	80.82	13.12	
2/11/2008	4:46:09	19.15	21.93	8.06	1.1	-1.4	80.18	13.23	
2/11/2008	5:01:09	19.14	22.111	8.06	0.6	-1.4	79.65	13.35	
2/11/2008	5:16:09	19.13	22.288	8.06	0.1	-1.4	79.13	13.47	
2/11/2008	5:31:09	19.13	22.441	8.06	0.7	-1.4	78.86	13.57	
2/11/2008	5:46:09	19.12	22.577	8.06	0.2	-1.3	78.44	13.66	
2/11/2008	6:01:09	19.12	22.707	8.05	0.5	-1.4	78.05	13.74	1.45
2/11/2008	6:16:09	19.12	22.8	8.05	0	-1.4	77.83	13.81	
2/11/2008	6:31:10	19.12	22.808	8.06	0	-1.3	77.76	13.81	
2/11/2008	6:46:09	19.13	22.688	8.06	-0.6	-1.4	78.22	13.73	
2/11/2008	7:01:10	19.14	22.524	8.06	0.5	-1.4	78.74	13.62	
2/11/2008	7:16:09	19.15	22.407	8.06	0.4	-1.4	79.04	13.55	
2/11/2008	7:31:09	19.16	22.288	8.06	0.1	-1.4	79.4	13.47	
2/11/2008	7:46:09	19.18	22.125	8.07	0.7	-1.4	80.15	13.36	
2/11/2008	8:01:09	19.19	21.948	8.07	0.8	-1.3	80.64	13.24	
2/11/2008	8:16:09	19.21	21.801	8.07	0.5	-1.4	81.16	13.15	
2/11/2008	8:31:09	19.22	21.689	8.07	0.7	-1.4	81.64	13.07	
2/11/2008	8:46:10	19.24	21.584	8.07	0.1	-1.4	82.1	13	
2/11/2008	9:01:09	19.25	21.5	8.07	0.4	-1.4	82.45	12.95	
2/11/2008	9:16:09	19.27	21.411	8.07	0.4	-1.4	82.96	12.89	
2/11/2008	9:31:09	19.28	21.304	8.07	0.5	-1.3	83.27	12.82	
2/11/2008	9:46:09	19.29	21.215	8.07	0.3	-1.3	83.79	12.76	
2/11/2008	10:01:10	19.3	21.119	8.07	0.8	-1.4	84.15	12.7	
2/11/2008	10:16:09	19.31	21.028	8.08	0.4	-1.4	84.54	12.64	
2/11/2008	10:31:08	19.32	20.948	8.08	0.6	-1.4	84.92	12.59	
2/11/2008	10:46:09	19.32	20.904	8.08	0.9	-1.4	85.17	12.56	
2/11/2008	11:01:09	19.33	20.854	8.08	0.7	-1.4	85.37	12.53	
2/11/2008	11:16:09	19.33	20.828	8.08	1.3	-1.3	85.54	12.51	
2/11/2008	11:31:09	19.33	20.807	8.08	0.9	-1.4	85.64	12.49	
2/11/2008	11:46:09	19.33	20.794	8.08	0	-1.5	85.63	12.49	
2/11/2008	12:01:09	19.33	20.765	8.08	0	-1.4	85.61	12.47	
2/11/2008	12:16:09	19.32	20.726	8.08	0	-1.4	85.72	12.44	
2/11/2008	12:31:09	19.32	20.688	8.08	0	-1.4	85.78	12.42	-0.07
2/11/2008	12:46:09	19.32	20.658	8.08	0.5	-1.4	85.68	12.4	
2/11/2008	13:01:09	19.31	20.617	8.08	0.5	-1.4	85.7	12.37	
2/11/2008	13:16:09	19.31	20.583	8.08	-0.1	-1.4	85.62	12.35	
2/11/2008	13:31:09	19.3	20.561	8.08	0.2	-1.4	85.64	12.33	
2/11/2008	13:46:10	19.3	20.53	8.08	-0.3	-1.3	85.6	12.31	
2/11/2008	14:01:09	19.29	20.398	8.08	0	-1.4	85.41	12.23	
2/11/2008	14:16:09	19.28	20.504	8.08	1	-1.4	85.33	12.3	
2/11/2008	14:31:09	19.28	20.496	8.08	0.5	-1.4	85.18	12.29	
2/11/2008	14:46:10	19.27	20.489	8.08	0.7	-1.4	85	12.29	

Date M/D/Y	Time hh:mm:ss	Temp C	SpCond mS/cm	pH	Chlorophyll ug/L	Turbidity+ NTU	DO (%)	Salinity ppt	Tide ft
2/11/2008	15:01:09	19.25	20.48	8.08	0.4	-1.4	84.71	12.28	
2/11/2008	15:16:09	19.24	20.508	8.08	-0.2	-1.4	84.64	12.3	
2/11/2008	15:31:09	19.24	20.516	8.08	0.1	-1.4	84.39	12.31	
2/11/2008	15:46:09	19.23	20.569	8.08	0.5	-1.4	84.28	12.34	
2/11/2008	16:01:09	19.22	20.635	8.08	0.5	-1.4	83.97	12.38	
2/11/2008	16:16:09	19.22	20.697	8.08	-0.3	-1.4	83.81	12.42	
2/11/2008	16:31:10	19.22	20.817	8.08	0.4	-1.4	83.38	12.5	
2/11/2008	16:46:09	19.21	20.92	8.08	0.2	-1.4	83.13	12.57	
2/11/2008	17:01:09	19.21	21.079	8.08	0.5	-1.4	82.57	12.67	
2/11/2008	17:16:09	19.2	21.336	8.08	-0.3	-1.4	81.91	12.84	
2/11/2008	17:31:10	19.18	21.579	8.08	0	-1.4	81.19	13	
2/11/2008	17:46:10	19.18	21.819	8.07	0.2	-1.3	80.35	13.16	
2/11/2008	18:01:10	19.17	22.065	8.07	0.1	-1.4	79.7	13.32	
2/11/2008	18:16:10	19.16	22.28	8.07	0.5	-1.4	79.04	13.46	
2/11/2008	18:31:09	19.15	22.495	8.07	1	-1.3	78.64	13.6	
2/11/2008	18:46:09	19.14	22.718	8.07	0.2	-1.4	77.88	13.75	
2/11/2008	19:01:09	19.14	22.901	8.07	0.1	-1.4	77.46	13.87	
2/11/2008	19:16:09	19.14	23.031	8.06	0	-1.4	77.05	13.96	
2/11/2008	19:31:10	19.13	23.166	8.06	0.4	-1.4	76.86	14.05	
2/11/2008	19:46:09	19.14	23.243	8.06	0.8	-1.4	76.47	14.1	1.65
2/11/2008	20:01:09	19.13	23.348	8.06	1.1	-1.4	76.2	14.17	
2/11/2008	20:16:09	19.14	23.251	8.07	0.6	-1.3	76.51	14.1	
2/11/2008	20:31:09	19.16	23.142	8.07	-0.2	-1.4	76.83	14.03	
2/11/2008	20:46:10	19.17	23.007	8.07	0.6	-1.4	77.32	13.94	
2/11/2008	21:01:09	19.19	22.829	8.07	-0.6	-1.4	77.81	13.82	
2/11/2008	21:16:09	19.2	22.666	8.07	0.4	-1.4	78.4	13.72	
2/11/2008	21:31:10	19.22	22.476	8.08	0.3	-1.4	78.81	13.59	
2/11/2008	21:46:10	19.23	22.309	8.08	0.7	-1.4	79.49	13.48	
2/11/2008	22:01:10	19.25	22.147	8.08	-0.1	-1.4	80.07	13.37	
2/11/2008	22:16:09	19.26	21.987	8.08	1.3	-1.4	80.6	13.27	
2/11/2008	22:31:10	19.27	21.853	8.08	0.2	-1.3	81.08	13.18	
2/11/2008	22:46:10	19.28	21.766	8.08	0.9	-1.4	81.39	13.12	
2/11/2008	23:01:09	19.29	21.717	8.08	0.5	-1.4	81.78	13.09	
2/11/2008	23:16:10	19.29	21.592	8.08	0.4	-1.4	82.25	13.01	
2/11/2008	23:31:10	19.3	21.514	8.09	0.4	-1.3	82.58	12.96	
2/11/2008	23:46:09	19.3	21.427	8.09	0.4	-1.4	82.9	12.9	
2/12/2008	0:01:10	19.31	21.348	8.09	1.2	-1.3	83.17	12.85	
2/12/2008	0:16:10	19.31	21.277	8.09	0.8	-1.4	83.52	12.8	
2/12/2008	0:31:10	19.31	21.186	8.09	0.5	-1.3	83.94	12.74	
2/12/2008	0:46:10	19.31	21.126	8.09	0.7	-1.4	84.08	12.7	
2/12/2008	1:01:09	19.31	21.058	8.09	0.3	-1.4	84.19	12.66	
2/12/2008	1:16:09	19.31	21.007	8.09	0.2	-1.4	84.25	12.63	

Date M/D/Y	Time hh:mm:ss	Temp C	SpCond mS/cm	pH	Chlorophyll ug/L	Turbidity+ NTU	DO (%)	Salinity ppt	Tide ft
2/12/2008	1:31:10	19.3	20.973	8.09	0.7	-1.4	84.27	12.6	0.66
2/12/2008	1:46:10	19.29	20.967	8.09	0.2	-1.3	84.38	12.6	
2/12/2008	2:01:10	19.28	20.934	8.09	-0.3	-1.4	84.25	12.58	
2/12/2008	2:16:10	19.28	20.887	8.09	-0.2	-1.4	84.29	12.55	
2/12/2008	2:31:09	19.27	20.856	8.09	0	-1.4	84.32	12.53	
2/12/2008	2:46:09	19.27	20.845	8.09	0.3	-1.4	84.16	12.52	
2/12/2008	3:01:10	19.26	20.732	8.09	0.3	-1.4	84.19	12.45	
2/12/2008	3:16:09	19.26	20.794	8.09	0.9	-1.4	84.19	12.49	
2/12/2008	3:31:09	19.25	20.784	8.09	0	-1.4	84.03	12.48	
2/12/2008	3:46:10	19.25	20.782	8.08	-0.4	-1.4	84.09	12.48	
2/12/2008	4:01:10	19.24	20.812	8.09	-0.2	-1.3	83.66	12.5	
2/12/2008	4:16:09	19.23	20.82	8.09	0.5	-1.4	83.66	12.5	
2/12/2008	4:31:09	19.22	20.837	8.09	0.5	-1.4	83.73	12.52	
2/12/2008	4:46:10	19.22	20.883	8.09	1	-1.3	83.37	12.55	1.15
2/12/2008	5:01:10	19.21	21	8.09	0.2	-1.3	82.99	12.62	
2/12/2008	5:16:09	19.2	21.087	8.09	0.1	-1.4	82.62	12.68	
2/12/2008	5:31:09	19.19	21.171	8.09	0.5	-1.4	82.46	12.73	
2/12/2008	5:46:09	19.19	21.232	8.09	0.3	-1.4	82.22	12.77	
2/12/2008	6:01:10	19.18	21.292	8.09	-0.5	-1.4	82	12.81	
2/12/2008	6:16:10	19.18	21.376	8.08	0.4	-1.4	81.78	12.87	
2/12/2008	6:31:10	19.18	21.421	8.09	0.2	-1.3	81.59	12.9	
2/12/2008	6:46:09	19.18	21.464	8.09	0.5	-1.4	81.36	12.93	
2/12/2008	7:01:10	19.18	21.443	8.09	0.8	-1.4	81.54	12.91	
2/12/2008	7:16:10	19.18	21.425	8.09	0.1	-1.4	81.48	12.9	
2/12/2008	7:31:09	19.19	21.364	8.09	0.1	-1.4	81.69	12.86	
2/12/2008	7:46:09	19.2	21.296	8.09	0.1	-1.4	82.13	12.82	1.15
2/12/2008	8:01:09	19.21	21.206	8.09	0.1	-1.4	82.25	12.76	
2/12/2008	8:16:10	19.22	21.115	8.09	0.8	-1.4	82.7	12.7	
2/12/2008	8:31:10	19.22	21.058	8.09	0.3	-1.4	82.98	12.66	
2/12/2008	8:46:09	19.23	21.005	8.09	0.5	-1.4	83.16	12.63	
2/12/2008	9:01:10	19.24	20.932	8.09	0.9	-1.4	83.35	12.58	
2/12/2008	9:16:10	19.25	20.867	8.09	0.8	-1.3	83.71	12.53	
2/12/2008	9:31:10	19.26	20.8	8.09	0.8	-1.4	84.02	12.49	
2/12/2008	9:46:09	19.27	20.737	8.09	0.5	-1.4	84.35	12.45	
2/12/2008	10:01:09	19.28	20.655	8.09	0.2	-1.4	84.68	12.4	
2/12/2008	10:16:10	19.3	20.588	8.09	-0.6	-1.4	84.68	12.35	
2/12/2008	10:31:10	19.31	20.527	8.1	0.3	-1.4	85.21	12.31	
2/12/2008	10:46:10	19.31	20.5	8.09	0.6	-1.4	85.32	12.29	1.15
2/12/2008	11:01:10	19.32	20.466	8.09	0.9	-1.3	85.44	12.27	
2/12/2008	11:16:09	19.32	20.445	8.09	0	-1.4	85.55	12.26	
2/12/2008	11:31:10	19.32	20.419	8.09	0.2	-1.4	85.69	12.24	
2/12/2008	11:46:09	19.32	20.386	8.1	0.4	-1.4	85.84	12.22	

