

HONORS

UNIVERSITY OF HAWAI'I at MĀNOA

SENIOR HONORS PROJECT FORMATTING GUIDE

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UNIVERSITY OF HAWAI'I AT MĀNOA

HONORS PROGRAM

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Title of Thesis

A Senior Honors Project Presented to the Faculty of the
Department of [your department], University
of Hawai'i at Mānoa

In Partial Fulfillment of the Requirements
For Bachelor of [Degree] with Honors

By [your name]
[date]

Committee:
[First and last name], Mentor
[First and last name]
[First and last name]

Promoting Biodiversity in a Pinch: The Influence of a Hawaiian Coastal Refuge on Ghost Crab
(*Ocypodidae*) Size and Density on O‘ahu, Hawai‘i.

A Senior Honors Project Presented to the Faculty of the Department of Biology
University of Hawai‘i at Mānoa

In Partial Fulfillment of the Requirements
For Bachelor of Science in Marine Biology with Honors

By Jessica Tritsch
15 April 2021

Committee:
Dr. Kathleen Cole, Mentor
Patrick Nichols

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Finally, thank you to my friends and family who provided personal support throughout this research project.

Abstract

In an effort to preserve ecosystem biodiversity, marine protected areas (MPAs) are established following governmental regulations. Protected areas are based on the fundamentals of the spillover effect, leading to the areas adjacent benefiting from the conservation. To better understand the significance of the refuge, ghost crabs (genus *Ocypode*, Hawaiian name Ōhiki), which tunnel deep into the sand and leave behind burrow holes, were used as an indicator species. The goal of this research was to compare the size, abundance, and density of ghost crabs inside and outside of James Campbell National Wildlife Refuge (JCNWR) to better understand the conservation success towards increasing beach biota. First, the sandy locations along the site were mapped using a GPS, then transects were randomized both inside and outside JCNWR. Within each transect, the burrow holes were counted, and the diameters were measured to estimate body size and abundance. The total number of burrows per unit area was used to calculate population densities. The results show no significant difference in ghost crab size, abundance, or density when comparing these variables inside and outside the refuge. The results suggest the refuge may not have a significant impact on the population metrics for ghost crabs, as they are an important component to the food web that the protected shorebirds prey upon. Ultimately, the findings from this research can aid in conservation efforts at JCNWR to better protect the terrestrial crab.

Keywords: biodiversity, marine protected area (MPA), spillover effect, conservation, refuge, ghost crabs, *Ocypodidae*

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IMPACT OF SEA LEVEL RISE ON AGING POPULATION'S ACCESSIBILITY TO ESSENTIAL SERVICES IN HONOLULU, HAWAI'I

A THESIS SUBMITTED FOR PARTIAL FULFILLMENT
OF THE REQUIREMENTS FOR

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By
Dingyi Liu

Thesis Committee:

Dr. Suwan Shen, Chairperson
Dr. Jiwnath Ghimire

For everyone who supports me on my journey. For communities in Honolulu, Hawai'i.

Example

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ABSTRACT

Demographic studies have shown two trends: (1) elderly population is growing as a consequence of longer life expectancy; (2) population in low elevation coastal zones will significantly increase. One of the potential risks of living in low elevation coastal zones is the projected sea level rise. As sea level rises, more and more frequent flooding can cause disruptions and damage to the roadways in coastal areas. Seniors could be especially vulnerable to such disruptions given their need for emergency services, which could also increase because of the adverse impacts climate change has on health. This study aims to investigate the impacts of sea-level rise on the aging population's accessibility to essential services and its implication for long term adaptation planning using Honolulu, Hawaii as a case study. Using Cohort Change Ratio (CCR), the study projects the elderly population in each Traffic Analysis Zones (TAZs) in future decades. Road segments and essential facilities (grocery stores, police stations, fire stations, and hospitals and clinics) at risk under different sea-level rise scenarios (1.1 feet, 2.0 feet, and 3.2 feet) are identified. Network connectivities from each TAZs to nearest essential services are analyzed. The results show that while the physical impacts on infrastructures are mild, some vulnerable communities' access to essential services will be greatly affected even under 1.1 feet sea-level rise scenarios. Especially some areas with a high projected density of the elderly population will be cut off to essential services due to transportation bottlenecks. For the rest of the population, sea level rise could significantly reduce the number of people with timely access to essential services. The results not only urge transportation network planners to take actions to make sure transportation connectivities

