



IN VIVO

The Publication of the Metropolitan Association of College and University Biologists

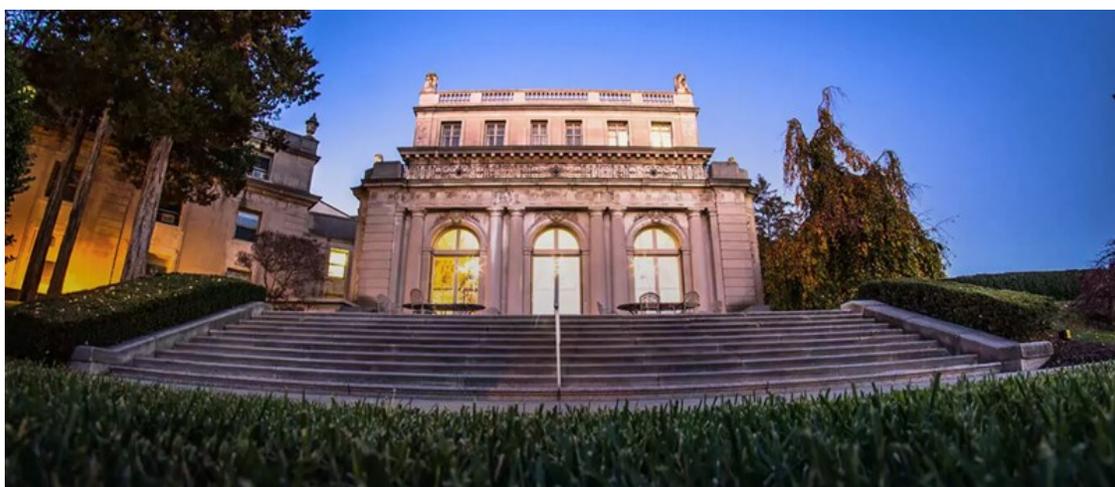
Fall 2019

Volume 41, Issue 1

52nd ANNUAL MACUB CONFERENCE

Saturday, October 26, 2019

8:30 AM - 4:00 PM



MONMOUTH UNIVERSITY
West Long Branch, NJ

Marine Biology: In the Deep and on the Edge

Invited Speakers

Dr. Amanda Netburn, Oceanographer
National Oceanic and Atmospheric Administration

Dr. Christina Colon, Associate Professor
Kingsborough Community College, CUNY

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Articles can be submitted electronically to invivo@mec.cuny.edu or mailed as a printed copy (preferably with a diskette that contains the file) to the Editorial Board at Medgar Evers College. All submissions should be formatted double spaced with 1 inch margins. The title of the article, the full names of each author, their academic affiliations and addresses, and the name of the person to whom correspondence should be sent must be given. As a rule, full length articles should include a brief abstract and be divided into the following sections: introduction, materials and methods, results, discussion, acknowledgments and references. Reviews and short communications can be arranged differently. References should be identified in the text by using numerical superscripts in consecutive order. In the reference section, references should be arranged in the order that they appeared in the text using the following format: last name, initials., year of publication. title of article, journal volume number: page numbers. (eg. - ¹Hassan, M. and V. Herbert, 2000. Colon Cancer. *In Vivo* **32**: 3 - 8). For books the order should be last name, initial, year of publication, title of book in italics, publisher and city, and page number referred to. (eg. - Prosser, C.L., 1973. *Comparative Animal Physiology*, Saunders Co., Philadelphia, p 59.). Abbreviations and technical jargon should be avoided. Tables and figures should be submitted on separate

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Welcome from Monmouth University

Monmouth University welcomes the members and guests of the Metropolitan Association of College and University Biologists to MACUB's 52nd annual conference on Saturday, October 26th 2019 in West Long Branch, New Jersey.

Monmouth's beautiful coastal campus is just one hour from New York City and Philadelphia. Many of the faculty are involved in academic research with small class size and a student faculty ratio of 13 to 1. Monmouth University has a student population of more than 6,000, coming from 31 countries and 35 states.

Student life at Monmouth supports 23 athletic teams in Division I NCAA sports, 31 academic and leadership honor societies, and more than 100 recognized clubs, including the American Society of Biochemistry and Molecular Biology (ASBMB) Most Outstanding Chapter, 2019.

Notable buildings include the Woodrow Wilson Hall, a national historic landmark, and the Guggenheim wing of the Library. Monmouth University maintains The Bruce Springsteen Archives and Center for American Music and has five Centers of Distinction: The MU Polling Institute, the Center for the Arts, the Kislak Real Estate Institute, the Institute for Health and Wellness, and the Urban Coast Institute.

Monmouth University recently unveiled the completion, remodeling and expansion of its science facility. The new science complex includes state-of-the-art research and teaching labs, student conference rooms, warm and cold rooms, tissue culture lab, instrument labs and a vivarium. The facility houses the Urban Coast Institute and sponsors the School of Science Undergraduate Summer Research Program which promotes an academic research culture in biology and other



52nd MACUB CONFERENCE INVITED SPEAKERS



Amanda N. Netburn, Ph.D., is an Oceanographer at NOAA's Office of Ocean Exploration and Research, where she leads the effort to incorporate water column observations and sampling into the exploration paradigm. This is accomplished through advising on NOAA Ship Okeanos Explorer and other expeditions, supporting NOAA grants programs, and developing novel partnerships. Amanda has a PhD in Oceanography and a Masters degree in Marine Conservation and Biodiversity from the Scripps Institution of Oceanography at UC San Diego. For her dissertation research, she studied the effects of deep hypoxic waters on the physiology and distributions of mesopelagic fishes off of southern California. In the past, Amanda has researched sustainable seafood at a non-governmental organization, taught SCUBA, captained small boats, and worked in aquaculture. She has sailed on fifteen oceanographic cruises, and uses submersible technologies, acoustics, and trawling to explore the mesopelagic zone, including leading many midwater ROV surveys remotely via telepresence.



