My first name, 海, means “ocean” in Japanese. My parents chose this name due to the great importance of the ocean in Japanese culture, as they hoped I could become just as strong and influential. My cultural background, as well as my varied experience in school, research, and technical work, gives me a unique perspective on the cultural, spiritual, and economic importance of the ocean. Combined with my love for biology and a desire to teach, I am driven to pursue a career as a teaching research professor. I hope to contribute novel work to the study of ocean acidification directed by my diverse skillset and research experience.

I was first introduced to marine science by competing and teaching on my high school’s National Ocean Sciences Bowl (NOSB) team. This Jeopardy-style academic competition tested contestants about every aspect of oceanography. After exhausting my team’s reserve of college-level oceanography textbooks, I began reading graduate-level books to supplement my knowledge. Not only did I compete on the varsity team in the national competition, but I also became the team’s de facto physical oceanography instructor by teaching a weekly 10-person class using my own lesson plans. The year after I graduated, my former students kept me informed of their own winning record. The most fulfilling part of NOSB was receiving thanks and recognition from my students.

During high school I was also an intern at the Scripps Research Institute in San Diego, where I purified proteins and antibodies for researchers studying nuclear pore complex proteins. I enjoyed the demanding work, and was able to lay a very strong foundation in lab protocol by working with *E. coli*. Most of my work was conducted independently with the supervision of my research mentor who taught me safe lab skills and walked me through techniques. Even though the internship was not perfectly aligned with my career goals, I loved learning the meticulous lab techniques and was satisfied that I could add to my skillset.

This background in careful laboratory procedures proved to be useful in my salmon ecology work with the National Oceanographic and Atmospheric Administration (NOAA) Fisheries Service as an undergraduate. I was surprised to find that I had significantly more laboratory experience than my mentor, and I aided her in cleaning, weighing and preparing seagull feathers for mass spectrometry to determine the historical impact of gull predation on the juvenile salmon population in Scott Creek, Santa Cruz, CA.

In addition to the lab work, I sought out as many volunteer opportunities as possible with the NOAA salmon ecology group. While gaining valuable field experience seining lagoons, electrofishing streams, and tagging salmon, I developed an expertise in working with the RFID antennas in Scott Creek. My system detects tagged salmon swimming by the submerged 15-foot antennas and contributes to a long-term dataset looking at movement of adults and juveniles through the creek. By drawing on my self-taught knowledge of electronics, I worked with the researchers to keep the six antennas operational for three years through countless flash floods, downpours, and leaks. Regardless of whether I was waist-deep the creek soldering wires or back at the lab making the antennas, I loved every minute of the challenging experience. I learned how to conduct different field techniques, collaborate in a large field team, and use my knowledge of electronics to contribute to salmon ecology research. I was delighted to see the level of support our science had from locals who were curious about salmon conservation. The value of the creek to their lives reminded me of the value of the ocean to Japan – a major part of their life that they could not imagine living without. Overall, my work experience was highly interdisciplinary and extremely satisfying; seeing researchers benefit from my work has been a rewarding experience.

My technical work with NOAA helped tremendously when I started launching high-altitude weather balloons with my student group, hibal.org. I was recruited to help with the

onboard electronics due to my technical experience but quickly gained a leadership role as we began to work on larger projects. We worked with NASA to test their satellite designs before deployment into orbit and helped design Google's weather balloon project to broadcast free wireless Internet across New Zealand (Project Loon). Our work was presented for three consecutive years at Maker Faire, a do-it-yourself convention focusing on amateur hobbyists.

We are currently using our acquired knowledge and experience to work with K~12 classes across the United States, helping them launch their own weather balloons and integrate this project into their STEM curriculums. Although launching weather balloons is an exciting activity, the truly exhilarating part of working with Hibal was the success stories we would hear from teachers and students. Whether it was teachers explaining how their students were ecstatic to launch balloons and learn about atmospheric science, or students talking about how much they learned with our help, I am extremely proud to be part of a group that works to foster scientific learning. I will take this enthusiasm and experience with me, and I hope that Hibal will be a valuable addition to my skillset as I continue through my career as an NSF fellow.

Dabbling in atmospheric science got me thinking about global climate change, but I specifically became interested in ocean acidification during a graduate-level chemical oceanography course I took in college. I was pleasantly surprised to find that my high school experience covered half the content of a class filled with Ph.D. students. The most impactful part of the course for me was the discussion of several then-recent papers regarding ocean acidification. The reading brought a lot of the global issues surrounding ocean acidification into perspective for me, making me consider the global decreasing seawater pH from a biological standpoint. I had been interested in human impacts on coastal ecosystems since my high school work, and understand the potential impact for strongly ocean-dependent nations. I have found ocean acidification to be an urgent, pressing global issue that intrigues me from a biological perspective and fits well within my expertise.