to vulnerable elder population at-risk are protected, but also suggest that over the long-term land use planning would be one of a key factors to adapt to climate change. These findings have broad implications for other coastal locations with similar development and growth patterns, and the methodology used could be easily adapted to be used in a variety of other metropolitan areas across the country to conduct similar vulnerability analyses to aid in adaptation planning in practice. Also, audience will learn the emergent needs of sea level rise adaptation planning.

Key words: Elderly population; Accessibility; Coastal road infrastructure; Sea level rise adaptation

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**The exocyst complex is an insulin-sensitive regulator of
amyloid precursor protein (APP) trafficking and
beta-amyloid generation in neurons**

A Senior Honors Project

Presented to the Faculty of

the Department of Anatomy, Biochemistry, and Physiology

John A. Burns School of Medicine

University of Hawai'i at Mānoa

In Partial Fulfillment of the Requirements

For Bachelor of Science in

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By Geetika Y. Patwardhan

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Robert A. Nichols, PhD

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ABSTRACT

Alzheimer's disease (AD) is a progressive neurodegenerative disorder characterized by the loss of cognitive function, language, and memory. Despite decades of AD research, there are still no effective therapies, and the pathogenic mechanisms are not fully understood. One prominent histopathological hallmark of AD is the accumulation of amyloid beta ($A\beta$) peptide plaques. Neuronal generation of the $A\beta$ peptide arises from proteolytic processing of the amyloid precursor protein (APP) by β - and γ -secretases, and regulation of APP intracellular trafficking plays a key role in the balance of amyloidogenic APP processing.

The exocyst is a highly-conserved eight-protein complex that acts as a Rab GTPase effector to guide subsets of intracellular transport vesicles to their destination for vesicle fusion. Assembly and targeting of the exocyst is controlled by a variety of protein kinases and small GTPases through mechanisms that are often cell type-specific. For example, adipocytes and muscle cells use the exocyst for dynamic exocytosis of GLUT4-containing vesicles in response to insulin signaling. We hypothesize that the exocyst plays a key regulatory role in the neuronal intracellular trafficking of APP, which if true, would reveal new potential targets for AD therapeutics.

Using a transgenic SH-SY5Y cell line that we generated to express APP containing several familial AD mutations leading to high levels of $A\beta$ production, RNAi silencing of each exocyst subunit led to dramatic decreases in sAPP and $A\beta$ secretion, with intracellular accumulation of full-length APP. In addition, we observed the same results with RNAi silencing of Exoc3L2, an uncharacterized exocyst gene homolog linked to late onset AD through genetic studies. We show in human SH-SY5Y neuroblastoma cells

differentiated into neurons, and in primary mouse hippocampal neurons, exocyst subunits were co-localized with APP on intracellular vesicles via high-resolution imaging. We confirmed these findings using proximity ligation assays (PLAs), a novel technique to measure protein-protein interactions within the cell, showing that APP and Exoc5 protein co-localized within 40nm. However, after 15 mins of insulin treatment, this APP-Exoc5 interaction was greatly reduced, while the association of Exoc5 with GLUT4 was increased. These experiments show for the first time that the exocyst plays a key role in APP trafficking and A β secretion in neurons, and this activity is directly regulated by insulin signaling.

Keywords: Alzheimer's disease, amyloid-beta, APP, exocyst, insulin signaling

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Example



Figure 2. This photograph gives a representation of the type of ghost crabs in this research that inhabit James Campbell National Wildlife Refuge. These ghost crabs (*Ocypodidae*) consist of various species and are seen in numerous locations throughout Hawaii and elsewhere. This particular photo was taken at Waimanalo, Oahu, courtesy of Keoki Stender Marine Life Photography, <https://www.marinelifephotography.com/marine/arthropods/crabs/ocypode-pallidula.html>.

