

The rise in sea surface temperature (SST) is one of the most substantial impacts of climate change, as ocean warming is predicted to increase by 0.86-2.89°C by 2100. Giant kelp (*Macrocystis pyrifera*) forests in Southern California are sensitive to changes in ocean temperatures, with a thermal threshold of 18–25°C. They are ecologically significant because they provide many ecosystem services and serve as a foundation species for trophic interactions with purple sea urchins (*Strongylocentrotus purpuratus*) and southern sea otters (*Enhydra lutris nereis*). This thesis investigates the response of giant kelp biomass to SST changes in the Santa Barbara Channel using modelling to explore the ecological outcomes from 1850-2100. The model used an ensemble of three CMIP6 climate models (CMCC-CM2-SR5, HadGEM3-GC31-LL, and MCM-UA-1-0) under three different emission scenarios (SSP1-2.6, SSP2-4.5, and SSP5-8.5). This study found a negative correlation ($r=-0.59$, $p<0.001$) between observed annual maximum SST and giant kelp biomass. Kelp biomass declines were projected under three Shared Socioeconomic Pathways (SSPs), with a kelp population of zero projected by approximately 2060 under SSP5-8.5. These findings expand upon previous literature by projecting kelp decline under future warming, which emphasize the trophic cascade impacts on sea urchin and sea otter populations, and highlight the importance of active restoration techniques, such as the “green gravel” method and transplantation, to support giant kelp forests through 2100.