

GETTING READY!

IRES: Monitoring marine megafauna and coral reef communities using remote technologies.

Program Summary: With an estimated number of over 500,000 species, Costa Rica, is considered one of the 20 most diverse countries in the world (Kappelle, 2016), accounting for 5% of terrestrial and 3.5% of the marine biodiversity in the world (Wehrtmann et al., 2009, Avalos 2019). This marine biodiversity is found in several coastal environments including rocky intertidal areas, mangroves, estuaries, seagrass beds, coral reefs, coastal islands, and pelagic environments (Cortes and Wehrtmann 2009, Cortes 2017). There are urgent efforts to safeguard this marine biodiversity (Alvarado et al., 2012) as Costa Rican marine ecosystems are increasingly threatened by thermal water oscillations, algal blooms, bioerosion, overexploitation, coastal development, habitat degradation, and tourism disturbance, all of which directly impact the integrity and health of marine ecosystems and their diversity (Alvarado et al., 2012, Glynn et al., 2017). In the last two decades the most important natural event affecting marine communities in Costa Rica has been the El Niño-Southern Oscillation (ENSO), which have caused three major massive death events of corals along the Pacific coast (Jimenez et al., 2001, Cortes and Wehrtmann 2009, Alvarado et al., 2019). Dead coral has been replaced in many areas by turf algae (Cortes and Jimenez 2003, Fernandez-Garcia et al., 2012) which does well in eutrophic, acidic, warm, and polluted conditions (Harris 2015). The increased macroalgae presence has fueled the proliferation of sea urchins, which subsequently increase coral bioerosion rates (Alvarado et al., 2015) and through this physical habitat degradation, changed the trophic structure and diversity of fish assemblages (Arias-Godinez et al., 2021). This deterioration of the coral reefs in Costa Rica is further exacerbated by human activities associated with sedimentation from coastal construction, noise from boat traffic, and overexploitation (Alvarado et al., 2018).

This IRES program takes place in the Santa Elena Bay, located in the northwest Pacific coast of Costa Rica. A unique oceanographic feature of this region is the seasonal upwelling also known as the “Papagayo Upwelling” which brings deep cold and nutrient rich water to the surface during the trade wind season, driving high productivity and biodiversity in the area (Alfaro and Cortes 2012). Because of these unique oceanographic and biological characteristics, the gulf is part of the Guanacaste Conservation Area and a UNESCO Heritage Nature site, protecting coral reefs, seagrass, and mangroves ecosystems (Cortes 2017), which are critical habitats for sharks and rays (e.g., Espinoza et al., 2020), northern and southern hemisphere humpback whales and several species of dolphins (May-Collado et al., 2017).







Goals and objectives of the program for research and student training and professional development.

Research Goal	Research Objectives	Program Goal for Students	Program Objectives for Students
	(1) Evaluate the health and drivers of coral reef decline and recovery using photomosaics, passive acoustic monitoring, and		(1) Contribute to a better understanding of the short- and long-term impacts of climate change and human activities in tropical marine ecosystems.

<p>Investigate the environmental, biological, and anthropogenic factors impacting the coral reefs and marine megafauna of the Santa Elena Bay, Costa Rica.</p>	<p>conventional monitoring methods.</p>	<p>Provide training and research opportunities to undergraduate and graduate students in marine ecology and conservation.</p>	<p>(2) Develop an understanding of the challenges faced in marine conservation through the lens of cultural and outreach experiences, collaborations with local students, and science-community based efforts.</p>
	<p>(2) Study the diversity, abundance, and movement patterns of rays using acoustic tags.</p>		<p>(3) Acquire skills in scientific scuba diving, remote technology, and conventional underwater monitoring methods to study coral reefs and marine megafauna.</p>
	<p>(3) Study the effect of underwater noise on whale communication, behavior, and habitat using passive acoustic and drone technology.</p>		<p>(4) Discover their interest as scientists, by carrying out group and independent research projects, engaging in outreach activities, and meeting scientists in different career paths.</p>
			<p>(5) For graduate students gain mentoring experiences integral to their formation as researchers.</p>

Below is an example of the potential projects we will be developing throughout the program.

