



SJSU SAN JOSÉ STATE
UNIVERSITY

MOSS LANDING MARINE LABS - SAN JOSÉ STATE UNIVERSITY

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1 Executive summary

As did all of the CSU, Moss Landing Marine Laboratories was impacted mid fiscal year by the COVID-19 epidemic and most recently by the numerous nearby wildfires. We rapidly transitioned to online courses when the CSU campuses closed in March, then with the support of SJSU opened up the laboratories to limited research activities in May. As the fall semester begins almost all of our courses are being taught as hybrid courses with lecture materials being delivered asynchronously or synchronously with some limited number of in-person laboratory/field trip sessions. The lack of in-person classes did not deter student interest in the program as we welcomed a record cohort of 29 new graduate students into the program this fall 2020.

Dr. Nick Welschmeyer, Biological Oceanographer, retired in January 2020. Dr. Welschmeyer served on the SJSU faculty in the College of Science at MLML starting in 1989, and has served as the major advisor for 24 SJSU-MLML alumni. He will remain at SJSU-MLML as an Emeritus Faculty and PI, continuing his research on the assessment of ballast water management and abatement of aquatic invasive species; this research has been conducted in collaboration with Cal Maritime Academy since 2010. Dr. Sarah Smith, will join MLML as an Assistant Professor in Fall 2021, replacing Dr. Welschmeyer as the new biological oceanographer. Dr. Smith is currently with the J. Craig Venter Institute at UCSD.

This past year, we accepted 18 new graduate students for Fall 2019, 17 graduate students received their M.S. degrees, and 83 graduate students are currently in the program. Recent MLML graduate, Brijonnay Madrigal, was awarded a prestigious Dr. Nancy Foster Scholarship from NOAA that will support her PhD work at the University of Hawaii. Former MLML student, Dr. Edem Mahu, recently was awarded the FLAIR Fellowship from the African Academy of Sciences. Heather Barrett, graduate student in the Vertebrate Ecology Lab won the Best Student Regional Award for her presentation of her thesis on the cost of disturbance to CA sea otters at the 1st International Conference of the Marine Mammal Society 2019 held in Barcelona Spain. For the first time in about 30 years the annual MLML Open House was cancelled due to concerns about COVID-19. This annual fundraiser for student support last year entertained 5,000 of the public, so this year we turned to a virtual fund-raising event that generated \$22,835 for student support.

MLML scientists were awarded \$9 million in research funding, and published 72 scientific papers in peer-reviewed journals. MLML joined the Cooperative Institute for Marine, Earth, and Atmospheric Systems (CIMEAS) headquartered at UCSD, this program provides support from NOAA for various collaborative research projects. Aquaculture funding continues to grow as an additional \$115,500 grants were awarded and progress continues with a build-out of the facilities.

MLML and the consortium are finishing the final report for the Chancellor's Office regarding the restructuring of MLML financial, educational, and organizational aspects. This will entail new methods for recovering student tuition for the administrative campus of SJSU, CSUMB providing student health support, and a restructuring of the Governing Board. MLML has formed a Diversity, Equity and Inclusion Committee that will develop new strategies for increasing diversity, fighting systemic racism, and forming more equitable processes.

2 Achievements against strategic plan milestones

Objective 1: EDUCATION AND STUDENT SUCCESS

- A. Shorten the time to M.S. degree
- B. Increase the diversity and number of students we serve

No.	Activity	Outputs/ milestones	Completion date	Comments
1.1	Increased accountability	Meetings with students and new procedures. Decreased time to graduation.	Completed, but more is needed to further reduce time to graduate.	The goal was to keep better track of student progress and to make the students more accountable for their progress and success, which has been demonstrated in a decrease in time to graduation.
1.2	Streamlined core courses	Continuing discussions on how we can streamline core courses.	Not Completed	This goal is going to take some time and will require the assistance of SJSU and the CSU regarding revising the MLML M.S. degree requirements.
1.3	Weekend, summer, and online courses	Courses transitioned online in March 2020 as	March 2020	All MLML courses were taught via online delivery in Spring and all will be hybrid courses for Fall. MLML is trying

		a result of COVID19.		to develop new methods of delivering laboratory and field experiences online.
1.4	Creation of an aquaculture program	ORTU and development of new courses.	Not Completed	An ORTU proposal for a Center for Aquaculture at SJSU is awaiting final approval from the SJSU campus. We have one aquaculture course and are in the initial stages of developing some additional courses.
1.5	Increased student funding	Increased scholarships but not enough to fully fund all of our students.	Completed, much more to be done	We continue to seek donations and funding for student research support, employment, and general student support.

Objective 2: RESEARCH

A. Improve and expand our research activities

No.	Activity	Outputs/ milestones	Completion date	Comments
2.1	Faculty empowerment and research initiatives	Research grant activity has increased, partly because of SJSU RSCA support.	Completed	We continue to promote a culture that encourages and supports faculty research, involvement of students, and incorporation of research into courses.
2.2	Integration of research faculty into academic program	Dr. Dave Ebert, member of the Research Faculty taught MS113/213 Marine Ichthyology.	Fall semester 2019	We encourage the Research Faculty to assist with some classes, which increases their exposure to the students and helps expand research collaborations between Research Faculty and students.
2.3	School of Marine Science	Not completed	Not Completed	Discussing a new SJSU School of Marine Science that will replace the departmental name of MLML.
2.4	Faculty Recruitments	Appointed a new Biological Oceanographer who will start Fall 2021.	Spring 2020	Dr. Sarah Smith, Biological Oceanographer currently with the J. Craig Venter Institute and MLML alumnus, class of 2009.

Objective 3: SOCIETAL BENEFITS

No.	Activity	Outputs/ milestones	Completion date	Comments
3.1	New and increased public education	MLML participated in 32 festivals, science fairs, and outreach activities in AY19-20. See 8.4 Community Impact, Outreach AY19-20.	Summer 2019 through February 2020, activities prior to COVID	COVID19 severely restricted outreach activities, however the MLML community participated in and contributed to several virtual events. In addition, students continued publishing blogs and an Alumni Newsletter was sent out in Summer 2020.

3.2	Enhanced online presence	New MLML webpages and improved website.	Throughout AY19-20	MLML's website continues to expand and improve with the addition of several pages designed for an Annual Report , a public data portal , and student blogs . A COVID19 Resource and MLML Protocol page was added in Summer 2020
3.3	K-12 Educational Modules	This project has just begun thus no milestones completed as of yet.	Not completed	The Vertebrate Ecology lab is developing and implementing a comprehensive K-12 outreach program on marine mammals and ocean acoustics. MLML has been invited by the Marine Protected Areas outreach office to contribute to education materials for K-12. MLML's Sea Otter Savvy program created digital materials for teachers and parents, including do-it-yourself learning activities, contests, and art projects.
3.4	New and strengthened partnerships	Increased number of industrial partners in aquaculture, stronger collaboration with MBARI, and joining CIMEAS.	Throughout AY19-20	Renewed discussions with UCSC regarding a joint PhD program. MLML Joins the Cooperative Institute for Marine, Earth, and Atmospheric Systems (CIMEAS) funded by NOAA.

Objective 4: INFRASTRUCTURE AND FUNDING

- A. Improve and expand MLML's infrastructure
- B. Improve structural hurdles in MLML's financing

No.	Activity	Outputs/ milestones	Completion date	Comments
4.1	Continued development of MLML's properties	Expanding capacity for aquaculture research and education.	Continuing	Build-out of the aquaculture facility, with new tanks, plumbing, and electrical systems.
4.2	Continued development in County planning	MLML continues to participate and contribute to North Monterey County's Moss Landing Development Plan.	Throughout AY19-20	The Director and Asst to the Director attended all Monterey County Planning Commission meetings that addressed the Moss Landing Community Plan with special attention to county parcel designations for research and education, and discussions concerning sea level rise and coastal hazards.
4.3	Staff development	Continued progress training staff as needed. Much of this training comes as	Continuing	Leadership at MLML encourages all employees to pursue professional development opportunities. Our dedicated staff seek training and development in the areas of student

		there are many new processes associated with the SJSURF.		support, vessel operations and operations management. See Section 4 for a detailed list of workshops and training completed by our Graduate Program Coordinator and Marine Operations crew during AY19-20.
4.4	Greater generation of indirect cost revenue	Recent decreases in IDC returned to MLML has created an initiative to cut costs and increase IDC generated.	Continuing	We have added more Research Faculty and Research Affiliates to increase funding capabilities. Development of support for aquaculture has resulted in an increased funding stream. MLML continues to struggle with low return of indirect costs.
4.5	Philanthropic development	Increased donations to MLML needed.	Not Completed	This will require support from SJSU University Advancement, which is in the works.

3 Impact

3.1 Scientific impact

SJSU-MLML Tenure Track Faculty, Research Faculty members and Research Affiliates published 72 peer-reviewed papers in AY19-20. Some highlights from their projects, activities, and labs over the last year:

Director Jim Harvey, Vertebrate Ecology

Dr. Harvey has published two scientific papers, finished a draft of a chapter for a book on the *Ethology of Phocid Seals*, and brought in \$375,815 in grants. He continues to collaborate with researchers on the ecology of leatherback turtles and humpback whales.

SJSU-MLML Faculty are tenure/tenure-track faculty members of San José State University and serve as major advisors for all students enrolled in the Master's degree program at MLML. They have research labs and offices in the main building of MLML and teach most of the courses offered at MLML.

Professor Ivano Aiello, Geological Oceanography: Dr. Aiello and colleagues from Aix-Marseille Université & Universität Bremen published their research about the phenomena of 'suspended' seafloors through the journal of Deep Sea Research Part II: Topical Studies in Oceanography, "*Anatomy of a 'suspended' seafloor in the dense brine waters of the deep hypersaline Urania Basin*". Dr. Aiello went on several research cruises to the Chilean margin, Gulf of CA, IODP Exp. 387T in 2019 to offshore Patagonia and southern Chile, and again in 2019 on IODP Exp. 385 to the Guaymas Basin, Gulf of California. He also received donations from Dr. Rick Starr, the California Marine Sanctuary Foundation and Dean Kaufman, SJSU College of Science to expand capabilities of his seafloor mapping instrumentation.

Assistant Professor Tom Connolly, Physical Oceanography: Along with his students in the Physical Oceanography lab, Dr. Connolly contributed to two papers on deep sea currents and ecosystems in a special issue of Deep Sea Research Part II, along with scientists and engineers from the Monterey Bay Aquarium Research Institute (MBARI). In addition to advising students at MLML, Dr. Connolly served as a mentor in an eight-week nationwide virtual Research Experience for Undergraduates (REU) program organized by Rutgers University. Dr. Connolly and Physical Oceanography student Miya Pavlock both presented research at the Ocean Sciences Meeting in San Diego. In addition, Dr. Connolly continues serving as a PI for the Central and Northern California Ocean Observing System (CeNCOOS), contributing to the observing system, analyses of the data, and the development of ocean observation tools and techniques.

