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 (1.55-5.20˚F) 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 (64.4-77˚F). They are ecologically significant because they provide many ecosystem services, such as coastal erosion control and biofuel. Giant kelp also serve as a foundation species for trophic interactions, which describes how energy moves through an ecosystem, 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, located off the coast of Southern California in the United States, using modelling to explore the ecological outcomes from 1850-2100. Three climate models were combined and run under three potential emission scenarios (best case, most likely, and worst case) to project giant kelp biomass decline. This study found a negative correlation between observed annual maximum SST and giant kelp biomass, with a kelp population of zero projected by approximately 2060 under the worst case scenario. These findings expand upon previous literature by projecting kelp decline under future warming. This emphasizes the trophic cascade impacts on sea urchin and sea otter populations, which undermine the ecosystem balance within the giant kelp forest. This study highlights the importance of active restoration techniques, such as generating kelp via laboratory cultures for site seedings and transplantation, to support giant kelp forests through 2100.