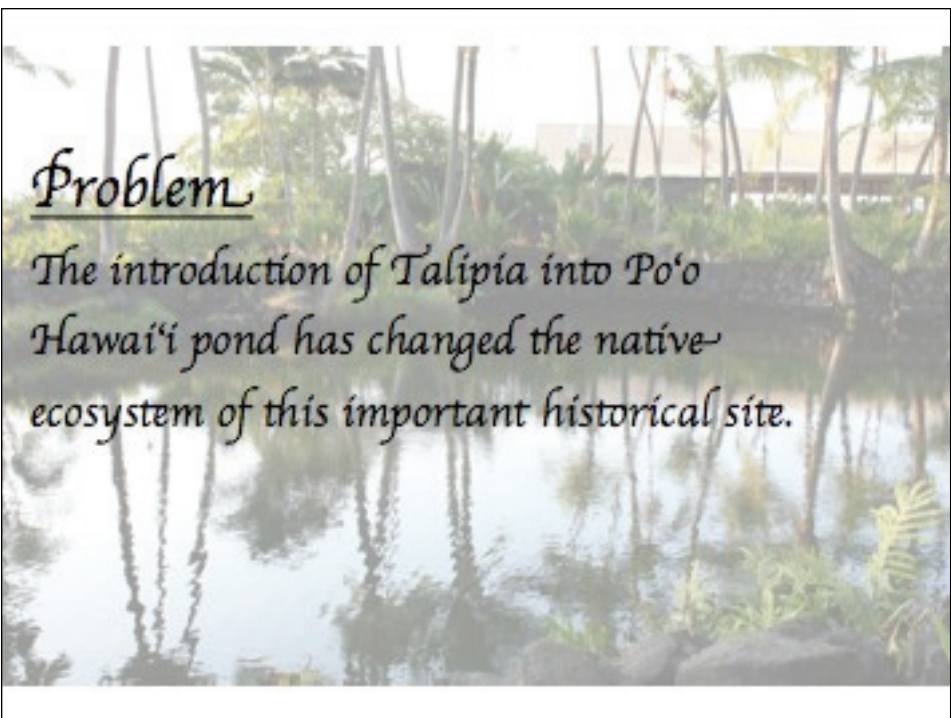


Po'o Hawai'i

Ke Kula 'o 'Ehunuikaimalino

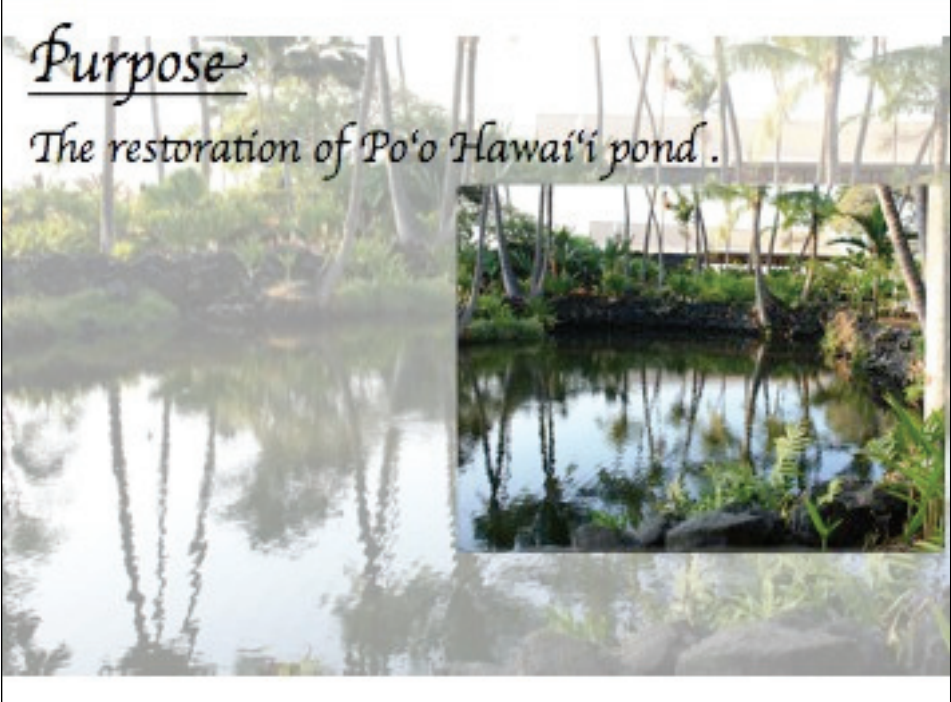


In ancient times the Mo'i Waialeale (Queen) would come to bathe at Po'o Hawai'i at sunset, no one was allowed to look upon the pond at that time.



