Kahana Bay

Multi-Increment Sampling

Introduction

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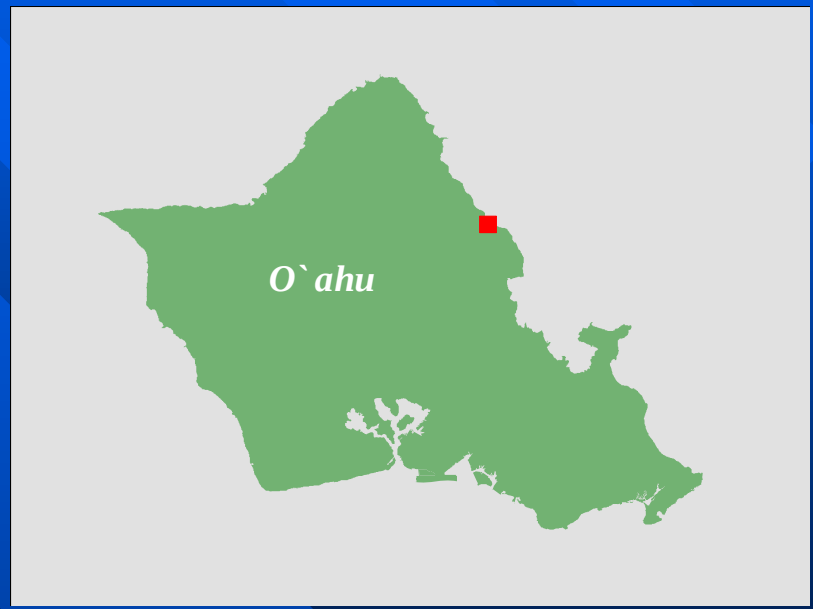
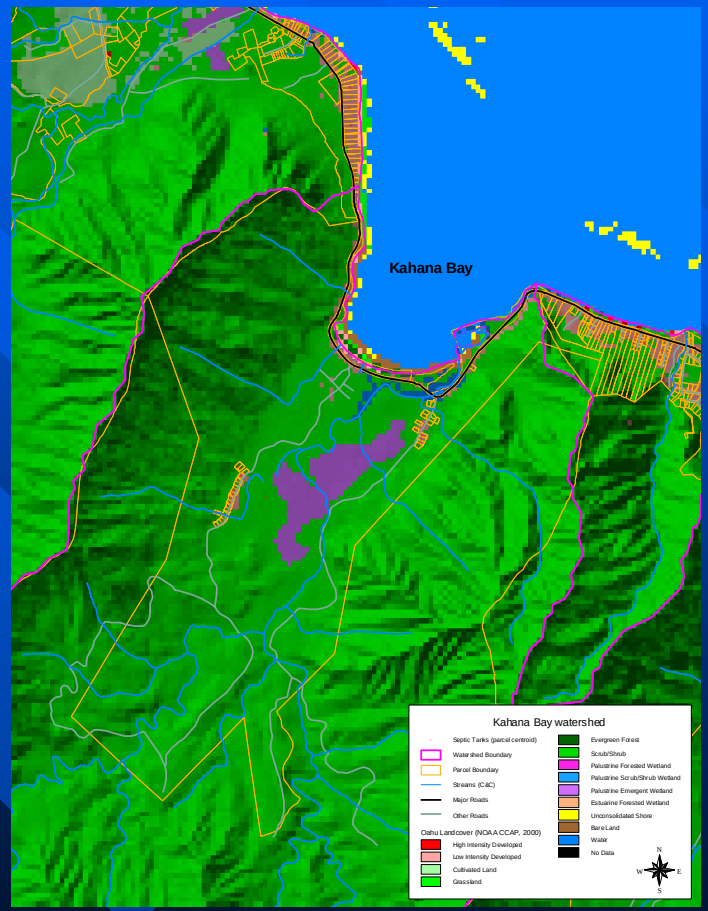
Location

- Kahana Bay is located on the windward side of Oahu. Watershed of 5300 acres is relatively unspoiled. Ahupua'a O Kahana State Park is the only publicly owned ahupua'a in the State.



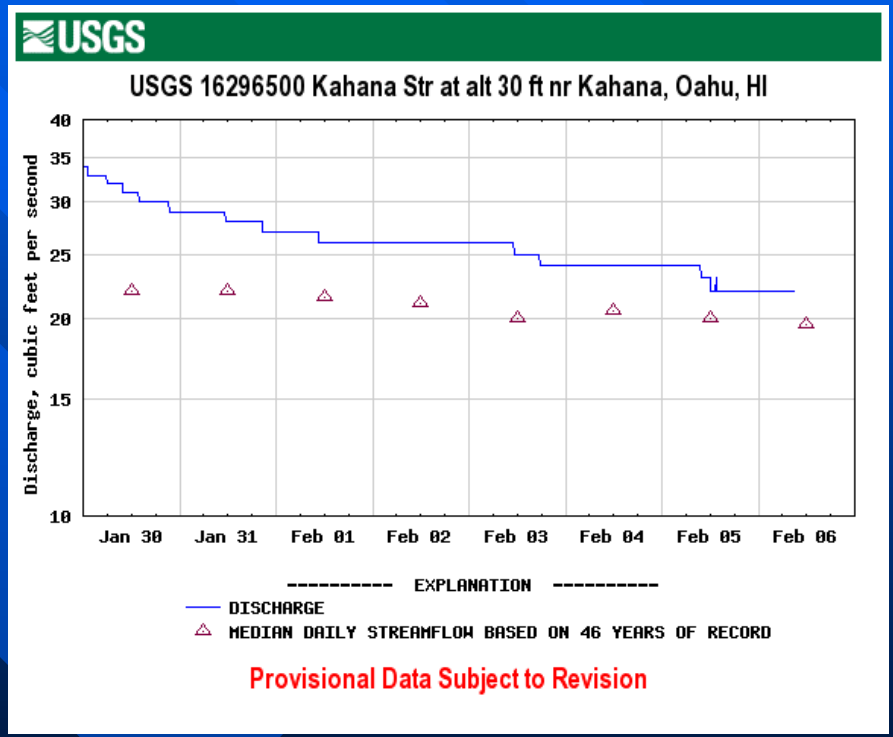
Kahana Valley Land Use

- Very little houses in valley. Red dot indicates septic system. Kahana Valley is a Living Park. Nurture and foster native Hawaiian culture, spread knowledge and values of its ways.