Date M/D/Y	Time hh:mm:ss	Temp C	SpCond mS/cm	pH	Chlorophyll ug/L	Turbidity+ NTU	DO (%)	Salinity ppt	Tide ft
2/12/2008	12:01:09	19.32	20.384	8.09	0.6	-1.4	85.83	12.22	
2/12/2008	12:16:09	19.32	20.359	8.09	0.2	-1.4	85.92	12.2	
2/12/2008	12:31:09	19.32	20.34	8.09	0.3	-1.4	85.76	12.19	
2/12/2008	12:46:09	19.32	20.322	8.09	0.7	-1.4	85.88	12.18	
2/12/2008	13:01:09	19.32	20.276	8.09	0.3	-1.4	86.02	12.15	
2/12/2008	13:16:09	19.32	20.26	8.09	0.2	-1.3	86.12	12.14	
2/12/2008	13:31:09	19.32	20.239	8.09	1	-1.4	86.15	12.12	-0.06
2/12/2008	13:46:09	19.31	20.216	8.09	1	-1.4	86.01	12.11	
2/12/2008	14:01:09	19.31	20.192	8.09	0.7	-1.4	85.94	12.09	
2/12/2008	14:16:10	19.3	20.184	8.09	0.7	-1.5	85.9	12.09	
2/12/2008	14:31:10	19.3	20.156	8.09	0.2	-1.4	85.91	12.07	
2/12/2008	14:46:10	19.29	20.125	8.1	0.8	-1.4	85.82	12.05	
2/12/2008	15:01:10	19.28	20.115	8.1	0.9	-1.4	85.79	12.04	
2/12/2008	15:16:10	19.27	20.092	8.1	0.4	-1.3	85.55	12.03	
2/12/2008	15:31:09	19.26	20.093	8.1	0.3	-1.4	85.51	12.03	
2/12/2008	15:46:10	19.25	20.09	8.1	0.6	-1.4	85.33	12.03	
2/12/2008	16:01:09	19.24	20.103	8.1	1	-1.4	85.12	12.04	
2/12/2008	16:16:09	19.24	20.13	8.1	1.2	-1.4	85.02	12.05	
2/12/2008	16:31:09	19.23	20.172	8.1	0.4	-1.3	84.82	12.08	
2/12/2008	16:46:10	19.23	20.247	8.1	0.7	-1.4	84.66	12.13	
2/12/2008	17:01:10	19.22	20.333	8.1	0.5	-1.4	84.28	12.19	
2/12/2008	17:16:10	19.22	20.438	8.1	-0.1	-1.3	84.08	12.25	
2/12/2008	17:31:10	19.22	20.576	8.1	0.6	-1.3	83.62	12.34	
2/12/2008	17:46:10	19.21	20.752	8.1	0.5	-1.4	83.1	12.46	
2/12/2008	18:01:10	19.2	20.977	8.09	0.5	-1.4	82.41	12.61	
2/12/2008	18:16:10	19.19	21.209	8.09	0.8	-1.5	81.89	12.76	
2/12/2008	18:31:10	19.18	21.495	8.09	0.4	-1.4	80.94	12.95	
2/12/2008	18:46:10	19.18	21.739	8.09	0.9	-1.4	80.43	13.11	
2/12/2008	19:01:10	19.17	21.943	8.09	0.2	-1.4	79.75	13.24	
2/12/2008	19:16:10	19.17	22.14	8.09	0.8	-1.3	79.38	13.37	
2/12/2008	19:31:10	19.16	22.373	8.08	0.2	-1.3	78.53	13.52	
2/12/2008	19:46:09	19.15	22.609	8.08	0.4	-1.3	77.93	13.68	
2/12/2008	20:01:09	19.14	22.827	8.08	0.2	-1.4	77.46	13.82	
2/12/2008	20:16:10	19.14	22.977	8.08	0.6	-1.4	76.88	13.92	
2/12/2008	20:31:10	19.13	23.13	8.08	1.1	-1.4	76.56	14.02	
2/12/2008	20:46:09	19.13	23.264	8.08	0.5	-1.4	76.37	14.11	
2/12/2008	21:01:10	19.13	23.378	8.08	-0.1	-1.4	76.1	14.19	1.78
2/12/2008	21:16:10	19.12	23.459	8.08	0.7	-1.4	75.7	14.24	
2/12/2008	21:31:10	19.13	23.472	8.08	0.6	-1.3	75.78	14.25	
2/12/2008	21:46:10	19.14	23.386	8.08	0.5	-1.4	75.99	14.19	
2/12/2008	22:01:09	19.15	23.295	8.08	1	-1.3	76.18	14.13	
2/12/2008	22:16:09	19.17	23.146	8.08	0.8	-1.4	76.72	14.03	

Date M/D/Y	Time hh:mm:ss	Temp C	SpCond mS/cm	pH	Chlorophyll ug/L	Turbidity+ NTU	DO (%)	Salinity ppt	Tide ft
2/12/2008	22:31:09	19.18	22.947	8.08	0.3	-1.4	77.42	13.9	
2/12/2008	22:46:10	19.2	22.786	8.09	0.5	-1.4	77.83	13.8	
2/12/2008	23:01:10	19.21	22.655	8.09	0.4	-1.3	78.25	13.71	
2/12/2008	23:16:10	19.22	22.49	8.09	-0.8	-1.4	78.74	13.6	
2/12/2008	23:31:10	19.24	22.287	8.09	0.8	-1.3	79.07	13.47	
2/12/2008	23:46:10	19.25	22.073	8.09	0.1	-1.4	79.92	13.33	
2/13/2008	0:01:09	19.27	21.857	8.1	0.7	-1.4	80.64	13.18	
2/13/2008	0:16:10	19.28	21.689	8.1	-0.1	-1.3	81.31	13.07	
2/13/2008	0:31:10	19.29	21.592	8.1	0.7	-1.4	81.87	13.01	
2/13/2008	0:46:09	19.3	21.498	8.1	0.7	-1.4	82.27	12.95	
2/13/2008	1:01:09	19.31	21.395	8.1	0.3	-1.4	82.68	12.88	
2/13/2008	1:16:10	19.31	21.305	8.1	0.2	-1.3	82.96	12.82	
2/13/2008	1:31:10	19.32	21.218	8.1	0.4	-1.4	83.43	12.76	
2/13/2008	1:46:09	19.32	21.154	8.1	-0.3	-1.4	83.63	12.72	
2/13/2008	2:01:09	19.32	21.102	8.1	-0.6	-1.3	83.87	12.69	
2/13/2008	2:16:09	19.32	21.065	8.1	0.3	-1.4	84.09	12.66	
2/13/2008	2:31:09	19.32	21.015	8.1	-0.2	-1.4	84.1	12.63	
2/13/2008	2:46:09	19.31	20.978	8.1	0	-1.4	84.18	12.61	
2/13/2008	3:01:09	19.31	20.938	8.1	0.2	-1.4	84.29	12.58	
2/13/2008	3:16:10	19.31	20.901	8.1	1	-1.4	84.24	12.56	
2/13/2008	3:31:10	19.3	20.865	8.1	0	-1.4	84.08	12.53	
2/13/2008	3:46:10	19.3	20.843	8.1	0.6	-1.4	84.31	12.52	
2/13/2008	4:01:10	19.29	20.818	8.1	1.8	-1.4	84.19	12.5	
2/13/2008	4:16:10	19.29	20.795	8.1	0.8	-1.4	84.16	12.49	0.7
2/13/2008	4:31:09	19.28	20.759	8.1	0.9	-1.4	84.24	12.46	
2/13/2008	4:46:09	19.28	20.745	8.1	1.1	-1.3	84.15	12.45	
2/13/2008	5:01:09	19.28	20.719	8.1	-0.1	-1.4	84.21	12.44	
2/13/2008	5:16:10	19.27	20.717	8.1	0.2	-1.4	84.09	12.44	
2/13/2008	5:31:09	19.27	20.697	8.1	1.1	-1.4	84.24	12.42	
2/13/2008	5:46:10	19.26	20.683	8.1	0.7	-1.4	84.03	12.41	
2/13/2008	6:01:09	19.26	20.681	8.1	0.5	-1.4	83.97	12.41	
2/13/2008	6:16:10	19.26	20.666	8.1	0.7	-1.4	83.92	12.4	
2/13/2008	6:31:09	19.25	20.671	8.1	0.3	-1.4	83.93	12.41	
2/13/2008	6:46:09	19.25	20.651	8.1	0.8	-1.4	83.87	12.39	
2/13/2008	7:01:09	19.25	20.634	8.1	0.7	-1.5	83.8	12.38	
2/13/2008	7:16:10	19.25	20.621	8.1	0.5	-1.4	83.92	12.37	0.87
2/13/2008	7:31:09	19.25	20.621	8.1	0.4	-1.4	83.77	12.37	
2/13/2008	7:46:10	19.25	20.605	8.1	-0.2	-1.4	83.88	12.36	
2/13/2008	8:01:10	19.25	20.603	8.1	-0.4	-1.4	83.85	12.36	
2/13/2008	8:16:09	19.25	20.581	8.1	-0.1	-1.4	83.97	12.35	
2/13/2008	8:31:10	19.26	20.549	8.1	0.9	-1.4	84.21	12.33	
2/13/2008	8:46:09	19.26	20.524	8.1	0.6	-1.4	84	12.31	