Christina Paulette Colón, Ph.D., is Associate Professor and CSTEP Coordinator in the Department of Biological Sciences at Kingsborough Community College, CUNY. Prior to joining the faculty at Kingsborough Community College Dr. Colon was an adjunct at Columbia University, a curator at The New York Botanical Garden, and an educator at the Bronx Zoo. She conducted her Masters' thesis (NYU, 1990) on jaguars in Belize, and her doctoral dissertation (Fordham, 1999) on the Malay civet in Borneo. After years of active research in Asia studying palm civets, binturongs and sun bears, she has shifted her focus to local species in an effort to involve her students in her research. She currently works with dozens of students each spring to study the breeding ecology of American horseshoe crabs in Jamaica Bay, and studies Gotham's resident coyotes during the fall. Dr. Colón currently lives on her native island of Manhattan. Prior to academia, she has worked as a zoo keeper, wildlife rehabilitator, travel writer, bartender and maid.

From New York City to Cuba: The First New York/University of Havana Marine Biology Course Partnership

Kathleen A. Nolan¹, Kristy Biolsi¹ and Patricia González-Díaz²

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²Centro Investigaciones Marinas-University of Havana (CIM-UH)

Abstract

Thirteen students, led by two NYC and one Cuban professor participated in the inaugural partnership between St. Francis College and the University of Havana for the field portion of a marine biology course. Students snorkeled in four locations, and conducted research projects in two. These course-embedded, short research projects (CURE's) helped to reinforce marine biology concepts. The students focused on coral reef ecology, which was the focus of our host, Dr. Patricia González-Díaz in Cuba. Results from a student satisfaction survey and selected journal entries are presented here. Lessons learned and comparisons to other CURE studies in the literature are also reported.

Introduction

Students from St. Francis College in Brooklyn, New York, have participated in fifteen marine biology/animal behavior courses in the Caribbean since 2007¹⁻⁵. Three of these courses took place in Belize, two in Honduras, and nine in the U.S. Virgin Islands. Unfortunately, the Hurricanes Maria and Irma conjured together to destroy the Virgin Islands Environmental Resources Station or VIERS in the fall and winter of 2017-2018. Our last course at VIERS was in January 2017. Because we no longer had a field site to run our course in the Caribbean, we decided to search for other field sites.

Nolan was in Cuba in March 2018 with SFC professors Sintia Molina and Virginia Franklin, who were leading their own course with seven students to Cuba. Their focus was on Spanish culture and photography, and this was their fifth trip. The two professors accommodated her interest in exploring the possibility of hosting a marine biology course with a travel component in Cuba arranging a snorkeling trip in the Bay of Pigs in southern Cuba. Through serendipity, Nolan was able to make a connection by physically visiting the inauspicious University of Havana Centro Investigaciones Marinas-University of Havana (CIM-UH), Cuba in the

Miramar section of Havana (after a kind cab driver drove door-to-door asking the location of the center as Nolan probably did not copy the address down correctly). She met a former director, Michael Armentero, who conducts research on polychaetes⁶, and who gave her suggestions with how to proceed in conducting such as course.

She eventually connected with Patricia González-Díaz, Ph.D., who is the Director of CIM, and the three co-authors arranged to meet in a conference (required by the Cuban government for planning purposes) in January 2019. The mission of CIM is: "To contribute to the preservation of the environment and sustainable development through the integration of research and human capacity building in Marine Biology, Aquaculture and Coastal Management, with a holistic and interdisciplinary approach". Their personnel includes 11 professors, 8 researchers, 13 technicians, 6 trainees and 11 staff members. CIM scientists conduct research in the arenas of marine ecology, conservation genetics, management and conservation of marine resources, and aquaculture. CIM has a special focus on sharks, manatees, sea grass beds, in which scientists look at the molecular genetics and ecology of these organisms and make recommendations for management and conservation and marine protected áreas or

MPA's. Dr. González-Díaz's research especially focuses on the structure and function of coral reefs, paleoclimatic reconstructions and human impacts on coral reefs based on coral cores, reef health and mechanisms of resilience, biodiversity patterns of corals at a regional scale, and connectivity processes and patterns seen with the interactions of other organisms with coral reefs⁷. Figure 1 depicts examples of healthy coral.

The plans were made, and the two New York professors, Nolan and Biolsi, after teaching an online portion of a marine biology/animal behavior course, returned with 13 students in May 2019. Cuba was hot, muggy, and the rainy season was apparent. We stayed in a hotel during our time in Havana (the first two and last two days), and three days in the two of Playa Larga in the Zapata Swamp area on the southern side of Cuba. Our first snorkel was just west of Havana at Playa Baracoa (a "playa" is a beach). The students were introduced to turtle and manatee grass, and invertebrates such as conch, *Diadema* sea urchins and sea cucumbers (Fig. 2.)

Before and during the travel portion of the course, students were presented with information by Patricia González-Díaz on the coral reef ecosystem and the connectivity of the reef to other ecosystems. Additional information on these topics can be found in Foster *et al.*⁸ Karr *et al.*⁹. Students were also given optional readings with specific information such as the genetics of Cuban shrimp¹⁰ and were taught about the invasive lionfish¹⁰.

Student Research Projects (Course-embedded undergraduate research experiences (CURE))

The use of CURE's has been well-documented; a few references are listed here. Guenther *et al.*¹² utilized a CURE project in their January term at Elmhurst College and found increased retention in their STEM majors. Nadelson *et al.*¹³ found that students in summer Research Experiences for Undergraduates (REU's) gained an increased understanding of the process of doing science. Brownell and Kloser¹⁰ suggest that thinking like a scientist and picking projects that have relevance to the student are important parameters in CURE, and offer ways to assess these as well as other attributes of CURE's. Brew and Mantai¹⁴ list challenges to CURE's that exist. Shortlidge *et al.*¹⁵, also identified challenges, but purported benefits for faculty as well. Tootle *et al.*¹⁶ suggest that mini-CURE's might enhance recruitment of students into STEM fields. Stanford *et al.*¹⁷ found that both STEM and non-STEM students had enhanced learning outcomes after participating in CURE's. Goldberg and Castellón¹⁸ reported that students that conducted field research projects gained a greater understanding of hypothesis testing and noted that these types of projects might be able to be further developed into citizen science projects. Anthony *et al.*¹⁹ found that students increased their "identity as a scientist" after completing a marine biology CURE.