Professor Jon Geller, Invertebrate Zoology: The Invertebrate Zoology and Molecular Ecology lab has been active in faculty and student research. Ongoing projects with, and sponsored by, the California Department of Fish and Wildlife, the Smithsonian Institution, the Charles Darwin Foundation, and the Prince William Sound Regional Citizens' Advisory Council have furthered our work on the ecology and genetics of marine invasive species, primarily in California but also South and Central America including the Galapagos Islands. We are beginning a new project to study invasive species in the US Great Lakes. Emily Pierce defended her thesis on aspects of environmental DNA production and degradation and is beginning a PhD program at the University of Maine. Felicia Miller travelled to Friday Harbor Laboratories to complete biomechanical analyses of mussel byssal threads and expects to defend her thesis in Fall of 2020. Emily and Felicia presented posters at the 2019 SICB meeting in Austin, Texas. Emmet Haggard is completing a transcriptomic analysis of venom production in sea urchins.

Professor Michael Graham, Phycology: Received two CA SeaGrant awards for new research to support sustainable aquaculture and kelp forest recovery. One was awarded for the "Development of techniques for the cultivation of monkeyface pricklebacks as a sustainable alternative to unagi" with Scott Hamilton and the other for "Assessment of practical methods for re-establishment of northern California bull kelp populations at an ecologically relevant scale". He has submitted five other proposals to support aquaculture research at MLML, is graduating 3 students in Fall 2020, and accepted 4 new students. Dr. Graham is in the last years serving as the Editor for the Journal of Phycology, the largest journal on the science of seaweeds.

Assistant Professor Max Grand, Chemical Oceanography: Received a NSF award to develop a new generation of microfluidic trace metal and nutrient analyzers. As part of this collaborative proposal with the University of Hawaii, we will instrument the CeNCOOS Moss Landing Shore Station with phosphate and silicate analyzers to monitor these chemical species at hourly intervals for at least a year. He co-authored a poster presentation describing the technology that will be optimized and deployed at the shore station at the OceanObs'19 meeting in Honolulu and organized and led a session at the 2020 Ocean Science meeting in San Diego entitled: "*Autonomous observing systems for macronutrients and bioactive trace metals in coastal and open ocean settings: present status, challenges and emerging technologies*". Dr. Grand also published a paper in Science of the Total Environment with colleagues from the British Antarctic Survey, which investigated the suitability of several Antarctic benthic invertebrate species for metal biomonitoring around the Rothera research station.

Professor Scott Hamilton, Ichthyology: Received two CA SeaGrant awards for new research to support sustainable aquaculture and resilient coastal communities. One was awarded to his student Katherine Neylan "Evaluating microalgae supplemented feeds for sablefish nutrition and growth" and the second for the "Development of techniques for the cultivation of monkeyface pricklebacks as a sustainable alternative to unagi". Along with Drs. Aiello and Starr, he is working on two statewide Marine Protected area projects evaluating performance of the marine reserve network.

Assistant Professor Amanda Kahn, Invertebrate Zoology: Has participated in two research cruises with MBARI and will soon participate in a third upcoming R/V Western Flyer cruise (via telepresence due to COVID-19) to characterize flow fields and their effect on morphology of

deep-sea sponges and corals at Sur Ridge. She also published a paper in Deep-Sea Research Part II, which mined 30 years of time-lapse camera imagery to describe several behaviors of sponges and cnidarians on the abyssal plain.

Associate Professor Katie Lage, Librarian: Presented ongoing research on new ways to track research output and impact at the International Association of Aquatic and Marine Science Libraries and Information Centers (IAMSLIC) annual conference. Planned and organized to co-host a conference of the Pacific Coast regional group of the International Association of Aquatic and Marine Science Libraries and Information Centers. (Unfortunately it was cancelled two weeks before it was to be held, due to COVID.) Transitioned all library services online in Spring 2020 when campus closed due to COVID. Supported library student employees' transition to remote work. Continue to support teaching, learning, and research through remote services, changing or reinventing processes as needed. Created eight new online library guides, ingested two large research data collections into the MLML institutional repository, and continued to make progress on processing two former faculty archival collections. Is revising a co-authored article which analyzes citations to show the use of fundamental laws in chemical physics with colleagues at MBARI.

Associate Professor Gitte McDonald, Vertebrate Ecology: In the Fall, Dr. McDonald and one of her graduate students completed their first field season at Cape Crozier, Antarctica, studying the foraging ecology of emperor penguins with her New Zealand collaborators at NIWA. She presented preliminary results at the Scientific Committee of Antarctic Research virtual conference this summer. She published 7 papers this year including a paper in NATURE: Climate Change that used biologging data from crabeater seals to project future shifts in their foraging habitat in the rapidly changing western Antarctic Peninsula and a paper in NATURE using tracking data from 17 bird and mammal species to identify important regions in the southern ocean. She received two grants to support the Moss Landing Stranding Network (Prescott Marine Mammal Stranding Assistance Grants, NOAA, and California State Funds through UC Davis). She and her students gave numerous science and outreach talks including the first webinar hosted by International Bio-Logging Society "The Breadth of Bio-Logging" and serving on a career panel at Westlake Elementary School.

Professor Emeritus Nick Welschmeyer, Biological Oceanography: Professor Nick Welschmeyer, Biological Oceanography has announced his retirement. He joined MLML in 1989 and served as the main advisor to 24 alumni between 2001 – present. Nick's research focused primarily on the assessment of ballast water management and abatement of aquatic invasive species; this research has been conducted in collaboration with Cal Maritime Academy since 2010. Nick will remain at MLML as an Emeritus Faculty member and researcher continuing his subject matter expertise on the 'best available science' for rendering non-viable organisms for use by ballast water treatment protocols. Dr. Welschmeyer's lab utilizes techniques/instrumentation fundamental to the understanding of growth and physiology of marine plankton.

Professor Emeritus, Dr. Greg Cailliet, Ichthyologist: Continues to serve as a Trustee (and now President) of the Myers Oceanographic Trust, which provides grants to graduate students at MLML and other Monterey Bay area research and educational institutions. Dr. Cailliet continues to work with Milton Love, Scott Hamilton and Lara Ferry on a new edition of Fishes: A Laboratory and Field Guide through Waveland Press. He regularly attends Research Activity Panel (R.A.P.) meetings of the Monterey Bay National Marine Sanctuary (M.B.N.M.S.).

Research Faculty refers to those persons who have demonstrated a commitment to the education and research goals of MLML. Further, Research Faculty are those researchers who are in residence at MLML, hold a Ph.D. degree, serve as Principal Investigators (PIs) on grants, can be appointed as lecturers, and are permitted to serve on student thesis committees.

Dr. Colleen Durkin, Biological Oceanographer: Dr. Durkin was selected for a CSU COAST grant development award "Ecological mechanisms of carbon export in the California Current

resolved by a fleet of autonomous imaging robots". She published two articles in Deep Sea Research II that each use new approaches to identify the biological contents of sinking particles that are responsible for deep ocean carbon sequestration. In December she sailed on a research expedition on the R/V Sally Ride along with her graduate student Annie Bodel. Another student, Cindy Michaud, successfully defended her thesis and is preparing this work for publication in a journal.

Dr. Dave Ebert, Pacific Shark Research Center: Over the past year the PSRC has produced 14 publications, including three books. Dr. Ebert gave keynote presentations at the American Elasmobranch Society annual meeting, Peru Sharks and Rays Symposium, the Universidad Científica del Sur (Peru), and presented at the California Academy of Sciences *Sharktoberfest* NightLife and at the Academy's Planetarium show. He also attended an IUCN workshop in Nagasaki, Japan. Dr. Ebert did interviews for the Smithsonian Magazine, Washington Post, Forbes, and BroBible, among other major publications. He was also a guest on the podcast Speak Up For Blue. In addition, Dr. Ebert received funding to start a new podcast for the American Elasmobranch Society that he will be co-hosting. The Beyond Jaws podcast will start in the fall 2020. Dr. Ebert's "Playing for Time" research project received continued funding through the Save Our Seas Foundation and South African Institute for Aquatic Biodiversity. Finally, appeared in the Discovery Channel's Shark Week program Extinct or Alive: Land of the Lost Sharks, and he is currently filming another program for the National Geographic Society.

Dr. Luke Gardner, CA Sea Grant Aquaculture Specialist: Aquaculture research has increased significantly at MLML. The aquaculture research facility is rapidly filling with tanks and associated equipment for current and future projects. Dr. Gardner was admitted to the Western Regional Aquaculture Center and served on the executive committee for development of research funding priorities. Gardner also participated as a US delegate in two bilateral committees on aquaculture, US - Korea Joint Participation on Aquaculture and US - Japan Natural Resources panel on Aquaculture. Gardner was Co-PI with Dr. Hamilton on several grants recently awarded including "Evaluating microalgae supplemented feeds for sablefish nutrition and growth" and "Development of techniques for the cultivation of monkeyface pricklebacks as a sustainable alternative to unagi". Ongoing projects include white abalone restoration aquaculture, Olympia oyster restoration aquaculture, purple urchin ranching, cattle methane reduction potential of seaweeds, and hatchery development of purple hinged scallops.

Dr. Valerie Loeb, Biological Oceanography: Inclusion in an NSF funded project awarded to Drs. Karen Wishner and Brad Siebel, University of Rhode Island, "Small-scale Biological and Physical Variability at Midwater Depths in the Eastern Tropical North Pacific Oxygen Minimum Zone". Some marine organisms have physiological adaptations to exist in extremely low oxygen levels as survival mechanisms (e.g., predation avoidance) during their life history cycles. Valerie is currently engaged in establishing the species, maturity stage and size attributes of mesopelagic fishes collected by stratified MOCNESS tows between 0 and 1000 m to assess their relationship to extreme vertical and horizontal differences in oxygen concentrations. Preliminary results suggest that these very low oxygen waters may provide a refuge for vulnerable transitioning stages between larval and juvenile forms.

Dr. Iliana Ruiz-Cooley, Vertebrate and invertebrate Ecologist: Dr. Ruiz-Cooley and colleagues from Fisheries and Oceans Canada published their work on cetaceans' trophic ecology in the journal of Ecology and Evolution. She and her collaborators from the Center for Scientific Research and Higher Education in Ensenada (CICESE) and NOAA have two manuscript in review: one in Ecosphere regarding fish nutrition and isotopic fractionation, and another one in the Journal of Animal Ecology regarding their novel findings on feeding cooperation in common dolphins throughout ontogenesis. Together with her colleagues and potential postdocs, they submitted three proposals to CONACyT for research on the role of fisheries and the near extinct cetacean the vaquita in the upper Gulf of California; migration of swordfish; and coastal food web dynamics in Baja California. Dr. Ruiz-Cooley is currently collaborating with researchers from NOAA and other various institutions in the project "Rapid response to increase our understanding of the origins of thiamine deficiency in Central Valley Chinook salmon". As the Principal investigator, she and her co-PIs from SCCOOS and UCSC were recently interviewed by the California Sea Grant communication team for their work on

nitrogen tracing and domoic acid trophic transfer in Monterey Bay,
<https://caseagrant.ucsd.edu/news/tackling-toxic-algal-blooms-from-two-directions>

Dr. G. Jason Smith and Dr. Holly Bowers, Environmental Biotechnology Lab: It has been a good, productive year for the EBL team, but also one of transition. Smith worked with his international team of colleagues to summarize the efforts of the Moore Foundation's Experimental Model Systems grantees on enabling genetic transformation and manipulation of diverse and ecologically critical groups of marine protists. This enabling work will have impacts on our understanding of species interactions within marine microbial communities. This past year also brought the final year of our tremendously successful Alliance for Coastal Technologies (ACT) program by wrapping up our evaluations of field compatible phytotoxin detection technologies and guiding the development of a technical workshop on current sampling and extraction bottlenecks in marine eDNA surveys. The COVID19 pandemic forced this workshop into a virtual workshop so the team has gained expertise in a range of e-meeting applications. Associated with this eDNA focus, Dr Bowers received a 3 month Visiting Scholar fellowship from the Cawthron Institute in Nelson NZ to work with their staff to assess potential for development of passive eDNA sampling. As this fellowship began before the pandemic struck, Dr. Bowers has been happily trapped in healthy NZ where she has full lab access. We anticipate her return as soon as MLML returns to operations. Dr Bowers (Smith Co-PI) was also awarded three years of funding from OPC-USC Seagrant to develop 'point of sampling' molecular detection assays for California's suite of harmful alga species. We have had the great pleasure to have MLML graduate student Lyndsey Claassen working on this portable detection technology project which aligns with her research interests on phytoplankton technologies.