Date M/D/Y	Time hh:mm:ss	Temp C	SpCond mS/cm	pH	Chlorophyll ug/L	Turbidity+ NTU	DO (%)	Salinity ppt	Tide ft
2/13/2008	9:01:09	19.26	20.498	8.1	0.7	-1.4	84.24	12.29	
2/13/2008	9:16:10	19.27	20.458	8.1	0.7	-1.4	84.43	12.27	
2/13/2008	9:31:10	19.28	20.418	8.1	0.3	-1.4	84.6	12.24	
2/13/2008	9:46:10	19.28	20.396	8.1	0.2	-1.4	84.62	12.23	
2/13/2008	10:01:09	19.28	20.354	8.1	1.1	-1.4	84.89	12.2	
2/13/2008	10:16:10	19.29	20.312	8.1	0.6	-1.4	84.92	12.17	
2/13/2008	10:31:10	19.3	20.266	8.1	0.5	-1.4	85.23	12.14	
2/13/2008	10:46:10	19.31	20.237	8.1	0.5	-1.4	85.23	12.12	
2/13/2008	11:01:10	19.31	20.202	8.1	0.1	-1.5	85.53	12.1	
2/13/2008	11:16:10	19.32	20.176	8.1	0.3	-1.4	85.49	12.08	
2/13/2008	11:31:10	19.33	20.155	8.1	0	-1.4	85.78	12.07	
2/13/2008	11:46:09	19.33	20.128	8.1	0	-1.4	85.86	12.05	
2/13/2008	12:01:09	19.33	20.115	8.1	0.4	-1.4	85.69	12.04	
2/13/2008	12:16:10	19.32	20.099	8.1	0.3	-1.4	85.93	12.03	
2/13/2008	12:31:10	19.32	20.072	8.1	-0.5	-1.4	85.96	12.02	
2/13/2008	12:46:09	19.32	20.052	8.1	0.8	-1.4	86.18	12	
2/13/2008	13:01:09	19.32	20.024	8.1	1	-1.3	86.17	11.98	
2/13/2008	13:16:09	19.31	20.006	8.1	1	-1.4	86.24	11.97	
2/13/2008	13:31:10	19.31	19.981	8.1	0.7	-1.4	86.08	11.96	
2/13/2008	13:46:10	19.31	19.962	8.1	0.9	-1.4	86.09	11.94	
2/13/2008	14:01:10	19.3	19.938	8.1	0.8	-1.3	86.16	11.93	
2/13/2008	14:16:10	19.3	19.935	8.1	0.3	-1.4	86.05	11.93	-0.03
2/13/2008	14:31:10	19.3	19.919	8.1	0.8	-1.4	86.32	11.92	
2/13/2008	14:46:09	19.29	19.885	8.1	0	-1.4	86.12	11.89	
2/13/2008	15:01:09	19.29	19.867	8.1	0.6	-1.4	85.98	11.88	
2/13/2008	15:16:10	19.28	19.867	8.1	0.4	-1.4	86.01	11.88	
2/13/2008	15:31:09	19.28	19.857	8.1	0.3	-1.5	86.08	11.88	
2/13/2008	15:46:09	19.27	19.824	8.1	0.7	-1.4	85.9	11.85	
2/13/2008	16:01:09	19.27	19.816	8.1	-0.3	-1.4	85.82	11.85	
2/13/2008	16:16:10	19.26	19.815	8.1	0.5	-1.4	85.63	11.85	
2/13/2008	16:31:10	19.25	19.819	8.1	0.6	-1.4	85.51	11.85	
2/13/2008	16:46:10	19.24	19.836	8.1	1	-1.4	85.4	11.86	
2/13/2008	17:01:10	19.24	19.88	8.1	1	-1.3	85.23	11.89	
2/13/2008	17:16:10	19.23	19.937	8.1	0.1	-1.4	85.07	11.93	
2/13/2008	17:31:10	19.23	19.997	8.1	0.8	-1.4	84.9	11.97	
2/13/2008	17:46:09	19.22	20.062	8.1	0.3	-1.4	84.47	12.01	
2/13/2008	18:01:10	19.22	20.141	8.1	-0.4	-1.4	84.39	12.06	
2/13/2008	18:16:10	19.22	20.242	8.1	0.9	-1.4	83.94	12.13	
2/13/2008	18:31:10	19.22	20.39	8.1	0.1	-1.3	83.48	12.22	
2/13/2008	18:46:10	19.21	20.555	8.1	0.2	-1.4	83.08	12.33	
2/13/2008	19:01:10	19.2	20.762	8.1	0.5	-1.4	82.58	12.47	
2/13/2008	19:16:10	19.2	20.964	8.1	0.6	-1.4	82.1	12.6	

Date M/D/Y	Time hh:mm:ss	Temp C	SpCond mS/cm	pH	Chlorophyll ug/L	Turbidity+ NTU	DO (%)	Salinity ppt	Tide ft
2/13/2008	19:31:10	19.19	21.182	8.1	0.3	-1.4	81.56	12.74	
2/13/2008	19:46:10	19.18	21.451	8.09	0.9	-1.4	80.81	12.92	
2/13/2008	20:01:10	19.18	21.653	8.09	-0.1	-1.4	80.05	13.05	
2/13/2008	20:16:10	19.17	21.909	8.09	0.7	-1.4	79.43	13.22	
2/13/2008	20:31:10	19.16	22.12	8.09	0.3	-1.4	78.96	13.36	
2/13/2008	20:46:10	19.15	22.35	8.09	0.8	-1.4	78.49	13.51	
2/13/2008	21:01:10	19.14	22.601	8.08	0.8	-1.4	77.73	13.67	
2/13/2008	21:16:10	19.14	22.739	8.08	-0.6	-1.4	77.31	13.76	
2/13/2008	21:31:10	19.14	22.921	8.08	0.1	-1.4	77.29	13.89	
2/13/2008	21:46:09	19.14	23.05	8.08	0.2	-1.5	76.73	13.97	
2/13/2008	22:01:10	19.13	23.213	8.08	-0.1	-1.4	76.3	14.08	
2/13/2008	22:16:09	19.13	23.269	8.08	-0.3	-1.4	76.1	14.12	
2/13/2008	22:31:10	19.14	23.31	8.08	0.7	-1.4	76.03	14.14	1.94
2/13/2008	22:46:09	19.14	23.306	8.08	0.7	-1.4	76.16	14.14	
2/13/2008	23:01:10	19.14	23.318	8.08	-0.2	-1.4	76.11	14.15	
2/13/2008	23:16:10	19.15	23.232	8.08	0.1	-1.4	76.36	14.09	
2/13/2008	23:31:09	19.17	23.087	8.08	0.9	-1.4	76.87	13.99	
2/13/2008	23:46:09	19.18	22.895	8.09	0.4	-1.4	77.34	13.87	
2/14/2008	0:01:10	19.2	22.695	8.09	0.9	-1.4	77.82	13.74	
2/14/2008	0:16:10	19.21	22.518	8.09	1	-1.4	78.35	13.62	
2/14/2008	0:31:10	19.23	22.316	8.09	-0.1	-1.3	78.94	13.49	
2/14/2008	0:46:09	19.24	22.125	8.09	1.5	-1.4	79.49	13.36	
2/14/2008	1:01:10	19.26	22.001	8.1	0.7	-1.4	80.06	13.28	
2/14/2008	1:16:10	19.27	21.884	8.1	0.2	-1.4	80.4	13.2	
2/14/2008	1:31:10	19.27	21.78	8.1	0	-1.4	80.8	13.13	
2/14/2008	1:46:10	19.28	21.653	8.1	0.7	-1.4	81.22	13.05	
2/14/2008	2:01:10	19.29	21.548	8.1	0.3	-1.4	81.69	12.98	
2/14/2008	2:16:09	19.3	21.421	8.1	0.2	-1.3	82.14	12.9	
2/14/2008	2:31:09	19.31	21.334	8.1	1.8	-1.4	82.37	12.84	
2/14/2008	2:46:09	19.31	21.285	8.1	0.9	-1.4	82.81	12.81	
2/14/2008	3:01:10	19.31	21.213	8.1	0.7	-1.4	82.96	12.76	
2/14/2008	3:16:09	19.31	21.143	8.1	0.6	-1.4	83.25	12.71	
2/14/2008	3:31:09	19.31	21.046	8.1	0.3	-1.4	83.51	12.65	
2/14/2008	3:46:09	19.31	20.995	8.1	-0.6	-1.4	83.56	12.62	
2/14/2008	4:01:10	19.31	20.964	8.1	0.4	-1.4	83.76	12.6	
2/14/2008	4:16:10	19.31	20.893	8.1	0.4	-1.4	83.83	12.55	
2/14/2008	4:31:10	19.31	20.82	8.1	0.9	-1.4	84.23	12.5	
2/14/2008	4:46:10	19.31	20.758	8.1	0.8	-1.4	84.17	12.46	
2/14/2008	5:01:10	19.31	20.705	8.1	0.6	-1.4	84.34	12.43	
2/14/2008	5:16:10	19.31	20.691	8.1	-0.2	-1.4	84.45	12.42	
2/14/2008	5:31:09	19.3	20.642	8.1	0	-1.3	84.66	12.39	
2/14/2008	5:46:09	19.3	20.611	8.1	0.3	-1.4	84.5	12.37	

Date M/D/Y	Time hh:mm:ss	Temp C	SpCond mS/cm	pH	Chlorophyll ug/L	Turbidity+ NTU	DO (%)	Salinity ppt	Tide ft
2/14/2008	6:01:10	19.3	20.57	8.1	1.2	-1.4	84.56	12.34	
2/14/2008	6:16:09	19.29	20.541	8.1	1.1	-1.4	84.6	12.32	
2/14/2008	6:31:09	19.29	20.504	8.1	0.5	-1.4	84.76	12.3	
2/14/2008	6:46:09	19.28	20.487	8.1	0.4	-1.4	84.7	12.29	
2/14/2008	7:01:10	19.28	20.461	8.1	-0.1	-1.4	84.64	12.27	
2/14/2008	7:16:09	19.27	20.439	8.1	0.6	-1.4	84.76	12.25	0.53
2/14/2008	7:31:09	19.27	20.407	8.1	-0.5	-1.4	84.71	12.23	
2/14/2008	7:46:09	19.27	20.398	8.1	0	-1.4	84.66	12.23	
2/14/2008	8:01:09	19.26	20.387	8.1	0.5	-1.5	84.76	12.22	
2/14/2008	8:16:09	19.26	20.367	8.1	0.3	-1.4	84.75	12.21	
2/14/2008	8:31:10	19.26	20.339	8.1	0.3	-1.4	84.59	12.19	0.64
2/14/2008	8:46:10	19.26	20.339	8.1	0.7	-1.4	84.82	12.19	
2/14/2008	9:01:10	19.26	20.322	8.1	0.2	-1.4	84.69	12.18	
2/14/2008	9:16:10	19.26	20.303	8.1	0	-1.4	84.59	12.17	
2/14/2008	9:31:09	19.26	20.285	8.1	0.8	-1.4	84.66	12.15	
2/14/2008	9:46:10	19.26	20.273	8.1	-0.1	-1.4	84.81	12.15	
2/14/2008	10:01:09	19.26	20.234	8.1	0.2	-1.4	84.96	12.12	
2/14/2008	10:16:10	19.27	20.213	8.1	0	-1.3	85.05	12.11	
2/14/2008	10:31:10	19.27	20.195	8.1	0.4	-1.4	84.99	12.1	
2/14/2008	10:46:10	19.28	20.181	8.1	0.5	-1.4	84.98	12.09	
2/14/2008	11:01:09	19.28	20.158	8.1	0.3	-1.4	85.1	12.07	
2/14/2008	11:16:10	19.29	20.107	8.1	-0.2	-1.4	85.21	12.04	
2/14/2008	11:31:10	19.3	20.086	8.1	0.6	-1.4	85.27	12.02	
2/14/2008	11:46:10	19.31	20.093	8.1	0.1	-1.3	85.33	12.03	
2/14/2008	12:01:09	19.31	20.061	8.1	0.4	-1.4	85.42	12.01	
2/14/2008	12:16:10	19.31	20.016	8.1	0.6	-1.4	85.55	11.98	
2/14/2008	12:31:10	19.32	19.973	8.1	0.1	-1.4	85.68	11.95	
2/14/2008	12:46:09	19.32	19.984	8.1	-0.2	-1.4	85.91	11.96	
2/14/2008	13:01:10	19.32	19.968	8.1	0.8	-1.4	85.75	11.95	
2/14/2008	13:16:10	19.33	19.966	8.1	1	-1.3	85.8	11.95	
2/14/2008	13:31:10	19.33	19.923	8.1	0.5	-1.3	85.85	11.92	
2/14/2008	13:46:10	19.33	19.869	8.1	0.4	-1.5	85.8	11.88	
2/14/2008	14:01:10	19.32	19.842	8.1	0.6	-1.4	85.96	11.87	
2/14/2008	14:16:10	19.32	19.837	8.1	0.5	-1.4	86.01	11.86	
2/14/2008	14:31:10	19.32	19.81	8.1	0.5	-1.4	86.01	11.85	
2/14/2008	14:46:10	19.32	19.794	8.1	0.6	-1.4	86.12	11.83	
2/14/2008	15:01:10	19.31	19.76	8.1	0.1	-1.3	86.02	11.81	
2/14/2008	15:16:10	19.31	19.746	8.1	0.1	-1.5	86.17	11.8	-0.01
2/14/2008	15:31:10	19.3	19.728	8.1	0.1	-1.4	86.01	11.79	
2/14/2008	15:46:10	19.29	19.696	8.1	-0.3	-1.4	85.93	11.77	
2/14/2008	16:01:09	19.29	19.687	8.1	1.1	-1.4	85.97	11.77	
2/14/2008	16:16:09	19.28	19.652	8.1	0.7	-1.4	85.93	11.74	