The ghost crab population metrics will be compared inside and outside of the wildlife refuge, that is respectively “closed” and “open” to human traffic, for the purpose of inspecting possible disturbance effects on beach biota and the success of the protection conducted by the refuge. Furthermore, ghost crab population metrics have been measured in previous years and that data will be used to compare any changes occurring with time. Ghost crabs create burrow holes when hiding during the daytime, therefore measuring how many active burrow holes are present in a given area can lead to findings about the difference in size and density inside and outside James Campbell National Wildlife Refuge. Ghost crab density plays a role in determining human traffic impacts on other biota, for example the endangered and endemic

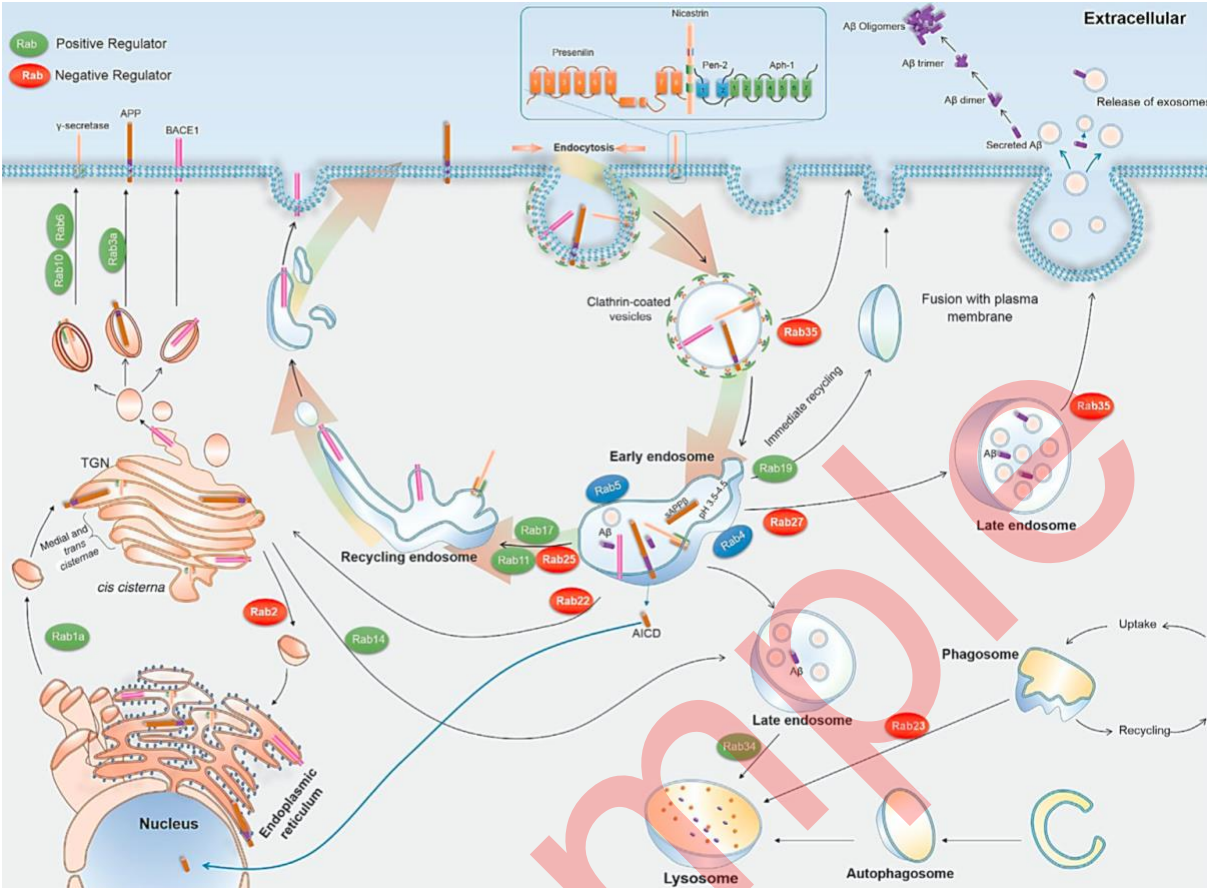


Figure 2. Regulation of APP processing by Rab GTPases. Schematic of Rab GTPases involved in trafficking of APP throughout the cell. Full length APP and its secretases are trafficked from the Trans Golgi Network (TGN) to the plasma membrane for insertion. APP may be cut by γ -secretase at the plasma membrane or be internalized and sorted into Rab5+ early endosomes where it encounters BACE1. Fragments of APP may be transported to the late endosome for degradation by lysosomes or exocytosed in various cleaved forms. BACE1 is recycled in Rab11+ recycling endosomes for reinsertion to the plasma membrane¹⁵.