Figure 1. Coral in Cuba

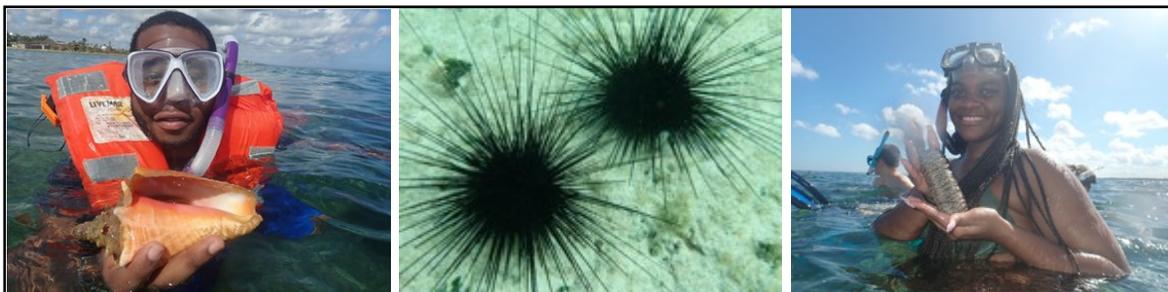


Figure 2. Conch, *Diadema* (black spiny sea urchins) and sea cucumber

We have been including CURE's in our general biology and some other advanced biology courses at SFC for years. Dr. González-Díaz also feels that including research projects in this short travel course is very important for the students, and she helped to facilitate this for us. She told the students the general concepts of four projects that they would undertake in groups, and they consequently developed hypotheses for their research projects, tested them, collected and analyzed data, and made final presentations. Even though these projects were short, the students were required to apply the scientific method to a problem, and this helped them to engage more deeply with the material.

Students were arranged in groups to conduct four research projects. Figure 3 depicts the students just before beginning their projects. Two were designed for students that had more of an affinity for the water, whereas the other two projects were conducted on the beach.



Figure 3. Dr. González-Díaz explaining research projects to students

Project 1 involved using one-meter quadrats to survey coral diversity and density in the near shore areas and the edge of the shelf

Project 2 explored interactions among corals in which evidence of competition was gleaned when two corals abutted each other. They also used a smaller square frame 0.25 m² to study coral recruitment). In some cases, there was a white line that separated two different types of corals due to competition.

Project 3 explored both trash and plant life along the shore.

Project 4 explored beach and protected area use by visitors and our students arrived at similar conclusions as Garcia-Tamayo *et al.*²⁰, who studied the effects of visitor centers on Cuban protected areas and found that conservation information provided to visitors enhanced the value of the parks. A side project was also conducted by this

group that depicted diversity of sea shells that were found along the shore in El Tanque and Cueva de los Pesces (Table 1a,b). Even though more species were found in El Tanque, Cueva de los Pesces was more diverse because there was a higher species evenness. We used the Shannon-Weiner formula for species diversity where p is the proportion that each species makes up of the whole.

$$H = - \sum_{i=1}^S p_i \ln p_i$$

Despite the fact that the students only had essentially three days to conduct and report on their projects, there was definitely a benefit to conducting them. Even though Dr. González-Díaz was the driver for the projects, the students developed their own null hypotheses to test, designed the methodology for the project, executed the project, made a PowerPoint presentation on the project, and presented the project to the class.

We devised an anonymous survey of 33 questions that focused on the students' satisfaction with the course. Students could choose from a 5-point Likert scale that ranged from strongly disagree to strongly agree (as listed below) or, in questions # 32 and 33, a five-point Likert scale from least likely to very likely. Question 34 asked the students to consider, if they were to return to the Cuba or the Caribbean as an ecotourist, how much they would be willing to spend to do so. The total expenses, not including tuition, were approximately \$2,000 for the week. The students were also encouraged to add comments after each question.

Cuba Marine Biology Course Survey 2019

Survey of Student Satisfaction on first St. Francis College Marine Biology course partnership with the University of Havana-CIMS. These were answered on a scale of 1-5: **1 = strongly disagree; 2 = disagree; 3 = neutral; 4 = agree and 5 = strongly agree.** Thirteen students participated. The questions are listed and the results are given below each question.

1. I liked the Hotel Vedado in Havana.
2. I liked the introduction by Patricia on the coral reefs at CIMS.
3. I liked the first snorkel in Havana at Baracoa.
4. I liked the lunch in Old Havana.
5. I liked the tour of Old Havana by Liz.
6. I liked the roommate situation.
7. I liked the social interaction with the other students.
8. I liked the social interaction with the professors.
9. I liked the divers.

Table 1a. Playa El Tanque in Bayhia Choquina	
Common name	Abundance
Venus clam	53
Turban snails (top snail)	11
Limpet	3
Queen conch	1
Whelks	3
Helmet conch	1
Surf clam	2
Purple snail	2
Tree snail	1
Calico shell	1
Cone snail	1
Species richness 11	79

Table 1b. Cueva de los Pesces	
Common name	Abundance
Venus clam	6
Turban snails (top snail)	1
Limpet	1
Queen conch	2
Surf clam	2
Purple snail fresh water	5
White snail fresh water	2
Cone snail	1
Species richness 8	20

10. I liked the second snorkel in Playa Coral in Matanza east of Havana and in the north.
11. I liked the experience of snorkeling.
12. I enjoyed looking at the coral.
13. I enjoyed looking at the fish.
14. I enjoyed seeing invertebrates such as Diadema, sea egg, donkey dung and sea star.
15. I enjoyed the debriefing (circle) discussions.
16. I liked the bus and driver.
17. I enjoyed the snorkel in El Tanque (first in Bay of Pigs).
18. I enjoyed the second snorkel/shoreline project in El Tanque (first group work).
19. I liked the meals in Playa Larga.
20. I liked the housing at Playa Larga
21. I like the town of Playa Larga
22. I liked the second snorkel at Cueva de los Pesces in the Bay of Pigs.
23. I liked the second round of conducting a research project at Cueva de los Pesces.
24. I liked the coral reef lectures in the evening by Dr. Patricia González-Díaz .
25. I feel that the research project made me connect to the marine biology of Cuba.
26. I enjoyed working on the research project in Cuba.
27. I enjoyed the swimming at the first swimming hole in Cueva de los Pesces.