Date M/D/Y	Time hh:mm:ss	Temp C	SpCond mS/cm	pH	Chlorophyll ug/L	Turbidity+ NTU	DO (%)	Salinity ppt	Tide ft
2/14/2008	16:31:10	19.27	19.645	8.1	1	-1.4	85.91	11.74	
2/14/2008	16:46:10	19.26	19.591	8.1	1.5	-1.5	85.77	11.7	
2/14/2008	17:01:10	19.26	19.589	8.1	0.6	-1.4	85.7	11.7	
2/14/2008	17:16:10	19.26	19.611	8.1	0.8	-1.4	85.72	11.72	
2/14/2008	17:31:10	19.25	19.624	8.1	0.5	-1.4	85.49	11.72	
2/14/2008	17:46:10	19.24	19.621	8.1	0.3	-1.4	85.42	11.72	
2/14/2008	18:01:10	19.24	19.625	8.1	0.6	-1.4	85.43	11.73	
2/14/2008	18:16:10	19.24	19.644	8.11	0.3	-1.4	85.44	11.74	
2/14/2008	18:31:10	19.24	19.683	8.1	0.3	-1.5	85.05	11.76	
2/14/2008	18:46:09	19.24	19.758	8.1	0.6	-1.5	85.01	11.81	
2/14/2008	19:01:10	19.23	19.844	8.1	0.7	-1.4	84.67	11.87	
2/14/2008	19:16:09	19.23	19.93	8.1	0.1	-1.4	84.53	11.92	
2/14/2008	19:31:09	19.23	20.047	8.1	0.6	-1.4	84.23	12	
2/14/2008	19:46:10	19.22	20.222	8.1	1	-1.4	83.55	12.11	
2/14/2008	20:01:10	19.21	20.51	8.1	1	-1.4	83.14	12.3	
2/14/2008	20:16:09	19.2	20.857	8.1	0.5	-1.4	82.15	12.53	
2/14/2008	20:31:09	19.19	21.182	8.09	0.2	-1.4	81.13	12.74	
2/14/2008	20:46:09	19.18	21.45	8.09	0.7	-1.4	80.63	12.92	
2/14/2008	21:01:09	19.16	21.841	8.09	0.2	-1.4	79.95	13.17	
2/14/2008	21:16:10	19.15	22.22	8.08	0.6	-1.3	78.76	13.42	
2/14/2008	21:31:10	19.13	22.565	8.08	-0.1	-1.4	77.59	13.65	
2/14/2008	21:46:10	19.12	22.894	8.08	0.6	-1.4	76.67	13.87	
2/14/2008	22:01:10	19.1	23.221	8.07	0.6	-1.4	75.83	14.08	
2/14/2008	22:16:09	19.09	23.499	8.07	0.1	-1.5	75.13	14.27	
2/14/2008	22:31:09	19.08	23.773	8.07	0.6	-1.3	74.28	14.45	
2/14/2008	22:46:09	19.07	23.963	8.07	0.7	-1.4	73.69	14.58	
2/14/2008	23:01:09	19.07	24.151	8.07	0.4	-1.4	73.32	14.7	
2/14/2008	23:16:10	19.06	24.362	8.07	0.2	-1.4	72.59	14.84	
2/14/2008	23:31:10	19.06	24.502	8.07	0.4	-1.3	72.41	14.93	2.11
2/14/2008	23:46:09	19.05	24.614	8.06	0.1	-1.4	72.2	15.01	
2/15/2008	0:01:09	19.05	24.736	8.07	0.4	-1.3	71.97	15.09	
2/15/2008	0:16:09	19.05	24.828	8.07	0.6	-1.4	71.81	15.15	
2/15/2008	0:31:10	19.06	24.783	8.07	-0.8	-1.4	71.88	15.12	
2/15/2008	0:46:10	19.06	24.78	8.07	-0.2	-1.3	71.97	15.12	
2/15/2008	1:01:10	19.07	24.726	8.07	0.7	-1.3	72.22	15.08	
2/15/2008	1:16:10	19.08	24.667	8.07	0	-1.4	72.23	15.04	
2/15/2008	1:31:10	19.09	24.566	8.07	0.1	-1.4	72.59	14.98	
2/15/2008	1:46:10	19.1	24.395	8.07	0.2	-1.4	73.06	14.86	
2/15/2008	2:01:09	19.12	24.092	8.07	0.5	-1.3	73.95	14.66	
2/15/2008	2:16:09	19.15	23.716	8.08	0.2	-1.4	74.69	14.41	
2/15/2008	2:31:10	19.17	23.385	8.08	0	-1.4	75.7	14.19	
2/15/2008	2:46:10	19.19	23.137	8.08	1	-1.4	76.28	14.03	

Date M/D/Y	Time hh:mm:ss	Temp C	SpCond mS/cm	pH	Chlorophyll ug/L	Turbidity+ NTU	DO (%)	Salinity ppt	Tide ft
2/15/2008	3:01:09	19.21	22.858	8.09	0	-1.3	77.44	13.84	
2/15/2008	3:16:10	19.24	22.414	8.09	0.6	-1.4	78.7	13.55	
2/15/2008	3:31:10	19.27	22.027	8.1	0.3	-1.4	79.78	13.3	
2/15/2008	3:46:09	19.3	21.668	8.1	-0.3	-1.4	81.17	13.06	
2/15/2008	4:01:10	19.32	21.363	8.11	0.9	-1.5	82.36	12.86	
2/15/2008	4:16:10	19.34	21.223	8.11	1.3	-1.4	82.83	12.77	
2/15/2008	4:31:09	19.35	21.163	8.11	0.6	-1.4	83.48	12.73	
2/15/2008	4:46:09	19.36	21.079	8.11	0.4	-1.4	83.94	12.67	
2/15/2008	5:01:10	19.37	20.979	8.11	0.8	-1.4	84.31	12.61	
2/15/2008	5:16:10	19.37	21.002	8.11	0.5	-1.5	84.42	12.62	
2/15/2008	5:31:10	19.37	20.996	8.11	0.1	-1.5	84.42	12.62	
2/15/2008	5:46:10	19.37	20.883	8.11	0.9	-1.5	84.76	12.54	
2/15/2008	6:01:09	19.37	20.844	8.11	0	-1.4	85.03	12.52	
2/15/2008	6:16:10	19.37	20.811	8.11	0.7	-1.4	85.1	12.5	
2/15/2008	6:31:09	19.36	20.782	8.11	0.4	-1.4	85.31	12.48	
2/15/2008	6:46:09	19.36	20.743	8.11	0.1	-1.5	85.41	12.45	
2/15/2008	7:01:09	19.36	20.689	8.11	-0.3	-1.4	85.5	12.42	
2/15/2008	7:16:09	19.35	20.648	8.11	0	-1.5	85.42	12.39	
2/15/2008	7:31:09	19.35	20.616	8.11	0.5	-1.4	85.65	12.37	
2/15/2008	7:46:10	19.34	20.599	8.11	0.8	-1.4	85.52	12.36	
2/15/2008	8:01:10	19.33	20.551	8.11	0.4	-1.4	85.57	12.33	0.35
2/15/2008	8:16:09	19.33	20.538	8.11	0.2	-1.4	85.51	12.32	
2/15/2008	8:31:09	19.32	20.507	8.1	0.1	-1.4	85.31	12.3	
2/15/2008	8:46:09	19.31	20.462	8.1	0.9	-1.4	85.22	12.27	
2/15/2008	9:01:09	19.31	20.441	8.1	1	-1.4	85.35	12.26	
2/15/2008	9:16:09	19.3	20.433	8.1	0.4	-1.3	85.14	12.25	
2/15/2008	9:31:09	19.3	20.425	8.1	0.8	-1.4	85.23	12.25	
2/15/2008	9:46:09	19.29	20.386	8.1	0.2	-1.5	85.11	12.22	
2/15/2008	10:01:09	19.29	20.326	8.1	0.3	-1.4	85.35	12.18	
2/15/2008	10:16:09	19.3	20.34	8.1	0	-1.5	85.11	12.19	
2/15/2008	10:31:10	19.3	20.324	8.1	0.3	-1.4	85.18	12.18	
2/15/2008	10:46:09	19.3	20.281	8.1	0	-1.4	85.17	12.15	
2/15/2008	11:01:09	19.3	20.255	8.1	0.2	-1.4	85.28	12.13	0.53
2/15/2008	11:16:09	19.3	20.234	8.1	0.7	-1.4	85.26	12.12	
2/15/2008	11:31:10	19.31	20.238	8.1	0.3	-1.4	85.19	12.12	
2/15/2008	11:46:10	19.31	20.206	8.1	0.4	-1.4	85.33	12.1	
2/15/2008	12:01:09	19.31	20.173	8.1	0.3	-1.4	85.24	12.08	
2/15/2008	12:16:10	19.32	20.15	8.1	0.5	-1.5	85.37	12.07	
2/15/2008	12:31:10	19.32	20.132	8.1	0.8	-1.4	85.47	12.05	
2/15/2008	12:46:09	19.33	20.108	8.1	0	-1.4	85.43	12.04	
2/15/2008	13:01:10	19.33	20.077	8.1	-0.1	-1.4	85.49	12.02	
2/15/2008	13:16:10	19.34	20.077	8.1	0.1	-1.4	85.65	12.02	

Date M/D/Y	Time hh:mm:ss	Temp C	SpCond mS/cm	pH	Chlorophyll ug/L	Turbidity+ NTU	DO (%)	Salinity ppt	Tide ft
2/15/2008	13:31:09	19.34	20.051	8.1	-0.3	-1.5	85.7	12	
2/15/2008	13:46:10	19.34	20.011	8.1	0.2	-1.5	85.82	11.98	
2/15/2008	14:01:10	19.34	20.006	8.1	0.6	-1.4	85.78	11.97	
2/15/2008	14:16:10	19.35	19.993	8.1	0.6	-1.5	86.06	11.96	
2/15/2008	14:31:09	19.34	19.963	8.1	1.1	-1.4	85.96	11.94	
2/15/2008	14:46:10	19.34	19.94	8.1	0.3	-1.4	86.02	11.93	
2/15/2008	15:01:11	19.34	19.923	8.1	0.2	-1.4	85.98	11.92	
2/15/2008	15:16:10	19.33	19.906	8.1	1.6	-1.4	86.04	11.91	
2/15/2008	15:31:10	19.33	19.844	8.1	0.1	-1.4	86.16	11.87	
2/15/2008	15:46:10	19.32	19.854	8.1	0.4	-1.4	86.08	11.87	
2/15/2008	16:01:10	19.32	19.858	8.1	0.2	-1.4	86.06	11.88	
2/15/2008	16:16:09	19.32	19.813	8.1	0.4	-1.4	86.22	11.85	
2/15/2008	16:31:10	19.31	19.772	8.1	-0.6	-1.4	86.31	11.82	0
2/15/2008	16:46:10	19.31	19.763	8.1	0.3	-1.4	85.96	11.81	
2/15/2008	17:01:09	19.3	19.707	8.1	1.2	-1.5	85.95	11.78	
2/15/2008	17:16:09	19.3	19.68	8.1	0.6	-1.4	86.01	11.76	
2/15/2008	17:31:09	19.29	19.699	8.1	1.1	-1.4	86.06	11.77	
2/15/2008	17:46:09	19.29	19.688	8.1	0.1	-1.3	85.84	11.77	
2/15/2008	18:01:09	19.28	19.665	8.1	0.3	-1.4	85.83	11.75	
2/15/2008	18:16:09	19.28	19.644	8.1	0.5	-1.4	85.9	11.74	
2/15/2008	18:31:09	19.27	19.634	8.1	1.1	-1.4	85.59	11.73	
2/15/2008	18:46:10	19.27	19.629	8.1	0.9	-1.4	85.83	11.73	
2/15/2008	19:01:09	19.26	19.634	8.1	0.8	-1.4	85.68	11.73	
2/15/2008	19:16:10	19.26	19.652	8.1	0.7	-1.3	85.58	11.74	
2/15/2008	19:31:10	19.25	19.701	8.1	0.3	-1.5	85.29	11.77	
2/15/2008	19:46:09	19.25	19.74	8.1	-0.2	-1.4	85.24	11.8	
2/15/2008	20:01:09	19.24	19.817	8.1	0.2	-1.4	85	11.85	
2/15/2008	20:16:10	19.24	19.898	8.1	0.3	-1.4	84.68	11.9	
2/15/2008	20:31:10	19.24	20.007	8.1	0	-1.4	84.36	11.97	
2/15/2008	20:46:09	19.23	20.149	8.1	0.2	-1.4	84.06	12.07	
2/15/2008	21:01:09	19.23	20.363	8.1	0	-1.4	83.46	12.21	
2/15/2008	21:16:09	19.22	20.654	8.1	0.2	-1.4	82.75	12.4	
2/15/2008	21:31:10	19.21	20.964	8.09	0.8	-1.4	81.77	12.6	
2/15/2008	21:46:10	19.2	21.304	8.09	0.4	-1.3	80.95	12.82	
2/15/2008	22:01:09	19.18	21.688	8.09	0.4	-1.4	80.22	13.07	
2/15/2008	22:16:09	19.17	22.103	8.08	0	-1.5	79.14	13.35	
2/15/2008	22:31:10	19.14	22.579	8.08	0.5	-1.4	77.95	13.66	
2/15/2008	22:46:10	19.12	22.932	8.08	0.5	-1.4	76.86	13.89	
2/15/2008	23:01:10	19.11	23.27	8.07	0.9	-1.5	75.78	14.12	
2/15/2008	23:16:10	19.09	23.572	8.07	-0.5	-1.4	74.94	14.32	
2/15/2008	23:31:10	19.08	23.862	8.07	0.1	-1.4	74.23	14.51	
2/15/2008	23:46:10	19.07	24.174	8.06	-0.1	-1.5	73.43	14.72	