involving the coordination of Rab GTPases and a variety of Rab effectors, guanine nucleotide exchange factors (GEFs) and GTPase activating proteins (GAPs)¹⁴. APP and its secretases are internalized via clathrin-mediated endocytosis and delivered to Rab5+ early endosomes¹⁶. From the early endosome, further trafficking to the recycling endosome, lysosome, or plasma membrane are coordinated by Rabs¹⁵ (Fig. 2). Numerous studies implicate defects in Rabs that regulate the endolysosomal system in AD pathology^{17–20}. In 2011, the U.S. government and National Institutes of Health set

rising by a rate of 3.3 mm per year on average (Cazenave and Llovel, 2010). Ongoing global warming will accelerate the speed of sea level rise (Nerem et al, 2018). Sea level rise adaptation empowers coastal communities to reduce the potential negative impact of sea level rise (Tol et al, 2008). In particular, transportation infrastructure is exceedingly vulnerable with even a minimal increase of sea level rise (Oawald and Treat, 2013). Studies have examined the vulnerability of transportation networks under sea level rise (Lu and Peng, 2011; Sun et al, 2020; Bloetscher et al, 2012). However, there is a lack of research exploring the impacts of vulnerable transportation networks on the aging population under sea level rise scenarios.

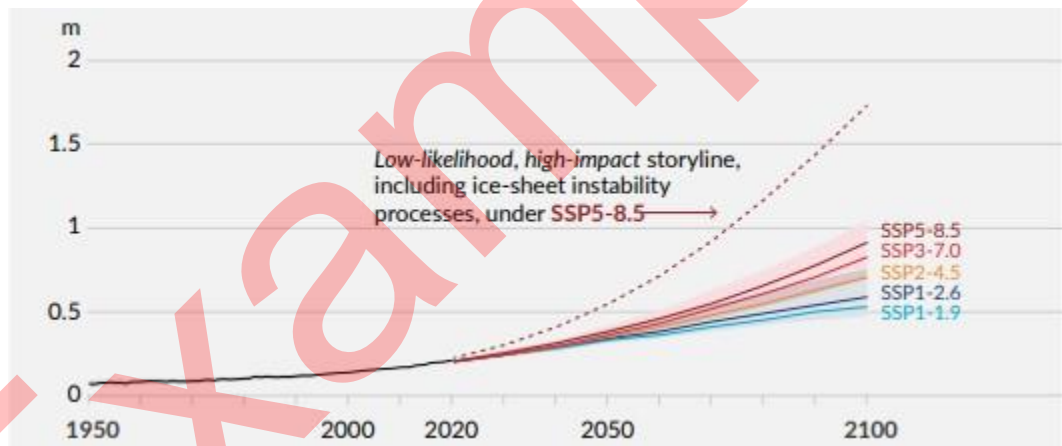


Figure 1. Global mean sea level in the past and as projected for the 21st century (IPCC, 2021)

Figure 1 shows the global mean sea level changes in meters in the past (1950-2020) and projected from 2021-2100, relative to 1900. The projection sea level rise are based on five illustrative scenarios, SSP 1-1.9, SSP 1-2.6, SSP 2-4.5, SSP 3-7.0, SSP 5-8.5 (IPCC, 2021).

The purpose of this study is to evaluate the impact of sea level rise on the accessibility of the aging population to essential services and facilities (i.e. grocery

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