Examples of research projects

	<p>Quantification of coral reef health with and without restoration efforts using various indicators. Students within this cohort students can develop research question that related to (1) coral reef building species coverage and (2) complexity of corals, (3) diversity and biomass of reef fish, and (4) macroinvertebrates; and (5) sound pressure levels (dB) as indicator of species diversity</p>	
	<p>Drivers of decline of sharks (and relatives). Students within this cohort group students can develop research questions to study (1) population size using capture-recapture rate, (2) community structure using presence/absence of species, (3) movement patterns, (4) demographic data, and (5) shark habitat suitability</p>	
	<p>Effects of boat traffic underwater noise on cetacean habitats and their communication. Students within this cohort group can develop research questions to study (1) spatial and temporal variation in ambient noise, (2) contribution of boats to overall soundscape, (3) acoustic response of cetaceans to boat presence, and (4) develop species identification algorithms to study spatial and temporal variation of cetaceans using passive acoustic data.</p>	

This year we will be focusing on three main projects:

- (1) *Rays' movement* patterns for which you will be catching and implanting acoustic tags on rays with Dr. Mario Espinoza, Diego Fallas and Miguel Gomez. Acoustic transmitters send a unique low-frequency signal that is recorded by an array of receivers that have been deployed in the study region as part of a long-term monitoring effort by Dr. Espinoza and his students. Participants will be able to analyze ray movement patterns in response to habitat and environmental drivers.
- (2) *Coral health monitoring* for which you will be working with Dr. Juan Jose Alvarado and guest Dr. Cindy Fernandez. Diving along transects, you will take photographs using a Nikon Coolpix S700 in a housing to photograph the substrate along transects divided in 25 x 25 cm plots for a total of ~20 "photo-plots". Photographs will be stitched into a single 2D high-resolution photomosaic to identify and quantify the density of adult and juvenile reef-building coral species that are life, dead, and bleached, macroalgae, turf, sand, and rock. For life coral, students will collect information on coloration, evidence of bleaching, and loss of tissue. For fish assemblages we will use a combination of traditional visual census in combination with acoustic monitoring (see below). We will also visit a restoration project led by Dr. Alvarado in Papagayo Gulf.
- (3) *Acoustic monitoring of cetaceans* using long-term acoustic monitoring stations. To understand how soundscape dynamics may influence when and how cetaceans are acoustically active, you will deploy short term acoustic recorders called hydrophones in multiple habitats in collaboration with the coral project. Long-term bottom-mounted acoustic stations consisting of Soundtraps 400STD will be recovered and redeployed within the Santa Elena Bay to passively monitor the acoustic presence of boats, dolphins, and overall soundscape which varies throughout the day, providing an opportunity to measure the variability of ambient noise levels and the contribution of vessels to the overall soundscape. We will also be recording dolphins and whales from the boat, to study the acoustic structure of their signals and behavioral context, and generate a better understanding of how changes in their soundscapes may influence their communication.

Program expectations from participants.

1. Participate in creating a dynamic and respectful environment that promotes collaboration and contributions among participants and instructors through problem solving and analysis.
2. Learn that science is not about eureka moments! Good science takes time, involves failure, troubleshooting, discussions, re-evaluations, and yes frustration. Good science is always challenging at different levels, from collecting the data to its analysis.
3. Learn that there is not a single "right" way to do science! Different questions, systems, or species will require different approaches.
4. Be independent, respectful, and resourceful scientists that show initiative on all aspects of the program.