Hydrology

- Kahana Valley is one of the wettest valleys on Oahu with 237 inches per year. Stream flow is about 23 cubic feet/sec. Overcast skies and showers are frequent. Prevailing trades cool the bay and valley.



BEACH Act of 2000

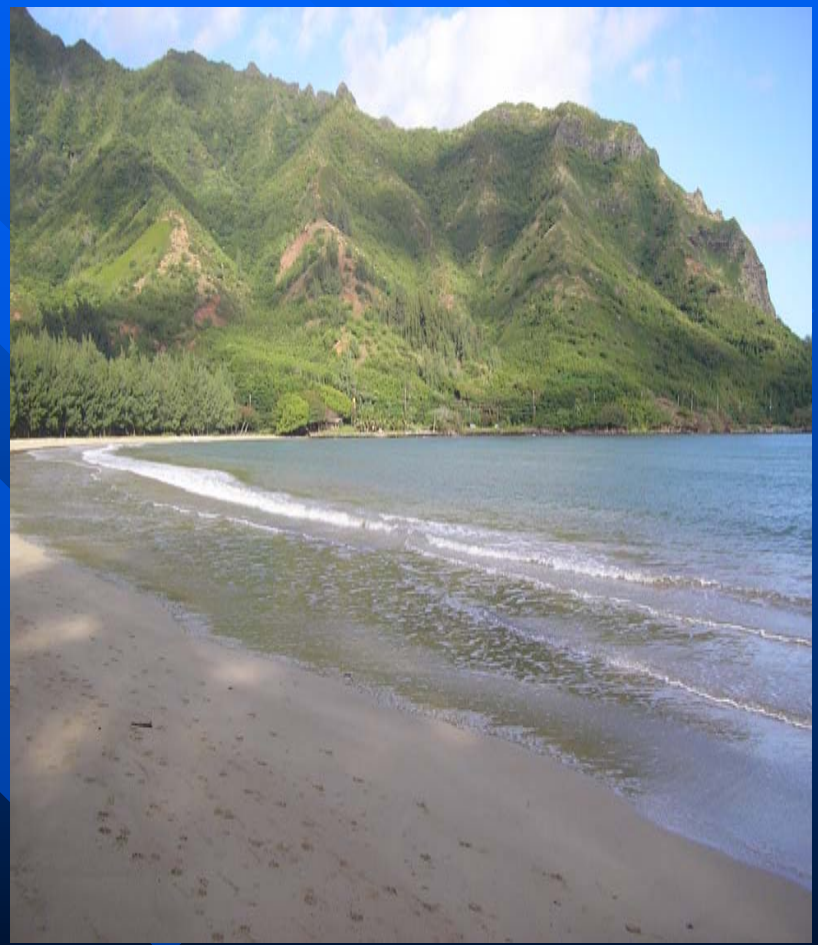
- The Beaches Environmental Assessment and Coastal Health Act of 2000 required states w/coastal recreational waters to adopt prior to April 10, 2004 WQ criteria and standards for the coastal recreational waters for those pathogens and pathogen indicators as indicated by EPA's *Ambient Water Quality Criteria for Bacteria-1986 (EPA 440/5-84-002, January 1986)*

Enterococci

- Aerobic bacteria
- Can survive 3 hrs in sunlight
- Establish itself in soil, held in check by other microorganisms utilizing available nutrients and by producing by products that inhibit Enterococci growth
- Persistent and opportunistic; waits for nutrient source to trigger growth. Under natural conditions growth is slow
- Has the tendency to clump together and to congregate on particles.
- Rats, Chicken, Mice, Pig, Pigeons, and Ducks contribute high levels in their feces.

Kahana Beach

- Clean Beaches Council, 2005 State of the Beach Report: Bacteria and Sand a National Call to Action. Low sloped beaches with fine sand and a high beach water table are sick beaches.



Makaha Beach

- High slope beach- healthy beach

Questions

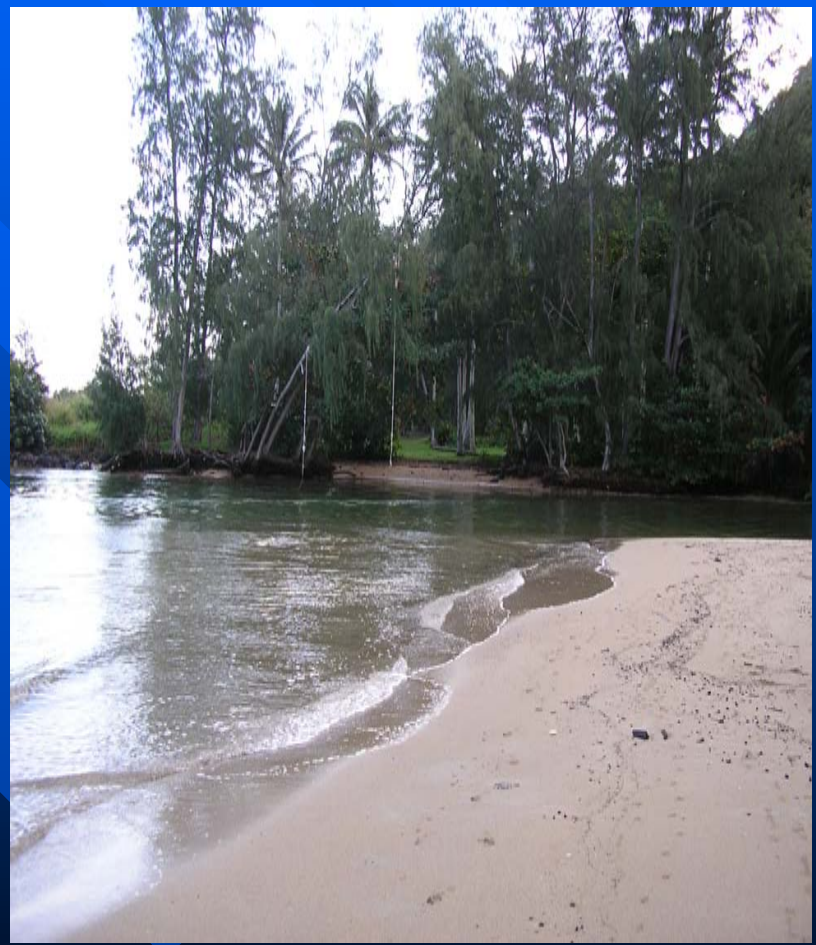
- Does it make a difference where a sample is taken in the bay?
- Can a discrete sample be representative of the water in Kahana Bay?
- Does timing of sampling make any difference?
- Does multi-increment sampling give better results than discrete sampling?

