Introduction: The Moss Landing Power Plant (MLPP) began operation in 1950. The natural gas-fired power plant generates 2,560 megawatts of electricity, enough to provide power for 2.5 million homes. Cooling operations are vital to the safe functioning of the power plant (one of California’s largest), and requires large quantities of ocean water for thermal regulation. Sea water is taken in through intake structures located in Moss Landing Harbor, routed through the MLPP, and finally discharged into Monterey Bay via two outflow pipes extending 200m offshore. Discharge into the Monterey Bay is estimated to be 4.56 billion liters (120 million gallons) per day. As a consequence of cooling operations, water exiting the outflow pipes are generally warmer than ambient ocean water, resulting in what is known as thermal outfall.

This poster presents an overview of research projects initiated to understand the impacts of the MLPP thermal outfall on local marine fauna, and the broader environmental implications of the thermal discharge. It is possible that because the thermal outfall is located at the head of the Monterey Canyon (see bathymetry in Figure 3), and at the mouth of the Elkhorn Slough, thermal impacts are minimal.

Figure 1: Satellite imagery of the Moss Landing Harbor. (Image: Google Earth)

The goal of this study was to assess potential impacts of the thermal outfall at an ecosystem scale. In order to address this issue, researchers sampled phytoplankton and bacteria, benthic invertebrates, fish, and sea birds at 4 sites in the Moss Landing area. Results of this study show that:

1) Phytoplankton production will be inhibited and bacterial production will be enhanced due to entrainment.
2) No significant impacts of the thermal outfall on benthic invertebrates (intertidal or shallow-subtidal) were detected.
3) Bat rays were observed congregating around the site of the thermal outfall, which may be a result of thermal irregularity behavior.
4) Certain species of sea birds and local marine mammals appear to be more actively utilizing the thermal outfall than for foraging relative to non-outfall sites, however no measured impacts were observed.

Table: Effects of the MLPP thermal discharge on marine life (Oliver et al., 2006)

<table>
<thead>
<tr>
<th>Impact</th>
<th>MLPP Discharge Site</th>
<th>Non-MLPP Discharge Site</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phytoplankton production</td>
<td>Inhibited</td>
<td>Enhanced</td>
</tr>
<tr>
<td>Bacterial production</td>
<td>Enhanced</td>
<td>Inhibited</td>
</tr>
<tr>
<td>Benthic invertebrates</td>
<td>No significant</td>
<td>No significant</td>
</tr>
<tr>
<td>Bat rays</td>
<td>Observed</td>
<td>Not observed</td>
</tr>
<tr>
<td>Certain species of sea birds and local marine mammals</td>
<td>Actively utilizing</td>
<td>Not observed</td>
</tr>
</tbody>
</table>

Figure 2: Location of the MLPP Thermal Outfall and Coastal MARINE

Ecological Effects of the MLPP Thermal Discharge (Oliver et al., 2006)

The project sought to compare the natural thermal outfall produced by the Elkhorn Slough to the anthropogenic thermal outfall produced by the Moss Landing Power Plant. Data were collected both remotely and onsite using a variety of technologies, ranging from tide gauges and water level sensors, to infrared imaging. Results indicate that while the temperature gradient produced by the MLPP is larger, the overall thermal contribution from the Elkhorn Slough is greater. Thermal imagery and a comparison of discharge plumes from Elkhorn Slough and the Moss Landing Power Plant (Fischer, 2006)

Figure 3: Location of the MLPP Thermal Outfall and Coastal MARINE

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