

# Potential Environmental Impacts of an OTEC Facility

# Effects Categories from NOAA's Final EIS in 1981

## Major Effects

- Platform presence
  - Biota attraction
- Withdrawal of surface and deep ocean waters
  - Organism entrainment and impingement
- Discharge of waters
  - Nutrient redistribution resulting in increased productivity
- Biocide release
  - Organism toxic response

# Effects Categories from NOAA's Final EIS in 1981

## **Minor Effects**

- Protective hull-coating release
  - Concentration of trace metals in organism tissues
- Power cycle erosion and corrosion
  - Effect of trace constituent release
- Implantation of coldwater pipe and transmission cable
  - Habitat destruction and turbidity during dredging

# Effects Categories from NOAA's Final EIS in 1981

## **Minor Effects(cont'd)**

- Low-frequency sound production
  - Interference with marine life
- Discharge of surfactants
  - Organism toxic response
- Open-cycle plant operation
  - Alteration of oxygen and salt concentrations in downstream waters

# Effects Categories from NOAA's Final EIS in 1981

## **Potential Effects from Accidents**

- Potential working fluid release from spills and leaks
  - Organism toxic response
- Potential oil releases
  - Organism toxic response

# Water Intakes

## Entrainment

- Warm water
  - Phytoplankton
  - Microzooplankton
  - Macrozooplankton
    - Some Adults
    - Eggs & Larvae
  - Benthos
    - Eggs & Larvae
  - Vertebrate Fish
    - Eggs & Larvae
- Cold water
  - Microzooplankton
  - Macrozooplankton
    - Some Adults
    - Eggs & Larvae
  - Benthos
    - Eggs & Larvae
  - Vertebrate Fish
    - Eggs & Larvae