Program Instructors:

Faculty	Areas of research	Institution	Contact
Laura J May-Collado, PI	Marine soundscapes, Marine Mammal communication	University of Vermont.	lmaycoll@uvm.edu (802) 9998558
Joaquin Nunez, co PI	Genetics of a diversity of organisms	University of Vermont	joaquin.nunez@uvm.edu (786) 5140636
Mario Espinoza, collaborator	Spatial ecology and conservation of sharks and rays	University of Costa Rica	marioespinozamen@gmail.com
Juan Jose Alvarado, collaborator	Ecology of coral reefs	University of Costa Rica	juanalva76@yahoo.com
Cindy Rodriguez guest researcher	Ecology of Macroalgae	University of Costa Rica	
Ilaria Coero, Ph.D. Student	Acoustic of humpback whales	University of Vermont	ilaria.coero-borga@uvm.edu JetBlue 9:56 p.m.
Franny Oppenheimer, M.Sc. Student	Acoustic of humpback whales	University of Vermont	frances.oppenheimer@uvm.edu JetBlue 9:56 p.m.
Diego Fallas, M.Sc. Student	Ecology of sharks and rays	University of Costa Rica	niuvinor@gmail.com
Miguel Gomez, Ph.D. Student TA	Ecology of sharks	University of New Hampshire	miguel.gomezgarcia@unh.edu American 1:15 p.m.

Instructors Biography

Dr. Laura May-Collado is the main PI and will oversee the entire program in collaboration with the Co-PIs. Traveling with students to CR, organizing outreach activities, and participating in research activities. Dr. May-Collado is an experienced integrative marine biologist, Assistant Professor at the Department of Biology and Research Associate at Smithsonian Tropical Research Institute, Panama, and Chair of Committee of Scientific Advisors for the Society of Marine Mammalogy. She has over two decades of research and teaching experience working in collaboration with a network of researchers in Central America. She has extensive experience leading research expeditions and providing research opportunities to undergraduate/graduate students in the US and Central America. She also has extensive experience developing outreach and education activities aimed to inspire and educate students and the public.

Dr. Joaquin Nunez is an Assistant Professor at University of Vermont, and Co-Pi of this training and research program. The primary goal of his lab is to quantify the relative contributions of selection and drift to the levels of genetic variation observed in natural populations. Current projects include characterizing the dynamics of rapid evolution in fluctuating ecosystems as well as understanding the genomic consequences of boom-and-bust demography in seasonal

populations. To this end, his lab combines computational, experimental, and multi-omics approaches across a variety of study systems (fruit flies, barnacles, sea urchins, ants, and simulations).

Dr. Juan Jose Alvarado is a Professor and Researcher at the Department of Biology, the Center for Research in Marine Sciences and Limnology (CIMAR), and the Center for Research in Biodiversity and Tropical Ecology (CIBET) at the University of Costa Rica. He is also the Director of the graduate program for Integrated Management of Tropical Coastal Areas at the University of Costa Rica. He has over 20 years of experience researching the ecology of coral reefs and sea urchins in Central America. His lab leads several monitoring efforts of the coral reefs in Costa Rica, and through a collaborative network involving private companies, the government, and NGOs he is establishing several restoration projects of coral reef communities in both the Pacific and Caribbean coasts of Costa Rica.

Dr. Mario Espinoza is a Professor at the University of Costa Rica (UCR) and researcher at CIMAR with a strong background in behavioral ecology, fisheries management, and conservation. He is leading research on the critically endangered Largetooth Sawfish, and a national monitoring program of shark and ray populations in the entire Pacific of Costa Rica using multiple techniques (acoustic telemetry, baited remote underwater video stations, aerial surveys with drones, stable isotopes, and physiological markers). He is also a Regional Vice-Chair from the IUCN Shark Specialist Group (SSG), and an Advisor Committee member from the CMS-Sharks (Convention of Migratory Species). His ultimate research and conservation goals are to combine ecological and social indicators to gain more information on the patterns and consequences of shark declines in aquatic ecosystems.