28. I liked the hike to the Enigma. De la Rocca.
29. I liked the student presentations.
30. Overall, I enjoyed the Cuba trip.
31. I would recommend the course to others.

Dr. Biolsi and I are interested in the concept of ecotourism. We feel that if people native to a country or a place can make a living from the money that students might bring into the country, that there would be more of an emphasis on trying to preserve the visited habitat. (This may or may not be true, but that is another issue).

32. How likely are you to revisit Cuba on your own and participate in similar activities (either with a group, with friends, or alone) after your experience?

Very likely	Likely	Neutral	Not likely	Never
5	4	3	2	1

33. How likely are you to participate in another ecotourism type adventure/course?

Very likely	Likely	Neutral	Not likely	Never
5	4	3	2	1

34. If you were to return to Cuba (or another location) for such an experience, how much money do you think you would be willing to spend? (Just a ballpark figure.)

Very likely 5	Likely 4	Neutral 3	Not likely 2	Never 1
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Comments:

Please feel free to make any other comments about the course that you wish. We enjoy teaching these types of experiential courses and are always looking for ways to improve them. We know that we are not perfect!

Results of the Survey

We decided to group their results according to category: Housing, teaching, swimming hole and hiking (activities not directly associated with snorkeling), the people they were working with, food and tours, the organisms they encountered in the water, and their research projects. Figures of the results are shown on the following pages.

Quotes from journals:

We included these quotes because they provide a well-rounded qualitative assessment by the students of the marine biology course in Cuba.

Judine

"I was really so scared but Patricia (the Director of the Marine Institute) made me feel really comfortable." (first day)
"It's our last day and I'm so sad. I really enjoyed this trip so much!"

Anissah

"As I entered Cuba my excitement level jumped from a 10 to 1000. While still in the air I can already see how beautiful the country is! Not having full Internet access was a little stressful, but I've always wanted to completely detach myself from my phone and it allowed me to do just that. First entering the water was terrifying, but then the further we went out it got really interesting and cool. I got to swim with the fish—it felt relaxing and it is something I will never forget. All my troubles went away seeing fish and corals and clear blue water. Snorkeling is very fun but exhausting."

Fred

"Went snorkeling for the first time ever! It was enjoyable but a little frightful given I can't swim.

Wearing the life vest definitely made things much easier. After snorkeling we had lunch in Havana. It tasted really great as has all the food I have so far tried in Cuba. I tried guava for the first time and it was incredibly sweet. We then took a tour of Havana and I learned that Cuba has a really rich and eventful culture. It reminded me of my family's country, Haiti. Place of lively people, tall and colorful buildings and many many dogs and cats around. I felt like I wasn't going anywhere at first but eventually I learned how to paddle my legs to push me forward. (By last day snorkeling) "I was moving more comfortably in the water and I was proud of that. We looked at the pictures we took in the water and they were amazing".

Breanna

"I got stung by a sea urchin---it hurt tremendously I loved the sea grass and seeing the tiny fish swimming around me."

2nd day: "I really enjoyed snorkeling—there weren't a ton of rocks. The quick transition between shallow water and deep water.

I enjoyed the snorkeling at El Tanque—there were a lot of fish and seeing the "Titanic" was cool too.

The hiking was fun. I feel like the professors knew that no one would really enjoy it. I don't like the bugs—it was hot and kind of scary because of the rocks. Even if those factors weren't present, I couldn't really hear what the tour guide was saying because there were like 20 of us and I was near the back. So I'm pretty sure the other half of the line couldn't hear also.

I overall enjoyed the trip."

Alejandro

"Waking up in a different country is refreshing and confusing at the same time.

Snorkeling was enjoyable and although I have done it before I felt challenged this time because in the past the trips were much shorter. I got to hold a sea cucumber for the first time and holding it was quite strange. I had seen sea urchins before but this was the first time in which I've seen so many and all gathered in a group.

I felt homesick at times and felt myself having to compare the city to parts of Mexico that I have been to. Staying in the city afterwards and with a majority of the group, was great; we got a lot closer.

The road trip from a city to a small town was fantastic; I was excited to see a change of scenery from one province to another. I got to see how different Cuba can become within miles.

The snorkeling trip was challenging compared to yesterday and although I wanted to give up, I'm proud that I kept up with the group. It was good

to have spotted fish since I didn't see any yesterday. The depth of the ocean was also different today than from yesterday, but it was enjoyable.

I love the room that I was assigned to—it is so comfortable and I feel so comfortable walking in the streets again. I can't help but think of my family's hometown in Mexico. Dinner was great and the lecture was nice. Class in the evening in Cuba is quite the experience."

Day 4

Waking up in Senora Maria's house was quite comforting and waking to a homemade breakfast is great. Senora Maria is great and made me feel quite at home. For the project, I was paired with Brendan and Fred and our assignment involved observing the number of people that arrived to the beach and then finding people to interview. We went up to three different persons and asked them about themselves and the beach itself. We later went on to take pictures of the people, cars, etc. We then got back to the province around 1 PM and had free time in which I was able to take a nice shower and big nap. Dinner was great and afterwards we hit another lecture and we got to do group work afterward.

Day 5

We went snorkeling once again and the waves made today's snorkeling more challenging than normal. We got to see another boat that sank years ago. The sea depth was also much greater than the first two days. One thing that I did not enjoy about today's snorkeling was the jellyfish. At one point they were in a great crowd and caused me great anxiety. We got to see an artificial nursery (tires) We later went to a freshwater area that was 77 meters deep.