Dr. Rick Starr, Fisheries and Conservation Biology Laboratory: AY19-20 was another busy year for Dr. Rick Starr and the Fisheries and Conservation Biology Lab. In the summer of 2019, Starr and Dr. Scott Hamilton started work on a \$1 million grant from the Ocean Protection Council to coordinate collaborative fisheries monitoring programs across the entire state and to evaluate changes in MPAs since 2007. Starr also started work on a \$2.4 million grant to lead a group of researchers from four organizations to evaluate changes in mid-depth rocky habitats using a variety of underwater visual census tools. These two grants are intended to provide the California Department of Fish and Wildlife and Ocean Protection Council with information to evaluate the MPA network in 2022. In the last few years Dr. Starr has been working with The Nature Conservancy and National Marine Fisheries Service to conduct visual surveys of continental shelf fishes. The purpose of the research is to help improve the stock assessments for fishes that live in high-relief rocky habitats that are not surveyed by NMFS trawl gear. In AY19-20, Starr and students spent 10 days at sea surveying habitats near San Clemente Island.

Dr. Diana Steller, Phycologist and Scientific Diving Safety Officer: Is conducting CA Sea Grant funded research on 'Assessing the disturbance impacts of boat mooring on the rhodolith beds of Catalina Island'. This research is a collaborative grant between MLML and San Diego State University.

Dr. Alison Stimpert, Vertebrate Ecologist and Bioacoustics: Co-authored a paper in the journal of Science with collaborators at Hopkins Marine Station (Stanford). The paper synthesizes a decade of cetacean tagging research to investigate body size in large whales. She also published a paper about noise produced by scientific equipment during fisheries surveys so as to better understand how this noise might affect the behavior of the fish being surveyed, and a paper evaluating the utility of bio-logging tags on large whales for determining which animal is producing recorded sounds. One of her students first-authored a paper in Peer J that describes the first underwater, on-animal (recorded by a tag) footage of humpback whale nursing behavior, coupled with quantitative body movement and behavioral data, revealing exciting new insights about the frequency and duration of nursing bouts on humpback foraging grounds.

Research Affiliates are researchers who are generally in residence at MLML, generally hold a Ph.D. or a M.S. degree, most can serve as Principal Investigators on grants, but they typically

do not mentor students or teach courses. Research Affiliates can serve on thesis committees if they have a Ph.D. degree.

Scott Benson, NOAA Fisheries Ecologist, Marine Turtle Ecology and Assessment

Program: Research and monitoring of endangered Pacific leatherback turtles at central California foraging grounds resumed in AY 2019 aided largely by support from a local NGO (Upwell) that provided \$43k in vessel support for use of the R/V Sheila B., and an additional \$88k for aerial surveys and reconnaissance. Six leatherback turtles were captured and sampled before being released with satellite-linked transmitters. Data on abundance and movements of leatherback turtles was provided in near real-time to the California Department of Fish and Wildlife and the Dungeness Crab Working Group to inform stakeholders prior to the opening of the commercial Dungeness Crab fishing season. Further MLML vessel support was received for AY 2020-2021 from Upwell (\$66k). Benson was part of a first-ever global status review of leatherback turtles published in August 2020 by NOAA and USFWS and co-authored published journal articles on leatherback foraging ecology and leatherback maturation attributes and reproductive longevity.

Gena Bentall, Director, Sea Otter Savvy: At Sea Otter Savvy we have continued to evolve and expand our outreach to adapt to the changing times of COVID-19. We created digital materials for teachers and parents, including do-it-yourself learning activities, contests, and art projects. We lead the organization and promotion of Sea Otter Awareness Week 2019 with a digital campaign emphasizing stewardship and science-based information about sea otters, and a field station network that logged over 5000 peer-to-peer contacts statewide. We organized and co-hosted the 5th Annual California Coastal Wildlife Disturbance Symposium at the Asilomar Conference Center with seventeen talks addressing the topic of wildlife disturbance and a special panel session on law enforcement and wildlife disturbance. We are currently planning an entirely virtual 6th symposium for Nov. 17-18 of 2020. In December 2020, Sea Otter Savvy Science Communication Director, and MLML graduate Heather Barrett represented us at the World Marine Mammal Conference in Barcelona. Heather was awarded Best Student Regional Award for her speed talk on her thesis work on the energetic cost of disturbance to sea otters. So far in 2020, Sea Otter Savvy has collaborated on research projects with students from Cal Poly and University of Bristol and is working with MLML Vertebrate Lab student Sierra Fullmer on her thesis work investigating the effect of disturbance on sea otter spatial use and group dynamics on the CA central coast. We are currently at work in collaboration with Dr Tim Tinker of Dalhousie University on fine tuning an innovative model for evaluating the effect of multiple variables (including human stimulus) on sea otter activity in California.

Dr. Dustin Carroll, Physical Oceanography, Jet Propulsion Laboratory: Selected for NASA Interdisciplinary Science 2019 proposal, "Impacts of Changing Sea-Ice Regimes on Arctic Ocean Biology" (Co-I) and 2021 fieldwork in Greenland through EUROFLEETS (Co-I). Co-authored papers on Arctic glacier dynamics and iceberg iron fertilization in *The Cryosphere*, *Nature Communications*, and *Geophysical Research Letters*. Served as primary chair for the "Moving beyond melt: the impact of melting glaciers, icebergs and sea-ice on ocean environments" session at the AGU Ocean Sciences 2020 meeting. Dr. Carroll is also the lead developer for the NASA ECCO-Darwin ocean biogeochemistry model and recently published a paper detailing new model development in *Journal of Advances in Modeling Earth Systems*.

Ross Clark, Program Manager, Central Coast Wetland Group (CCWG): Central Coast Wetland Group (CCWG) continues to develop tools to document the environmental benefits of wetland management and restoration. This year the Group submitted documentation to the State demonstrating the incremental water quality improvements (achieving water quality objectives) within the Moro Cojo Slough that has resulted from 20 years of wetland restoration within the watershed. The Group will be working with Holly Bowers at the MLML Environmental Biotechnology Lab on an EPA grant to document how reductions in nutrient loads (through wetland restoration activities) from local watersheds can reduce offshore harmful algal blooms. The Group is working with faculty from four other California universities to develop an estuarine monitoring program (based on findings in Clark and O'Connor (2019) for California's 24 estuarine Marine Protected Areas. CCWG also continues to work on sea level rise adaptation strategies within Monterey Bay, focusing presently on flood risks to Salinas Valley farmers and

impacts to beaches of Santa Cruz and sand dunes between the Salinas River and Moss Landing. Ongoing restoration activities in partnership with Coastal Conservation and Research are focused on the Moss Landing sand dunes and the Hugo Tottino wetland restoration project within the Moro Cojo Slough. More information is available in our recent newsletter.

Dr. Karin Forney, NOAA Fisheries, Marine Mammal and Turtle Division: Research activities have primarily focused on collaborative projects to assess and mitigate whale and turtle entanglement risk in nearshore pot and trap fisheries. As a Scientific Advisor to the California Dungeness Crab Fishing Gear Working Group, Forney conducted aerial surveys during October 2019 to examine whale and leatherback distributions just before the start of the Dungeness crab fishing season. These surveys provided near real-time data to the California Department of Fish and Wildlife to inform their management actions to protect whales and leatherback turtles. A new, dynamic spatial model of humpback whale density and distribution has been developed and is being used in ongoing entanglement risk assessments and socio-economic trade-off analyses for the Dungeness Crab fishery. Ecosystem changes that led to increased whale entanglements during 2014-2016 were identified by a multidisciplinary team, and this research was published in *Nature Communications* during early 2020 (Santora et al. 2020). Other collaborative research projects include an evaluation of population trends for California harbor porpoises and leatherback turtles, assessing potential impacts of seal bombs (used in California purse seine fisheries) on harbor porpoises in Monterey Bay, and improving estimates of statistical uncertainty in habitat-based spatial models of cetacean abundance off the U.S. West Coast and around Hawaii.

Wesley Heim, Project Director, Marine Pollutions Study Lab- DFW (MPSL): MPSL continues work to better understand contaminants transport and fate in the environment. A five year study of mercury in the Yolo Bypass, Ca has been concluded with a draft final report submitted to the Central Valley Regional Water Quality Control Board. MPSL also completed a mercury bioaccumulation project in Lake Hodges, Ca., and analytical work for the San Francisco Bay Regional Monitoring Program. Current projects include a mercury bioaccumulation project in the San Francisco Bay Delta and the California State Board Surface Water Ambient Monitoring Program. MPSL has expertise in trace metal field and analytical work and is ELAP certified. Laboratory capabilities include trace metal and mercury analysis in multiple matrix types as well as a host of other ancillary analysis. Recently MPSL has added mercury and selenium speciation capabilities.

Mark Yarborough, Principal Investigator, Marine Optical Buoy (MOBY): MOBY is an autonomous optical buoy which is moored off the island of Lanai in Hawaii. The Marine Optical Buoy (MOBY) is a NOAA funded project to provide vicarious calibration of ocean color satellites (SeaWiFS and MODIS) (Clark et al., 1997). Moss Landing Marine Laboratories (MLML) was selected through the NOAA grant process to participate in the engineering and construction of the prototype and operational version of the system in 1989. The system was designed for measuring sunlight incidents on and scattered out of the ocean. These measurements are provided in near real time for the vicarious calibration procedures conducted by ocean color scientists. MOBY collects data on a daily basis. Additionally, MLML has had the primary responsibility for maintaining, calibrating the buoy and data production of the system.

Dr. Jenifer Zeligs, Principal Investigator, Science, Learning and Education With the Help of Sea Lions (SLEWTHS): SLEWTHS is finishing a three-year study digitizing sea lion mobility for development of unmanned underwater vehicles in collaboration with West Chester University and George Washington University. This work has been approved for a continuing 3-year renewal of funding. The SLEWTHS project also contributed to a chapter in the upcoming book *Zoo and Wild Animal Dentistry*. Although most of our educational and outreach programs (including all in person) are on hold due to COVID19, with major support from SJSU IACUC, Dean Kaufman, College of Science, SJSU Tower Foundation and MLML leadership, we were able to continue working daily to care for the five rescued sea lions we have adopted. Dr. Zeligs taught two biology classes for CSUMB and a four-week online lecture series. Our educational outreach programs included five elementary school demonstrations featuring marine research, conservation, and a beach clean-up, and visiting 2 state fairs (Oregon and Arizona) reaching hundreds of thousands of people over 6 weeks. Dr. Zeligs taught workshops in both California

and Poland and presented at an International horse welfare conference. In addition, she also gave presentations to a Roads Scholar group and an online interview series by world renowned horse trainer Karen Rolf. Dr. Zeligs also serves on the Moss Landing Animal Care Committee.