Problem


*The introduction of *Talipia* into Po'o Hawai'i pond has changed the native ecosystem of this important historical site.*



Purpose

The restoration of Po'o Hawai'i pond.



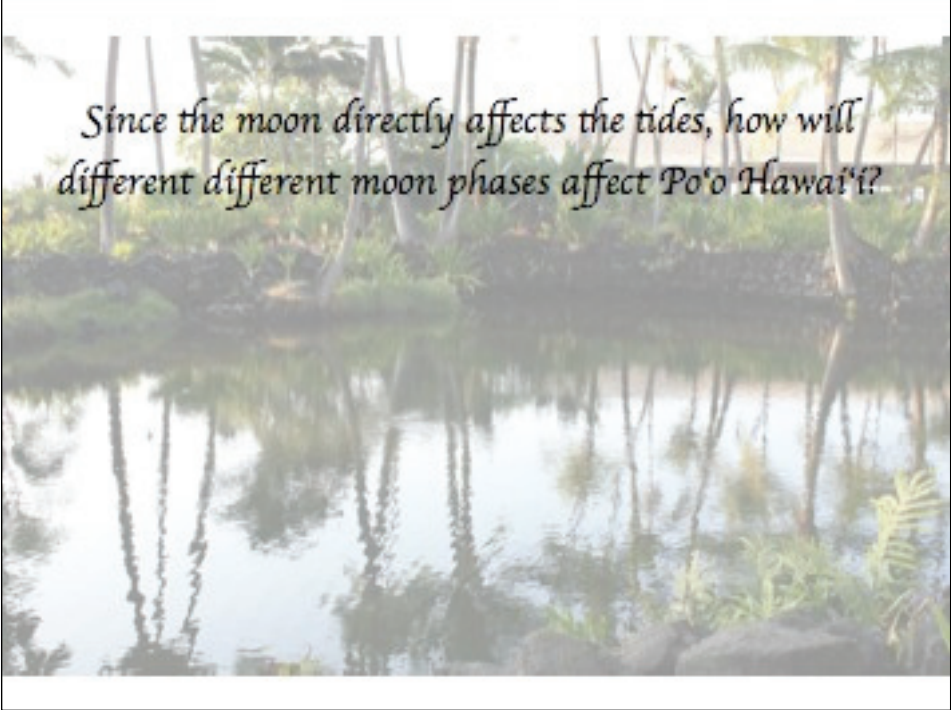


Projects

Water Quality Measurements

Invertebrate Survey

Fish Survey



Since the moon directly affects the tides, how will different moon phases affect Po'o Hawai'i?

Water Quality Parameters

- ◆ Temperature
- ◆ Salinity
- ◆ pH
- ◆ Nitrate
- ◆ Turbidity
- ◆ Dissolved Oxygen

Materials/Apparatus

- Distilled water
- Graphing calculator
- Probes
- Cups
- Stop watch
- Notes/composition book
- pen/pencil
- Po'o Hawai'i Pond
- GPS





Due to the size of Po'o Huiwai'i, 11 stations were set up around the pond and one station off shore to collect water samples. These locations were identified and recorded using a GPS.

Sample Sites

| Station | Location |
|----------|----------------------------|
| Offshore | N 19° 34.696 W 155° 58.024 |
| 1 | N 19° 34.703 W 155° 58.053 |
| 2 | N 19° 34.710 W 155° 58.048 |
| 3 | N 19° 34.709 W 155° 58.045 |
| 4 | N 19° 34.703 W 155° 58.043 |
| 5 | N 19° 34.698 W 155° 58.042 |
| 6 | N 19° 34.696 W 155° 58.048 |
| 7 | N 19° 34.693 W 155° 58.049 |
| 8 | N 19° 35.689 W 155° 58.056 |
| 9 | N 19° 34.700 W 155° 58.051 |
| 10 | N 19° 34.702 W 155° 58.053 |
| 11 | N 19° 34.702 W 155° 58.055 |

