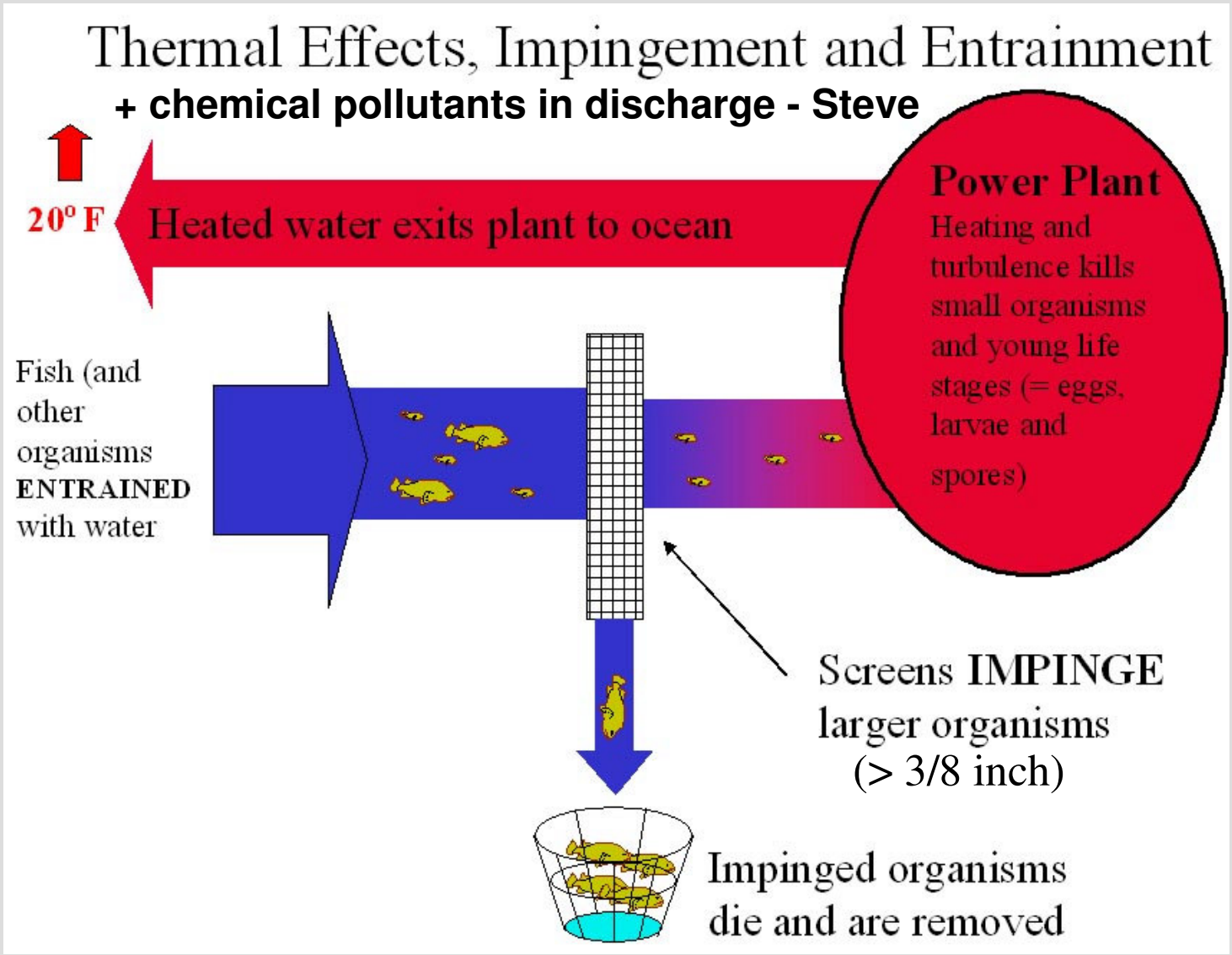
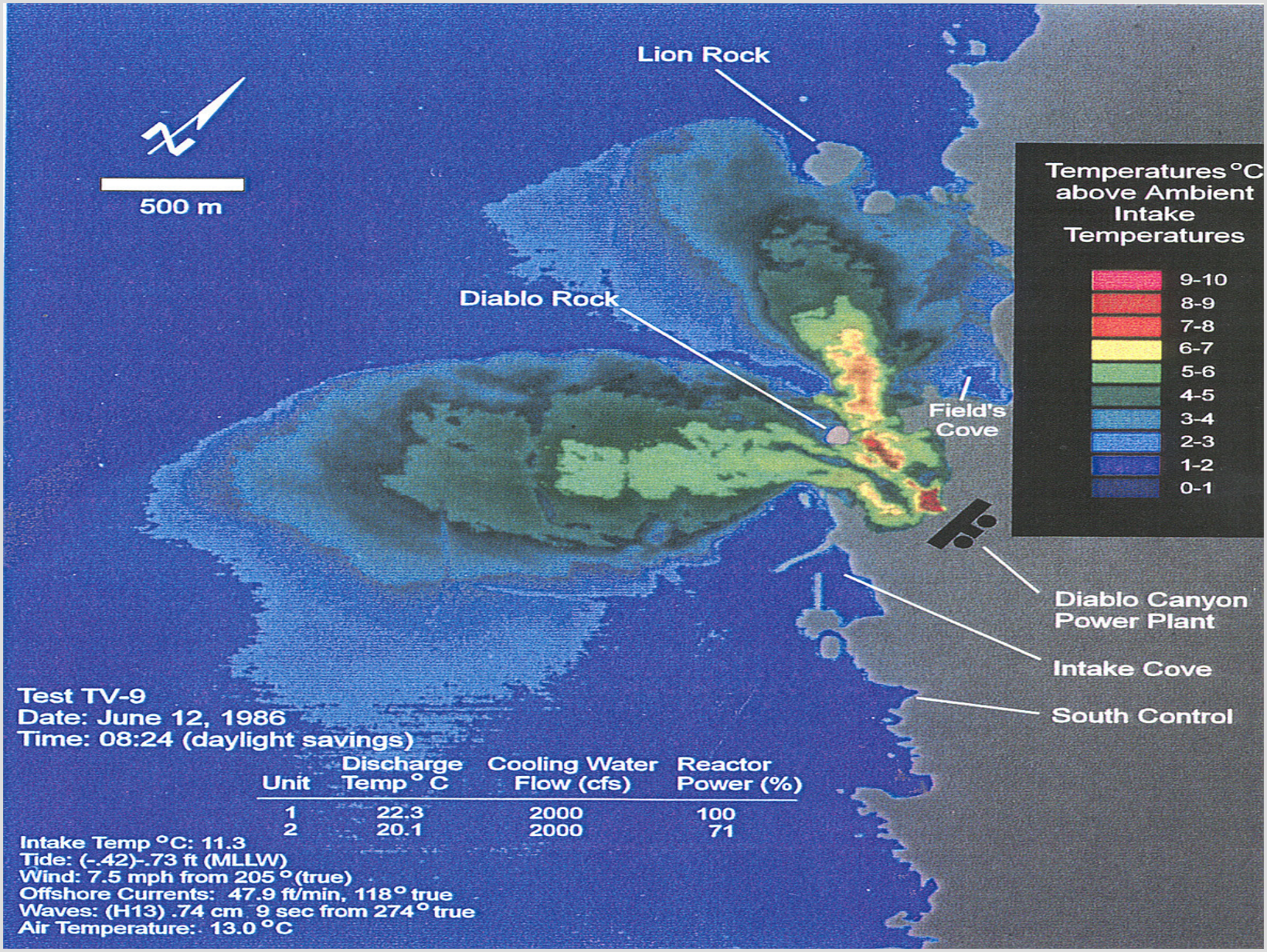