Adjunct Faculty have *Principal Investigator status through MLML and SJSU Research Foundation, they conduct research through MLML, potentially using some of the facilities, and can serve on student thesis committees. However, Adjunct Faculty do not have a physical presence at MLML, thus they may or may not have lab space and do not have an office.*

Dr. Qing Wang, Naval Postgraduate School: Dr. Qing Wang is Full Professor in the Meteorology department at the Naval Postgraduate School in Monterey and a Research Affiliate at Moss Landing Marine Laboratories. She currently directs several multi-disciplinary and multi-institutional programs nationwide and is working with MLML's Chemical Oceanography Laboratory regarding the role of fog in the transport of contaminants from the sea to the land. She is an expert in electromagnetic ducting at the air-sea interface: the study of how light and radio-waves are bent and distorted forming mirages and radar distortion along the horizon. Her studies employ instrumentation to measure heat and water vapor flux, marine aerosol composition, atmospheric water droplet inventory and optical/infrared/x-band radio distortion.

Marine Operations:

COVID 19 required MLML Marine Operations to shut down 17 March 2020. By May, both Captains were designated as "essential personnel" to work onsite maintaining the boats and facilities. With support from Dean Kaufman and SJSU leadership, a limited number of students, faculty and researchers received approval to begin at-sea research in July 2020. During the COVID 19 campus closure, the Marine Operations team was tasked with grant research, development of training tools and mitigation procedures for safe working conditions which align with SJSU, State and County mandates.

R/V John H Martin

- Supported commercial diving operations to repair the sea water intake (76.5 hrs).
- Cities of Watsonville/Marina contracted vessel time for required Sea Water surface sampling.
- California American Water contracted vessel use for CTD for Desal monitoring.
- UW Bottom Trawling for Midshipmen.
- The *R/V John H Martin* supported the MLML Scientific Diving program's subtidal dives and marine ecology course.

MLML's *R/V Sheila B* served as the primary vessel for Dr. Scott Benson, NOAA and Jim Harvey for their ongoing Leatherback Turtle research throughout AY19-20. The vessel was out of the water during Winter and Spring 2020 for engine repairs but is soon to be relaunched Fall 2020. MLML's fleet of Whalers and the RHIB remain a valuable resource for students, faculty and researchers.

Museum - Biological Collection:

Moss Landing Marine Laboratories (MLML) maintains a marine biological museum with a collection of vertebrates (including marine mammals, birds, turtles, fishes, and sharks, skates, and rays), invertebrates (such as deep-sea crustaceans, echinoderms, and polychaetes), and an herbarium collection of seaweeds (kelp and other marine algae). Specialized collections include a collection of sea otter skeletons, considered one of the largest in the world, a unique collection of fish otoliths, the Global Kelp Archive, and a small but unique collection of otoliths obtained from predators in a museum to meet the research and teaching needs at MLML. These collections represent a thorough sampling of specimens from the Monterey Bay, the California coast, the north-eastern Pacific Ocean and, in the case of the kelp collection, the entire world. Growth of the collections and activities of MLML scientists and students has increased the research value of these collections.

The MLML Museum houses many specimens of birds, mammals, turtles, fishes, and invertebrates along with the herbarium collection of marine macrophyte (algae and plant) pressings. The collection contains at least 11,000 accessioned biological specimens, with ~75% housed in research collections and ~25% in teaching collections. This is a unique collection focusing on the biota of the Monterey Bay, collected during the last 50 years. It represents a thorough sampling of the flora and fauna of Monterey Bay and the larger sub-tropical and temperate northeast Pacific region (Baja California, California, Oregon, and Washington).

The specialized geographic and taxonomic areas represented by this collection are under significant environmental pressure due to increased hypoxia and ocean acidification and warming. These collections represent the history and biodiversity of these ecosystems and organisms. Thus, these specimens, collected over a period of more than 50 years, are of great import for research as diverse as tracing change in resource availability over time in a central coast estuary, analyzing the impact of mercury pollution on seabirds, or examining the genetic diversity of sea otters, to give only a few examples of the important research and educational value of this fragile collection.

3.2 Financial impact for CSU

Indicate whether affinity group projects generated revenue beyond grant funding

MLML Classroom and Seminar Room Rental Revenue: \$6,380

MLML Merchandise Store: \$4,133 *revenue loss due to COVID19 campus closure and cancelled Open House*

Sandholdt Housing Rentals: \$21,775

Univ. of AK/SJSU Space Use Agreement: \$26,880

Del Mar Wharf Property Rental: \$96,000

MLML Student's Annual Open House: \$22,835

Lab Instrumentation Cost Centers: \$41,000

Donations AY19-20 (administered by SJSU's Tower Foundation): \$163,294

3.3 Student success impact

As a department in the SJSU College of Science and an affinity group under CSU, MLML aims to impact student success and encourage state, national, and international student enrollment. MLML students demonstrate such success through scholarships, grant awards, and professional recognition within the field of marine sciences.

AY19-20

- 18 new students started the MS program.
- 17 students graduated from MLML with a MS degree.
- 83 MS students enrolled from consortium campuses during the Fall semester and 74 during the Spring semester.
- 21 external graduate students took courses at MLML.
- 6 students took courses at MLML via CSU Open University.
- 10 undergraduates took courses at MLML.
- 27 scholarships were awarded to MLML MS students totalling \$29,800.
- 5 students received CSU COAST awards totalling \$4000.
- Heather Barrett, Vertebrate Ecology lab won the *Best Student Regional Award* for her presentation of her thesis on the cost of disturbance to CA sea otters at the 1st International Conference of the Marine Mammal Society held in Barcelona Spain, October 2019.

- \$22,835 was raised through the SJSU-MLML Open House 2020 Crowdfunding campaign.

3.4 Community impact

A major vision of MLML lies within its ability to strengthen the local Moss Landing community, along with the larger state, national, and international communities. MLML's research is done in this spirit of advancing knowledge of the marine sciences and to promote sustainable ocean systems. The MLML community impact relies on the outreach of students, faculty, and staff with support from SJSU's College of Science, SJSU Research Foundation, SJSU Tower Foundation and SJSU's Associated Students. MLML strives to promote community integration, communication, and environmental recognition as both an academic and research facility and through the professional accomplishments of its faculty.

MLML is a member of the Moss Landing Chamber of Commerce and participates in all public meetings conducted by the County of Monterey regarding Planning and Development of Moss Landing, California and its harbor. Additionally, MLML continues its positive relationship with neighbouring research institution Elkhorn Slough Foundation by collaborating on several research and conservation efforts in this pristine wetland area, and the Monterey Bay Aquarium Research Institute (MBARI) by collaborating on research projects, sharing scientific subject matter expertise, maintaining security and sharing use of boats, dock space, and the library.

The 2020 COVID19 epidemic restricted all outreach activities such as tours, events, and festivals. Consequently, MLML only gave 3 tours in the Fall 2019 semester. Prior to COVID19, MLML students visited K-12 classes with programs such as "*Sounds of The Sea*" and volunteered in underserved schools in some of San Francisco's most impoverished neighbourhoods. MLML faculty researchers were invited to Notre Dame High School in Watsonville, CA to talk about careers in science and Dr. Gitte McDonald presented at the Career Fair at Westlake Elementary School in Santa Cruz, CA. The MLML Tour Program hosted the North Monterey County Girl Scouts troop for a day of marine science that included a tour, fish identification game and marine mammal bone scavenger hunt. The MLML Museum team created a new display on Marine Protected Areas with materials and design support from the Monterey National Marine Sanctuary. The Sea Otter Savvy Program created digital materials for teachers and parents, including do-it-yourself learning activities, contests, and art projects.

The MLML Annual Open House is a well-known event in the Monterey Bay area and draws visitors of all ages from across the state, consortium campuses, family and friends. It is put on by MLML students with support from the SJSU Associated Students and SJSU Tower Foundation. Unfortunately, due to the COVID-19 epidemic, MLML Open House for 2020 was cancelled. Because this event is the main fund-raiser for MLML students, the students worked with SJSU University Advancement to conduct a crowdfunding campaign that was enormously successful and exceeded the fundraising goal. MLML students raised \$22,835 for student scholarships.

MLML welcomed 16 different organizations in the Seminar Room and classrooms for retreats, conferences, and meetings. These groups provided MLML with \$6,380 in rental revenue for the use of the rooms, an amount directly used towards lab operations and facility maintenance. MLML endeavours to host community organizations free of charge and only charges fees when necessary to maintain the facility and to earn funds towards a kitchen remodel.

Organizations:

Elkhorn Slough Foundation

Gavilan Community College

Monterey Bay Economic Partnership

Santa Cruz County Parks and Recreation

California Strawberry Commission

Communities Organized for Relational Power in Action

Stevenson High School

Assemblymember Mark Stone

The Center for Excellence in Education

CSUMB Student Information Systems

North Monterey County Unified School District

Communities Organized for Relational Power in Action

First 5 Monterey County

Point Blue Conservation Science

MLML understands the importance of raising awareness of oceanic life through public education and takes advantage of community-based platform opportunities to do so. MLML invites outside researchers from The Elkhorn Slough Foundation to use the Biological Oceanography lab and Aquarium Room every week for continued collaboration on wetland restoration and aquaculture. SJSU set up a Space Use Agreement between the University of Alaska, Fairbanks (UAKF) and MLML. Professor Geoff Wheat, Geochemist, UAKF rents a lab, office and storage space in the Main building for \$26,880 per year which MLML hopes can be used to upgrade facilities and supplement the operations budget. MLML's Assistant to the Director served as a science judge at York High School's science competition and at the Sea Lion Bowl at CSUMB, the local contest under the National Ocean Science Board. Many of MLML's Research Affiliate programs continued their public education programs; Sea Otter Savvy continues their public education on preventing sea otter disturbance, and MLML assisted NOAA's Whale Entanglement Team respond to whales in distress within Monterey Bay.

Faculty and staff also play a distinct role in MLML's community impact strategy. Professor Emeritus, Dr. Mike Foster, Phycology serves on the Advisory Committee of the Salinas Valley Groundwater Sustainability Agency. Professor Emeritus Greg Cailliet serves as President of the Cannery Row Foundation Board of Directors whose mission is to preserve historical sites along Cannery Row in Monterey. Dr. Harvey serves on two federal task forces, and is an advisor for The Marine Mammal Center, Elkhorn Slough National Estuarine Research Reserve, and California Sea Grant.

OUTREACH AY19-20:

- MLML faculty and graduate students mentored four summer interns through the National Science Foundation Research Experience for Undergraduates (REU) program.
- Pacific Shark Research Center students presented an outreach table at the 10th Annual Whalefest Festival in Monterey.
- Invertebrate Zoology Lab graduate student Emily Pierce created a new science education podcast "NudiBrains" and interviewed MLML researchers for several episodes.
- 15 MLML graduate students wrote posts about their thesis research projects, coursework, and unique graduate school experiences for *The Drop-In*, MLML's student run blog.
- Vertebrate Ecology Lab graduate students hosted a marine mammal exhibit for "Science Saturday" at the Pacific Grove Museum of Natural History.
- MLML contributed experts and specimens for the Pacific Grove Natural History Museum's "Animal Athletes" event.
- Several graduate students led "Skype A Scientist" video chat outreach talks followed by Q&A sessions for numerous elementary and middle classrooms.
- Researchers and staff from the Science, Learning, and Education with the Help of Sea Lions (SLEWTHS) team held public presentations, workshops, and talks focused on marine mammal science and training throughout the year.
- Staff and students hosted an outreach booth at the Cement Ship Centennial event celebrating the 100th Anniversary of the SS Palo Alto "Cement Ship" in Aptos.