Temperature

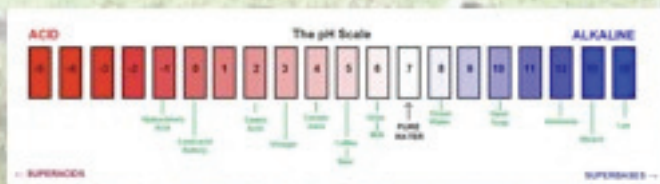
- ◆ Tidal height
Inverse relationship - During low tides the temperature is slightly higher, at high tide the temperature is slightly lower. The temperature range is
- ◆ Sunlight
The temperature of the pond is relatively stable during the day due to the fresh water spring located on the mizuka side of the pond.
- ◆ Biomass
Based on observations, Po'o Hawai'i pond is home to a large population of organisms; however, the spring and tidal circulation maintains stable temperatures.
- ◆ Flow rates of spring
During low tides there is an increase in the flow rate at the fresh water spring, during high tides there is an increase in the flow rate of seawater into the pond.

Question:

How does the pH affect Po'o Hawai'i Pond.

Hypothesis:

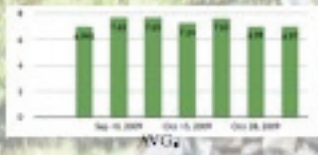
If the tide is high then the pH will be lower when compared to the pH at a high tide.



pH Data

Variable Po'o Hawai'i Pond

| STATION | SEP 4, 2009 | SEP 14, 2009 | SEP 24, 2009 | SEP 30, 2009 | OCT 11, 2009 | OCT 21, 2009 | OCT 31, 2009 | NOV 4, 2009 |
|---------|-------------|--------------|--------------|--------------|--------------|--------------|--------------|-------------|
| 1 | 6.4 | 7.07 | 7.17 | 6.55 | 7.17 | 6.75 | 6.75 | 6.92 |
| 2 | 6.7 | 7.02 | 7.24 | 7.02 | 7.04 | 6.75 | 6.92 | 6.86 |
| 3 | 7.04 | 7.02 | 7.24 | 7.12 | 7.02 | 6.94 | 6.94 | 6.75 |
| 4 | 6.4 | 7.02 | 7.02 | 7.02 | 7.02 | 6.92 | 6.92 | 6.97 |
| 5 | 7.0 | 7.02 | 7.02 | 7.04 | 7.07 | 6.92 | 6.92 | 7.02 |
| 6 | 7.1 | 7.02 | 7.02 | 7.02 | 7.02 | 7.02 | 7.02 | 7.07 |
| 7 | 7.02 | 7.02 | 7.02 | 7.02 | 7.02 | 7.12 | 7.12 | 7.12 |
| 8 | 7.1 | 7.07 | 7.04 | 7.02 | 7.07 | 7.02 | 7.02 | 7.17 |
| 9 | 7.0 | 7.07 | 7.02 | 7.02 | 7.02 | 7.02 | 7.02 | 7.24 |
| 10 | 7.0 | 7.02 | 7.07 | 7.07 | 7.02 | 7.07 | 7.07 | 7.24 |
| 11 | 7.0 | 7.07 | 7.02 | 7.02 | 7.02 | 7.02 | 7.02 | 7.02 |
| AVG | 6.99 | 7.02 | 7.02 | 7.04 | 7.02 | 6.92 | 6.92 | 6.97 |



At Po'o Hawai'i pH ranged from 6.2 to 7.67
Offshore pH ranged from 6.35 to 7.01

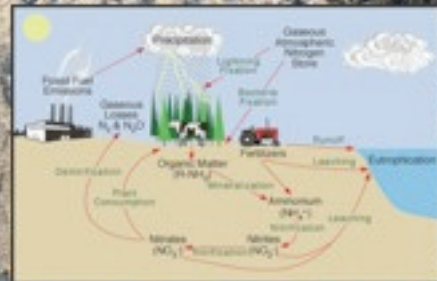
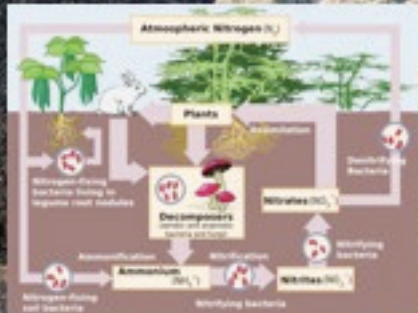
pH

- The pH is reasonable and acceptable for the life in Po'o Hawai'i pond. The pH is very balanced for having so much vog and acid form the volcano. The pH in the water is primarily influenced by the photosynthesis and respiration. During the night hours the plants and animals produce carbon dioxide through respiration, lowering the pH but in the day the plants use carbon dioxide in photosynthesis increasing the pH levels in the pond. I accept my hypothesis because the data that I collected supports my hypothesis. The data to support my hypothesis is that during a high tide the pH was lower than most times it was 6.945, 6.97 and 7.63. And during low tide the pH was higher than usual, it was 7.24 and 6.99. During mean tides the pH was exactly the same, the numbers were 7.65 and 7.65.