(modified from Raimondi)

THERMAL



Foster MLML

THERMAL

Problem

Impacts of thermal discharge of at least 12 existing power plants are incompletely known

From: CEC. 2005. "Issues and ---." CEC-700-2005-013 Appendices, Apprendix A.

Thermal Effects

etermination of thermal plume distribution

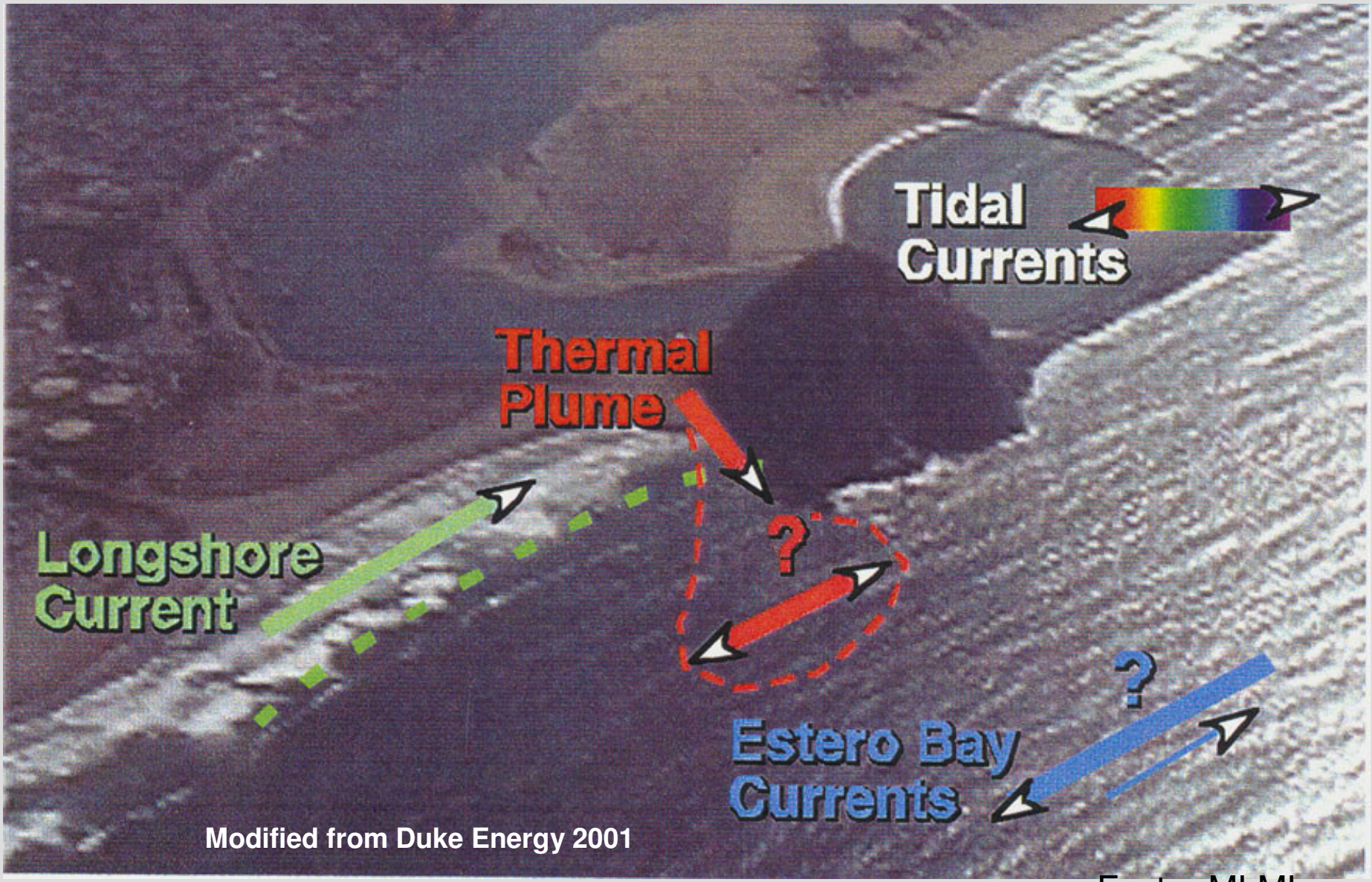
- Ecological impacts resulting from plume
  – usually on benthos