Boat ramp

- For many years our sampling station was at the boat ramp. It was not a clean area of the bay. Debris, trash, fish parts, and a restroom overlooking the parking and shower area.

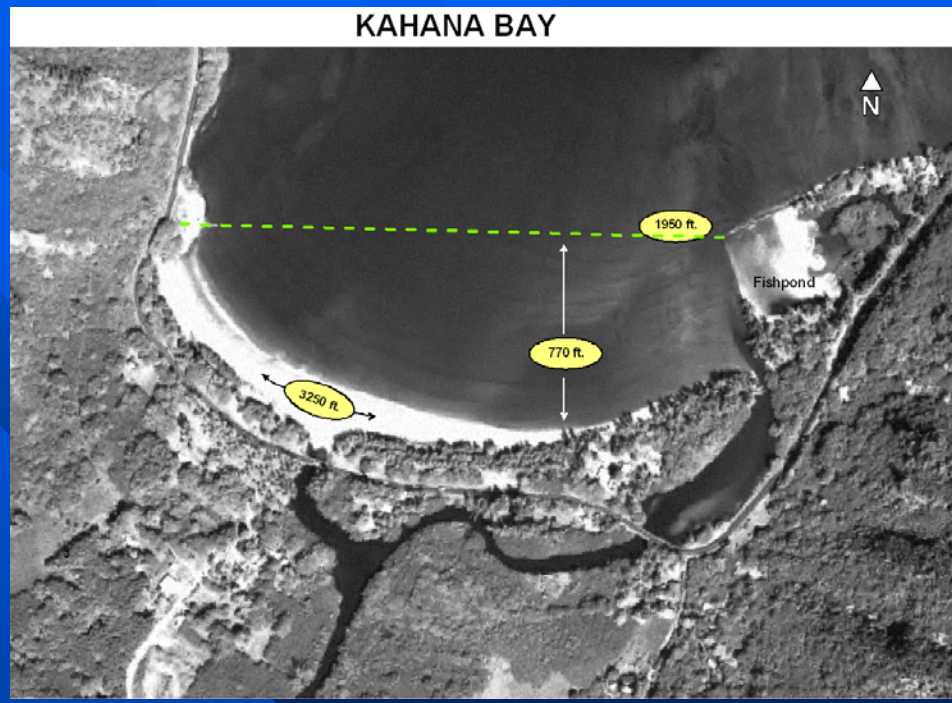
Kahana Stream

- Maybe we could go to the other side of the bay by the fishpond, where Kahana Stream comes out. From past experience, we know that streams are not good sampling sites. So we settled for the middle of the beach.



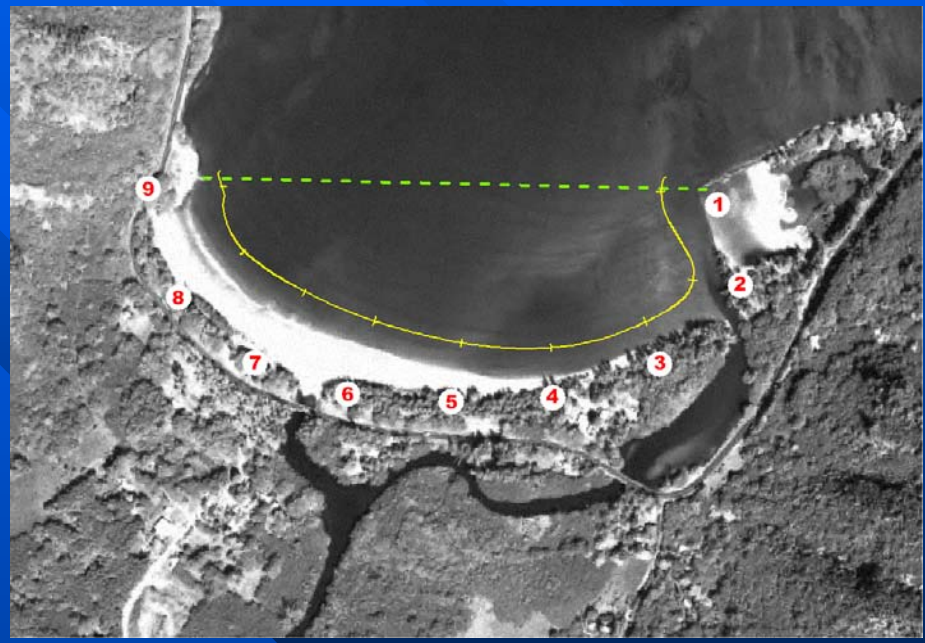
Kahana Bay

- Layout of Kahana Bay, establishing the boundaries.



Station Locations

- Layout of shore stations and waist deep stations.