Partners

Center of Research in Marine Sciences and Limnology (CIMAR) at the University of Costa Rica is a renowned leading marine research and conservation institute in Central America. The institute was founded in 1979, and since has played a major role in the scientific discovery of marine organisms and ecosystems, and as a leader designing scientific strategies and policies for the government of Costa Rica. The University of Costa Rica was founded in 1940 and ranks #1 in Central America and #19 in Latin America. Students participating in this program will have the opportunity to meet CR students and scientists, participate in cultural and outreach activities, and projects led by CR researchers at CIMAR. CR mentors will provide support with research permits, housing, recruiting CR students, transport, fieldwork logistics, and mentoring.

Diving Center Cuajiniquil: is a local dive shop from Cuajiniquil that has been collaborating in different projects develop by CIMAR since the late 1990s. Apart from all their experience working, diving, and fishing in the Santa Elena Gulf, this family-based dive shop has been trained in different monitoring techniques, including UVS, BRUVS, fishing handling and tagging, aerial surveys with drones, acoustic telemetry, and whale monitoring surveys. Moreover, this dive shop in Cuajiniquil is truly the definition of what local stakeholders are, and their impact in marine conservation, as their presence in the community has inspired many others to transition from fishing to tourism, thus promoting a better management and the conservation of key marine habitats and species in the region. This family also has many years of experience working closely together with US-based University Student Programs from California as described above. They have coordinated housing and field research opportunities for US

students with local families in Cuajiniquil. Therefore, this dive center has been a true partner in our scientific studies in Santa Elena Bay.

Program Participants: Some of you might taking the same flight to Costa Rica use the WhatsApp group to connect.

Participants	Institution	Arrival	Departure
Nox Giordano	University of Vermont	United 8:19 p.m.	United 7:15 am
Abigail Macomber	University of Vermont	JetBlue 11:30 a.m.	JetBlue 11:59 pm
Fiona Legg	University of Vermont	JetBlue 11:30 a.m.	JetBlue 11:59 pm
Jade Salis, M.Sc. Student	Kennesaw State University	Delta 11:53 a.m.	Delta 7 a.m.
Jennifer Gil Acevedo, Ph.D Student	University of Puerto Rico	JetBlue 11:30 a.m.	JetBlue 2:30 pm
Baylen Ratliff	University of Washington	American 1:15p.m.	United 11 a.m.
Jennifer Valenzuela	West Valley College / Mission College	Southwest 7:40 p.m.	Delta 7 a.m.
Camila Rodriguez	University of Costa Rica	-----	-----

Code of Conduct for fieldwork

Together our faculty has been doing field research with students and colleagues for a very long time, and we all love it! But we all agree that our job is more enjoyable and productive when our team members get along and respect one another. In the next four weeks we are going to be sharing space in the boat and in living space, and sometimes (and understandably) we will be tired. Therefore, it is very important that we contribute to creating an environment where all feel respected, safe, and included but also feel the trust to ask for privacy to recharge. Here are a few things we can do for one another (based on the code of conduct for fieldwork from the *Association of Polar Early Career Scientists* and the *Society for Marine Mammalogy*).

1. *Be thoughtful and respectful.* Respect personal boundaries. Keep your side of the room organized, clean up after yourself, ask permission to take photos or record team members in any way, respect other's property and the facilities. Other ways of respect come from acknowledging local and indigenous knowledge. Treat colleagues with respect and fairness. Respect the culture and community of the people that live in this region. Make efforts to learn the culture and value the knowledge that the residents hold from their marine communities. Make efforts to build relationships for future collaborations.
2. *Be on time.* Daylight hours are used for fieldwork, we need to use them to their max, especially when there is diving involved. Be on time for breakfast and for all established activities, including those at night. Our Costa Rican colleagues are not paid by this program, they are volunteering their time to teach you how to be a marine biologist, so please respect their time.
3. *Be helpful.* Do not wait to be asked for help! We will be carrying lots of equipment that is fragile and requires good care. Help to carry things to the car and the boat. Ensure that all equipment and field lunch are on the boat. Help clean up equipment after returning from the field. Ask how you can help.