xpected pattern if communities are affected - **HYPOTHESES**

stimation of impacts – **SAMPLING DESIGN AND ANALYSES**

Foster MLML

Environmental Variables Affecting Plume Distribution



Foster MLML

Estimation of thermal plume

- Fixed Stations
- Boat sampling
- Aerial surveys

Modified from
Duke Energy 2001

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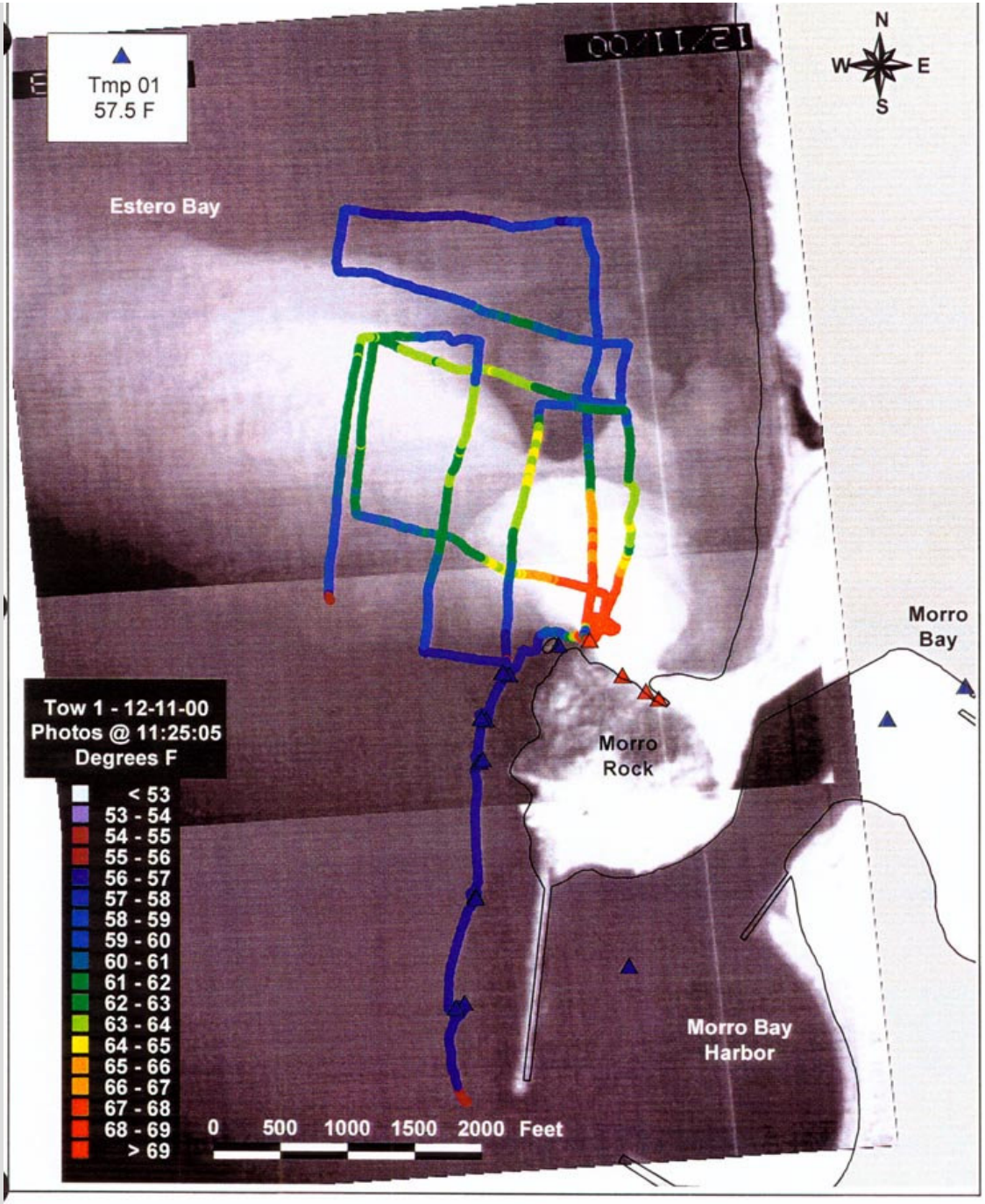