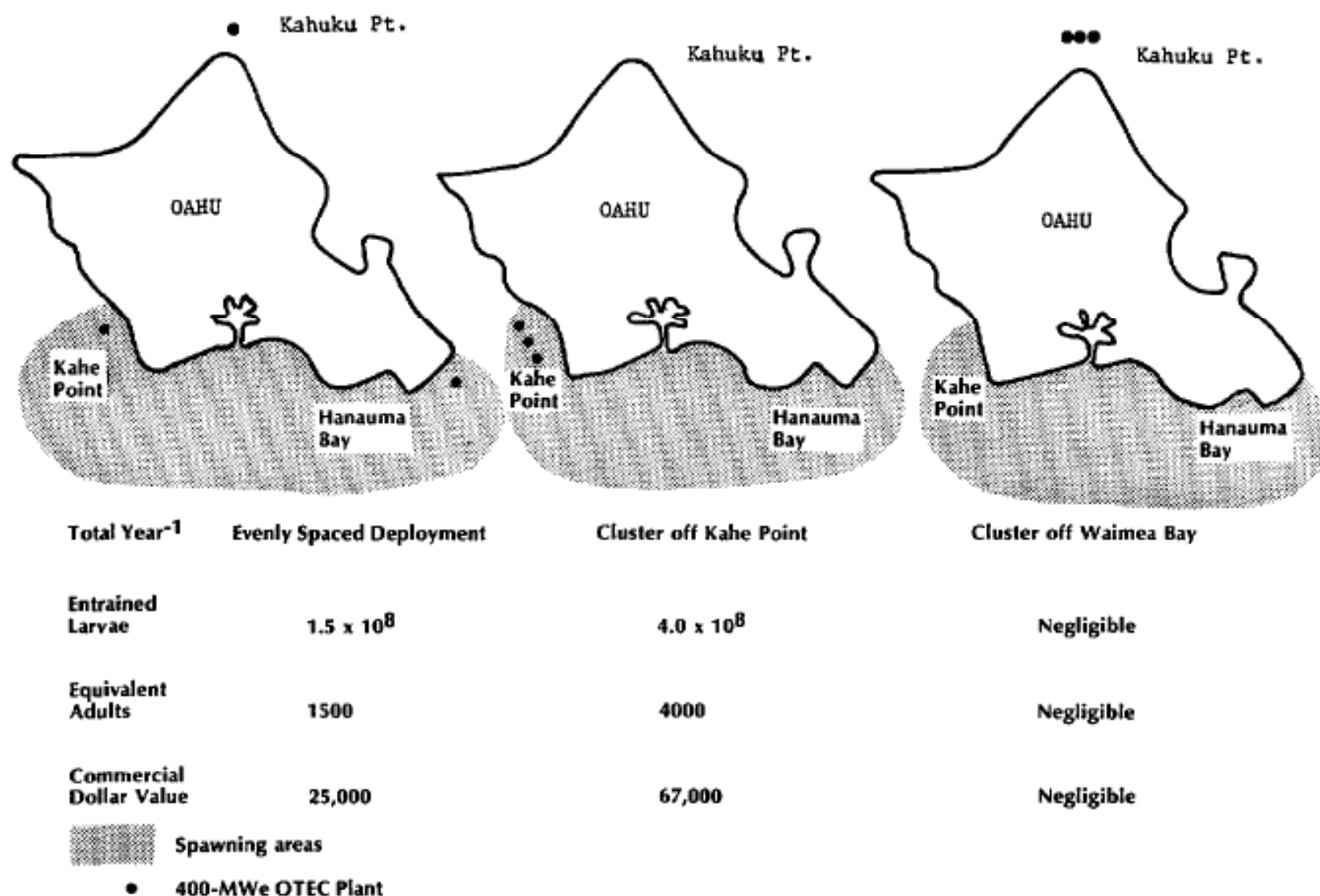
# Water Intakes

## Impingement

- Warm water
  - Macrozooplankton
  - Vertebrate Fish
  - Benthos?
    - Eggs & Larvae
  - Sea turtles
    - Hatchlings
- Cold water
  - Macrozooplankton
  - Benthos?
    - Eggs & Larvae
  - Vertebrate Fish

# Impingement and Entrainment Estimates for 40 MW OTEC Facility

<b>Parameter</b>	<b>Units</b>	<b>Warm Water Intake</b>	<b>Cold Water Intake</b>
<b>Depth</b>	m	20	750-1000
<b>Flow Rate</b>	m <sup>3</sup> /s	120-200	120
<b>Flow Velocities</b> <b>Outside of intake</b> <b>In pipe</b>	m/s	0.25-0.30 1.5-2.5	1.5-2.5
<b>Average Impingeable Biomass</b>	mg/m <sup>3</sup>	2.1	3.8
<b>Daily Biomass Impinged</b>	kg live wt	20-35	40-65
<b>Impingement mortality</b>	percent	?	100
<b>Zooplankton Entrained</b>	kg C	20-34	2-4
<b>Entrainable Phytoplankton</b> <b>(as Chlorophyll-a)</b>	mg/m <sup>3</sup>	0.05-0.25	
<b>Daily Phytoplankton Entrained</b> <b>(as Chlorophyll-a)</b>	kg	0.5-4.3	
<b>Entrainment mortality</b>	percent	?	100



See Appendix D for larval density information and catch statistics

Figure 4-5. Equivalent Number and Commercial Value of Adult Amberjack (*Seriola* spp.) Lost as a Result of Ichthyoplankton Entrainment with Various Deployment Scenarios.

## Comparison of Percent Commercial Catch Lost for Three Location Scenarios

<b>Species</b>	<b>400 MW OTEC locations</b>	<b>% Hawaiian Commercial Catch Lost by Weight</b>
Seliola spp. (amberjack)	3 off Kahe Pt	70
	3 off Waimea Bay	0
	3 around Oahu	30
Abudefduf abdominalis (sergeant major)	3 off Kahe Pt	670
	3 off Waimea Bay	30
	3 around Oahu	260
Thunnus albacores (yellowfin)	3 off Kahe Pt	10
	3 off Waimea Bay	0
	3 around Oahu	20

“These estimates of impingeable biomass are based on the assumption that larger organisms can detect and avoid the intake screens.”

# Cycle Water Release Characteristics

- Separate
  - Below ambient temperature
  - Corrosion products
  - Working fluid from leaks
  - Dead organisms
- Warm water
  - Antifouling chemicals
- Cold water
  - Increased nutrients and CO<sub>2</sub>
  - Reduced pH
- Combined
  - All the above

# Cycle Water Release Concerns

## Secondary Entrainment

- Phytoplankton
- Microzooplankton
- Macrozooplankton
- Benthos
  - Eggs & Larvae
- Vertebrate Fish
  - Eggs & Larvae

# Cycle Water Release Concerns

- Physico-Chemical Effects
  - Nutrient enrichment
    - Phytoplankton blooms
      - Increased productivity
      - Toxic alga blooms
  - Reduced shell formation
  - Current changes

# Installation and Physical Presence

- Component
  - Transmission cables
    - Installation - Destruction of benthic community
    - Physical presence - Entanglement of marine mammals & sea turtles
  - Anchoring system
    - Installation - Destruction of benthic community
    - Physical presence
      - Entanglement of marine mammals & sea turtles
      - Change benthic substrate
  - Platform
    - Installation - Noise, chemical releases
    - Physical presence - Fish attractant, toxic releases
  - Cold water pipe
    - Installation
    - Physical presence

# Noise and Electromagnetic Fields

- Noise
  - Source
    - Pumps & generators
    - Water movement through cold water pipe
    - Discharge turbulence
  - Impact
    - Disrupt marine mammal behavior
- EMF
  - Source
    - Transmission cable
  - Impact
    - Disrupt marine mammal and vertebrate fish behavior