Dissolved Oxygen

Dissolved oxygen levels ranged from 6.2 ppm to 8.5 ppm. This range of DO can adequately support the organisms in the pond. During low tide the DO levels dropped, and during high tide the DO levels increased. DO levels in the pond are affected by rate of photosynthesis and respiration. During the day DO levels increase throughout the day due to photosynthesis, at night DO levels drop due to the respiration of plants and animals in the pond.

The Nitrogen Cycle





Question:

How does the nitrate levels fluctuate in Po'o Hawai'i Pond ?

Hypothesis:

Nitrates levels are influenced by waste products produced by organisms in the pond and vegetation that decomposes in the pond. During high tides nitrate levels dropped, while at low tides nitrate levels tended to increase.

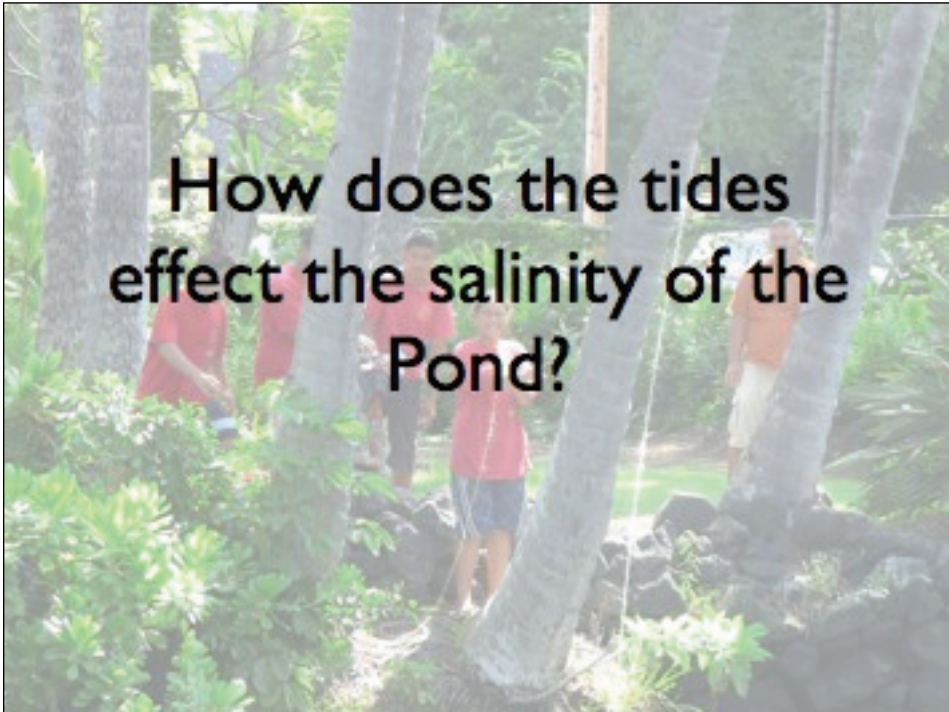


Nitrates in Po'o Hawai'i Pond
Nitrate acts as a nutrient for
the phytoplankton & seaweed
in the pond.

Nitrate levels ranged from 1 (ppm) part per million to 6.1 ppm.



How does the tides effect the salinity of the Pond?



Salinity Data

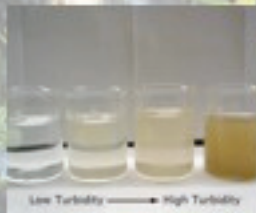
- Salinity is a measure of the total amount of dissolved solids in water, and since salts make up approximately 99% of these solids, it is usually the only compound that is considered. Salinity is usually measured as grams (1 g) per kilogram (1000 G) of water or parts per thousand (ppt). A salinity of 34ppt is the average for tropical oceans.
- Salinity increased at low tide and decreased during high tide. There is a higher level of dissolved solids at low tide than at high tide.
- The salinity ranged from 6.0 ppt to 11.8 ppt.

What is 'Turbidity'?

Turbidity is the cloudiness or haziness of the pond caused by particles that fall into the pond or from the waste of the organisms living within the pond. The higher the turbidity, the murkier the water and when the turbidity is lower, the water is less murky.