Date M/D/Y	Time hh:mm:ss	Temp C	SpCond mS/cm	pH	Chlorophyll ug/L	Turbidity+ NTU	DO (%)	Salinity ppt	Tide ft
2/16/2008	0:01:09	19.06	24.451	8.06	0.5	-1.4	72.71	14.9	2.26
2/16/2008	0:16:09	19.06	24.622	8.06	-0.4	-1.4	72.41	15.01	
2/16/2008	0:31:10	19.05	24.778	8.06	0.2	-1.4	71.97	15.12	
2/16/2008	0:46:10	19.05	24.885	8.06	0.3	-1.4	71.76	15.19	
2/16/2008	1:01:10	19.06	24.929	8.06	0	-1.4	71.76	15.22	
2/16/2008	1:16:10	19.06	24.906	8.06	-0.3	-1.4	71.96	15.2	
2/16/2008	1:31:09	19.07	24.879	8.06	-0.1	-1.4	72.01	15.19	
2/16/2008	1:46:09	19.08	24.802	8.07	0.4	-1.4	72.33	15.13	
2/16/2008	2:01:10	19.1	24.668	8.07	-0.5	-1.4	72.88	15.04	
2/16/2008	2:16:10	19.13	24.348	8.07	0.2	-1.4	73.52	14.83	
2/16/2008	2:31:10	19.16	23.961	8.08	0	-1.4	74.43	14.57	
2/16/2008	2:46:10	19.19	23.607	8.08	-0.1	-1.4	75.37	14.34	
2/16/2008	3:01:10	19.22	23.29	8.08	-0.4	-1.4	76.31	14.13	
2/16/2008	3:16:10	19.25	22.993	8.09	0.6	-1.4	77.57	13.93	
2/16/2008	3:31:10	19.27	22.661	8.09	0.2	-1.4	78.3	13.71	
2/16/2008	3:46:10	19.3	22.371	8.09	0.2	-1.4	79.32	13.52	
2/16/2008	4:01:10	19.32	22.11	8.1	-0.6	-1.4	80.28	13.35	0.21
2/16/2008	4:16:10	19.33	21.912	8.1	0.7	-1.4	81.08	13.22	
2/16/2008	4:31:10	19.35	21.745	8.1	0.2	-1.4	81.6	13.11	
2/16/2008	4:46:09	19.36	21.599	8.1	0.7	-1.5	82.31	13.01	
2/16/2008	5:01:09	19.37	21.487	8.1	0.6	-1.4	82.86	12.94	
2/16/2008	5:16:09	19.38	21.385	8.11	0.2	-1.5	83.35	12.87	
2/16/2008	5:31:09	19.38	21.306	8.11	1.1	-1.5	83.67	12.82	
2/16/2008	5:46:10	19.39	21.246	8.11	0.3	-1.4	84.05	12.78	
2/16/2008	6:01:09	19.39	21.189	8.11	1	-1.5	84.19	12.74	
2/16/2008	6:16:10	19.39	21.126	8.11	0.2	-1.4	84.55	12.7	
2/16/2008	6:31:10	19.39	21.06	8.11	0	-1.4	84.79	12.66	
2/16/2008	6:46:10	19.38	21.002	8.11	0.4	-1.4	85.03	12.62	
2/16/2008	7:01:09	19.38	20.949	8.11	0.6	-1.4	85.14	12.59	
2/16/2008	7:16:09	19.38	20.904	8.1	1	-1.5	85.36	12.56	
2/16/2008	7:31:10	19.37	20.858	8.1	0.6	-1.4	85.45	12.53	
2/16/2008	7:46:09	19.36	20.833	8.1	0.3	-1.4	85.39	12.51	
2/16/2008	8:01:09	19.36	20.807	8.1	0.7	-1.4	85.42	12.49	
2/16/2008	8:16:10	19.35	20.777	8.1	0.4	-1.4	85.23	12.48	
2/16/2008	8:31:10	19.34	20.746	8.1	0.5	-1.4	85.18	12.46	
2/16/2008	8:46:10	19.33	20.729	8.1	0.3	-1.4	85.18	12.44	
2/16/2008	9:01:10	19.33	20.708	8.1	0.3	-1.4	85.05	12.43	
2/16/2008	9:16:10	19.32	20.679	8.1	-0.5	-1.4	84.9	12.41	
2/16/2008	9:31:09	19.31	20.656	8.1	0.8	-1.4	84.87	12.4	
2/16/2008	9:46:09	19.3	20.637	8.1	-0.2	-1.4	84.81	12.38	
2/16/2008	10:01:09	19.3	20.609	8.1	0.9	-1.4	84.8	12.37	
2/16/2008	10:16:10	19.29	20.616	8.1	-0.3	-1.4	84.64	12.37	

Date M/D/Y	Time hh:mm:ss	Temp C	SpCond mS/cm	pH	Chlorophyll ug/L	Turbidity+ NTU	DO (%)	Salinity ppt	Tide ft
2/16/2008	10:31:10	19.29	20.594	8.1	0.5	-1.5	84.53	12.36	
2/16/2008	10:46:10	19.28	20.591	8.1	0.9	-1.4	84.53	12.35	
2/16/2008	11:01:09	19.28	20.594	8.1	0.2	-1.4	84.49	12.36	
2/16/2008	11:16:09	19.28	20.595	8.1	0.5	-1.4	84.37	12.36	
2/16/2008	11:31:10	19.28	20.594	8.1	0.2	-1.4	84.32	12.36	
2/16/2008	11:46:09	19.28	20.58	8.1	0.1	-1.4	84.24	12.35	
2/16/2008	12:01:09	19.28	20.568	8.1	-0.3	-1.5	84.28	12.34	
2/16/2008	12:16:09	19.29	20.554	8.1	0.5	-1.5	84.33	12.33	
2/16/2008	12:31:10	19.3	20.533	8.1	0.8	-1.3	84.39	12.32	0.58
2/16/2008	12:46:10	19.3	20.501	8.1	0.2	-1.5	84.54	12.3	
2/16/2008	13:01:10	19.31	20.472	8.1	0.3	-1.4	84.39	12.28	
2/16/2008	13:16:09	19.31	20.447	8.1	-0.5	-1.4	84.46	12.26	
2/16/2008	13:31:10	19.32	20.432	8.1	1	-1.4	84.65	12.25	
2/16/2008	13:46:09	19.32	20.417	8.1	0.3	-1.4	84.61	12.24	
2/16/2008	14:01:09	19.32	20.394	8.1	0.2	-1.4	84.71	12.23	
2/16/2008	14:16:10	19.32	20.373	8.1	0.5	-1.4	84.81	12.21	
2/16/2008	14:31:09	19.33	20.346	8.1	0	-1.4	84.84	12.19	
2/16/2008	14:46:09	19.32	20.324	8.1	0.8	-1.5	84.99	12.18	
2/16/2008	15:01:10	19.32	20.301	8.1	0.1	-1.4	84.85	12.16	
2/16/2008	15:16:10	19.32	20.267	8.1	0.7	-1.5	84.95	12.14	
2/16/2008	15:31:10	19.32	20.244	8.1	0.4	-1.4	85	12.13	
2/16/2008	15:46:09	19.32	20.228	8.1	-0.4	-1.4	85.11	12.12	
2/16/2008	16:01:10	19.32	20.205	8.1	0.8	-1.4	85.02	12.1	
2/16/2008	16:16:10	19.31	20.157	8.1	1	-1.4	85.15	12.07	
2/16/2008	16:31:10	19.31	20.141	8.1	0	-1.4	84.95	12.06	
2/16/2008	16:46:10	19.31	20.126	8.09	0.4	-1.4	85.2	12.05	
2/16/2008	17:01:10	19.31	20.103	8.09	0.3	-1.4	85.25	12.04	
2/16/2008	17:16:10	19.31	20.088	8.09	0.2	-1.5	85.23	12.03	
2/16/2008	17:31:10	19.31	20.068	8.09	0.7	-1.4	85.26	12.01	
2/16/2008	17:46:10	19.31	20.054	8.09	0.3	-1.4	85.28	12	-0.03
2/16/2008	18:01:10	19.3	20.026	8.09	0.2	-1.5	85.41	11.99	
2/16/2008	18:16:10	19.3	20.014	8.09	0.5	-1.4	85.27	11.98	
2/16/2008	18:31:10	19.29	20.004	8.09	0.7	-1.3	85.33	11.97	
2/16/2008	18:46:09	19.28	19.979	8.09	0.5	-1.4	85.2	11.96	
2/16/2008	19:01:10	19.28	19.944	8.09	0.1	-1.4	85.07	11.93	
2/16/2008	19:16:09	19.27	19.935	8.09	0.4	-1.4	85.37	11.93	
2/16/2008	19:31:10	19.27	19.923	8.09	0.3	-1.4	85.22	11.92	
2/16/2008	19:46:09	19.26	19.897	8.09	1.3	-1.4	85.15	11.9	
2/16/2008	20:01:10	19.26	19.901	8.09	0.4	-1.4	84.93	11.9	
2/16/2008	20:16:10	19.25	19.901	8.09	0.6	-1.4	84.95	11.9	
2/16/2008	20:31:10	19.24	19.924	8.1	0.7	-1.4	84.86	11.92	
2/16/2008	20:46:10	19.24	19.96	8.1	0.5	-1.4	84.65	11.94	