My background in marine chemistry and marine biology earned me a spot in an NSF Research Experience for Undergraduates (REU) program at Shannon Point Marine Center, WA. I worked with Dr. Kathy van Alstyne on algal secondary responses, which are generally released from cells to poison the water around them. Several species of brown and green algae have been shown to release toxic compounds in response to stress, such as sulfuric acid, dopamine, and DMS, and these have been shown to deter key predators. In my work, I looked for chemical defenses in 17 species using methods I modified from previous papers. I discovered that one of the species, *Ulva lactuca*, does not have any known chemical defenses but seems to leech an acidic compound in response to stress. Further research is being conducted on this algae to isolate the compound and determine its purpose. The internship culminated in a presentation and research paper, entitled *pH Fluctuation of Local Macroalgae in Response to Environmental Stressors.* This was also the first personal project I worked on entirely by myself, and through the experimental design, field collection, lab experiments, data analysis, and writing, I discovered that I enjoyed every step of the scientific process. This experience made me even more sure that I wanted to continue down the path of academic research.

Due to my interest in interdisciplinary work, I often seek out work that bridges my varied interests. As a biology major with a double minor in chemistry and electronic music, chemical oceanography integrated two of my key interests. My electronic music minor, on the other hand, was helpful in expanding my electronics background. I was familiar with one of the computer chips used in my antenna development work at NOAA because I used the same chip to construct an electronic instrument for a live music performance. Although I do not have a formal

engineering background, my understanding of electronic theory has allowed me to troubleshoot in the field, understand the limitations and advantages of technology, and talk efficiently with engineers while working at NOAA. I have also found that musical composition and arrangement foster logic and creativity, both of which I attempt to bring into my scientific thinking. My ability to draw connections between my various interests will be helpful as I continue working on the strongly interdisciplinary issues in global change biology.

Even though I decided to pursue a broader major and complete two minors, I still wanted to delve underwater. To accomplish this, I completed a Master Diver SCUBA certification and a scientific diver authorization to help me gain more experience in fieldwork. After earning a training assistant credential, I also TA'd the beginner and advanced SCUBA classes at UC Santa Cruz in both the pool and the ocean. The small classes allowed for a lot of individual attention on each student, and it was intensely rewarding to instill confidence and knowledge into novice divers. I hope to continue teaching and mentoring as I progress through my professional career.

I used these experiences to dive for the Raimondi-Carr lab at UC Santa Cruz conducting cage exclusion experiments in an attempt to look at the impact of sea otters on seagrass beds. Our field team consisted of biologists from two different universities with a wide variety of expertise. By playing to our strengths, we not only ran the experiment, but also collected valuable transect data for a long-term dataset of seagrass growth. As my first large-scale field project, I quickly learned how to collaborate with a group in order to work at an efficient pace and collect the necessary data. By the end of the summer, I was helping by delegating tasks, suggesting ideas, dealing with logistics, and ultimately felt like a team player among my peers. During this incredible growing experience, I felt increasingly confident about my ability to work on and contribute to a team. I helped through almost every step of the project, including experimental design, fieldwork, and lab analysis. Although our findings agreed with our hypothesis, the interaction does not seem to be as simple as we initially thought. I am currently co-authoring a paper on our results to be submitted by the end of this year.

Due to my acquired skills and diverse background, I was accepted into the Ph.D. program at UC Santa Barbara under the guidance of Dr. Gretchen Hofmann. The lab focuses on correlating current ocean pH conditions with marine biology to assess the capacity for organisms to survive through shifting global climate. We also utilize and help develop cutting-edge marine instrumentation to better understand the dynamics of marine chemistry. With my background in chemical oceanography, electronics, ecology, and stress responses, combined with a strong interest in teaching and research, I feel I have the foundation to succeed in graduate school with the Hofmann Lab.

I have grown significantly as a student and researcher since my first foray into science in high school. I gained a rigorous theoretical understanding through my academics, practical hands-on fieldwork experience through SCUBA and NOAA Fisheries, lab techniques through my cell biology and algae chemistry work, and education opportunities from my NOSB and weather balloon work. My unique skillset will allow me to conceive and execute novel interdisciplinary research, and I feel very prepared to make a positive contribution to science. My parents like to joke that my namesake "ocean" had an impact on my career choices, but it is clear to me that my emotional and intellectual passion has driven me to pursue a higher education in marine biology. The NSF Graduate Research Fellowship will provide me the resources and freedom to pursue my research interests through my doctoral program.