Turbidity (NTU)

250 100 50 25 10



Collecting Turbidity Data

QUESTION:
How does the tides affect the turbidity of Po'o Hawai'i Pond?

HYPOTHESIS:
If the tides are high, then the turbidity would be low compared to the turbidity at high tide.

PROCEDURE:
To collect the turbidity data, I connected the turbidity probe into the graphing calculator. After whoever had collected the water samples using the rope to lower the cup into the pond and scooping the water, I calculated the turbidity by putting the probe into the cup. I used the stop watch to keep accurate data and then waited a minute to determine the turbidity. Then, eventually I will compare the turbidity from the turbidity data calculated from the pond at 'Ehunu-kaimalo.

To determine the turbidity of the pond, the materials/ apparatus I used were:

- Graphing Calculator
- Turbidity Probe
- Pen/Pencil
- Distilled Water
- Stop Watch



CONCLUSION:
In conclusion, the turbidity is appropriate for Po'o Hawai'i Pond at Keauhou. Therefore, I accept my hypothesis. When the tide arose, the turbidity dropped low making the water not as murky as a low tide and while the tide ebbed the turbidity increased causing the water to become more murkier. While the tide was at an average height, the turbidity was average as well. The murk comes from the foliage. As it falls into the pond from up above the pond, it begins to break down becoming murk that lays at the bottom of the pond. Also, the murk comes from the living organisms living in the pond, when they dispose of their waste it would sink to the bottom. With high turbidity levels, it can reduce the amount of light reaching lower depths, which can inhibit growth of organisms affecting the organisms.

The Averages Of The Ponds

AVERAGE TURBIDITY (NTU)



■ Average (Po'o Hawai'i Pond)
■ Average (School Pond)

| DATE | WEEK 1 | WEEK 2 | WEEK 3 | WEEK 4 | WEEK 5 |
|--------------------------|--------|--------|--------|--------|--------|
| AVERAGE PO'O HAWAII POND | 100 | 140 | 150 | 140 | 180 |
| AVERAGE SCHOOL POND | 170 | 100 | 130 | 150 | 130 |

After each week we attended Po'o Hawai'i Pond, I calculated the averages between the Pond at our school and Po'o Hawai'i Pond. The table and graph above shows both averages.

Data Collected in 5 Weeks

Turbidity data from Polo Hawaii Pond.

| Station | Sept. 16 | Sept. 17 | Oct. 18 | Oct. 21 | Oct. 28 |
|----------|----------|----------|---------|---------|---------|
| 1 | 14.00 | 22.00 | 26.00 | 22.00 | 29.00 |
| 2 | 22.00 | 22.00 | 28.00 | 17.00 | 47.00 |
| 3 | 19.00 | 28.00 | 26.00 | 19.00 | 61.00 |
| 4 | 49.00 | 27.00 | 30.00 | 26.00 | 35.00 |
| 5 | 30.00 | 34.00 | 32.00 | 44.00 | 25.00 |
| 6 | 29.00 | 29.00 | 35.00 | 29.00 | 25.00 |
| 7 | 21.00 | 21.00 | 20.00 | 21.00 | 40.00 |
| 8 | 25.00 | 25.00 | 21.00 | 30.00 | 36.00 |
| 9 | 22.00 | 34.00 | 32.00 | 29.00 | 28.00 |
| 10 | 21.00 | 41.00 | 38.00 | 27.00 | 27.00 |
| 11 | 23.00 | 40.00 | 27.00 | 28.00 | 28.00 |
| Average | 24.93 | 31.81 | 32.00 | 27.46 | 35.54 |
| Low/High | Average | Average | Low | High | Low |