Day 6

Saying good-bye to Senora Maria was sad but her hug made up for it. We all went hiking today, and even though some people were upset and tired I loved it. I enjoyed seeing crabs in the forest; it was odd yet interesting at the same time. The bus ride was tiring but I'm glad I got to nap. My group, Fred and Brendan, then gathered together to work on our presentation and I was quite glad that we were able to work so well together. We focused on the interviews we collected after our two snorkeling trips at Cueva de los Pesces and El Tanque. The evening was quite—quiet.

Day 7

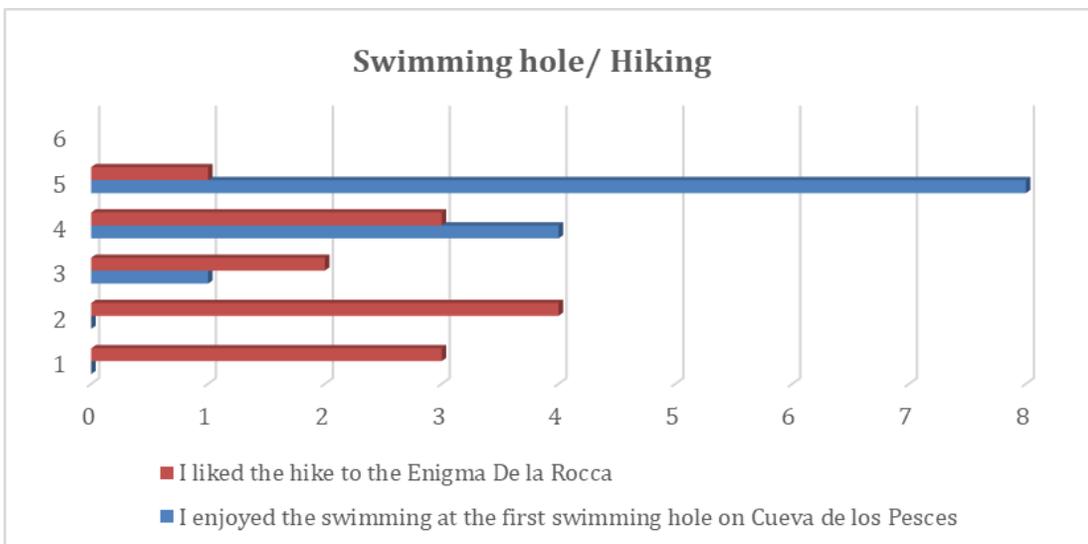
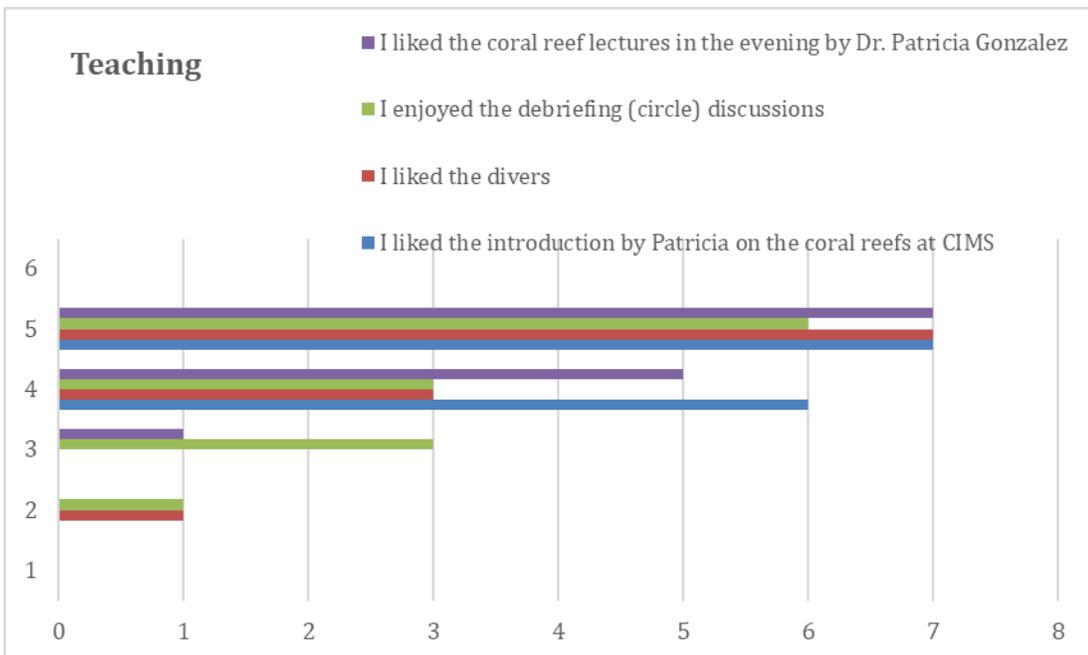
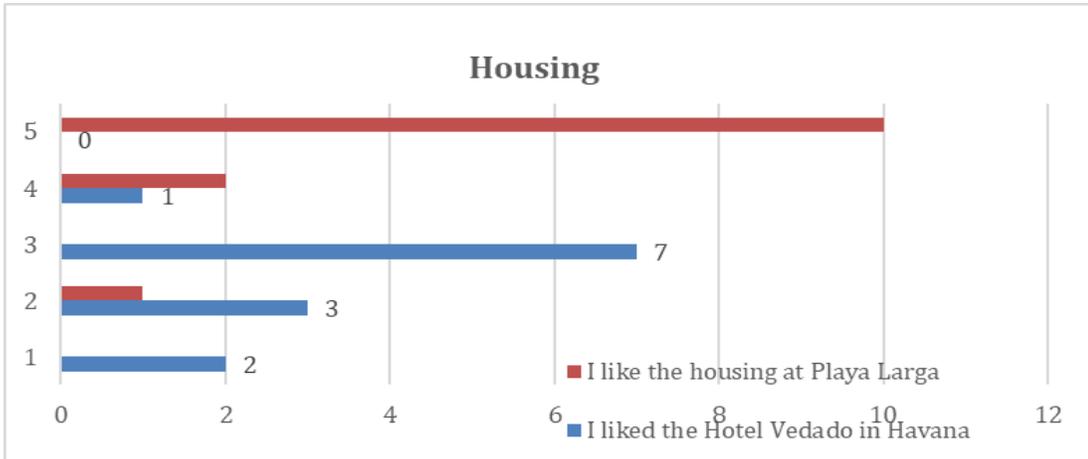
Today I was able to wake up a couple of hours after 7 AM and I loved it.