Figure 2-33. Aerial IR image with available boat and buoy temperatures

Estimation of thermal plume

- **Depth Profile**

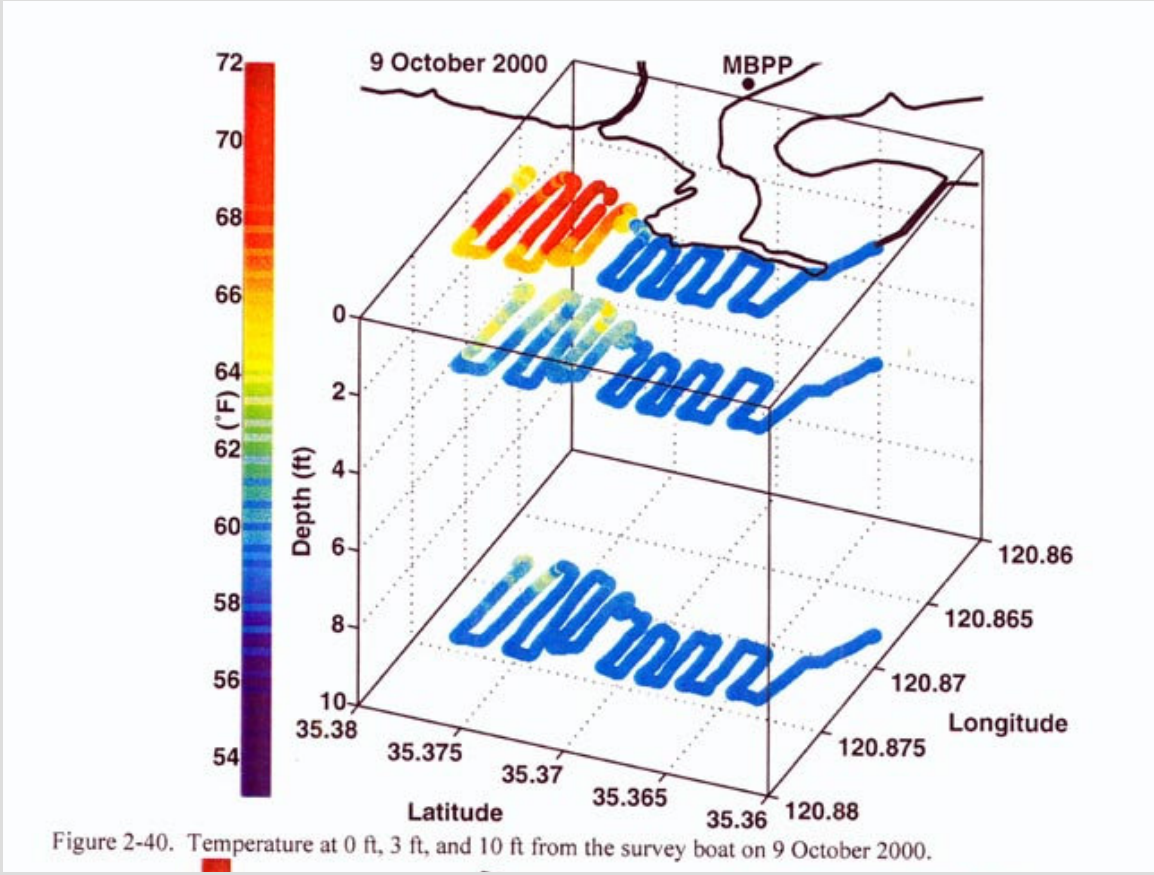


Figure 2-40. Temperature at 0 ft, 3 ft, and 10 ft from the survey boat on 9 October 2000.