4. *Be a team player:* Ask for help when you need it and respect those who ask for help. Recognize that people have different strengths, and some disabilities are invisible.
5. *Be accepting:* We will be living in a very different social and scientific culture, try to understand the context and ask questions. Be accepting of diverse viewpoints and allow all team members to express their opinions openly without judgment if viewpoints are not discriminatory. Scrutinize ideas, not individuals. Having said that, if you feel there is a situation or use of language that negatively affects one of our team members let the faculty know. We all deserve to feel safe, and your conversations with the faculty are confidential.
6. *Be patient:* Arranging the logistics of this type of field experience is cumbersome and sometimes things do not go as planned, no matter how much we plan things, be patient and be ready to support your faculty and peers.
7. *Be engage:* This is a unique opportunity to get to know the people involved in making this program possible, ask us about their experiences, participate in discussions, be proactive in the field, you are creating new collaborations and networking opportunities.

Unacceptable behavior

- Physical or verbal abuse, harassment, or assault
- Intimidation or bullying
- Sexual misconduct
- Behavior that endangers the mental or physical health and safety of oneself or others
- Acting as a bystander and not reporting misconduct
- The use of illicit drugs or alcohol during fieldwork or while in town
- Disregard for the personal property of others
- Loud and obnoxious behavior
- Disregard for quiet hours
- Repeatedly disregarding responsibilities
- Use of social or mainstream media to target team members in a way that could harm their privacy and/or reputation
- Deliberately mis-characterizing a person's gender identity, including through the use of a name or pronoun that the person has rejected.

Note: drinking age in Costa Rica is 18, however, we are traveling under UVM policies and we must respect the US drinking age limit of 21.

Body system

We will implement the body system for scuba diving, snorkeling, and recreational activities. We will spend a lot of our time doing research, however, there will be time for recreational activities or even time to go to the local store to get supplies and snacks. We ask you to do all of these activities in pairs. For diving and snorkeling this it is a fundamental rule, regardless of how experienced you are. While the town is safe and we will be in a safe space, being careful never hurts. So please make sure of the following

1. Diving/Snorkeling: we will have a log to keep track of who is diving with whom, and where.
2. Going to the store or to a recreational activity, notify your faculty and GTAs of where you are going and when you will be back.

- Emergencies use What'sApp to contact faculty or GTAs or call the hotel Hacienda Casa del Viento +506 61791278

Data Use and Sharing: The data that you will be using to develop your projects is the property of the PIs and collaborators of this program. We ask you not to make copies of the data in your laptop or hard drive unless you have received formal authorization from the PI. If you wish to pursue your research as independent research or undergraduate or graduate thesis under the mentorship of one of our program faculty, let us know, and we will craft a Memorandum of Agreement on data use and sharing.

Social media: We will be posting in the ONDAS Lab Instagram account **@maycolladolab** to share our experiences. The information posted here will be curated before posting. Please notify us if you consent or not to post photos, videos, and news involving you. You can repost these posts on your own social media.

Writing in the Age of Artificial Intelligence: Since writing, analytical, and critical thinking skills are part of the learning outcomes of this program, all writing assignments should be prepared by the participant. Developing strong competencies in this area will prepare you for a competitive workplace. Therefore, AI-generated submissions are not permitted and will be considered a violation of the code of Academic Integrity.

Recommended Literature (go to our website, select at least one paper per topic)

Recommended Software (all are free)

You do not need to download all of them but it would be great if you have Audacity and PhotoQuad to do data analysis in you on laptop and the Audiomoth and SountraTrap host to help configure the various recorders we will be deploying.

Audacity: this is a free, open source, cross platform audio software <https://www.audacityteam.org/> (to inspect audio files)

Audiomoth Configuration and Time Apps <https://www.openacousticdevices.info/applications> (to configure hydromoth audio recorders).