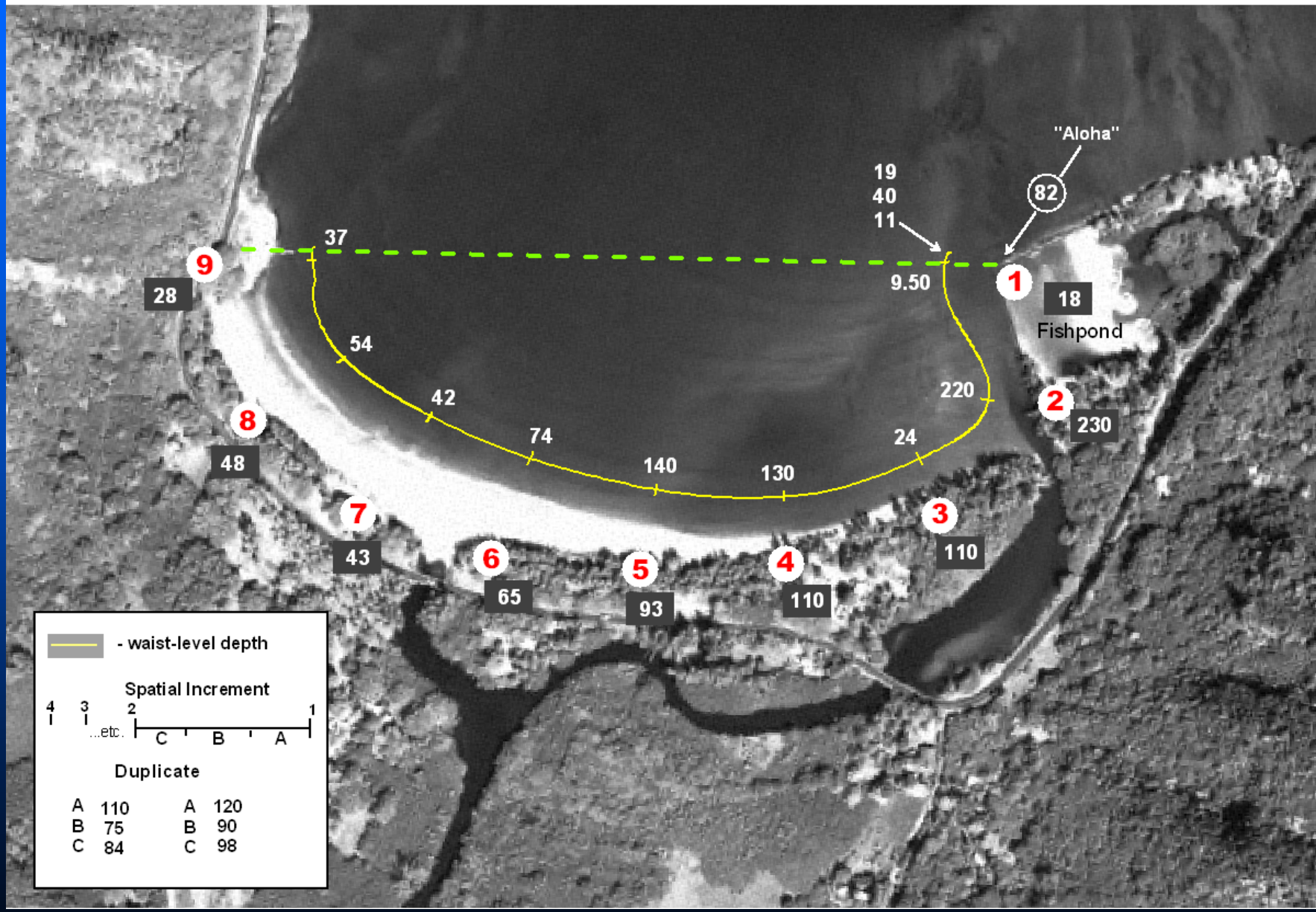
Aloha Sampler

- Aloha sampler is a 1 liter sample bottle with 2 holes drilled into cap of bottle. Hole is about ¼ inch in diameter. Standard 1 liter bottle on left. Developed by Terry Teruya and Chuck Ramsey of Envirostat.

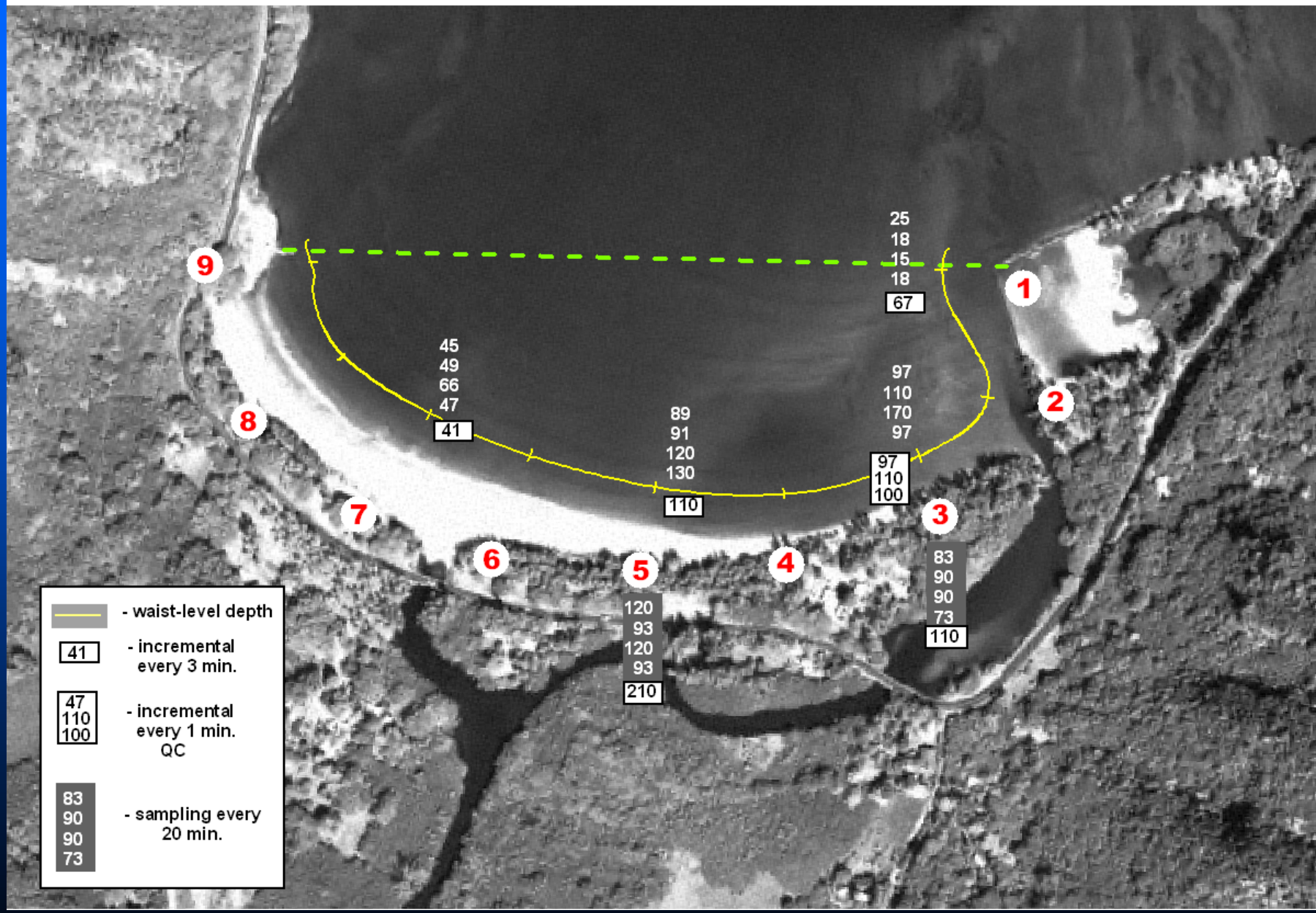
Shin Deep Sample

- Sample taken shin deep and timed for increment.