- MLML graduate students served as judges at the National Ocean Sciences Sea Lion Bowl hosted at CSUMB.
- MLML continued to host the Monterey Area Research Institutions' Network for Education (MARINE) for their quarterly gatherings and poster sessions; MLML researchers participated in MARINE's *Science Plus* event.
- The Association for Monterey Bay Area Governments hosted a public workshop at MLML to discuss the Central Coast Highway 1 Climate Resiliency Study.
- MLML hosted a table with experts at the Natural Bridges *Migration Festival* in Santa Cruz, CA.
- MLML hosted a table at the Water Harvest Festival in Santa Cruz, CA.
- Dr. Ross Clark, Program Manager for MLML's Central Coast Wetland Group presented at the University of Irvine's Coastal Resiliency Workshop.
- MLML hosted the North Monterey County Girl Scouts troop for a tour and education, marine science activities.
- The Sea Otter Savvy Program organized the 5th Annual California Coastal Wildlife Disturbance Symposium and Sea Otter Awareness Week 2019.

3.4.1 Economic impact

As an internationally recognized institute of marine science department in the College of Science at SJSU, MLML requires a broad economic strategy to maintain its academics, research lab and expeditions, and the maintenance of six properties. During AY19-20, MLML submitted 49 proposals totalling \$9 million. MLML operated on a \$3.7M budget from SJSU with \$80k funded by consortium campuses. SJSU College of Science also funds 25% of the CA Sea Grant Aquaculture Specialist's salary.

To qualify and remain competitive for grant revenue, SJSU must remain on the cutting edge of innovation because the scientific discoveries and investigations generated by MLML link powerfully to local, regional, state, national and international economics. For example, understanding the effects of climate change, shoreline erosion, the benefits of aquaculture, impact to ecosystems from invasive species, and overfishing informs diverse populations about ocean conservation, regulating local fisheries and assessing shoreline communities and assets. MLML was awarded 48 grants totalling \$7.2 million. This generated \$1.8 million in F&A revenue, of which, MLML was returned \$68,876 to support facilities and administration. In addition, SJSU's Research Foundation provided \$190k to further support facilities and administration because our department is off-campus.

3.4.2 Social impact

SJSU's MLML advocates on behalf of the marine sciences and oceanic life, and how the health of our oceans, coastlines, and sea life directly impacts society and the quality of individual lives (see outreach activities in section 3.4). As such, it is vital the College of Science and MLML continue efforts to highlight our exemplary research efforts through tours, outreach, public education, volunteer opportunities, traditional and social media, and through increased brand-marketing that consistently identifies the institution as a department in the College of Science at SJSU and a consortium of seven CSU campuses.

MLML's research activities throughout AY19-20 served to raise awareness and influence such societal issues as impacts of wildlife disturbance, sustainable aquaculture, fisheries management, impacts of climate change, pollution from anthropogenic sources like microplastics, agricultural runoff, ballast water release from ships, detecting and monitoring invasive species, wetland conservation and marine mammal protection.

We continue to expand our reputation within and outside of the scientific community by emphasizing SJSU and the College of Science and CSU in our media output, posters, papers, and during presentations. MLML's media presence, with support from SJSU Media Relations, the Chancellor's Office Press Office, SJSU Research Foundation, CSU COAST consistently and regularly highlights and reinforces the dedicated work of MLML faculty, students and researchers. The MLML Graduate Student blog, "*The Drop In*," communicates individual student

research and achievement and continues to gain popularity and success with our friends and the public.

MLML is making improvements to branding to increase awareness that the institution is a department at SJSU and prepare to transition to the SJSU School of Marine Science.

3.4.3 Environmental impact

With support from the SJSU Research Foundation, MLML has contributed financially to the development of an Environmental Impact Report in conjunction with the North Monterey County Moss Landing Community Plan. More than 10 years ago, Monterey County began the process of developing a community plan for the Moss Landing area. Because MLML has development plans (e.g. Academic Village, Aquaculture facility, Del Mar wharf and marine operations), MLML has been actively participating in the Community Plan process. MLML researchers contributed valuable subject matter expertise to the sections of the plan addressing sea level rise and coastal hazards and parcel designation for research and education.

NOAA Whale Entanglement Team

MLML was one of the first participants that helped establish a network of people from federal agencies, academia, the fishing industry, and local citizens to respond to whale entanglements off central California. The group, initially called the Whale Entanglement Team (WET), received training and advice from NOAA personnel. With the help of a number of local NGOs, critical gear was purchased that greatly facilitated the dangerous process of disentangling a whale. Currently MLML supports the disentanglement efforts with meeting spaces, vessels, and trained personnel that participate directly in removing whales from fishing and other gear.

BeachCOMBERS

MLML's Vertebrate Ecology Lab, with support from grants through the SJSURF, manages BeachCOMBERS, a regional team of 150 trained public volunteers that has been walking beaches from central California to southern California for 20 years, counting and surveying dead and stranded marine mammals, birds, and turtles.

Aquaculture

MLML researchers, with support from SJSU University Advancement and the College of Science, continue to grow efforts to promote sustainable aquaculture in California. In collaborations with local, state, national, international and private partners, MLML's aquaculture research team is developing responsible methods for seafood production.

The aquaculture program at MLML has grown exponentially with new courses, research projects, capabilities, collaborators and infrastructure:

- Dr. Luke Gardner, CA Sea Grant Aquaculture Specialist ran a class project determining purple urchin ranching potential. This project was featured on NPR, reported on in several newspapers throughout the area and inspired a German documentary production crew to feature MLML in a film about the increased purple sea urchin population causing kelp die off in CA.
- *NOAA Impediments Abalone-Seaweed (Hamilton/Graham)*: Project completed examining how the co-culture of seaweeds and shellfish can mitigate the effects of ocean acidification. Developed an integrated multi-trophic aquaculture system that significantly elevated pH and growth of abalone, paper to be submitted soon, follow up pre-proposal submitted to Western Region Aquaculture Center (WRAC) to further improve system design. Funding decision during summer. New Marine Ecologist faculty at SJSU (Maya deVries) is also developing a proposal to use the system.
- *Endangered White Abalone Nursery (Gardner)*: First round of settlement and nursery completed with over 1000 juvenile white abalone in captivity for two more years until out

planting in the wild. Funded by NOAA. There are currently more white abalone at MLML-SJSU's Aquaculture facility than currently exist in the wild.

- *Purple-hinged rock scallops (Gardner)*: Starting the second year of Pacific States Marine Fisheries Commission project to spawn and cultivate purple hinged rock scallops to develop a new species for the aquaculture industry.
- *Cow Burps (Gardner)*: Starting the second year of an Ocean Protection Council (OPC)-funded project to cultivate seaweed as feedstock to reduce methane production in livestock. Awaiting chemical analyses prior to starting in vitro trials.
- *Black cod feed modification (Neylan, Grad Student, Ichthyology)*: Funding by CA Sea Grant to investigate alternative feeds for sablefish. Goal is to replace fish oil (not sustainable) with algae sources of oil (sustainable) and test how it affects growth, nutrition, and taste.
- *Monkeyface culture development (Hamilton)*: Two recently funded proposals (CA Sea Grant, and NOAA Saltonstall-Kennedy) to cultivate monkeyface pricklebacks as a sustainable alternative to unagi. One of the few local fishes that is herbivorous as an adult and can be fed seaweed grown sustainably at the lab. Goal is to test growth on different diets, including seaweed feed pellets we will develop at MLML, reproduction, completing the life cycle, and market development with industry partners Two X Sea.
- *Ocean acidification and hypoxia lab (Hamilton)*: Continuation of projects funded by NSF, Sea Grant, NOAA, and CSU COAST to examine effects of climate change stressors on multiple species of fish across different life stages.

Marine Pollution Studies Lab/ CA Dept of Fish and Wildlife

MPSL is dedicated to the study of environmental contaminants. We focus on trace metals chemistry including mercury and assessments of the ecological condition of water bodies. Our goal is to increase scientific understanding of environmental contaminants transport, cycling, and fate to better inform policies aimed at alleviating pollution.

Sea Otter Savvy

The goal of this program is to reduce sea otter disturbance by inspiring responsible viewing of wild sea otters. The program will accomplish this goal by engaging and educating the wildlife-viewing public, either directly or indirectly through operators of marine recreation and ecotourism businesses.

Central Coast Wetlands Group

This program coordinates the advancement of wetland science and management on the Central Coast of CA. Their main focus areas are water quality, habitat restoration, climate change planning, wetland research and assessment, public education and regional planning. Other important research focuses on the fate and transport of chemical constituents at the land-sea interface.

3.5 Communication and dissemination activities

SJSU-MLML is dedicated to increasing positive impacts on the climate and local, national, and international ecosystems. Communication, via journal articles, lectures, research, website and social media are all vital pieces to achieving this type of positive global influence. Under the direction of the Dean, College of Science, MLML's dissemination strategy includes publishing research, enhancing online presence and accessibility, participating in lectures and seminars, and faculty involvement in committees or other events within the scientific community. To enhance accessibility for potential students or outside entities interested in MLML's research, scholarship, and academics, MLML continues to participate in SJSU's Graduate Program fair and improve both the academic program website and informational brochures.

As a result, MLML was involved with numerous positive communication activities. A total of 72 articles and papers were authored and co-authored by SJSU-MLML Faculty and Research Affiliates. The MLML faculty and research community were members of several organizations and committees: Monterey Area Research Information Network for Education (MARINE), the Monterey Bay National Marine Sanctuary Advisory Committee, Monterey County Advisory Committee (seeking ways to solve groundwater problems and saltwater intrusion in the Salinas Basin). Additionally, MLML distributed packets containing an academic report, budgets, and Director's update at Governing Board Meetings in both Fall and Spring semesters.

The COVID19 pandemic and resulting restrictions put a halt to travel and attendance at conferences, workshops and in-person presentations. Despite the setback, SJSU-MLML faculty and researchers were able to serve as guest lectures and presented at several local, national and international conferences and workshops during Fall semester 2019 and virtually in Spring 2020:

- Dr. Connolly and Dr. Grand presented at the Ocean Sciences 2020 Meeting in San Diego, CA.
- Dr. Grand presented at the OceanObs 2019 Conference in Honolulu, HI.
- Dr Geller and his students presented at the Society for Integrative and Comparative Biology Meeting in Austin, TX, January 2020.
- Dr. McDonald presented at the Scientific Committee on Antarctic Research in Summer 2020.
- Dr. McDonald was a guest lecturer on a webinar hosted by the International Bio-Logging Society.
- MLML Faculty, students and researchers attended and presented at the American Geophysical Union's 2020 Ocean Sciences conference.
- MLML was featured at the first International Marine Mammal Society conference held in Barcelona, Spain in Fall 2019.
- Katie Lage, MLML Librarian gave several talks and presented her research for the International Association of Aquatic and Marine Science Libraries and Information Centers.
- Gena Bentall, Director of the Sea Otter Savvy Program organized, presented, and led talks at the 5th Annual CA Coastal Wildlife Disturbance Symposium and her program played a major role in organizing Sea Otter Awareness Week 2019.
- Dr. Dave Ebert, Pacific Shark Research Center:
 - Gave a talk at the California Academy of Sciences in San Francisco, CA for the 2019 *Sharktoberfest* and again at their Planetarium for a series on prehistoric sharks and rays.
 - Presented at an International Union for Conservation workshop in Japan.
 - Was interviewed on the popular podcast "Speak Up For Blue".
 - Received funding from the American Elasmobranch Society to start a new podcast he is calling "*Beyond The Jaws*".