SoundTrap Host <https://www.oceaninstruments.co.nz/downloads/> (to configure soundtrap audio recorders)

PhotoQuad <https://www.mar.aegean.gr/sonarlab/photoquad/> (for analysis of photomosaic data)

ImageJ <https://imagej.net/ij/> (for analysis of photomosaic data)

Welcome to the Program

Date	Activities	Instructors
Pre-Travel Activities		
May	Complete Survey sent by Evaluator Linden Higgins Send May 17, 2024	
June 4, starting at 11 a.m. to 5 p.m. (eastern time)	Welcome to the Program Getting ready for the field component	Introducing the Team Led by Laura May-Collado

Costa Rica: 9 a.m. to 3 p.m. Pacific: 8 a.m. to 1 p.m. Central: 10 a.m. to 4 p.m. https://www.timetemperature.com/tzus/time_zone.shtml	Computational Workshop by Dr. Nunez in preparation for this workshop Go to https://www.icbnunez.org/field-stats-ires Step 1: Become familiar with the basic dynamics of R before our live workshops. I have also included extra resources for folks who are new to stats (from my favorite YouTube channel!) Step 2: This day we will have our first live workshop where we will build our first analytical pipeline in R.	Led by Dr. Nunez
June	Read Recommended Literature select at least one paper for each theme link to papers here https://drive.google.com/drive/folders/1rMF3P-qnJ-6kxo9P4OdlcG7GygK-aAsB?usp=sharing	Any questions ask Laura or Joaquin
July 1	Have a great flight! (check Participant section below and see if anyone else is in your flight and connect)	Laura will be picking you up at the airport. Text me or the WhatsApp group in case of delay or any other circumstance.
Research Activities in Costa Rica (July 1-22) Note: students will have the opportunity to participate in all projects		
July 1	Night at Echo Stay (dinner is on you own)	GTAs Franny, Ilaria, and Miguel will be available at the hotel for any question.
July 2	Day: <ul style="list-style-type: none"> Breakfast at hostel. Departing to Hotel Casa del Viento in Cuajiniquil at 8 a.m. This is a 5-hour drive. Lunch on the way covered by program. ~2 p.m. arrive to Cuajiniquil: get settled. Night: <ul style="list-style-type: none"> Lecture at night by our Scuba Diving instructor, Minor Lara 	GTAs Franny, Ilaria, Miguel will be driving with you on the bus, and Laura will be driving separately with diving gear and equipment. Minor Lara, Diving Center Cuajiniquil
July 3	Day: <ul style="list-style-type: none"> Scuba Diving activities with Diving Center Cuajiniquil Night: <ul style="list-style-type: none"> Lecture TBD, preparing for fieldwork next day, description of overall ray project. 	Minor Lara, Diving Center Cuajiniquil Laura, Mario, Diego, and GTA on site.
July 4	Day: <ul style="list-style-type: none"> Fishing and Tagging activities. Night: <ul style="list-style-type: none"> Lectures: Elasmobranch communities of Santa Elena. Discuss project ideas based on field day and write a 1-page proposal (see detail below). 	Laura, Mario, Diego, and GTA on site.
July 5	Day: <ul style="list-style-type: none"> Fishing and Tagging activities. Night:	Mario, Diego, and GTA on site.