Modified from Duke Energy 2001

Foster MLML

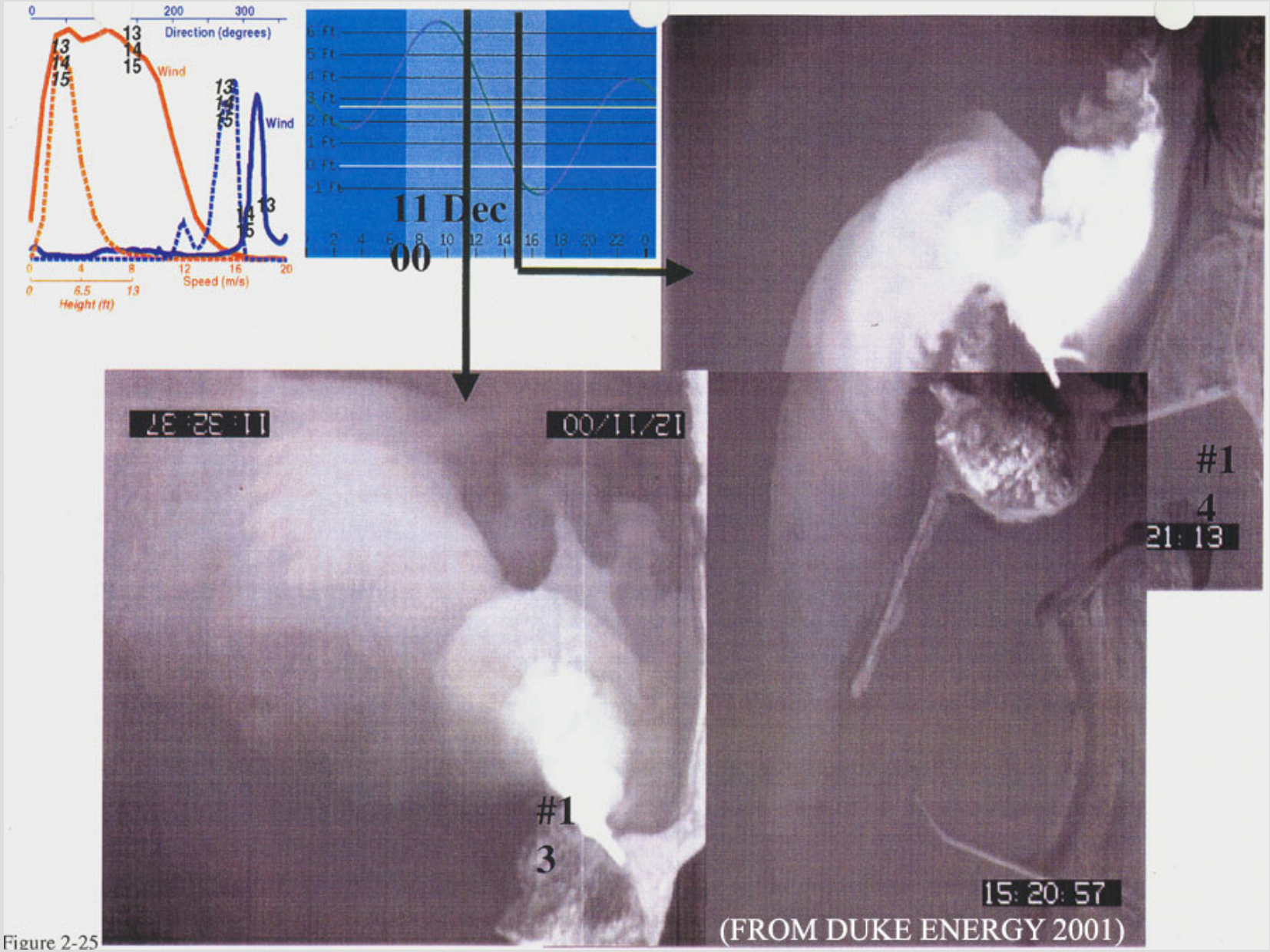
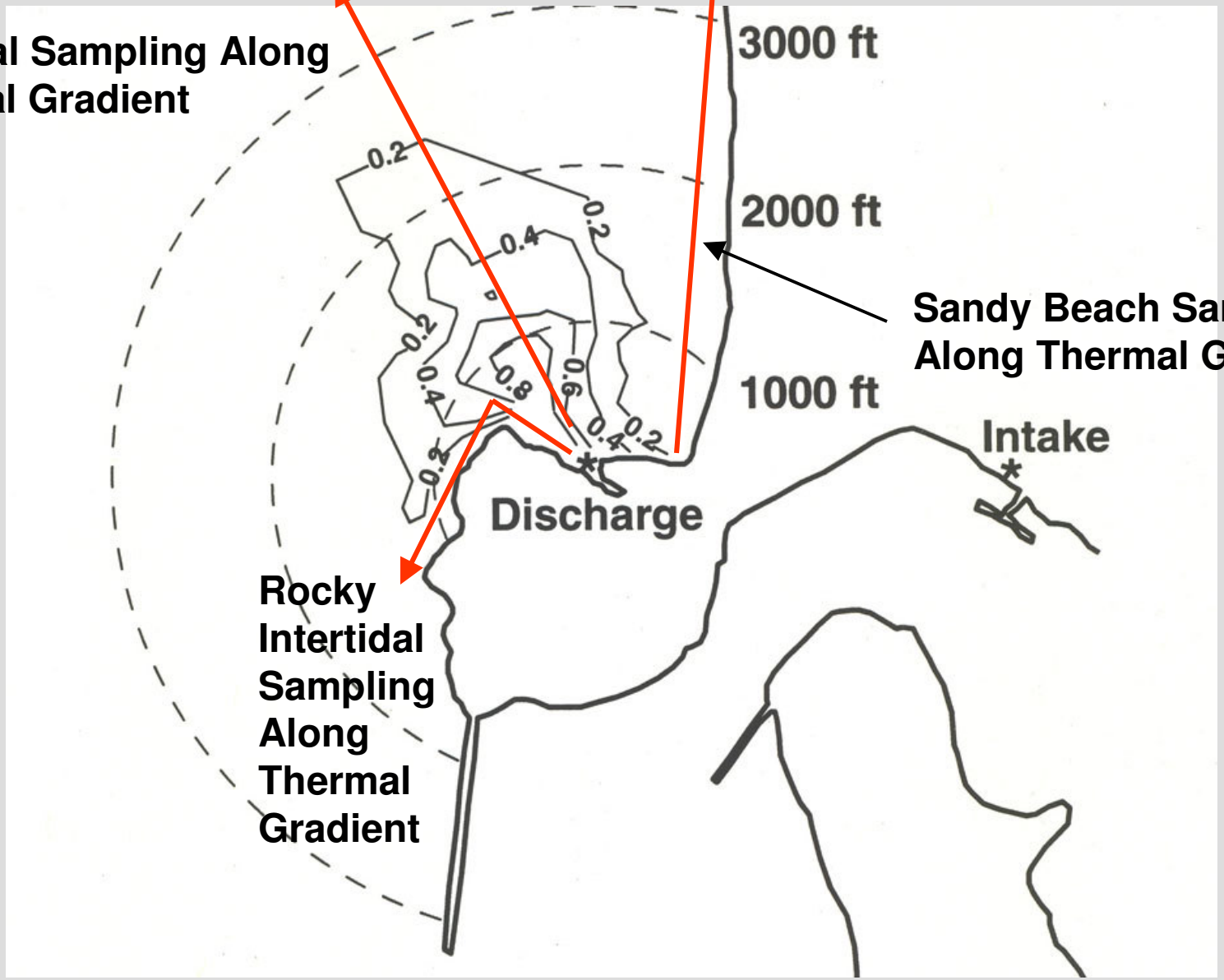