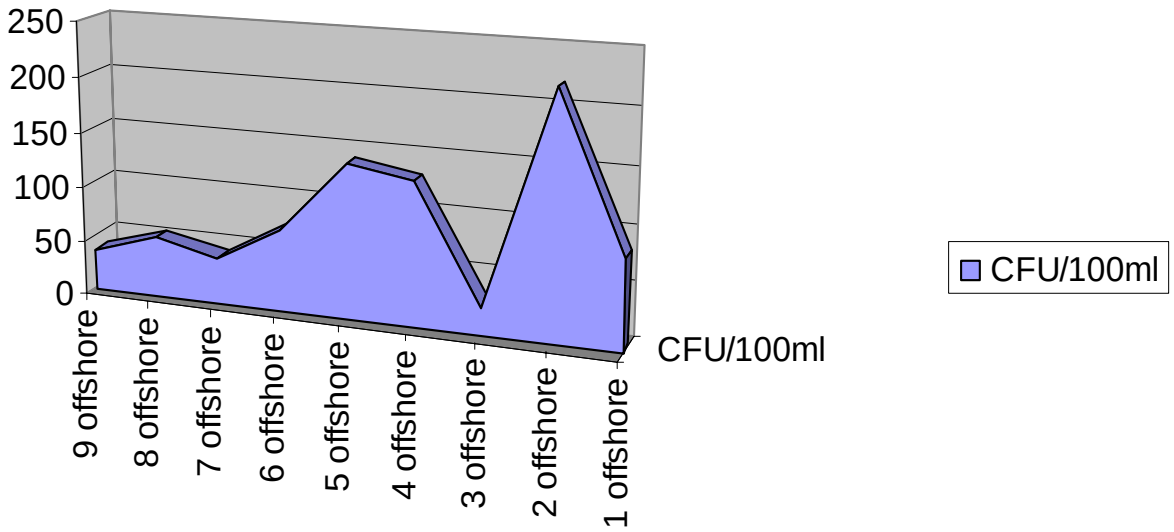
KAHANA BAY - SPATIAL INCREMENTAL SAMPLING 12/14/05



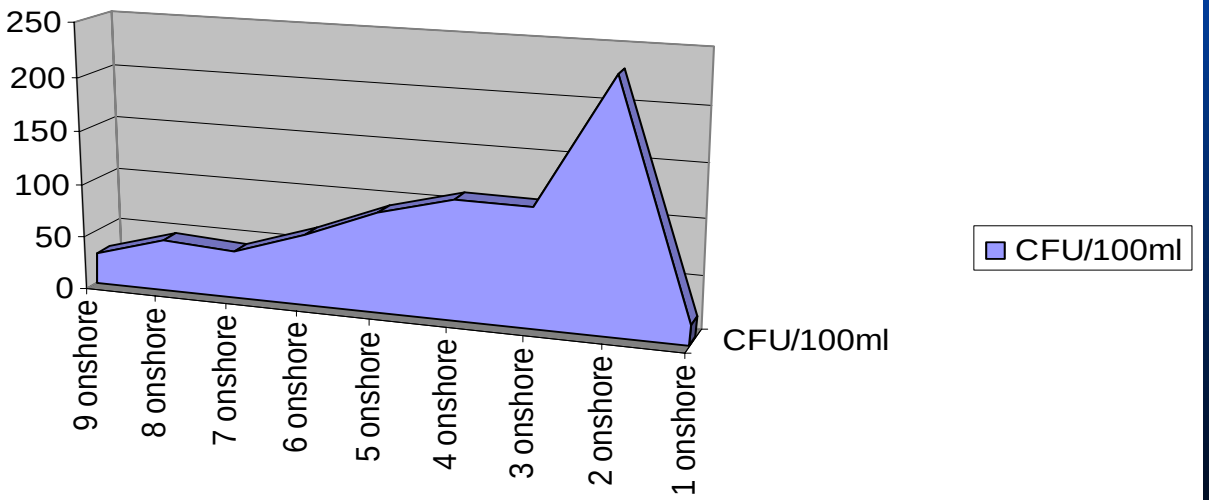
KAHANA BAY - TIME INCREMENTAL SAMPLING 1/4/06