	<ul style="list-style-type: none"> Lecture by Jennifer Gil (Science communication) 	
July 6	Day: <ul style="list-style-type: none"> Fishing and Tagging activities. Night: <ul style="list-style-type: none"> Data entry and processing Advance Coding Workshop 	Mario, Diego, and GTA on site. Joaquin
July 7	Day: <ul style="list-style-type: none"> Fishing and Tagging activities. Night: <ul style="list-style-type: none"> Data entry and processing Advance Coding Workshop 	Mario, Diego, and GTA on site. Joaquin
July 8	Day: <ul style="list-style-type: none"> Fishing and Tagging activities. Night: <ul style="list-style-type: none"> Data entry and processing 	Mario, Diego, and GTAs.
July 9	Day: <ul style="list-style-type: none"> Fishing and Tagging activities. Night: <ul style="list-style-type: none"> Data entry and processing 	Mario, Diego, and GTAs.
July 10	Day: <ul style="list-style-type: none"> Fishing and Tagging activities. Night: <ul style="list-style-type: none"> Data entry and processing 	Mario, Diego, and GTA on site.
July 11	Day: <ul style="list-style-type: none"> Finally ray project activities. Night: <ul style="list-style-type: none"> Projects preliminary result presentation and Farewell dinner to Mario, Diego, and Miguel 	Mario, Diego, and GTA on site. Laura and Juan Jose arrive
July 12	Day: <ul style="list-style-type: none"> Visiting field sites together Night: <ul style="list-style-type: none"> Lecture: Coral's status and conservation in CR (Dr. Alvarado) Lecture: Marine Mammals status and conservation in CR Split groups. Discuss project ideas based on field day and write a 1-page proposal (see detail below). 	Laura, Juan Jose, GTAs
July 13	Day: <ul style="list-style-type: none"> Group 1: Coral Reef Monitoring Group 2: Whale Monitoring Night: <ul style="list-style-type: none"> Data entry and processing Advance Coding Workshop 	Laura, Juan Jose, GTAs Joaquin
July 14	Day: <ul style="list-style-type: none"> Group 1: Coral Reef Monitoring Group 2: Whale Monitoring Night: <ul style="list-style-type: none"> Data entry and processing Advance Coding Workshop 	Laura, Juan Jose, GTAs Joaquin
July 15	Day: <ul style="list-style-type: none"> Group 1: Coral Reef Monitoring Group 2: Whale Monitoring 	Laura, Juan Jose, GTAs

	<p>Night:</p> <ul style="list-style-type: none"> • Data entry and processing • Lecture: Photomosaic analysis (chepe) 	
July 16	<p>Day:</p> <ul style="list-style-type: none"> • Group 1: Coral Reef Monitoring • Group 2: Whale Monitoring <p>Night:</p> <ul style="list-style-type: none"> • Data entry, processing, and analysis • Lecture: How to analyze Humpback whale songs (Ilaria) 	Laura, Juan Jose, GTAs
July 18	<p>Day:</p> <ul style="list-style-type: none"> • Group 1: Coral Reef Monitoring • Group 2: Whale Monitoring <p>Night:</p> <ul style="list-style-type: none"> • Data entry and processing • Data analysis • Discuss your 2-page “Scientific note” with faculty. 	Laura, Juan Jose, GTAs
July 19	<p>Day:</p> <ul style="list-style-type: none"> • Group 1: Coral Reef Monitoring • Group 2: Whale Monitoring <p>Night:</p> <ul style="list-style-type: none"> • Data entry and processing • Presentations. 	Laura, Juan Jose, GTAs
July 20	<p>Day: Visit to coral restoration project at Playa Hermosa led by Dr. Alvarado. We will do snorkeling and diving (for those that want to continue practicing) and discuss in site ongoing efforts to save the local corals.</p> <p>Night: Farewell dinner and final briefing with instructors (i.e., who wants to pursue their research project? Honor thesis? Graduate thesis? We will discuss ways in how to do it)</p>	Laura, Juan Jose, GTAs
July 21	Departure 7 a.m. to San Jose (lunch/dinner on your own)	Laura and GTAs
July 22	Hotel will arrange taxi to airport	GTAs will help you.
July 23-July 31	<ul style="list-style-type: none"> • Complete post program survey (you will receive an email from Program Evaluator Linden Higgins) • Send us your “Scientific note” via google drive for final feedback and inclusion in the Program 2024 Memory Book • 1-min video 	Remotely and at your own pace.

Students Deliverables

1. Two 1-page project proposals (after each activity)
2. One 2-page “Scientific Note”
3. A ~1-min video of your experience during the program
4. Completion of pre (LINK) and post (LINK) program survey
5. Inform instructors of your interest in (1) continuing working on your research project (i.e., data processing, analysis, scientific writing) or/and (2) developing coding and data analysis skills.

Program Deliverables

1. Students trained in several marine remote technology methods.
2. Collection of photomosaics, tagging data, PhotoID, and audio recordings.