Figure 2-25

Foster MLML

GRADIENT SAMPLING DESIGN - Probability of Surface Δ T > 4 ^{0} C

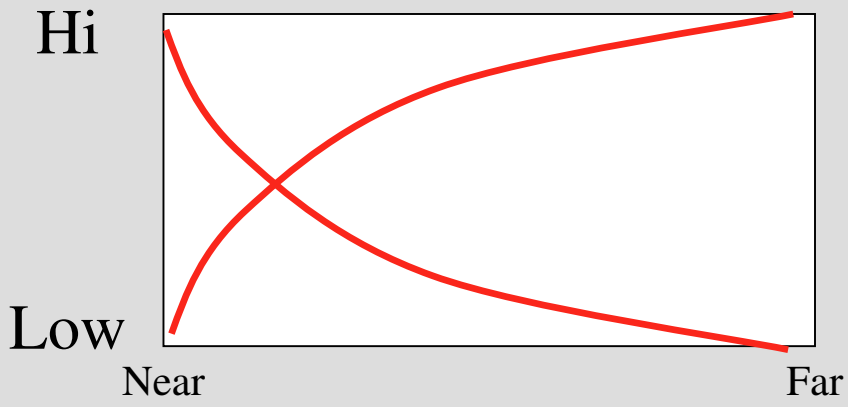


Foster MLML

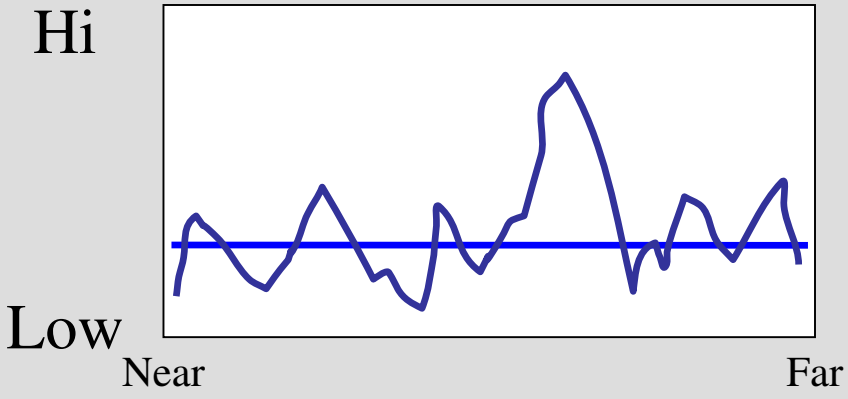
Modified from Duke Energy 2001

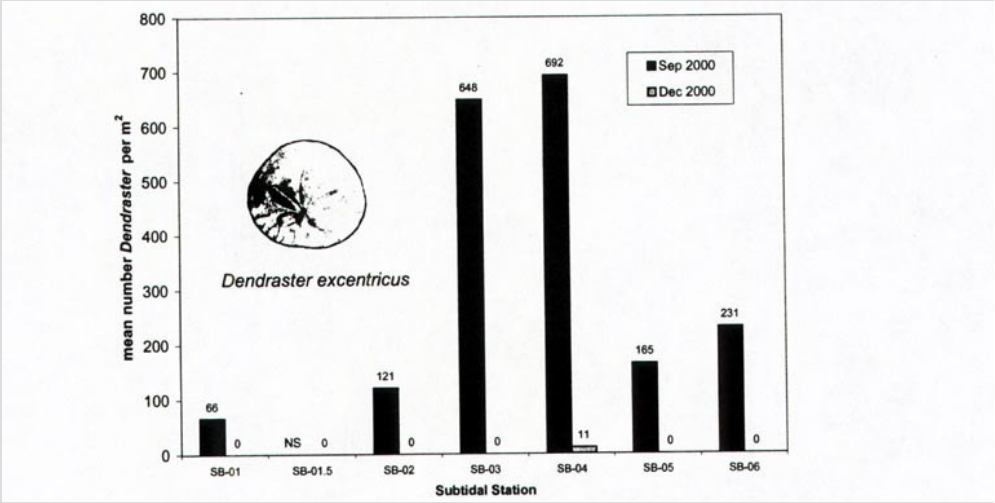
Subtidal Impact Hypotheses, Sampling Design & Analyses