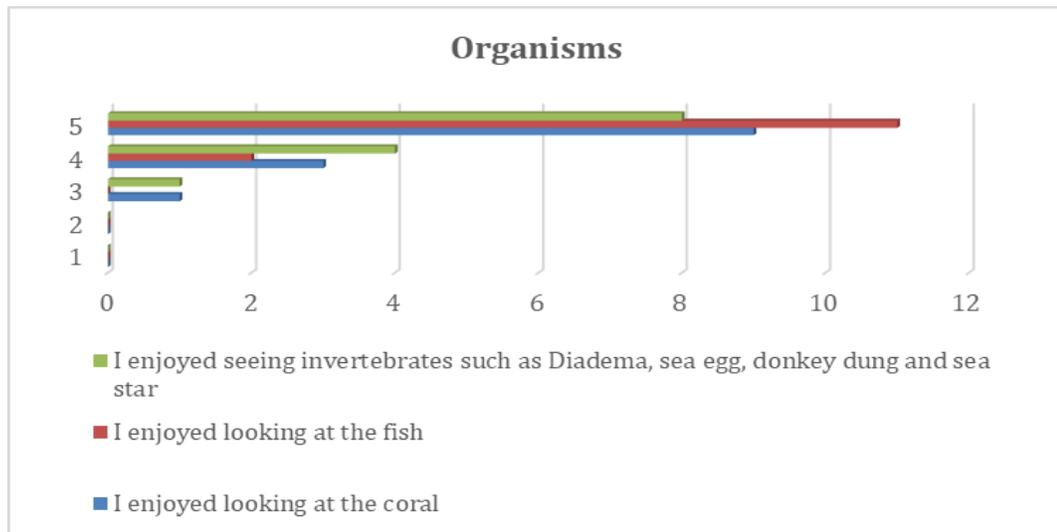
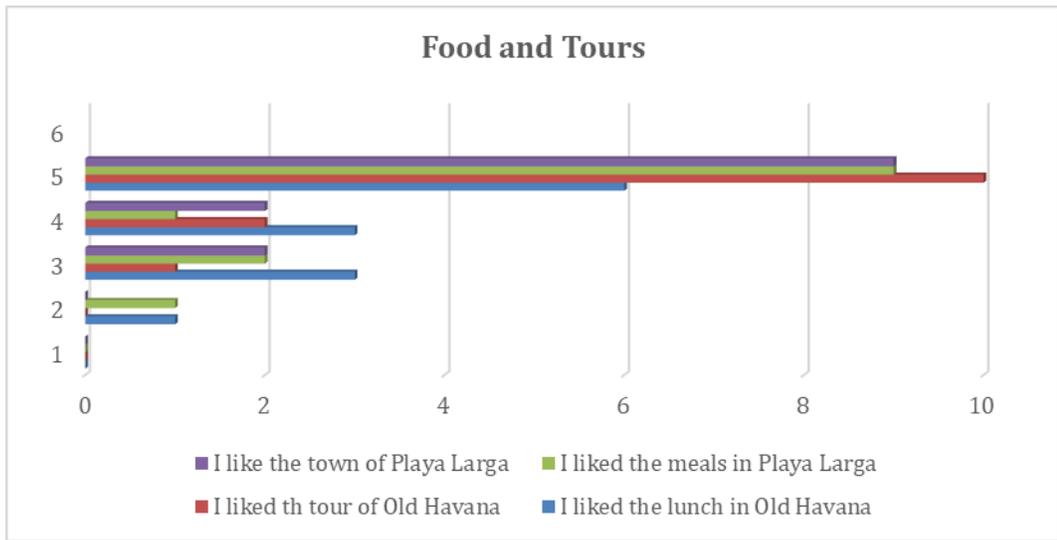
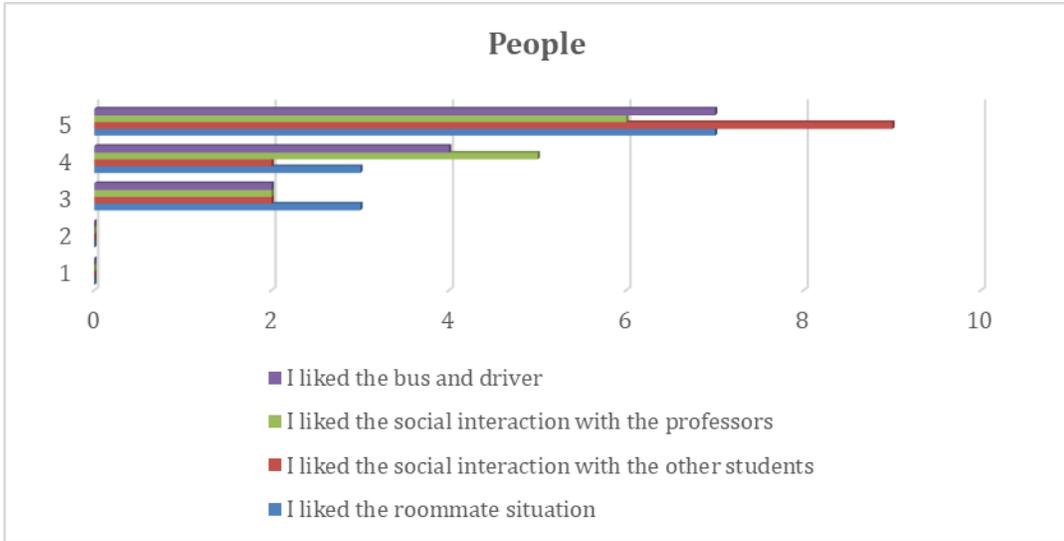
Arielle