How to Pack

We will be spending most of our daylight hours in a boat. Make sure you bring clothing that is appropriate for fieldwork. This includes the following.

- Long-sleeve shirts and leggings are recommended for long hours in the boat (UV protection if you have otherwise long-sleeve shirts and regular leggings help).
- Shorts and T-shirts for when we are in the hotel.
- UV protection face and neck mask (\$8 in amazon)
- Hats
- Sunscreen I recommend 50+
- Sandals
- Mosquito spray
- Bathing suit
- Personal items (shampoo, conditioner, soap, etc.)
- Your own first aid kit and any medication you might need.
- Water bottle
- UV protection gloves (optional)
- Always keep a pair of closed shoes, jeans, shirt, and socks dry.
- **Bring your laptop, and a USB drive.**
- Notebook and pencils.
- Laundry you will have to do your own laundry. Soap will be provided.
- Sea sickness bracelets or medication if you need it, preferably non-drowsy.

Note: all diving gear including wetsuits, snorkel, masks, tanks, belts, weights, regulators, etc.

1-page research GROUP proposal

We understand this is a very short training program and we cannot provide all the practice and time scientific writing requires, but we can get you started! One of the most important aspects of scientific research is to formulate a question. You will have the opportunity to see the habitat and animals and interact with the experts in the field under the large scope of the project. You and your peers that shared interest in specific questions can formulate together a question your group would like to answer within the frame of time dedicated to each theme. We will do this twice, once for theme 1 (Ray tagging project) and a second time for either theme 2 (Coral reef project) or theme 3 (Whales and anthropogenic noise). As your group writes your proposal feel free to ask for advice and notes from instructors and GTAs, we are here to make this assignment a collaborative experience.

- **Title: 1 sentence**
- **Introduction** (1 paragraph): Provide a short background to the problem with key citations. This section should include observations (yours or literature) that lead to your question or hypothesis.
- **Methods:** (1 paragraph): How will you answer this question. What type of data (and how much) do you need to answer the question? How will you collect it? Provide a short timeline.

- **Significance:** (1 paragraph): How does your project (with more time) advance knowledge on this field? How does it benefit society? (e.g., conservation and management efforts).
- **Note:** Use font arial 10, single spaced.

Upload here 1 page group proposals for Rays

<https://drive.google.com/drive/folders/1bSFqnsfXmplq4QTbBv1UT5bd7Lhblraw?usp=sharing>

Upload here 1 page group proposals for corasl/whales

https://drive.google.com/drive/folders/1i0LoYQszPIC8vQ1x0YEm_UuEZrGYFrpV?usp=sharing

2-page INDIVIDUAL Scientific note

Select the project you participated in that impacted you the most, that one that truly calls to your research interest and write a 2-page scientific note, using the data you collected. Scientific notes are short communications usually of interesting results but that are limited in scope, sample size, or rare observations. Some of the questions we pursue in our labs are built from the curiosity of scientists that published their findings in this format. It is possible that you are writing the note on one of the projects you wrote a proposal for, so can use your proposal as your starting point! The note headings should include: **Introduction/ Objective/Material and Methods/Results/ Conclusions/References/ Acknowledgements.**

The note also includes a short abstract (summary of your findings) of 200 words (Laura and Joaquin will translated to Spanish), and 5 to 7 key words that do not appear in the title. **Note:** Use font arial 10, single spaced and for references use APA 7ed style. See example here: <https://revistas.ucr.ac.cr/index.php/rbt/article/view/57281/57815>

Again, as you write your proposal feel free to ask for advice and notes from instructors and GTAs. The goal is twofold:

- To get you thinking about the work you did through your writing.
- Figure out if you want to pursue this project in the fall for your own interest or to earn research credits at your own institution.

Upload your Individual Scientific Note here:

<https://drive.google.com/drive/folders/1BBu8fXON9zRqmAp0KcoHomaFWVpgT7XR?usp=sharing>

Group oral presentations after each theme will done using an informal format to present the highlights of your group projects and discuss future directions.