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
  - Vertebrate Fish
  - Benthos?
    - Eggs & Larvae
  - Vertebrate Fish
## Impingement and Entrainment Estimates for 40 MW OTEC Facility

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Units</th>
<th>Warm Water Intake</th>
<th>Cold Water Intake</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depth</td>
<td>m</td>
<td>20</td>
<td>750-1000</td>
</tr>
<tr>
<td>Flow Rate</td>
<td>m3/s</td>
<td>120-200</td>
<td>120</td>
</tr>
<tr>
<td>Flow Velocities</td>
<td>m/s</td>
<td>0.25-0.30</td>
<td>1.5-2.5</td>
</tr>
<tr>
<td>Flow Velocities</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outside of intake</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In pipe</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average Impingeable Biomass</td>
<td>mg/m³</td>
<td>2.1</td>
<td>3.8</td>
</tr>
<tr>
<td>Daily Biomass Impinged</td>
<td>kg live wt</td>
<td>20-35</td>
<td>40-65</td>
</tr>
<tr>
<td>Impingement mortality</td>
<td>percent</td>
<td>?</td>
<td>100</td>
</tr>
<tr>
<td>Zooplankton Entrained</td>
<td>kg C</td>
<td>20-34</td>
<td>2-4</td>
</tr>
<tr>
<td>Entrainable Phytoplankton (as Chlorophyll-a)</td>
<td>mg/m³</td>
<td>0.05-0.25</td>
<td></td>
</tr>
<tr>
<td>Daily Phytoplankton Entrained (as Chlorophyll-a)</td>
<td>kg</td>
<td>0.5-4.3</td>
<td></td>
</tr>
<tr>
<td>Entrainment mortality</td>
<td>percent</td>
<td>?</td>
<td>100</td>
</tr>
</tbody>
</table>
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

<table>
<thead>
<tr>
<th>Species</th>
<th>400 MW OTEC locations</th>
<th>% Hawaiian Commercial Catch Lost by Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seliola spp. (amberjack)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3 off Kahe Pt</td>
<td>70</td>
</tr>
<tr>
<td></td>
<td>3 off Waimea Bay</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>3 around Oahu</td>
<td>30</td>
</tr>
<tr>
<td>Abudefduk abdominalis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(sergeant major)</td>
<td>3 off Kahe Pt</td>
<td>670</td>
</tr>
<tr>
<td></td>
<td>3 off Waimea Bay</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>3 around Oahu</td>
<td>260</td>
</tr>
<tr>
<td>Thunnus albaoreces</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(yellowfin)</td>
<td>3 off Kahe Pt</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>3 off Waimea Bay</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>3 around Oahu</td>
<td>20</td>
</tr>
</tbody>
</table>
“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 CO₂
  • 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
    - Physical presence
  - Anchoring system
    - Installation
    - Physical presence
  - Platform
    - Installation
    - Physical presence
  - Cold water pipe
    - Installation
    - Physical presence

- Destruction of benthic community
- Entanglement of marine mammals & sea turtles
- Change benthic substrate
- Noise, chemical releases
- Fish attractant, toxic releases
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