SJSU-MLML continues to draw attention from local, regional, national and international news outlets. The MLML Media Team responds to media requests, maintains active and popular social media pages and rapidly post publicity on MLML's homepage. SJSU-MLML faculty, researchers and students regularly provide outstanding subject matter expertise on a variety of ocean and environmental issues and topics with a reputation for high standards, knowledge, experience, and enthusiasm.

PUBLICITY AND MEDIA AY19-20:

- Moss Landing Marine Labs was featured in the CSU Board of Trustees report *System Wide Collaborations* in January 2020.
- Dr. Gitte McDonald is featured in San Jose State Research Foundation's 2020 Annual Report for her research: *Marine Mammals in Extreme Environments*.
- Five MLML students received CSU Council on Ocean Affairs, Science, & Technology (COAST) Graduate Student Research Awards.
- Former MLML Director Dr. John H. Martin's seminal work was commemorated in a Nature article titled "*30 Years of the Iron Hypothesis of Ice Ages*".

- Vertebrate Ecology Professor Birgitte McDonald was interviewed about her emperor penguin research on Radio New Zealand's *Voices from Antarctica* podcast.
- Ichthyology Lab graduate student Katherine Neylan was named a California Sea Grant Graduate Research Fellow.
- Research faculty member Dr. Luke Gardner and his aquaculture students were featured in an episode of NPR's *All Things Considered* radio show discussing their ongoing sea urchin research.
- Captain John Douglas of MLML Marine Operations was highlighted in a NOAA Fisheries feature story for his role in a successful humpback whale disentanglement effort by the NOAA WET program.
- MLML's new partnership with the NOAA Cooperative Institute for Marine, Earth, and Atmospheric Systems (CIMEANS) was featured in a number of articles and press releases, including NOAA Research News and the SJSU Newsroom.
- Vertebrate Ecology Lab alumna Brijonnay Madrigal received the prestigious NOAA Dr. Nancy Foster Scholarship to fund her PhD research at the University of Hawai'i.
- Central Coast Wetlands Group (CCWG) Director Ross Clark was interviewed by CSU Newswise for an article discussing the impacts of sea level rise on California beaches.
- Director Jim Harvey was awarded the *Ed Ricketts Memorial Award* by the Monterey Bay National Marine Sanctuary for his exemplary work and commitment to advancing the field of marine science over the course of his career.
- MLML California Collaborative Fisheries Research Program (CCFRP) researchers were shadowed by journalists from the Monterey County Weekly for an article highlighting their research on local fish populations.
- Pacific Shark Research Center Director David Ebert and several graduate students were featured on the Discovery Channel's *Shark Week 2020 Extinct or Alive: Land of Lost Sharks*.
- Phycology Lab Professor Michael Graham and the MLML Aquaculture Center were highlighted in the Monterey Bay Herald for their innovative seaweed farming techniques.
- Two MLML students received Honorable Mentions from the National Science Foundation's prestigious Graduate Research Fellowship Program.
- The MLML Marine Mammal & Sea Turtle Stranding Network, coordinated by graduate students in the Vertebrate Ecology Lab, was featured in the Monterey County Weekly.
- Four MLML students received research grants from the Dr. Earl H. & Ethel M. Myers Oceanographic & Marine Biology Trust.
- MLML alumna Catarina Pien was awarded a California Sea Grant State Fellowship.
- SJSU and MLML awarded nearly \$30,000 in scholarships to 27 graduate students.
- MLML students, with support from SJSU's University Advancement team raised \$22,835 through a crowdfunding campaign.
- The MLML Marine Pollution Studies Lab (MPSL) was featured in a San Luis Obispo Tribune story highlighting the effects of shipwrecks on water pollution.
- Chemical Oceanography Lab alumna Dr. Edem Mahu received a Future Leaders African Independent Research (FLAIR) fellowship from the African Academy of Sciences.
- Sea Otter Savvy researchers Gena Bentall and Heather Barrett were featured in an NBC video highlighting the need to respect wildlife and avoid disturbance.

4 Training and workforce development activities

KATHLEEN DONAHUE, ASSISTANT TO THE DIRECTOR, MLML-SJSU

- SJSU MPP courses on Conflict Resolution.
- SJSU MPP course "Advanced Resource Management: People, Organization, Finances".
- 5th year serving on SJSU's Academic Affairs Resource Team (AART).
- Marine Protected Area Collaborative Network workshop on grant writing.

TERRA EGGINK, GRADUATE PROGRAM COORDINATOR, MLML-SJSU

- Webinar: "Crossing the Finish Line: Strategies to Support Doctoral Completion," Council of Graduate Schools - October 21, 2019.

- Webinar: "Appreciative Advising in the COVID-19 Era: How to Optimize Virtual Student Interactions," Florida Atlantic University - March 18, 2020.
- Webinar: "Supporting Students' Stress Management During Distance Learning," The JED Foundation - April 1, 2020.
- Webinar: "Equity-Minded Student Services in the Online Environment," Center for Organizational Research and Education - April 9, 2020.
- Webinar: "Teaching and Learning in the Time of Pandemic," The Humanities Institute at UC Santa Cruz - May 21, 2020.
- Webinar: "Addressing Anti-Blackness on Campus: Implications for Educators and Institutions," Center for Organizational Research and Education - June 24, 2020.

JACKSON WINN, MARINE OPERATIONS RESEARCH TECHNICIAN AND RESEARCH VESSEL 1ST MATE, DECKHAND

- Attended the Scientific Boating and Safety Administration Conference, Manchester, New Hampshire.
- Standards of Training, Certification and Watchkeeping at CSU Cal Maritime Academy. The class also covered Basic Marine Firefighting.

ANN BISHOP, GRADUATE STUDENT, PHYCOLOGY LAB, MLML MUSEUM ASSISTANT

- Shaping How We Invest For Tomorrow (SHIFT) webinar workshop series conducted by the National Park Service.
- Society for Advancement of Chicanos/Hispanics and Native Americans in Science (SACNAS) training series on diversity.
- Marine Protected Area Collaborative Network workshop on grant writing.
- Attended lectures/webinars on biological museum maintenance.

5 Intellectual property (IP) and technology transfer

- a. *If relevant, indicate opportunities for intellectual property and technology transfer, including status and next steps.*

SJSU and SJSURF are working on an IP process for the university and we expect that this procedure would be useful for the future activities in aquaculture. We currently have three industry partners working at the aquaculture facility, and each of them has signed a Master Agreement that deals with potential IP issues. For one of the companies, MLML and SJSURF have an equity stake in their company such that IP issues are a shared responsibility between the company and MLML/SJSURF.

- b. *Indicate IP training events for participants on how to protect IP.*

No IP training events occurred.

6 New activities planned for the coming year

COVID19: remote learning, response, phased return to operations: MLML will continue to offer online courses for Fall 2020, after many of the SJSU faculty attended workshops for the faculty to provide additional training for delivering online courses. A few of the courses will have an in-person laboratory component given the graduate-level courses taught at MLML and the need to provide hands-on skills. MLML has developed a successful scheduling plan that allows us to manage personnel entering the labs, record their activities, thus contact trace if necessary. In collaboration with SJSU, more than 17 research projects have begun again of which 17 M.S. students are conducting their necessary research thesis work. We have attempted to phase the

return to research, so as not to overwhelm the human and physical resources, be able to modify and refine protocols to keep people safe, and to maintain the necessary supply of protective and sanitizing gear.

Diversity, Equity and Inclusion Committee: In response to the recent unrest regarding systemic racism and other issues associated with inequality and inclusion, President Papazian issued a swift call to action to every member of the SJSU community to “help SJSU become the fully inclusive, anti-racist, multi-cultural organization to which it aspires” (June 18, 2020). MLML developed a new Diversity, Equity, and Inclusion Committee in August 2020. The goal is to eradicate racism from the program, provide a more inclusive atmosphere and processes, and to greatly increase the diversity of the MLML community.

Director Jim Harvey Retiring December 2020: Dr. Jim Harvey will be retiring as Director of MLML after serving a faculty member for 23 years and Director for nine years. SJSU will begin a search for a new Director in Fall 2020, with the hope of having a replacement by the beginning of 2021.

Tenure-Track Faculty Recruitment for a new Biological Oceanography Professor: Dr. Nick Welschmeyer, Biological Oceanography Lab will be retired in January 2020. Dr. Welschmeyer served on the SJSU faculty in the College of Science at MLML starting in 1989. His work focuses on the assessment of ballast water management and abatement of aquatic invasive species. He currently serves as the Lead Scientist for the Golden Bear Research Center at CSU Cal Maritime Academy. Dr. Welschmeyer will continue to work at MLML as an Emeritus Faculty member and PI on grant-funded projects administered by the SJSU Research Foundation. SJSU’s College of Science and Faculty Affairs division supported MLML’s recruitment for a new Assistant Professor to join the faculty in the area of Biological Oceanography in Fall 2020. Dr. Sarah Smith, Biological Oceanographer currently with the J. Craig Venter Institute and MLML alumnus, class of 2009 will join MLML as an Assistant Professor in Fall 2021.

Joint PhD Program: The Ocean Sciences Department at the University of California Santa Cruz has begun conversations with MLML and administrators at SJSU to develop a joint PhD program in marine science. In the upcoming year, this team will work on the details of an agreement so that it can be considered by the UC and CSU systems.

Alumni Engagement and Stewardship: MLML will start producing an Alumni Newsletter every semester that will feature research, student activity and achievements. The newsletter will include a section “*Mentor Match*” to connect students with alumni working and thriving in their area of research.

MLML General Plan for North Monterey County-Moss Landing Community Development Plan: MLML has been actively involved in the Monterey County Planning Department and Commission with regards to the Moss Landing Community Plan. This document, which includes an Environmental Impact Report, will affect various plans for development of properties owned by the SJSURF. These development plans include: the Academic Village (housing, labs, classrooms, conference center), reconstruction of the wharf supporting research vessels, new buildings supporting aquaculture research, and buildout of the research labs on the Norte property.

Aquaculture Center:

- A Fish Feed Mill has been offered as a donation to MLML that will allow us to conduct experiments regarding the replacement of fish protein in fish meal. The mill can produce fish-free feed at research and commercial scale. Awaiting release of COVID19 shelter-in-place orders to bring in a technical team to train researchers and technicians on operation.