Date M/D/Y	Time hh:mm:ss	Temp C	SpCond mS/cm	pH	Chlorophyll ug/L	Turbidity+ NTU	DO (%)	Salinity ppt	Tide ft
2/16/2008	21:01:10	19.23	20.03	8.1	0.5	-1.4	84.34	11.99	
2/16/2008	21:16:10	19.22	20.125	8.1	0.8	-1.4	84.25	12.05	
2/16/2008	21:31:09	19.22	20.226	8.1	0.6	-1.4	84.09	12.12	
2/16/2008	21:46:10	19.22	20.363	8.09	0.3	-1.3	83.6	12.21	
2/16/2008	22:01:10	19.21	20.522	8.09	0.3	-1.4	83.12	12.31	
2/16/2008	22:16:09	19.21	20.752	8.09	0.6	-1.4	82.61	12.46	
2/16/2008	22:31:09	19.19	21.119	8.09	0.4	-1.4	81.67	12.7	
2/16/2008	22:46:10	19.18	21.477	8.09	0.9	-1.3	80.6	12.93	
2/16/2008	23:01:10	19.16	21.887	8.08	0.9	-1.4	79.62	13.2	
2/16/2008	23:16:10	19.15	22.257	8.08	0.5	-1.4	78.81	13.45	
2/16/2008	23:31:10	19.13	22.598	8.08	0.8	-1.4	77.71	13.67	
2/16/2008	23:46:09	19.12	22.993	8.07	-0.2	-1.4	76.67	13.93	
2/17/2008	0:01:10	19.1	23.329	8.07	0.6	-1.3	75.82	14.16	
2/17/2008	0:16:10	19.09	23.638	8.07	0.6	-1.4	74.95	14.36	
2/17/2008	0:31:10	19.08	23.961	8.06	0	-1.4	74.22	14.57	
2/17/2008	0:46:09	19.07	24.243	8.06	0.4	-1.3	73.38	14.76	
2/17/2008	1:01:10	19.06	24.486	8.06	0.4	-1.4	72.77	14.92	
2/17/2008	1:16:10	19.05	24.718	8.06	0.6	-1.4	72.28	15.08	
2/17/2008	1:31:10	19.05	24.928	8.06	0.3	-1.4	71.76	15.22	2.36
2/17/2008	1:46:09	19.05	25.113	8.06	0	-1.4	71.38	15.34	
2/17/2008	2:01:10	19.05	25.191	8.06	0	-1.4	71.09	15.39	
2/17/2008	2:16:10	19.06	25.214	8.06	0.1	-1.4	71.06	15.41	
2/17/2008	2:31:10	19.07	25.162	8.06	0	-1.3	71.46	15.37	
2/17/2008	2:46:10	19.08	25.03	8.06	-0.3	-1.4	71.84	15.29	
2/17/2008	3:01:09	19.11	24.766	8.07	0.2	-1.4	72.66	15.11	
2/17/2008	3:16:10	19.15	24.282	8.07	0.5	-1.4	73.95	14.79	
2/17/2008	3:31:10	19.18	23.925	8.08	0.5	-1.4	74.76	14.55	
2/17/2008	3:46:09	19.22	23.575	8.08	0.2	-1.4	75.98	14.32	
2/17/2008	4:01:10	19.25	23.203	8.08	0.8	-1.4	77.08	14.07	
2/17/2008	4:16:10	19.29	22.826	8.09	0.2	-1.4	78.29	13.82	
2/17/2008	4:31:10	19.31	22.538	8.09	0.8	-1.5	79.32	13.63	
2/17/2008	4:46:11	19.33	22.305	8.1	1.4	-1.4	80.32	13.48	
2/17/2008	5:01:10	19.35	22.095	8.1	0.7	-1.4	81.12	13.34	
2/17/2008	5:16:10	19.37	21.941	8.1	0.5	-1.4	81.87	13.24	
2/17/2008	5:31:10	19.38	21.81	8.1	1.1	-1.4	82.42	13.15	
2/17/2008	5:46:10	19.39	21.723	8.1	0.9	-1.4	83.1	13.1	
2/17/2008	6:01:10	19.4	21.638	8.1	0.3	-1.4	83.43	13.04	
2/17/2008	6:16:09	19.4	21.575	8.1	0.7	-1.5	83.79	13	
2/17/2008	6:31:10	19.4	21.523	8.1	0.2	-1.5	84.02	12.96	
2/17/2008	6:46:09	19.4	21.461	8.1	0.3	-1.4	84.25	12.92	
2/17/2008	7:01:09	19.4	21.392	8.1	1	-1.5	84.67	12.88	
2/17/2008	7:16:10	19.39	21.335	8.1	0.3	-1.5	84.68	12.84	

Date M/D/Y	Time hh:mm:ss	Temp C	SpCond mS/cm	pH	Chlorophyll ug/L	Turbidity+ NTU	DO (%)	Salinity ppt	Tide ft
2/17/2008	7:31:10	19.39	21.271	8.1	-0.2	-1.4	84.81	12.8	
2/17/2008	7:46:10	19.38	21.236	8.1	0	-1.4	85.02	12.78	
2/17/2008	8:01:10	19.37	21.19	8.1	0.5	-1.4	84.91	12.74	
2/17/2008	8:16:10	19.37	21.152	8.1	0.2	-1.5	84.9	12.72	
2/17/2008	8:31:10	19.36	21.113	8.1	0.2	-1.4	84.97	12.69	
2/17/2008	8:46:10	19.35	21.075	8.1	0.3	-1.4	84.97	12.67	
2/17/2008	9:01:10	19.34	21.037	8.1	0.9	-1.4	84.95	12.64	0.12
2/17/2008	9:16:10	19.34	21.002	8.1	0.6	-1.4	85.05	12.62	
2/17/2008	9:31:10	19.33	20.958	8.1	1	-1.5	84.84	12.59	
2/17/2008	9:46:10	19.33	20.921	8.1	-0.2	-1.4	84.72	12.57	
2/17/2008	10:01:10	19.32	20.884	8.1	0	-1.4	84.73	12.55	
2/17/2008	10:16:10	19.31	20.875	8.1	-0.3	-1.4	84.76	12.54	
2/17/2008	10:31:09	19.31	20.849	8.1	0.7	-1.4	84.65	12.52	
2/17/2008	10:46:09	19.3	20.829	8.1	0.8	-1.4	84.26	12.51	
2/17/2008	11:01:10	19.3	20.829	8.1	-0.1	-1.3	84.25	12.51	
2/17/2008	11:16:09	19.29	20.822	8.1	-0.2	-1.3	84.12	12.5	
2/17/2008	11:31:09	19.29	20.829	8.1	0	-1.3	83.94	12.51	
2/17/2008	11:46:09	19.28	20.851	8.1	0.9	-1.4	83.91	12.52	
2/17/2008	12:01:09	19.28	20.862	8.1	-0.1	-1.4	83.77	12.53	
2/17/2008	12:16:10	19.28	20.878	8.1	0.6	-1.4	83.72	12.54	
2/17/2008	12:31:10	19.27	20.903	8.1	-0.3	-1.4	83.66	12.56	
2/17/2008	12:46:09	19.27	20.921	8.1	0.5	-1.4	83.52	12.57	
2/17/2008	13:01:10	19.26	20.95	8.1	0.3	-1.4	83.51	12.59	
2/17/2008	13:16:10	19.26	20.974	8.1	0.6	-1.4	83.31	12.6	
2/17/2008	13:31:10	19.27	20.985	8.1	0.4	-1.4	83.19	12.61	0.7
2/17/2008	13:46:10	19.27	20.992	8.1	1	-1.4	83.22	12.62	
2/17/2008	14:01:10	19.27	20.975	8.1	0.6	-1.4	83.27	12.6	
2/17/2008	14:16:10	19.27	20.947	8.1	0.7	-1.4	83.38	12.59	
2/17/2008	14:31:10	19.29	20.912	8.1	0.2	-1.5	83.53	12.56	
2/17/2008	14:46:10	19.3	20.864	8.1	0.3	-1.4	83.64	12.53	
2/17/2008	15:01:09	19.3	20.825	8.1	0.5	-1.4	83.73	12.51	
2/17/2008	15:16:09	19.31	20.789	8.1	0.3	-1.5	83.84	12.48	
2/17/2008	15:31:10	19.31	20.755	8.1	0.3	-1.4	83.9	12.46	
2/17/2008	15:46:10	19.31	20.715	8.1	0.7	-1.4	83.99	12.43	
2/17/2008	16:01:10	19.31	20.677	8.1	0.3	-1.4	84.08	12.41	
2/17/2008	16:16:10	19.31	20.625	8.1	0.5	-1.5	84.28	12.38	
2/17/2008	16:31:10	19.31	20.593	8.1	0.8	-1.4	84.23	12.36	
2/17/2008	16:46:09	19.31	20.56	8.1	1	-1.4	84.35	12.33	
2/17/2008	17:01:10	19.31	20.519	8.1	0.1	-1.4	84.47	12.31	
2/17/2008	17:16:10	19.31	20.482	8.09	0	-1.4	84.6	12.28	
2/17/2008	17:31:10	19.31	20.45	8.09	-0.3	-1.4	84.83	12.26	
2/17/2008	17:46:10	19.31	20.416	8.09	0.5	-1.4	84.86	12.24	

Date M/D/Y	Time hh:mm:ss	Temp C	SpCond mS/cm	pH	Chlorophyll ug/L	Turbidity+ NTU	DO (%)	Salinity ppt	Tide ft
2/17/2008	18:01:10	19.31	20.388	8.09	-0.2	-1.4	84.69	12.22	
2/17/2008	18:16:10	19.31	20.362	8.09	1	-1.4	85.04	12.2	
2/17/2008	18:31:10	19.31	20.328	8.09	0.2	-1.4	85.12	12.18	
2/17/2008	18:46:10	19.31	20.298	8.09	0.8	-1.5	85.03	12.16	-0.07
2/17/2008	19:01:09	19.3	20.278	8.09	0.4	-1.4	84.96	12.15	
2/17/2008	19:16:10	19.3	20.255	8.09	0.2	-1.4	85.15	12.13	
2/17/2008	19:31:10	19.29	20.239	8.09	1	-1.4	85.18	12.12	
2/17/2008	19:46:10	19.29	20.218	8.09	0.4	-1.5	85.01	12.11	
2/17/2008	20:01:09	19.28	20.192	8.09	0.2	-1.4	84.97	12.09	
2/17/2008	20:16:09	19.28	20.183	8.09	0.1	-1.4	85.07	12.09	
2/17/2008	20:31:09	19.27	20.168	8.09	0.4	-1.4	85.09	12.08	
2/17/2008	20:46:09	19.26	20.148	8.09	0.2	-1.4	84.93	12.07	
2/17/2008	21:01:09	19.25	20.135	8.09	0.7	-1.4	84.89	12.06	
2/17/2008	21:16:10	19.24	20.136	8.1	0.6	-1.4	84.76	12.06	
2/17/2008	21:31:10	19.24	20.154	8.1	0.1	-1.4	84.48	12.07	
2/17/2008	21:46:10	19.23	20.196	8.1	-0.2	-1.4	84.36	12.1	
2/17/2008	22:01:10	19.22	20.269	8.1	0.4	-1.5	84.07	12.14	
2/17/2008	22:16:10	19.22	20.365	8.1	0.1	-1.4	83.77	12.21	
2/17/2008	22:31:10	19.21	20.526	8.09	0.6	-1.4	83.33	12.31	
2/17/2008	22:46:09	19.2	20.717	8.09	0.2	-1.4	82.88	12.44	
2/17/2008	23:01:09	19.2	20.926	8.09	0.2	-1.4	82.51	12.57	
2/17/2008	23:16:10	19.19	21.235	8.09	-0.4	-1.5	81.47	12.78	
2/17/2008	23:31:10	19.17	21.586	8.09	0.2	-1.4	80.47	13.01	
2/17/2008	23:46:10	19.16	21.982	8.08	0.3	-1.5	79.76	13.27	
2/18/2008	0:01:10	19.14	22.381	8.08	0.2	-1.4	78.68	13.53	
2/18/2008	0:16:10	19.12	22.81	8.08	0.2	-1.4	77.39	13.81	
2/18/2008	0:31:10	19.1	23.174	8.07	0.3	-1.5	76.59	14.05	
2/18/2008	0:46:10	19.09	23.483	8.07	-0.2	-1.4	75.54	14.26	
2/18/2008	1:01:10	19.08	23.765	8.07	0.5	-1.4	74.86	14.44	
2/18/2008	1:16:10	19.07	24.049	8.06	0.1	-1.4	73.89	14.63	
2/18/2008	1:31:09	19.06	24.289	8.06	-0.2	-1.4	73.3	14.79	
2/18/2008	1:46:09	19.06	24.554	8.06	0.6	-1.5	72.74	14.97	
2/18/2008	2:01:10	19.05	24.778	8.06	1.3	-1.4	72.34	15.12	2.39
2/18/2008	2:16:11	19.04	25.028	8.06	0.8	-1.4	71.63	15.28	
2/18/2008	2:31:10	19.04	25.269	8.06	-0.2	-1.4	71.07	15.45	
2/18/2008	2:46:11	19.04	25.365	8.06	0.4	-1.5	70.82	15.51	
2/18/2008	3:01:09	19.05	25.363	8.06	0.3	-1.4	70.89	15.51	
2/18/2008	3:16:09	19.06	25.29	8.06	0.2	-1.3	71.22	15.46	
2/18/2008	3:31:10	19.08	25.146	8.06	0.6	-1.5	71.8	15.36	
2/18/2008	3:46:10	19.11	24.944	8.07	-0.1	-1.3	72.44	15.23	
2/18/2008	4:01:10	19.14	24.515	8.07	0.1	-1.4	73.64	14.94	
2/18/2008	4:16:10	19.18	24.101	8.07	0.3	-1.4	74.49	14.67	