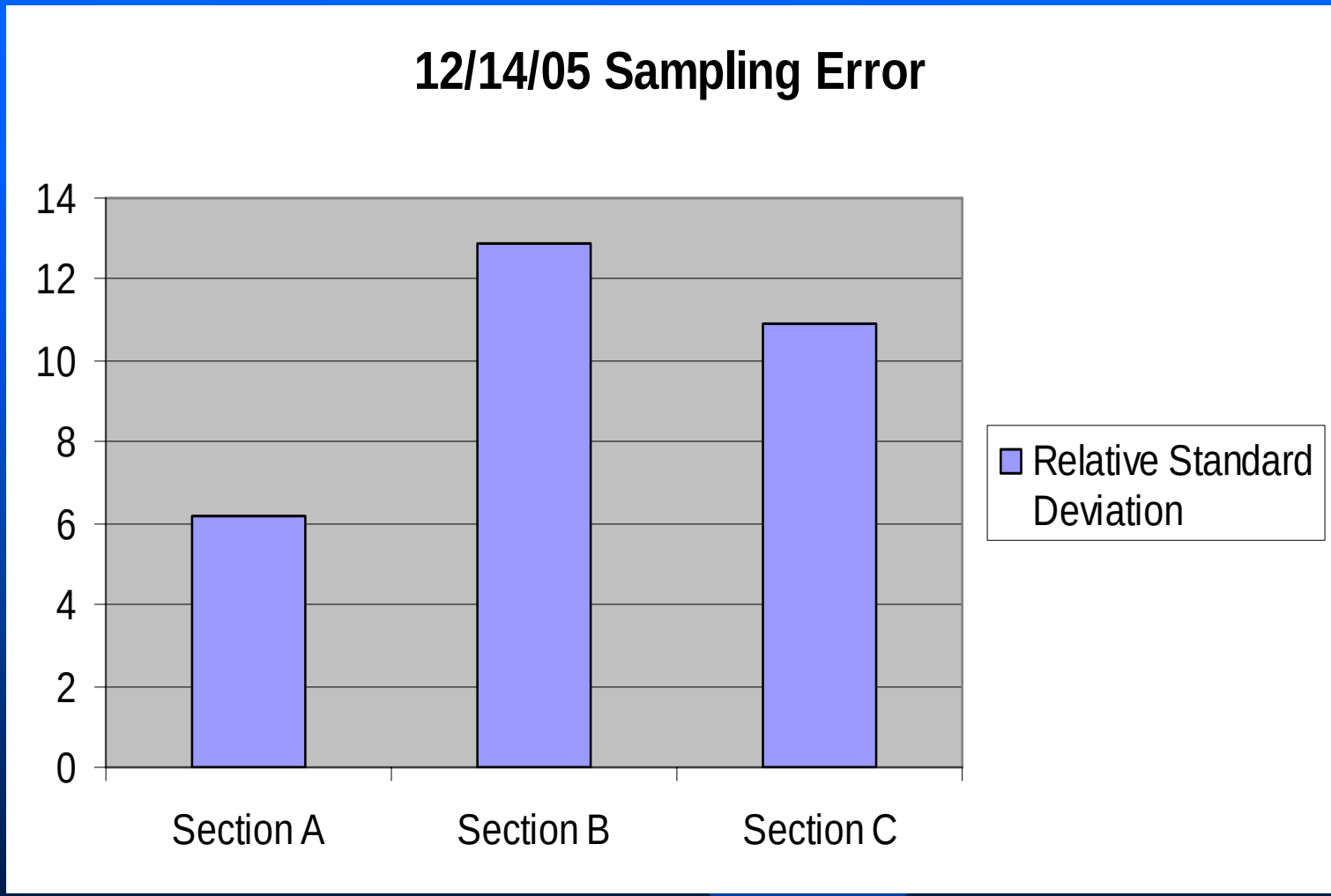


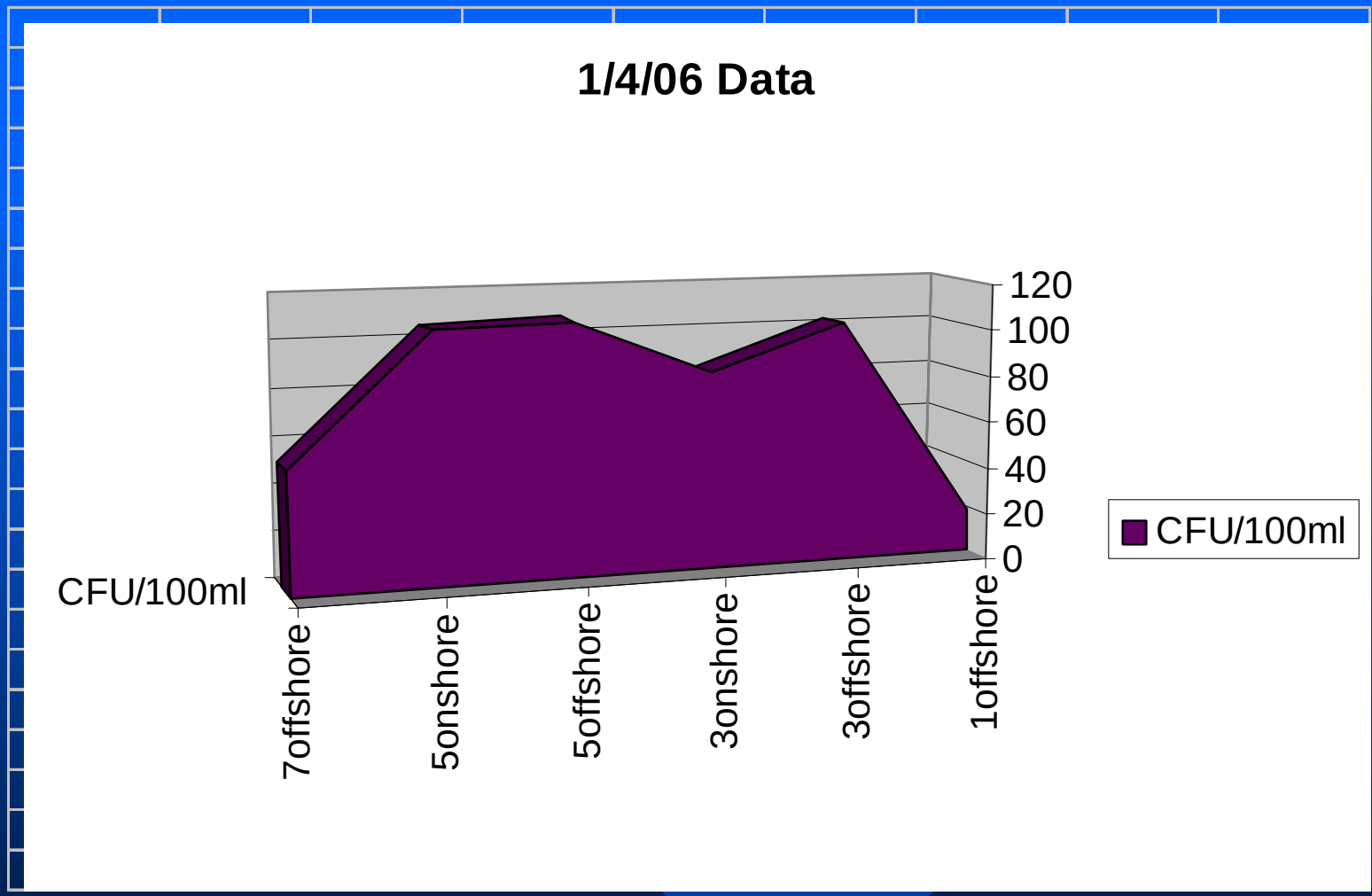
12/14/05 offshore data

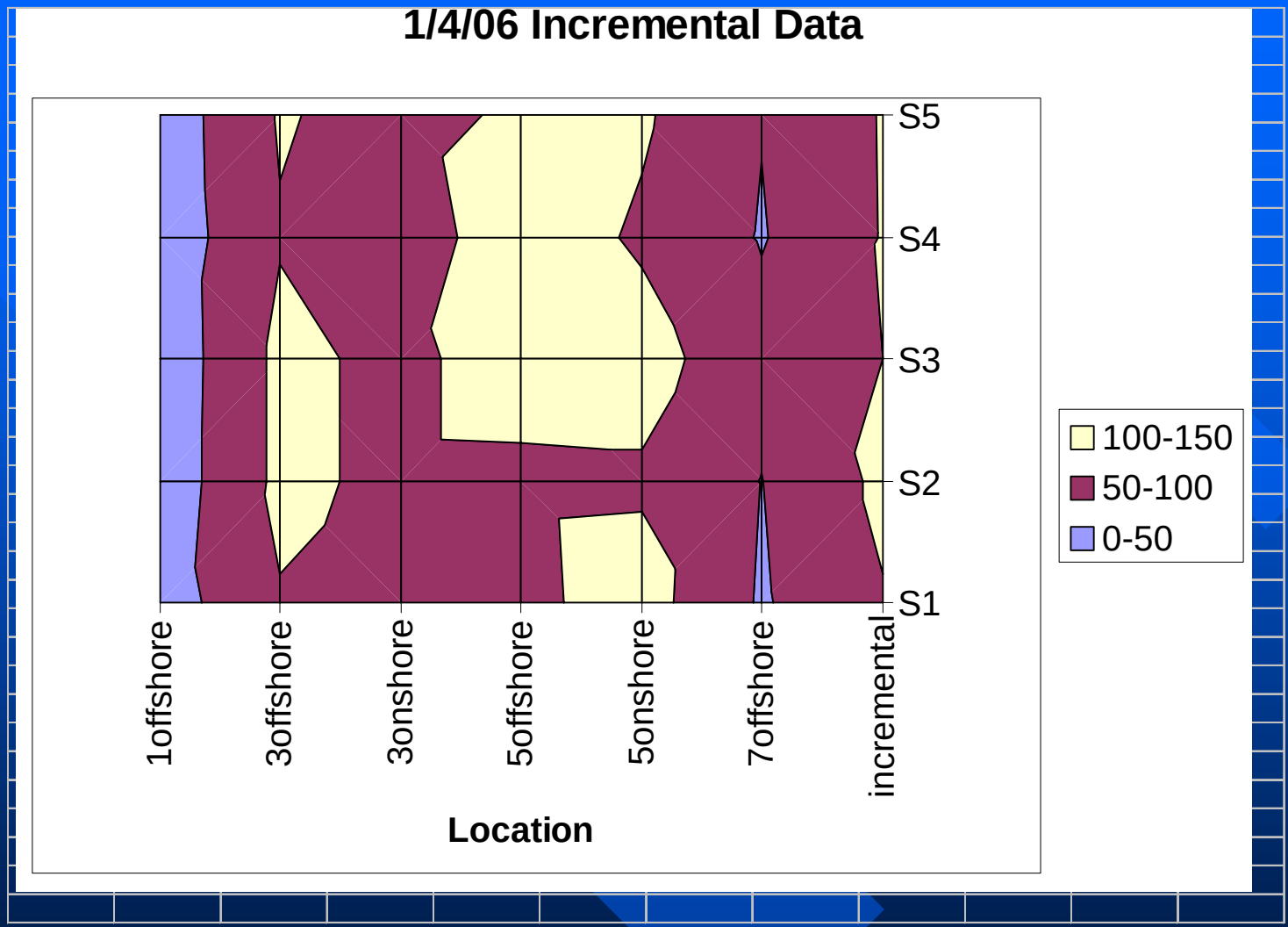


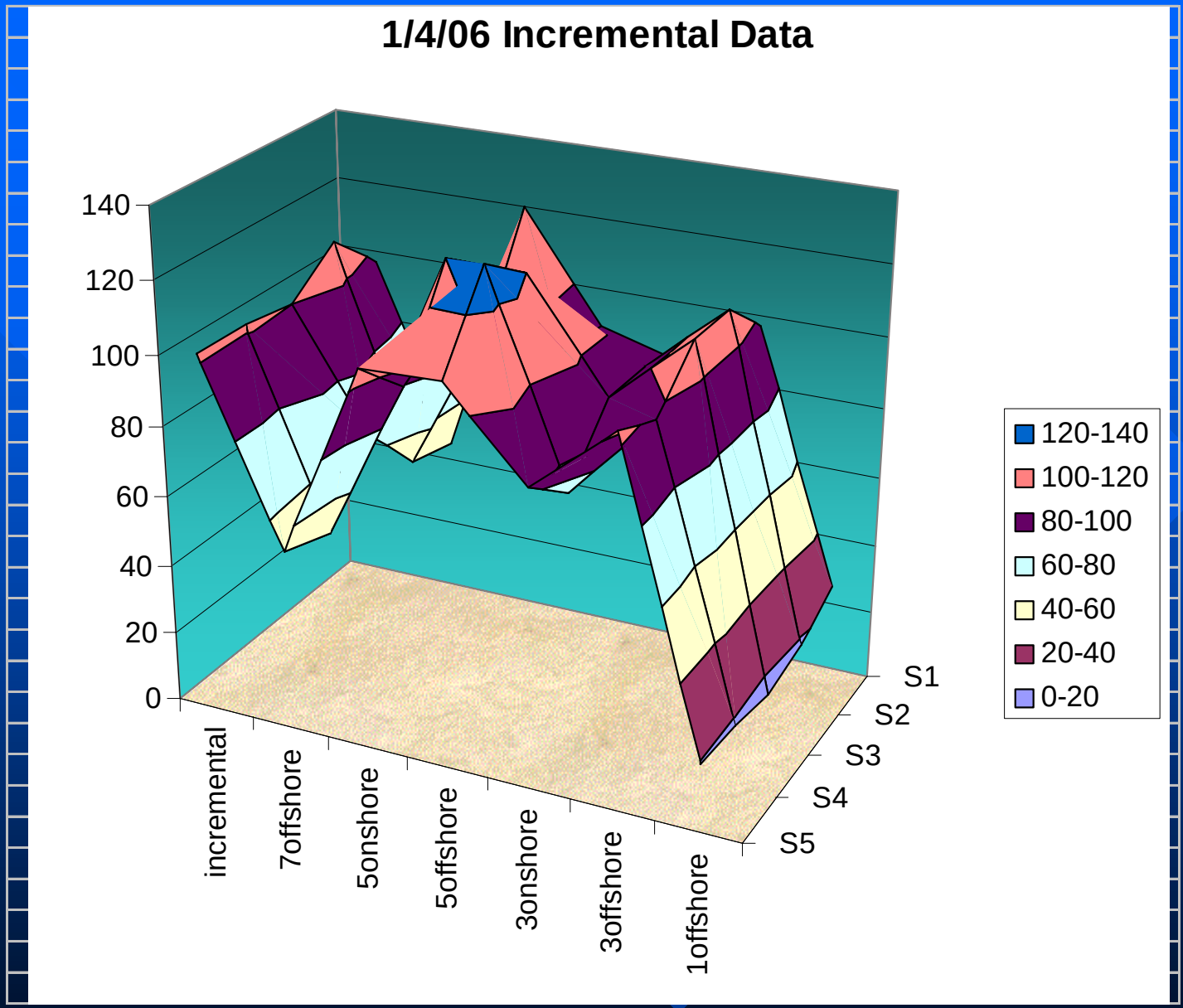
12/14/05 Onshore Data




12/14/05 Sampling Error
14
12
10
8
6
4
2
0
Section A
Section B
Section C
Relative Standard Deviation


1/4/06 Data
CFU/100ml
120
100
80
60
40
20
0
7offshore
5onshore
5offshore
3onshore
3offshore
1offshore
CFU/100ml