Evidence for Impact



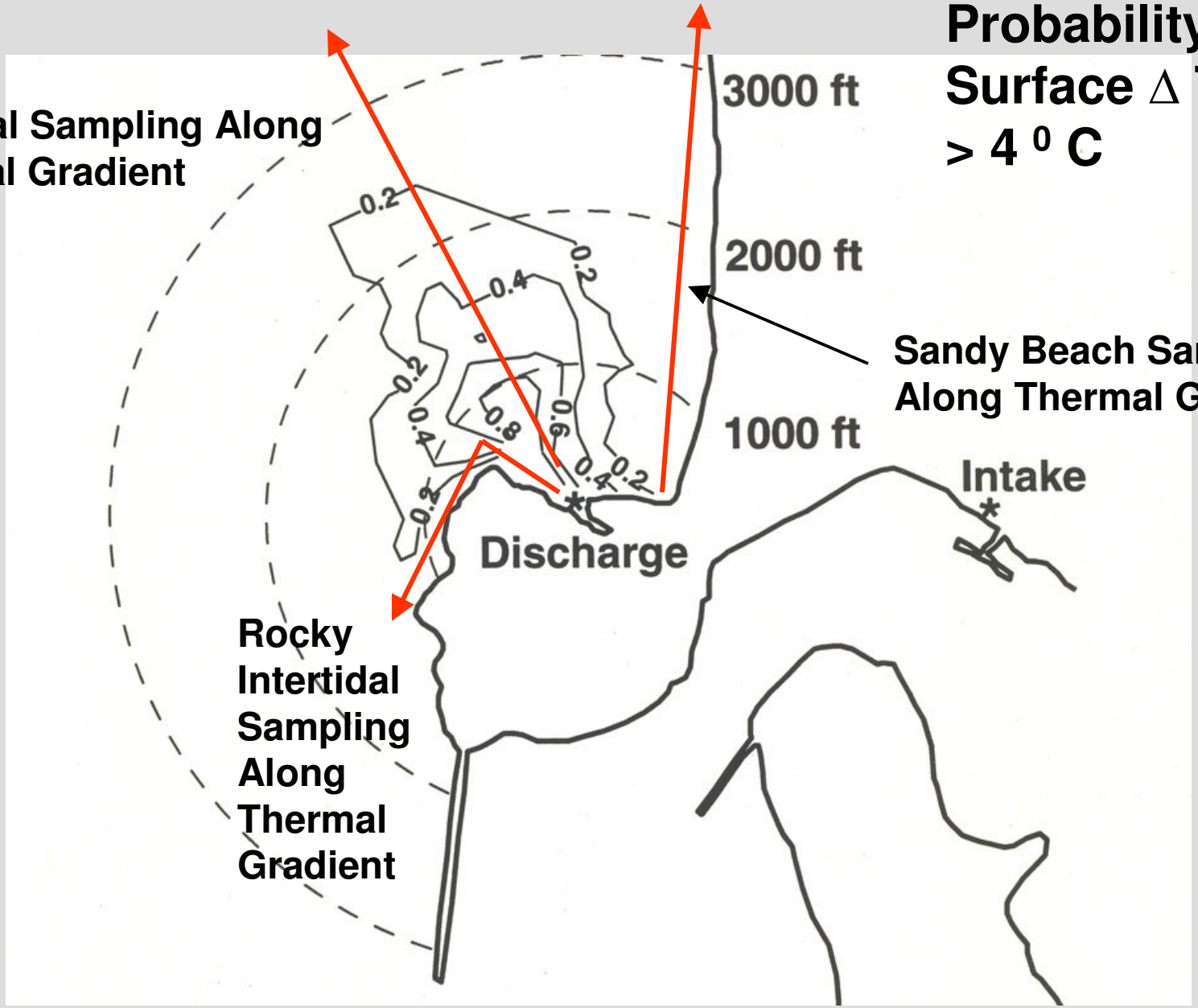
No support for Impact



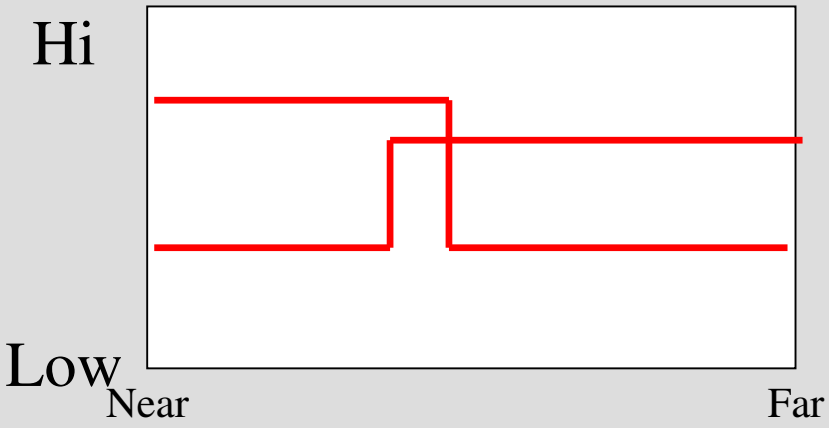


Modified from Duke Energy 2001

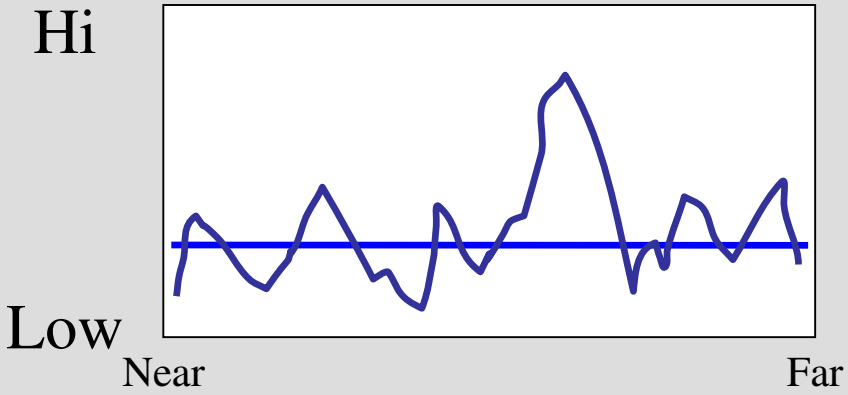
Foster MLML


Probability of Surface Δ T > 4 0 C
Subtidal Sampling Along Thermal Gradient
3000 ft
2000 ft
1000 ft
0.2
0.4
0.6
0.8
Sandy Beach Sampling Along Thermal Gradient
Intake
Discharge
Rocky Intertidal Sampling Along Thermal Gradient
Foster MLML
Modified from Duke Energy 2001