- MLML-SJSU CoS is excited about the potential approval of the Center for Aquaculture as an ORTU (Organized Research & Training Unit) for SJSU, the Consortium, and the CSU. This designation will help to coordinate and facilitate collaborative research and training in aquaculture throughout the CSU.
- *Purple Sea Urchin Ranching (Gardner)*: Big explosion of urchin barrens and collapse and loss of kelp in northern CA. If urchins are removed, what can you do with them? One idea is to fatten them up in an aquaculture facility until they are a commercially viable product (need large gonads). Initial project completed including aquaculture course and NPR segment, Proposal for socio-economic study was submitted with the Middlebury Institute of International Studies (MIIS), Monterey CA to CA Seagrant in July 2020.
- *Bull kelp recovery cultivation (Graham)*: Submitted proposal to OPC/Sea Grant to develop culturing techniques for bull kelp *Nereocystis* for out-planting in wild following purple urchin clearings. >95% of kelp has been lost in N. CA since 2016 following marine heatwave and loss of sea star predators on urchins due to sea star wasting. Kelp is a foundation species and its presence supports diverse populations of fish, inverts, and abalone. Funding decision expected June 2020.
- *Socio-economic benefits of aquaculture (Graham)*: Proposal for socio-economic study will be submitted with MIIS to Sea Grant in July 2020 to look at economic benefits of “California grown” branding for aquaculture products, as well as economic benefits of ecosystem services provided by aquaculture activities.
- *Production of hydrogen biofuel from seaweed refuse (Coale)*: Finalizing project to produce hydrogen gas and fertilization from seaweeds used to bioremediate coastal eutrophication. *Resulted in MS Thesis for Katie Graves, Chemical Oceanography.*
- *CA Sea Grant New Faculty proposals (Grand and Kahn)*: Submitted to assess bromoform production of seaweeds intended to be cultured and fed to cattle to reduce methane emissions (Grand). The second proposal seeks to look at improving aquaculture for olympia oysters used for restoration efforts in partnership with Elkhorn Slough NERR (Kahn).

7 Problems and Opportunities

- Problems: Nature of problems; resources needed to resolve the; status on resolving them.*

COVID-19

The COVID19 pandemic of 2020 has forced the closure of MLML for approximately three months as only essential personnel can occupy the MLML buildings to maintain spaces, the seawater system, organisms in captivity, and security. During this period there were no cases of COVID-19 in the MLML community. Faculty and students rapidly transitioned to online courses. MLML worked with SJSU’s Emergency Coordinators and Dean Kaufman to complete the process developed and managed by SJSU to allow RSCA activities. MLML was approved to resume several research activities. Some of these projects are of vital interest to the federal government (e.g. MOBY project) or to the State of California (e.g. MPSL). During the summer, MLML/SJSU faculty participated in training provided by SJSU’s Faculty Affairs for online course development and delivery. To solve this problem will require a vaccine and mostly eradication of COVID-19, but we expect that this will not occur until late 2021.

F&A Return Issues

MLML’s budget to support sponsored research has seen a precipitous drop in return of F&A generated within the last few years. This has led to concerns regarding the long-term prognosis for supporting research projects at MLML. It is critical that SJSU, the SJSURF Governing Board, and the Chancellor’s Office Implementation Team address MLML’s decreasing F&A return while planning to transition MLML to greater involvement by SJSU.

Research Faculty on Thesis Committees

Research Faculty continue to help mentor students, provide research opportunities, and serve on thesis committees. Their research and intellectual pursuits add a great deal of diversity and capacity to the research activities at MLML and expand the number of graduate students that MLML can serve. The diversity of expertise within the Research Faculty members allow our students access to many different types of projects, skills, instrumentation, and resources. However, we have not utilized this resource as best we can, and it will take a concerted and active plan and execution by the T/TT Faculty and the Research Faculty to better integrate the Research Faculty into the educational program.

Student Housing

One large problem for MLML is student housing. We operate in one of the most expensive housing markets in the U.S., and with increasing tuition and cost of living students have a difficult time attending MLML unless they have some assistance. MLML and SJSURF purchased the 9.2-acre Sandholdt Property in 2005 with the principle purpose of constructing housing, new research lab/teaching space, and a conference center. Development of this location would provide affordable housing for our students. In an effort to raise the funding for such a project we have partnered with SJSU Faculty member Josh Nelson (Industrial Design) and his students to create a visualization of the project (site plans and an animation). With assistance from the SJSU University Advancement we will pursue permitting and funding to get this important project underway. Additionally, CSUMB and SJSU are discussing an agreement that would allow any MLML students access to the student housing at CSUMB.

- b. Opportunities: Examples include enterprise-level projects (multi-campus; multi-sector), interdisciplinary projects; high-impact; new technology or tools.*

Aquaculture Center Agreements

ORTU establishes a Center for Aquaculture at SJSU. This formally designates a Center at MLML/SJSU to invigorate the burgeoning opportunities for research and training regarding aquaculture in California. We have added 40 new research tanks at the Aquaculture Facility that is supporting three large research projects associated with integrated multi-trophic aquaculture, impacts of ocean acidification, and expansion of the seaweed farm. Three industry partners have signed agreements with the SJSURF, allowing them to use the facility for hatchery/nursery, grow out, and holding processes.

We have recently funded proposals in place to investigate various species of marine algae that might reduce methane production in cattle, expanded research on combination of seaweeds and invertebrates in multi-trophic systems, and to develop techniques for raising scallops. We are developing proposals to fund a new position as an aquaculture technician and need to acquire funds to add additional power to this site for future development.

Marine Operations:

MLML Marine Operations Manager, Captain Brian Ackerman, Director Jim Harvey and SJSU's University Advancement have established a partnership with Marine Architect Tom Wylie and ship builder Jody Watt. In conjunction with the non-profit Ocean Planet Explorers (opexplorers.org) they have agreed to design and build a new 111', sail assisted research vessel that, once built, will be donated to Moss Landing Marine Labs. This low emission, silently operating ship will be capable of conducting research cruises both offshore and nearshore along the Pacific Coastline. MLML looks forward to working with SJSU to raise the funds necessary to bring this valuable resource to SJSU and the marine research community throughout California.

Research Opportunities:

Future research opportunities at MLML consist of expanding the vibrant and diverse research regarding aquaculture. This involves not only applied research developing new techniques for

aquaculture methodologies but also new species, sustainable new approaches, revisions to permitting issues, developing new courses, and understanding socio-economic issues. With many new partners, MLML also is planning to acquire a new ocean-going research vessel. If this becomes a reality, many new research projects will be developed that take advantage of the long-range and unique capabilities of this vessel. This will include voyages into the center of ocean basins, studies utilizing the quiet capacity of the vessel such as bioacoustics of whales and dolphins, studies of the coastal dynamics associated with climate change and ocean acidification, and deep-sea oceanography and ecology.

With closer ties to the faculty at SJSU, we also envision some collaborative work with faculty in engineering, social sciences, and the humanities. This includes future robotics, sensors, and autonomous vehicles. More studies of the importance of the coastal environments to underserved coastal communities and creating new works to inspire an appreciation and conservation of marine systems.

8 Budget

Indicate funds received from (a) the Chancellor’s Office, (b) Campus contributions, (c) External funds to support operation of affinity groups, and (d) External grants of faculty associated with the affinity group.

(A) Chancellor's Office and (B) SJSU Contributions.

The academic program at MLML is supported by about \$3.7 million almost all through the College of Science at SJSU. This past year the consortium campuses (not including SJSU) contributed \$71,425. Historically, the Chancellor’s Office contributed about \$1.5 million annually to support MLML but SJSU now supports MLML entirely except for the minor contributions from the other consortium campuses. The State budget for MLML is presented below indicating the actual costs for AY19-20 and the budgeted expenses for AY20-21.

SJSU College of Science-MLML Operating Budget AY19-20		
<i>Operating Budget For: Administration, Instructional Supplies, Dive Program, Facilities, IT</i>		
	AY 19-20 Actuals	AY 20-21 Budgeted
Salary	2,080,058	2,080,058
Benefits	976,490	976,490
OE&E	228,743	228,743
Utilities	310,775	310,775
Salary Recovery / Reimbursement	(66,609)	TBD
Consortium Funding-Visiting Scientist	21,425	21,425
Other Reimbursement/Support	42,000	12,000
CSUMB Contribution	50,000	50,000
Prior Year Balance Forward	123,403	39,854
Roll-Forward Encumbrances	36,649	TBD
TOTALS:	3,802,935	3,719,345

(C) External funds - donations administered by SJSU’s Tower Foundation

MLML General Donations	77,840
Friends of MLML Tours	503
Store	3,685
Open House 2020	22,835
Total MLML Donations AY19-20	163,294

(C) External funds – Classroom Rentals and Space Use Agreement

Classroom Rental Fees	6,380
SJSU-Univ of AK Space Use Agreement	26,880

(D) External grants administered by SJSU Research Foundation (SJSURF)

MLML also operates research activities based on return of F&A and additional support from the SJSU Research Foundation. We receive additional revenue from rental of facilities and other minor income. These funds go to pay primarily the salaries of staff and infrastructure that support research at MLML, including IT, facilities, marine ops, library, and diving. We maintain a reserve for those years where income does not match expenditures. Also, the purchase of a few properties that support marine ops and property planned for housing were purchased with SJSURF funding and MLML is slowly paying this back via a portion of F&A returned each year.

In AY19-20, MLML-SJSU faculty were awarded a total of 48 grants, totalling \$9 million, administered by the SJSU Research Foundation (SJSURF). The following table represents the F&A return to MLML and \$190k supplemental funding provided by the SJSURF to support our off-campus finance and administration (service typically provided on campus). These funds are used for critical infrastructure such as grant accounting and administration at MLML, IT, facilities, construction, scientific diving and small boat support for grant-funded research, and maintenance and repairs to the five SJSURF-owned properties in Moss Landing, CA.

MLML's budget to support sponsored research has seen a precipitous drop in return of F&A generated within the last few years. This has led to concerns regarding the long-term prognosis for supporting research projects at MLML. It is critical that SJSU, the SJSURF Governing Board, and the Chancellor's Office Implementation Team address MLML's decreasing F&A return while planning to transition MLML to greater involvement by SJSU.

MLML: SJSU Research Foundation F&A Return/Support for Operations

REVENUE	AY19-20 Actuals	AY20-21 Budgeted
Other Income	41,000	40,000
Rental Income (Del Mar, Sandholdt Center)	116,000	111,525
F&A Return (Less 30% to PI's, Reserve, Deficit Refinance)	68,836	20,342
SJSURF Admin and Facility Support	190,000	190,000
Balance Forward From Previous AY	(266,627)	(416,907)
Balance of Revenue To Fund Operations:	149,901	(55,040)
OPERATIONS DETAIL		
Salaries, Wages and Benefits	431,586	382,298
<i>SJSURF Facility and Admin Staff - not from Grant Direct Costs</i>		
Administrative Costs	35,638	35,000
Diving Costs	1,696	2,000
Information Technology	19,107	20,000
Construction	-	-
Maintenance and Repairs to SJSURF Properties:	19,147	23,500
<i>Del Mar, Norte, Aquaculture Center, Firehouse, Sandholdt</i>		
Services & Facility Costs	77,408	79,800
Supplies & Equipment	3,588	5,000
Small Boat Support	15,000	0
Total Operating Costs:	603,170	547,598
Est EOY Deficit:	(416,907)	(619,268)
RESERVE		
Reserve Account Balance EOY	563,513	563,513
REFINANCING ACCOUNT		
Refinancing Account Balance EOY	(2,969,142)	(2,980,000)

This second table details MLML's Marine Operations and Small Boats budget which exists on both SJSU OE&E as well as revenue earned through cost centers administered by SJSURF:

MLML Annual Report AY19-20: Marine Operations

MLML MARINE OPERATIONS BUDGET AND REVENUE AY19-20	
<i>SJSU College of Science General Fund and SJSURF Cost Centers</i>	
SJSU College of Science Funding-General Fund, OE&E:	3,773
SJSU Research Foundation (SJSURF) Cost Center Revenue*:	79,258
MLML SJSURF F&A Return Funding for Marine Ops:	15,000
Total Funding and Revenue AY19-20:	98,031
Operating Costs AY19-20:	240,593
EOY Balance:	(142,562)
* SJSURF COST CENTER REVENUE DETAIL	
R/V JOHN H. MARTIN	21,544
R/V SHEILA B.	41,027
ORANGE RHIB	7,611
MARINE OPERATIONS	4,000
WHALERS	5,076
Total Revenue AY19-20:	79,258

9 Affinity group's self-certification checklist

Requirements to grandfather in as a System-Wide Center or Institute under EO 1103

Check list for:

PURPOSE:

- Organized around a scholarly, creative, research, education, and/or public service activity that combines interests/expertise of individuals, departments or administrative units, and may draw on expertise of others external to the campus or the academy.
- May offer services to constituents beyond the CSU community (e.g., individuals as well as private and public entities).
- As specified otherwise.