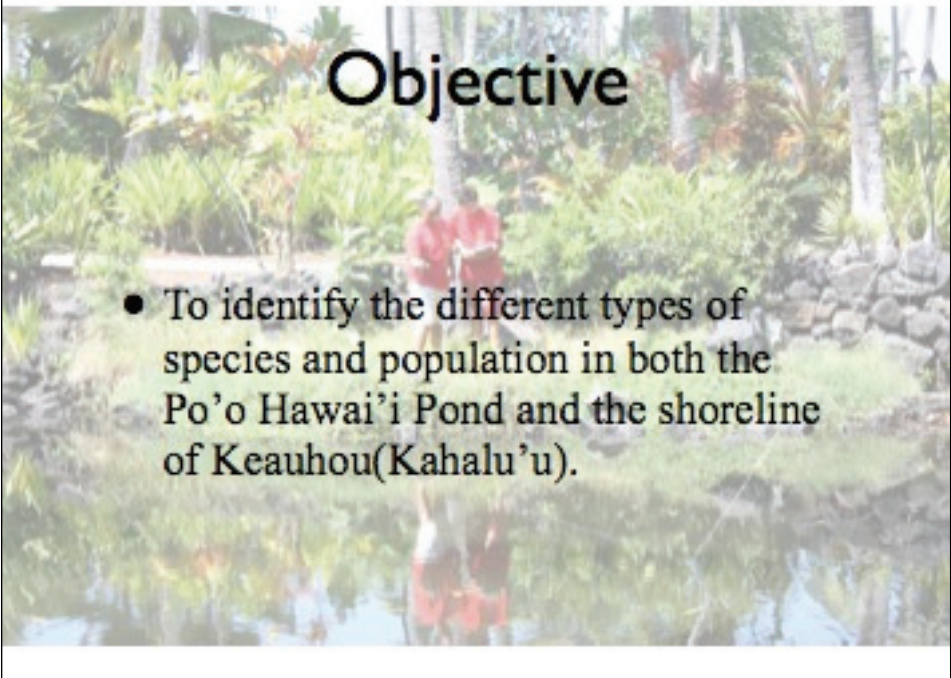
Turbidity data from Our school Pond.

| Station | Sept. 16 | Sept. 17 | Oct. 18 | Oct. 21 | Oct. 28 |
|---------|----------|----------|---------|---------|---------|
| 1 | 45.00 | 28.00 | 27.00 | 36.00 | 30.00 |
| 2 | 28.00 | 23.00 | 28.00 | 27.00 | 29.00 |
| 3 | 41.00 | 18.00 | 23.00 | 21.00 | 22.00 |
| Average | 41.66 | 22.00 | 27.63 | 24.33 | 27.00 |




Invertebrate Survey





Objective

- To identify the different types of species and population in both the Po'o Hawai'i Pond and the shoreline of Keauhou(Kahalu'u).



Procedure

- Make observations and analyze upon the shoreline of Keauhou(Kahalu'u) to identify the different types of invertebrates and, to estimate the population. Then, investigate the Po'o Hawai'i Pond for similar, or different results of invertebrates to determine the comparison between the ocean, and the pond.

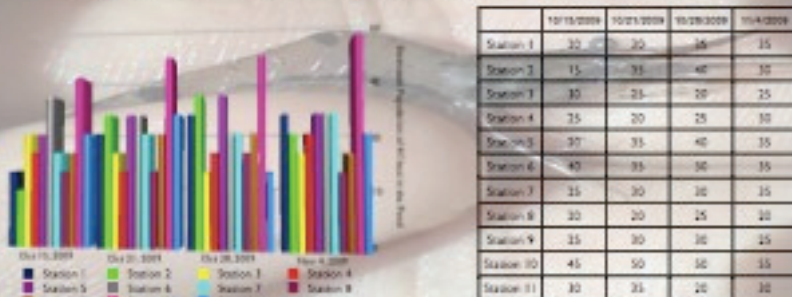
Population Data

- The different types of invertebrates identified in Po'o Hawai'i pond are Hi'iwai, 'A'ama crab, and 'opae (shrimp).
- The total population of invertebrates in general within the pond is approximately 500-600.
- Along the shoreline is estimated at approximately 10,000+.

| | 10/15/2009 | 10/21/2009 | 10/28/2009 | 11/4/2009 |
|------------|------------|------------|------------|-----------|
| Station 1 | 20 | 10 | 15 | 15 |
| Station 2 | 15 | 35 | 40 | 10 |
| Station 3 | 30 | 25 | 20 | 25 |
| Station 4 | 25 | 20 | 25 | 30 |
| Station 5 | 20 | 35 | 40 | 15 |
| Station 6 | 40 | 35 | 30 | 15 |
| Station 7 | 25 | 30 | 30 | 15 |
| Station 8 | 20 | 20 | 25 | 20 |
| Station 9 | 25 | 30 | 30 | 25 |
| Station 10 | 45 | 50 | 50 | 55 |
| Station 11 | 30 | 35 | 20 | 30 |

Population Data

- The total population of invertebrates in general within the pond is approximately 500-600.
- Along the shoreline is estimated at approximately 10,000+.



Mahalo Kohala Center