Ecological Impacts
Rocky Intertidal
Evidence for Impact



No support for Impact



Modified from Duke Energy 2001

Foster MLML

Distance From Discharge

Near Far Near Far

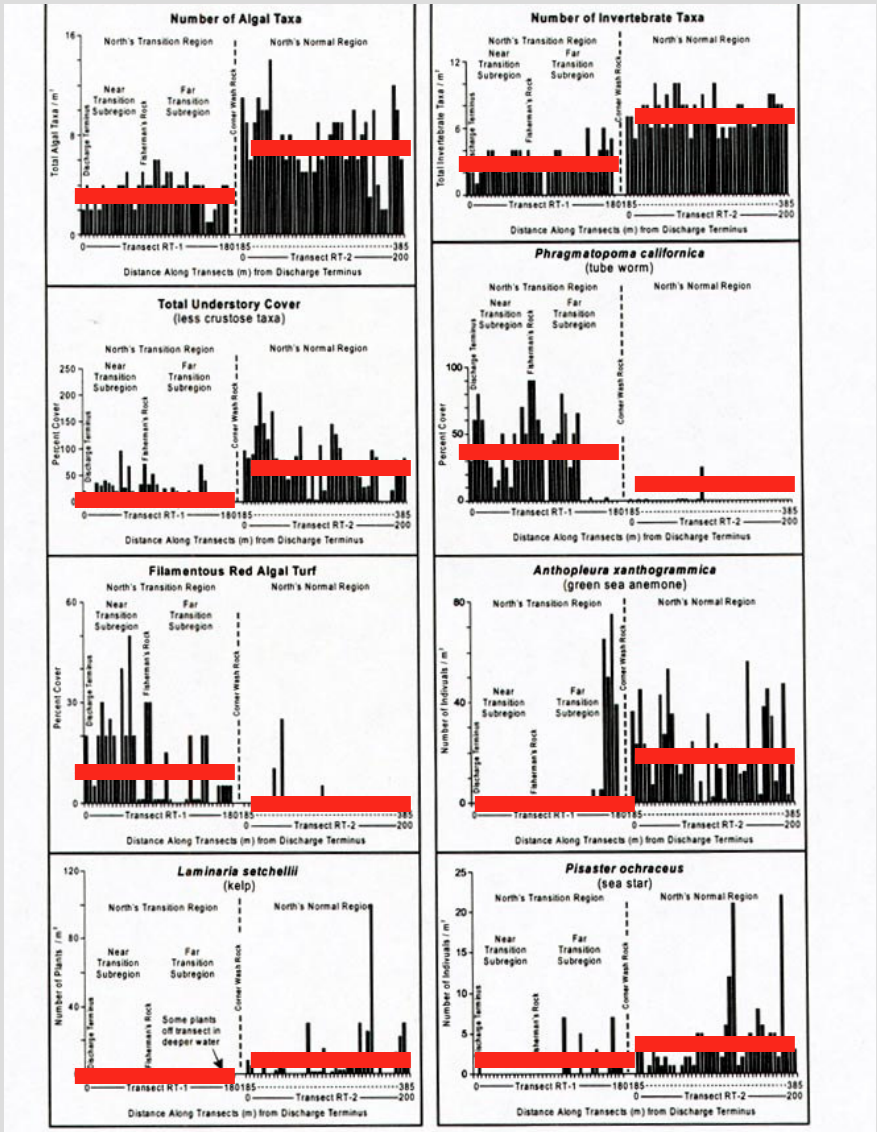


Figure 5-5. Abundances of select taxa in 1 m^2 quadrats in the North's Transition and Normal Region.

Thermal Effects

- Estimation of thermal plume
- Ecological impacts resulting from plume
  - Expected pattern if communities are affected
  - Estimation of impacts
    - **Sandy Beach – NONE DETECTED**
    - **Shallow subtidal sandy habitat – NONE DETECTED**
    - **Rocky reefs – LOCAL IMPACTS DETECTED**

-NEED similar, thorough studies at all power plants. Like entrainment, such studies and their interpretation can be VERY TECHNICAL

State-Wide 316 a & b

Technical Working Group

SOME GENERAL DISCHARGE OBSERVATIONS AND QUESTIONS

►"Routine" NPDES monitoring for thermal effects of discharges appears generally inadequate for impact detection. If a good thermal effects study is done for an operating plant, why require subsequent monitoring other than of discharge volume and Δ T at end of pipe???

►"Routine" NPDES monitoring for chemicals in the discharge: why allow other than intake water and antifouling chemicals to be discharged? Require "power plant wastes" to go to a waste treatment plant or be taken to hazardous waste disposal facility???