Date M/D/Y	Time hh:mm:ss	Temp C	SpCond mS/cm	pH	Chlorophyll ug/L	Turbidity+ NTU	DO (%)	Salinity ppt	Tide ft
2/18/2008	4:31:10	19.22	23.68	8.08	0.3	-1.4	75.74	14.39	
2/18/2008	4:46:10	19.26	23.268	8.08	0.5	-1.4	77.16	14.11	
2/18/2008	5:01:10	19.29	22.906	8.09	-0.3	-1.4	78.5	13.87	
2/18/2008	5:16:10	19.32	22.616	8.09	0.1	-1.4	79.47	13.68	
2/18/2008	5:31:09	19.35	22.395	8.1	0.7	-1.4	80.57	13.54	
2/18/2008	5:46:10	19.36	22.246	8.1	0.3	-1.4	81.42	13.44	
2/18/2008	6:01:10	19.38	22.113	8.1	0.7	-1.5	81.98	13.35	
2/18/2008	6:16:09	19.39	22.009	8.1	0	-1.5	82.64	13.28	
2/18/2008	6:31:10	19.4	21.926	8.1	0.6	-1.4	83.08	13.23	
2/18/2008	6:46:10	19.4	21.841	8.1	0.7	-1.4	83.45	13.17	
2/18/2008	7:01:10	19.41	21.766	8.1	0.1	-1.4	84.14	13.12	
2/18/2008	7:16:10	19.41	21.692	8.1	0	-1.5	84.57	13.07	
2/18/2008	7:31:09	19.42	21.623	8.1	0.7	-1.5	84.9	13.03	
2/18/2008	7:46:10	19.42	21.562	8.1	0.4	-1.4	85.03	12.99	
2/18/2008	8:01:10	19.41	21.508	8.1	0.3	-1.4	85.29	12.95	
2/18/2008	8:16:10	19.4	21.46	8.1	-0.2	-1.4	85.29	12.92	
2/18/2008	8:31:11	19.4	21.41	8.1	0.7	-1.3	85.35	12.89	
2/18/2008	8:46:10	19.39	21.371	8.1	0.4	-1.5	85.5	12.86	
2/18/2008	9:01:10	19.38	21.331	8.1	0.6	-1.4	85.47	12.84	
2/18/2008	9:16:10	19.37	21.295	8.1	0.2	-1.4	85.23	12.81	
2/18/2008	9:31:10	19.37	21.243	8.1	0.9	-1.5	85.26	12.78	0.06
2/18/2008	9:46:10	19.36	21.193	8.1	1.4	-1.4	85.22	12.75	
2/18/2008	10:01:10	19.35	21.144	8.1	0.5	-1.4	85.13	12.72	
2/18/2008	10:16:10	19.34	21.09	8.1	1.2	-1.4	84.96	12.68	
2/18/2008	10:31:10	19.33	21.059	8.1	0.6	-1.5	84.77	12.66	
2/18/2008	10:46:10	19.32	20.985	8.1	0.1	-1.4	84.75	12.61	
2/18/2008	11:01:09	19.31	21.013	8.1	-0.3	-1.4	84.5	12.63	
2/18/2008	11:16:09	19.31	21.001	8.1	-0.2	-1.4	84.6	12.62	
2/18/2008	11:31:09	19.3	20.993	8.1	-0.3	-1.4	84.49	12.62	
2/18/2008	11:46:10	19.3	20.999	8.1	0.3	-1.4	84.24	12.62	
2/18/2008	12:01:10	19.3	21.025	8.1	0.8	-1.4	84.24	12.64	
2/18/2008	12:16:10	19.29	21.013	8.1	0.6	-1.4	83.89	12.63	
2/18/2008	12:31:10	19.29	21.079	8.1	-0.3	-1.4	83.77	12.67	
2/18/2008	12:46:09	19.29	21.106	8.1	1	-1.4	83.76	12.69	
2/18/2008	13:01:09	19.29	21.136	8.1	-0.5	-1.4	83.43	12.71	
2/18/2008	13:16:09	19.29	21.175	8.1	0.2	-1.4	83.22	12.74	
2/18/2008	13:31:10	19.29	21.234	8.1	0.5	-1.5	82.98	12.77	
2/18/2008	13:46:10	19.28	21.307	8.1	0.5	-1.4	82.9	12.82	
2/18/2008	14:01:10	19.28	21.368	8.1	0.1	-1.4	82.61	12.86	
2/18/2008	14:16:10	19.28	21.41	8.1	0.8	-1.4	82.49	12.89	0.85
2/18/2008	14:31:10	19.28	21.454	8.09	0.4	-1.4	82.46	12.92	
2/18/2008	14:46:10	19.28	21.475	8.09	0.5	-1.5	82.1	12.93	

Date M/D/Y	Time hh:mm:ss	Temp C	SpCond mS/cm	pH	Chlorophyll ug/L	Turbidity+ NTU	DO (%)	Salinity ppt	Tide ft
2/18/2008	15:01:10	19.29	21.463	8.09	0.4	-1.4	82.2	12.92	
2/18/2008	15:16:10	19.29	21.43	8.09	0.7	-1.4	82.63	12.9	
2/18/2008	15:31:10	19.3	21.37	8.09	0.4	-1.4	82.7	12.86	
2/18/2008	15:46:10	19.31	21.316	8.09	0.8	-1.4	82.78	12.83	
2/18/2008	16:01:10	19.31	21.256	8.09	-0.3	-1.5	82.87	12.79	
2/18/2008	16:16:10	19.32	21.193	8.09	0.2	-1.5	83.26	12.75	
2/18/2008	16:31:09	19.32	21.137	8.09	0.1	-1.4	83.45	12.71	
2/18/2008	16:46:10	19.33	21.074	8.09	0.3	-1.4	83.78	12.67	
2/18/2008	17:01:10	19.33	21.018	8.09	0.5	-1.4	83.85	12.63	
2/18/2008	17:16:10	19.33	20.957	8.09	0.3	-1.4	84.06	12.59	
2/18/2008	17:31:10	19.33	20.906	8.09	0.6	-1.5	84.31	12.56	
2/18/2008	17:46:10	19.33	20.859	8.09	0.9	-1.4	84.3	12.53	
2/18/2008	18:01:09	19.33	20.805	8.09	0.5	-1.4	84.44	12.49	
2/18/2008	18:16:10	19.33	20.761	8.09	0.2	-1.5	84.5	12.46	
2/18/2008	18:31:09	19.33	20.721	8.09	0.2	-1.4	84.69	12.44	
2/18/2008	18:46:10	19.33	20.667	8.09	0.4	-1.4	84.8	12.4	
2/18/2008	19:01:10	19.33	20.631	8.09	0.2	-1.4	84.87	12.38	
2/18/2008	19:16:09	19.33	20.595	8.09	0.4	-1.4	85.02	12.36	
2/18/2008	19:31:09	19.32	20.56	8.09	0.4	-1.5	85.14	12.33	-0.09
2/18/2008	19:46:10	19.32	20.522	8.09	0.1	-1.4	85.34	12.31	
2/18/2008	20:01:10	19.32	20.505	8.09	0.7	-1.4	85.37	12.3	
2/18/2008	20:16:09	19.31	20.481	8.09	0.3	-1.5	85.39	12.28	
2/18/2008	20:31:10	19.3	20.454	8.09	0.1	-1.4	85.3	12.26	
2/18/2008	20:46:10	19.3	20.412	8.09	0.1	-1.5	85.23	12.24	
2/18/2008	21:01:09	19.29	20.379	8.09	0	-1.4	85.16	12.22	
2/18/2008	21:16:10	19.28	20.36	8.09	0.2	-1.4	85.18	12.2	
2/18/2008	21:31:09	19.27	20.351	8.09	0.4	-1.5	85.07	12.2	
2/18/2008	21:46:09	19.26	20.35	8.09	0	-1.4	84.88	12.2	
2/18/2008	22:01:10	19.26	20.341	8.09	-0.2	-1.4	84.86	12.19	
2/18/2008	22:16:10	19.24	20.349	8.09	0.5	-1.4	84.66	12.2	
2/18/2008	22:31:09	19.24	20.358	8.09	0	-1.3	84.45	12.2	
2/18/2008	22:46:09	19.23	20.408	8.09	0.1	-1.5	84.4	12.23	
2/18/2008	23:01:10	19.22	20.49	8.09	0	-1.5	84.08	12.29	
2/18/2008	23:16:09	19.21	20.607	8.09	1	-1.4	83.61	12.36	
2/18/2008	23:31:09	19.21	20.8	8.09	0	-1.5	83.12	12.49	
2/18/2008	23:46:10	19.2	21	8.09	0.6	-1.4	82.72	12.62	
2/19/2008	0:01:10	19.19	21.286	8.09	1.1	-1.4	81.88	12.81	
2/19/2008	0:16:10	19.17	21.699	8.09	0.4	-1.4	80.72	13.08	
2/19/2008	0:31:09	19.15	22.093	8.08	0.4	-1.5	79.82	13.34	
2/19/2008	0:46:10	19.13	22.567	8.08	0.2	-1.4	78.41	13.65	
2/19/2008	1:01:10	19.09	23.223	8.07	-0.3	-1.4	76.79	14.09	
2/19/2008	1:16:10	19.08	23.488	8.07	0	-1.4	75.82	14.26	

Date M/D/Y	Time hh:mm:ss	Temp C	SpCond mS/cm	pH	Chlorophyll ug/L	Turbidity+ NTU	DO (%)	Salinity ppt	Tide ft
2/19/2008	1:31:10	19.08	23.602	8.07	0.1	-1.4	75.39	14.34	
2/19/2008	1:46:10	19.07	23.793	8.07	0.3	-1.3	75.2	14.46	
2/19/2008	2:01:10	19.04	24.029	8.07	0.3	-1.4	74.71	14.62	
2/19/2008	2:16:10	19.02	24.221	8.07	-0.1	-1.3	74.18	14.75	
2/19/2008	2:31:10	19.02	24.345	8.07	-0.3	-1.5	73.33	14.83	
2/19/2008	2:46:11	19.02	24.511	8.06	-0.4	-1.4	72.96	14.94	2.35
2/19/2008	3:01:10	19	24.595	8.06	0.4	-1.5	72.94	15	
2/19/2008	3:16:09	19.01	24.745	8.06	0.2	-1.4	72.33	15.1	
2/19/2008	3:31:10	19.02	25.057	8.06	0.5	-1.4	71.6	15.3	
2/19/2008	3:46:10	19.05	25.35	8.05	0.1	-1.4	71.09	15.5	
2/19/2008	4:01:10	19.05	25.47	8.05	0.1	-1.3	70.63	15.58	
2/19/2008	4:16:10	19.06	25.405	8.06	0.7	-1.4	70.99	15.54	
2/19/2008	4:31:10	19.08	25.263	8.06	-0.1	-1.4	71.51	15.44	
2/19/2008	4:46:10	19.11	24.922	8.06	0.8	-1.4	72.58	15.21	
2/19/2008	5:01:10	19.16	24.291	8.07	0.5	-1.5	74.08	14.79	
2/19/2008	5:16:10	19.21	23.778	8.08	0.9	-1.3	75.63	14.45	
2/19/2008	5:31:09	19.25	23.333	8.08	-0.8	-1.4	77.33	14.16	
2/19/2008	5:46:10	19.29	22.987	8.09	0	-1.4	78.58	13.93	
2/19/2008	6:01:09	19.32	22.724	8.09	0.8	-1.4	79.73	13.75	
2/19/2008	6:16:09	19.35	22.458	8.1	-0.8	-1.4	80.9	13.58	
2/19/2008	6:31:10	19.37	22.27	8.1	0.8	-1.4	81.7	13.45	
2/19/2008	6:46:10	19.39	22.135	8.1	0.2	-1.4	82.53	13.37	
2/19/2008	7:01:10	19.4	22.039	8.1	0.4	-1.4	83.19	13.3	
2/19/2008	7:16:09	19.41	21.969	8.1	0.1	-1.3	83.81	13.26	
2/19/2008	7:31:09	19.42	21.921	8.1	0	-1.4	84.22	13.22	
2/19/2008	7:46:10	19.43	21.868	8.1	0	-1.5	84.65	13.19	
2/19/2008	8:01:10	19.43	21.815	8.1	-0.4	-1.4	85.02	13.15	
2/19/2008	8:16:10	19.43	21.757	8.1	-0.2	-1.5	85.36	13.12	
2/19/2008	8:31:10	19.43	21.699	8.1	0.2	-1.4	85.55	13.08	
2/19/2008	8:46:10	19.43	21.652	8.1	0.6	-1.4	85.79	13.05	
2/19/2008	9:01:10	19.43	21.609	8.1	0.2	-1.4	85.87	13.02	
2/19/2008	9:16:10	19.42	21.56	8.1	0.5	-1.4	85.87	12.99	
2/19/2008	9:31:09	19.41	21.515	8.1	0.4	-1.4	85.8	12.96	
2/19/2008	9:46:10	19.4	21.473	8.1	-0.1	-1.4	85.78	12.93	0.02
2/19/2008	10:01:10	19.39	21.428	8.1	1.1	-1.4	85.67	12.9	
2/19/2008	10:16:09	19.38	21.372	8.1	0.9	-1.4	85.52	12.86	
2/19/2008	10:31:10	19.37	21.325	8.1	0	-1.5	85.56	12.83	
2/19/2008	10:46:09	19.36	21.282	8.1	0.9	-1.4	85.28	12.81	
2/19/2008	11:01:10	19.36	21.235	8.1	0.6	-1.5	85.23	12.77	
2/19/2008	11:16:10	19.35	21.183	8.1	0.4	-1.4	85.11	12.74	
2/19/2008	11:31:10	19.34	21.102	8.1	0.5	-1.5	85.1	12.69	
2/19/2008	11:46:09	19.33	21.04	8.1	0.7	-1.4	84.72	12.65	