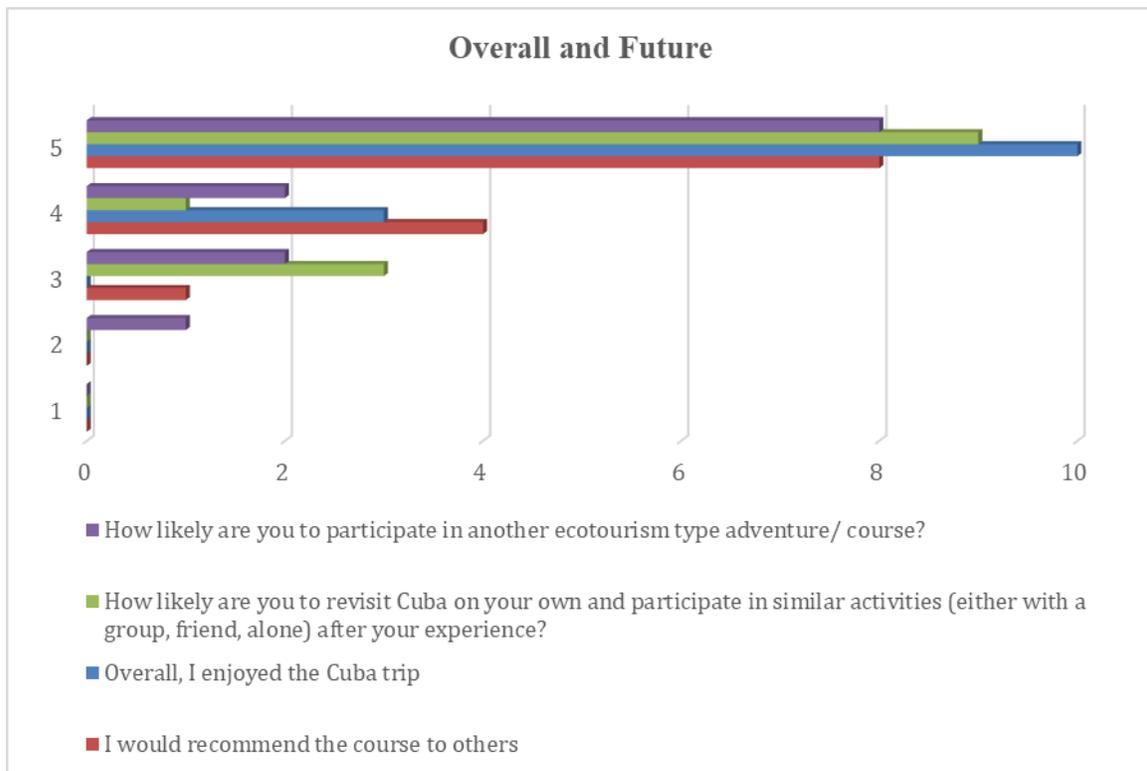
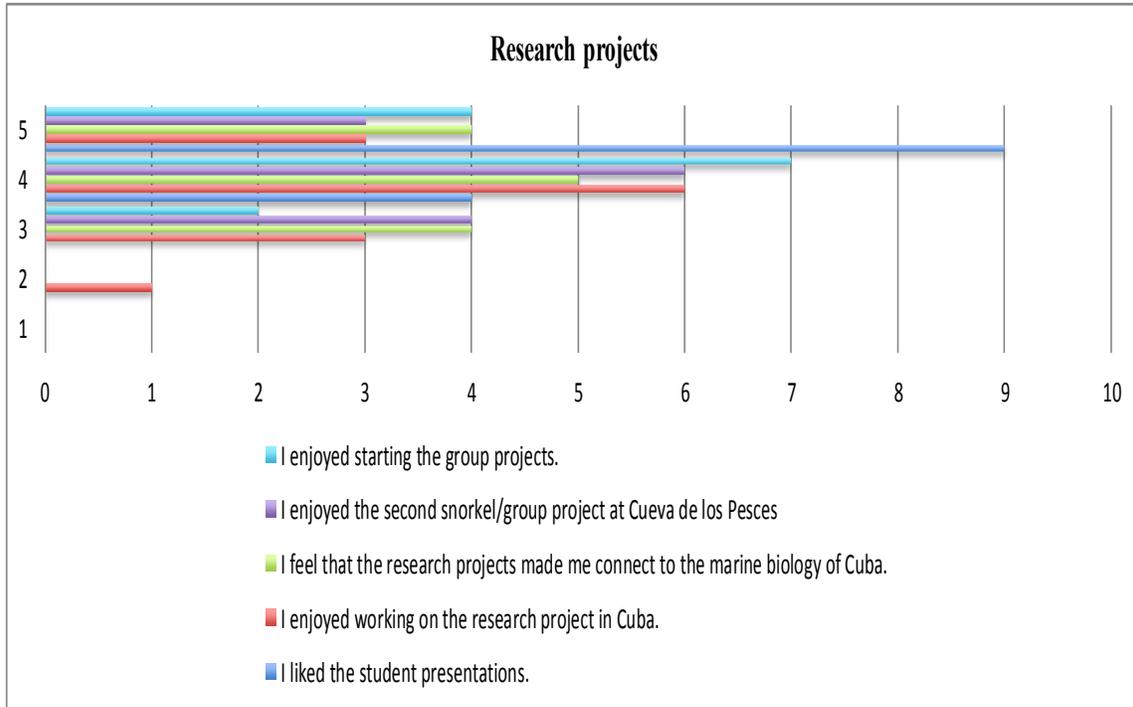
"...a bit overwhelming as I have never left my country before...I can already tell it is one of the best decisions I have made in my life.... One of the surprising things to me was how advanced the research facility is here compared to their limited resources....interested in marine mammal training...wanted to get out of NY because of lack of research facilities around....It is incredible to me how a "less advanced" country can have so much dedicated to this field. Then again there is a far greater amount of water in Cuba. To finally be able to see coral reefs is a dream come true. I was completely mortified right before we began to snorkel... Even though I took beginning swimming last semester...I felt uncomfortable wearing life jacket--....I was so proud that despite fears, I was able to keep up...I saw beautiful and interesting species—turtle and manatee grass... and conquered a fear of mine....as a group we all got to bond....although we know it is a course, we appreciated some of the time to roam free. It was a culture shock to learn about their low salary. The mixture between rich and poor, and all the stray animals. ...my favorites were the star coral and the blue tang...found experience at NY Aquarium helpful.... I'm excited to see what my presentation assignment is...I definitely do not want to give up on snorkeling yet and hope I get comfortable enough to try again. Next day....today was a lot better....calmer....snorkeling twice was a nice benefit as my group focused on coral biodiversity....Seray amazing—she felt confident enough to dive into the ocean ..we met people our age...not so different from us....."