1/4/06 Incremental Data
S5
S4
S3
S2
S1
1offshore
3offshore
3onshore
5offshore
5onshore
7offshore
incremental
Location
100-150
50-100
0-50


1/4/06 Incremental Data
140
120
100
80
60
40
20
0
incremental
7offshore
5onshore
5offshore
3onshore
3offshore
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S4
S5
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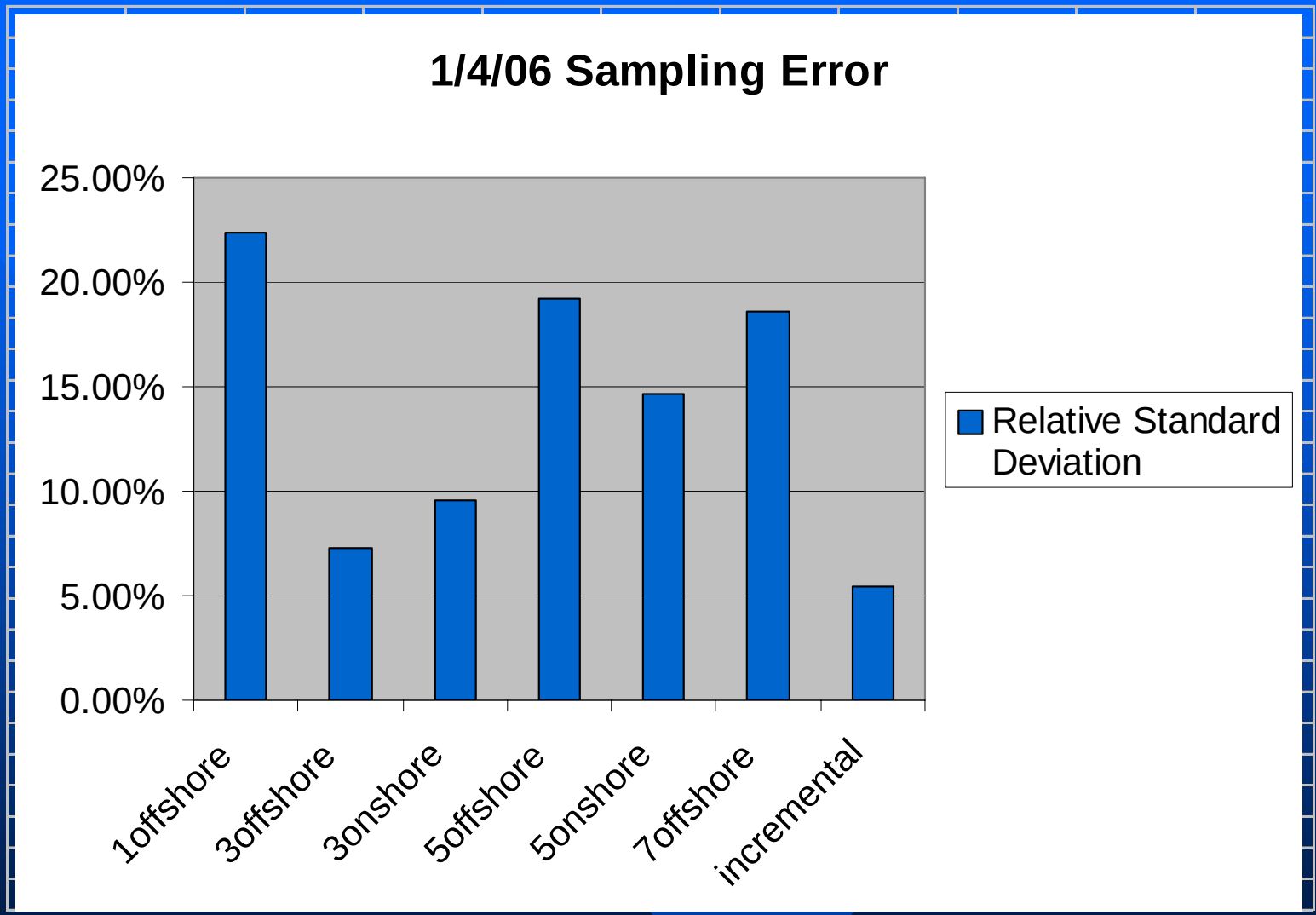
60-80
40-60
20-40
0-20


1/4/06 Sampling Error
25.00%
20.00%
15.00%
10.00%
5.00%
0.00%
1offshore
3offshore
3onshore
5offshore
5onshore
7offshore
incremental
Relative Standard Deviation

Conclusions

- It does make a difference where a sample is taken in Kahana Bay.
- No, a discrete sample would not be representative of Kahana Bay.
- Timing of sample does not make a difference.
- Yes, multi-increment sampling does give better results than discrete sampling.