Date M/D/Y	Time hh:mm:ss	Temp C	SpCond mS/cm	pH	Chlorophyll ug/L	Turbidity+ NTU	DO (%)	Salinity ppt	Tide ft
2/19/2008	12:01:10	19.32	20.995	8.1	-0.1	-1.4	84.81	12.62	
2/19/2008	12:16:10	19.32	21.022	8.1	-0.2	-1.4	84.63	12.64	
2/19/2008	12:31:09	19.3	21.033	8.1	0.2	-1.4	84.44	12.64	
2/19/2008	12:46:10	19.3	21.056	8.1	0.6	-1.4	84.42	12.66	
2/19/2008	13:01:10	19.29	21.07	8.1	0.7	-1.4	84.19	12.67	
2/19/2008	13:16:09	19.28	21.206	8.1	-0.1	-1.4	83.81	12.76	
2/19/2008	13:31:10	19.28	21.307	8.1	0.9	-1.5	83.54	12.82	
2/19/2008	13:46:10	19.27	21.437	8.1	0.9	-1.4	83.13	12.91	
2/19/2008	14:01:10	19.27	21.521	8.1	-0.2	-1.4	82.56	12.96	
2/19/2008	14:16:10	19.26	21.656	8.09	-0.2	-1.4	82.25	13.05	
2/19/2008	14:31:10	19.26	21.735	8.09	-0.1	-1.4	82.01	13.1	
2/19/2008	14:46:10	19.25	21.884	8.09	1.5	-1.4	81.47	13.2	
2/19/2008	15:01:09	19.24	22.025	8.09	0.7	-1.4	81.02	13.29	1.01
2/19/2008	15:16:10	19.25	22.054	8.09	0.9	-1.4	81	13.31	
2/19/2008	15:31:10	19.25	22.013	8.09	0.4	-1.4	80.93	13.29	
2/19/2008	15:46:09	19.26	22.033	8.09	0.8	-1.4	80.94	13.3	
2/19/2008	16:01:10	19.27	21.955	8.09	0.6	-1.5	81.29	13.25	
2/19/2008	16:16:09	19.28	21.868	8.09	0.8	-1.4	81.46	13.19	
2/19/2008	16:31:10	19.29	21.782	8.09	1.1	-1.4	81.74	13.13	
2/19/2008	16:46:10	19.3	21.679	8.09	-0.2	-1.4	82.15	13.07	
2/19/2008	17:01:10	19.31	21.567	8.09	0.8	-1.4	82.68	12.99	
2/19/2008	17:16:10	19.32	21.482	8.1	0.2	-1.4	82.78	12.94	
2/19/2008	17:31:11	19.33	21.397	8.1	0.5	-1.4	83.37	12.88	
2/19/2008	17:46:10	19.34	21.301	8.1	0.7	-1.4	83.66	12.82	
2/19/2008	18:01:10	19.35	21.213	8.1	0.5	-1.4	84.03	12.76	
2/19/2008	18:16:10	19.35	21.143	8.1	0.1	-1.5	84.17	12.71	
2/19/2008	18:31:10	19.35	21.094	8.09	0.3	-1.5	84.71	12.68	
2/19/2008	18:46:10	19.36	21.034	8.09	0.1	-1.4	84.82	12.64	
2/19/2008	19:01:10	19.36	20.997	8.09	0.8	-1.4	85.07	12.62	
2/19/2008	19:16:09	19.35	20.951	8.09	0.1	-1.4	85.22	12.59	
2/19/2008	19:31:09	19.35	20.888	8.09	0.5	-1.4	85.34	12.55	
2/19/2008	19:46:10	19.35	20.838	8.09	0.4	-1.5	85.46	12.52	
2/19/2008	20:01:09	19.35	20.797	8.09	0.3	-1.4	85.59	12.49	
2/19/2008	20:16:09	19.35	20.756	8.09	0.6	-1.4	85.79	12.46	
2/19/2008	20:31:10	19.34	20.71	8.09	0.9	-1.5	85.72	12.43	-0.07
2/19/2008	20:46:10	19.34	20.667	8.09	-0.7	-1.5	85.8	12.4	
2/19/2008	21:01:10	19.33	20.629	8.09	0.3	-1.4	85.95	12.38	
2/19/2008	21:16:09	19.32	20.576	8.09	0.8	-1.4	85.87	12.34	
2/19/2008	21:31:10	19.32	20.547	8.09	1.2	-1.4	85.84	12.33	
2/19/2008	21:46:10	19.31	20.523	8.09	0.5	-1.5	85.7	12.31	
2/19/2008	22:01:09	19.3	20.494	8.09	0.6	-1.4	85.58	12.29	
2/19/2008	22:16:10	19.29	20.465	8.09	0.3	-1.5	85.57	12.27	

Date M/D/Y	Time hh:mm:ss	Temp C	SpCond mS/cm	pH	Chlorophyll ug/L	Turbidity+ NTU	DO (%)	Salinity ppt	Tide ft
2/19/2008	22:31:10	19.28	20.437	8.09	-0.3	-1.5	85.41	12.25	
2/19/2008	22:46:10	19.27	20.444	8.1	0.4	-1.4	85.34	12.26	
2/19/2008	23:01:09	19.26	20.451	8.1	1	-1.4	85.05	12.26	
2/19/2008	23:16:09	19.25	20.488	8.1	0.7	-1.4	84.77	12.29	
2/19/2008	23:31:09	19.24	20.549	8.1	0.6	-1.4	84.53	12.33	
2/19/2008	23:46:09	19.23	20.671	8.1	0.3	-1.4	84.13	12.41	
2/20/2008	0:01:09	19.22	20.814	8.1	0.3	-1.4	83.73	12.5	
2/20/2008	0:16:09	19.21	20.989	8.09	0	-1.4	83.26	12.61	
2/20/2008	0:31:10	19.2	21.284	8.09	-0.5	-1.4	82.4	12.81	
2/20/2008	0:46:10	19.18	21.651	8.09	-0.3	-1.5	81.33	13.05	
2/20/2008	1:01:10	19.17	22	8.09	0.7	-1.4	80.36	13.28	
2/20/2008	1:16:10	19.15	22.378	8.08	0.5	-1.4	79.33	13.53	
2/20/2008	1:31:11	19.12	22.902	8.08	0.5	-1.4	77.92	13.87	
2/20/2008	1:46:10	19.09	23.288	8.07	1.1	-1.4	76.63	14.13	
2/20/2008	2:01:10	19.09	23.457	8.07	0.8	-1.5	75.83	14.24	
2/20/2008	2:16:09	19.08	23.631	8.07	-0.2	-1.4	75.65	14.36	
2/20/2008	2:31:10	19.06	23.821	8.07	-0.1	-1.4	75.37	14.48	
2/20/2008	2:46:10	19.05	24.016	8.07	-0.2	-1.3	75.01	14.61	
2/20/2008	3:01:09	19.05	24.169	8.07	-0.1	-1.4	74.04	14.71	
2/20/2008	3:16:10	19.11	24.672	8.06	1.1	-1.4	73.51	15.05	2.25
2/20/2008	3:31:10	19.09	25.385	8.06	0.9	-1.4	72.12	15.52	
2/20/2008	3:46:09	19.08	25.297	8.06	0.3	-1.4	72.47	15.46	
2/20/2008	4:01:10	19.09	24.918	8.06	0.3	-1.4	72.7	15.21	
2/20/2008	4:16:10	19.01	24.839	8.06	0.6	-1.4	72.29	15.16	
2/20/2008	4:31:09	19.03	25.004	8.06	-0.2	-1.5	71.88	15.27	
2/20/2008	4:46:10	19.07	25.252	8.05	-0.5	-1.4	71.34	15.43	
2/20/2008	5:01:10	19.07	25.26	8.06	0	-1.4	71.44	15.44	
2/20/2008	5:16:10	19.1	25.028	8.06	0.3	-1.4	72.36	15.28	
2/20/2008	5:31:10	19.13	24.515	8.07	0.5	-1.4	73.71	14.94	
2/20/2008	5:46:10	19.18	23.863	8.08	-0.3	-1.4	75.4	14.51	
2/20/2008	6:01:10	19.24	23.317	8.08	1.4	-1.4	77.11	14.15	
2/20/2008	6:16:10	19.28	22.903	8.09	0.2	-1.4	78.95	13.87	
2/20/2008	6:31:10	19.32	22.583	8.1	0.2	-1.5	80.27	13.66	
2/20/2008	6:46:10	19.35	22.37	8.1	0.5	-1.4	81.47	13.52	
2/20/2008	7:01:10	19.37	22.218	8.1	0	-1.4	82.35	13.42	
2/20/2008	7:16:09	19.39	22.094	8.11	0.1	-1.4	83.15	13.34	
2/20/2008	7:31:10	19.4	22.006	8.11	0.1	-1.5	83.84	13.28	
2/20/2008	7:46:09	19.41	21.965	8.11	0.7	-1.5	84.4	13.25	
2/20/2008	8:01:10	19.42	21.93	8.11	0	-1.5	84.84	13.23	
2/20/2008	8:16:10	19.43	21.893	8.11	0.6	-1.4	85.3	13.21	
2/20/2008	8:31:09	19.43	21.852	8.11	0.6	-1.5	85.47	13.18	
2/20/2008	8:46:10	19.43	21.804	8.11	0.5	-1.5	85.77	13.15	

Date M/D/Y	Time hh:mm:ss	Temp C	SpCond mS/cm	pH	Chlorophyll ug/L	Turbidity+ NTU	DO (%)	Salinity ppt	Tide ft
2/20/2008	9:01:10	19.43	21.736	8.11	-0.4	-1.5	86.05	13.1	
2/20/2008	9:16:10	19.43	21.675	8.1	0.9	-1.5	86.28	13.06	
2/20/2008	9:31:11	19.43	21.625	8.1	0.7	-1.5	86.2	13.03	
2/20/2008	9:46:10	19.42	21.613	8.1	0.2	-1.4	86.26	13.02	
2/20/2008	10:01:10	19.41	21.565	8.1	0.3	-1.4	86.17	12.99	
2/20/2008	10:16:09	19.4	21.525	8.1	0.6	-1.5	86.03	12.96	-0.01
2/20/2008	10:31:10	19.39	21.457	8.1	0.2	-1.5	85.91	12.92	
2/20/2008	10:46:10	19.38	21.417	8.1	0.7	-1.4	85.93	12.89	
2/20/2008	11:01:10	19.38	21.362	8.1	0	-1.5	85.76	12.86	
2/20/2008	11:16:09	19.36	21.32	8.1	0.8	-1.5	85.59	12.83	
2/20/2008	11:31:09	19.35	21.288	8.1	-0.1	-1.4	85.28	12.81	
2/20/2008	11:46:10	19.34	21.257	8.1	0.5	-1.5	85.28	12.79	
2/20/2008	12:01:09	19.34	21.238	8.1	0.4	-1.5	85.19	12.78	
2/20/2008	12:16:10	19.33	21.229	8.1	-0.4	-1.4	84.93	12.77	
2/20/2008	12:31:10	19.32	21.232	8.1	0.6	-1.4	84.72	12.77	
2/20/2008	12:46:10	19.31	21.24	8.1	0.5	-1.4	84.65	12.78	
2/20/2008	13:01:10	19.31	21.279	8.1	1	-1.4	84.39	12.8	
2/20/2008	13:16:09	19.3	21.285	8.1	0.7	-1.4	84.15	12.81	
2/20/2008	13:31:10	19.3	21.326	8.1	0.8	-1.4	83.77	12.83	
2/20/2008	13:46:10	19.29	21.408	8.1	0.2	-1.4	83.61	12.89	
2/20/2008	14:01:10	19.28	21.493	8.1	1.2	-1.5	83.08	12.94	
2/20/2008	14:16:09	21.09	21.381	8.08	-0.1	-0.6	86.95	12.86	ft