Discussion

The majority of the students liked the housing at Playa Largo, whereas the majority of the students were neutral or did not like the hotel in Havana. This could be because most of the St. Francis College students are commuter students, and they felt more at home in the family-type atmosphere of the "casa particulares" than they did in the more impersonal hotel. The authors have stayed in both the casa particulares and the hotel, and see advantages and disadvantages of both. Since the students are anxious to connect with the families upon first arriving in Havana, the hotel







provided the Internet, whereas both the casas in Havana and the Playa Largo did not. While staying in the casas particulares, people are required to go to an "Internet Park" which is a central area to obtain access to the Internet. The hotel provided a wider choice of breakfast items, but the food was also excellent at the casas with good coffee and a variety of fruits in addition to eggs, toast, and sometimes ham and cheese sandwiches.

Most of the students liked the teaching by Dr. González-Díaz in Cuba, which was positive as about half of the students were not science majors. The teaching was quite technical, and the students were most impressed with the passion, knowledge, and self-confidence of Dr. González-Díaz in the water. Hajdarpasic *et al.*²¹ found in a survey of 200 undergraduates in Australia that the majority of the students were in favor of faculty members conducting active research programs to enhance teaching. Three questions in their survey were answered in the following manner: (of learning from faculty that conduct research) Increased my understanding of the subject (74.7%), Increased my awareness of the problems and issues faced in my subject area (s) (654.8%) and stimulated my interest and enthusiasm for the subject (57.4%).

Our students also liked the debriefing sessions we held as a group before and after excursions. We realize, as professors, that we should have had more of these sessions. This is because, before the Cuba trip, the group of 13 students had only met twice on a trip that we organized to the New York Aquarium in February, and a luncheon we hosted for them a week before the trip. This was not enough time for the students to get to know each other before the trip. The lecture/quiz portion of the course was online during the semester. In the debriefing sessions, we solicited conversation from each student to help them feel more comfortable with the group.

The students liked swimming in the swimming hole and decidedly did not like the Enigma de la Roccas hike we went on during our last morning in Playa Largo before returning to Cuba. They also, in their comments, did not see how the bodies of water we encountered on this hike (a series of channels---one was a large swimming hole) were connected to marine biology, although it was clearly stated that there were connections of these places to the marine environment. We could have better reinforced this information. Also, it was quite hot, humid, and buggy, which our urban students are not as used to in their artificially-cooled environments.

Most of the students liked the bus and the driver (the bus was air-conditioned and had carpeted seats) the interactions with the professors and other students, and their roommate situation. We did not let them choose their roommates, and in some cases, they did not know their roommates.

All 13 students had an initial positive reaction to starting the research projects, which was after their third snorkel at El Tanque. As this area was considerably calmer than our second snorkel at the north of Cuba in Matanzas, we feel that this enthusiasm was partially garnered by these more placid surroundings.

By the time the students completed the second research snorkel in Cueva de los Pesces, their enthusiasm had considerably stemmed (only 9 liked or strongly liked the research projects, and 3 were neutral and 1 did not like the projects). Nine agreed that the projects helped them to connect more with marine biology in Cuba, and 4 were neutral about that concept. By the time the students had completed the research projects, however, 11 liked or strongly liked the research presentations, and only two were neutral beginning of a CURE about them.

In the literature, Mraz-Craig²² found that approximately 80% or 30 of 37 students who initially had an aspiration to go into a STEM field maintained a scientific identity by the end of a CURE. The authors found four characteristics that contributed to scientific identify, being: real-world contributors, problem-solvers, collaborators, and/or project owners. We feel in the future that we could help students identify for themselves into which of these four categories they fit. Wilson *et al.*²³ suggest that professors assess not only a final product, such as a paper or a presentation, but the process of conducting the project as well. What types of thinking went into conducting the project? Formative assessments are needed as well as summative ones. Hill and Walkington²⁴ found that students' confidence, ability to think critically and re-purpose work for diverse audiences increased after making presentations at undergraduate conferences. The Cuba research presentations also had a similar effect on our students. Overall, the students liked the course, and would recommend the course to others.

What were the professors' opinions about the course?

We feel fortunate to have met Patricia González-Díaz, as she is a very accomplished scientist who is passionate about her research, and Cuba.

We feel that the research projects were a real source of pride for the students, and a great culmination of the course. They were able to tie together the disparate things they had been learning about marine biology and animal (and people) behavior, and put together a project, as a group, on these.

In the future, we might spend more time in the Bay of Pigs area and less in Havana. The reef was varied and vital there and the students enjoyed staying with the families in the casas particulares. We also realized from our debriefing sessions that most of the students had never traveled away from their families before. As SFC is a small commuter school (2600 students), the students are not used to being with groups of people for an extended period of time that they do not know. We definitely would schedule at least two more sessions with them before we went on the trip, as this would allow for more interaction with the group and the professors.

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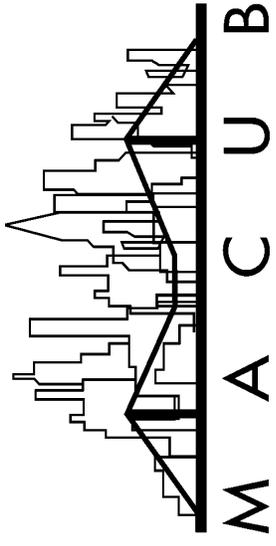
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