FUNCTION

- Provide opportunities for professional development of faculty and staff through teaching, research, scholarly and creative activities, and public service.
- Foster and facilitate interdisciplinary efforts among disciplines, departments, colleges, and universities.
- Provide a clearinghouse for information of interest to professionals and conducting workshops and conferences for continuing education.
- Improve student success by facilitating/supplementing student academic experience.
- Provide opportunities for faculty and staff to collaborate on multi-campus or system-wide proposals for external funding to support the above activities.
- Cite other functions as stated in proposal or strategic plan and approved following processes described below.

STRUCTURE

- Strategic plan, including purpose and mission.
- Campus or auxiliary responsible for administration of funds
- Financial support.
- Participating CSU campuses and non-CSU entities, and their roles and responsibilities.
- Organizational and governance structures.
- Suspension or dissolution guidelines.
- Hiring procedures, staff, and location.
- Protocol for changes in participants—identified under participating CSU campuses...

ADMINISTRATION

- Identify lead president or other executive as responsible for the oversight of each system-wide multi-campus center, institute, or affinity group.
- CSU personnel shall be subject to a letter of appointment from the campus; the letter sets forth the terms and conditions of his/her employment including, but not limited to, whether he/she serves at will in either capacity and whether his/her employment with the campus will continue after the employee's service to the unit terminates or is otherwise suspended and/or if the unit dissolves.

Appendix A.
Academic Year 2019-2020: Publications
***MLML Graduate Student**

- Aiello, I. W.**, Bova, S. C., Holbourn, A. E., Kulhanek, D. K., Ravelo, A. C., & Rosenthal, Y., 2019. Climate, sea level and tectonic controls on sediment discharge from the Sepik River, Papua New Guinea during the Mid-to Late Pleistocene. *Marine Geology*, 415, 105954.
- Hetherington ED, CM. Kurlle, **SR Benson**, TT Jones, JA Seminoff (2019). Re-examining trophic dead ends: stable isotope values link gelatinous zooplankton to leatherback turtles in the California Current. *Marine Ecology Progress Series*. 632: 205–219;
<https://doi.org/10.3354/meps13117>
- Avens L, LR Goshe, GR Zug, GH Balazs, **SR Benson**, H Harris (2020). Regional comparison of leatherback sea turtle maturation attributes and reproductive longevity. *Marine Biology* 167:4, <https://doi.org/10.1007/s00227-019-3617-y>.
- Stauffer BA, **Bowers HA**, Buckley E, Davis TW, Johengen TH, Kudela R, McManus MA, Purcell H, **Smith GJ**, Vander Woude A, Tamburri MN. 2019. Considerations in Harmful Algal Bloom Research and Monitoring: Perspectives From a Consensus-Building Workshop and Technology Testing. *Frontiers in Marine Science* 6 (399).
- Cortés, E. and **G. M. Cailliet**. 2019. Generation Time. Chapter In: Encyclopedia of Ecology (Second Edition) Volume 3; 381-383, <https://doi.org/10.1016/B978-0-12-409548-9.111107-8>;
- Zuercher, R., R.G. Kliever, and **G.M. Cailliet**. 2019. Life history of the deep-water persimmon eelpout (*Eucryphycus californicus*, family: Zoarcidae), and its use of drift vegetation as an ecological subsidy. *Environmental Biology of Fish*, <https://doi.org/10.1007/s10641-019-00896-1>;
- Caltabellota, F.P., Z. A. Siders, D. J. Murie, **G.M. Cailliet**, and O. B. F. Gadig. 2019 Age and growth of three endemic threatened guitarfishes *Pseudobatos horkelii*, *Pseudobatos percellens* and *Zapteryx brevirostris* in the Western South Atlantic. *Journal of Fish Biology*. DOI: 10.1111/jfb.14123
- Hopwood, M., **Carroll, D.**, Dunse, T., Hodson, A., Holding, J., Iriarte, J., Ribeiro, S., Achterberg, S., Cantoni, S., Carlson, D., Chierici, M., Clarke, J., Cozzi, S., Fransson, A., Juul-Pedersen, T., Winding, M., and L. Meire, 2020, Review article: How does glacier discharge affect marine biogeochemistry and primary production in the Arctic?, *The Cryosphere*, 14, 1347–1383.
- Hopwood, M.J., **Carroll, D.**, Höfer, J., Meire, L., Le Moigne, F.A.C., Bach, L., Eich, C., Sutherland, D.A., González Estay, H., and E.P. Achterberg, 2019, Highly variable iron content limits iceberg-ocean fertilization and carbon export, *Nature Communications*, 10(1), 1–10.
- Fried, M.J., **Carroll, D.**, Catania, G.A., Sutherland, D.A., Stearns, L.A., Shroyer, E.L., and J.D. Nash, 2019, Distinct frontal ablation processes drive heterogeneous submarine terminus morphology, *Geophysical Research Letters*, 46 (21), 12083–12091.

- Ebert, D.A.** & Fowler, S. Illustrations by Marc Dando. In Press. *Sharks of the World*. 2nd edition. Princeton University Press. Book
- Clark, R** and **O'Connor, K** (2019). A systematic survey of bar-built estuaries along the California coast. *Estuarine, Coastal and Shelf Science*. Vol. 226
<https://doi.org/10.1016/j.ecss.2019.106285>
- Connolly, T. P.**, P. R. McGill, R. G. Henthorn, D. A. Burrier*, C. Michaud*. 2020. Near-bottom currents at Station M in the abyssal Northeast Pacific. *Deep Sea Research II: Topical Studies in Oceanography*, 173, 104743. <https://doi.org/10.1016/j.dsr2.2020.104743>
- Smith, K. L., C. L. Huffard, P. R. McGill, A. D. Sherman, **T. P. Connolly**, S. Von Thun, L. A. Kuhnz. 2020. Gelatinous zooplankton abundance and benthic boundary layer currents in the abyssal Northeast Pacific: A 3-yr time series study. *Deep Sea Research II: Topical Studies in Oceanography*, 173, 104654. <https://doi.org/10.1016/j.dsr2.2019.104654>
- Huffard, C., **C.A. Durkin**, S. Wilson, P. McGill, R. Henthorn, K.L Smith Jr. 2020. Temporally resolved mechanisms of deep-ocean particle flux and impact on the seafloor carbon cycle in the northeast Pacific. *Deep Sea Research II* 173: 104763
- Preston, C., **C.A. Durkin**, K. Yamahara. 2019. DNA metabarcoding reveals organisms contributing to particulate matter flux to abyssal depths in the North East Pacific Ocean. *Deep Sea Research II* 73: 104708
- Heemstra, P.C., Heemstra, E., & **Ebert, D.A.** In Press. *Coastal fishes of the Western Indian Ocean*. South African Institute for Aquatic Biodiversity Special Publication. Book
- Ebert, D.A.** & Dando, M. 2020. *Field Guide to Sharks, Rays, & Chimaeras of Europe and the Mediterranean*. Princeton University Press. Book
- Krajangdara, T. Fahmi, & **Ebert, D.A.** In Press. New records of three ghost sharks (Chimaeriformes) from Andaman Sea of Thailand. *Thalassas: An International Journal of Marine Sciences*.
- Bennett, R.H., **Ebert, D.A.**, Siteo, J.J., Fernando, S., Harris, M., van Beuningen, D., & Bernard, A.T.F. 2020. First records of the critically endangered shorttail nurse shark *Pseudoginglymostoma brevicaudatum* (Orectolobiformes: Ginglymostomatidae) from Mozambique, with notes on morphology and research priorities. *Marine Biodiversity*.
- Nehmens, M.C.* , Feldheim, K.A., & **Ebert, D.A.** 2020. Understanding what we cannot see: a genetic approach to the mating system of the Southern Lanternshark, *Etmopterus granulosus*. *Marine Biology*.
- Buglass, S., Nagy, S., **Ebert, D.A.**, Sepa, P., Turchik, A., Bell, K.C., Rivera, F., & Giddens, J. 2020. First records of the seven-gilled *Notorynchus cepedianus* and six-gilled *Hexanchus griseus* sharks (Chondrichthyes: Hexanchiformes: Hexanchidae) found in the Galápagos Marine Reserve. *Journal of Fish Biology*. DOI: 10.1111/jfb.14447
- Kyne, P.M., Jabado, R.W., Rigby, C.L., Dharmadi, Gore, M.A., Pollock, C.M., Herman, K.B., Cheok, J., **Ebert, D.A.**, Simpfendorfer, C.A., & Dulvy, N.K. 2020. The thin edge of the wedge: extremely high extinction risk in wedgefishes and giant guitarfishes. *Aquatic Conservation: Marine & Freshwater Ecosystems*, 30(7): 1337-1361. DOI: 10.1002/aqc.3331

- Ebert, D.A.** & Leslie, R.W. 2019. *Leucoraja elaineae* n. sp., a new species of skate (Rajiformes: Rajidae) from the Western Indian Ocean. *Zootaxa*, 469(3): 225-234.
- Kuhnz, L.A., Bizzarro, J.J., & **Ebert, D.A.** 2019. *In situ* observations of deep-living skates in the eastern North Pacific. *Deepsea Research I*.
- Jew, M.*, **Ebert, D.A.**, Kemper, J.M., Walovich. K. & Quaranta, K.L. 2019. Correction to: Redescription of the bigeye chimaera, *Hydrolagus macrophthalmus* de Buen, 1959 (Chondrichthyes: Chimaeriformes), with a genetic characterizsation of the species. *Marine Biodiversity*, 49: 1615-1616.
- Jew, M.*, **Ebert, D.A.**, Kemper, J.M., Walovich. K. & Quaranta, K.L. 2019. Redescription of the bigeye chimaera, *Hydrolagus macrophthalmus* de Buen, 1959 (Chondrichthyes: Chimaeriformes), with a genetic characterizsation of the species. *Marine Biodiversity*, 49: 1605-1614.
- Ebert, D.A.**, Akhilesh, K.V., & Weigmann, S. 2019. *Planonasus indicus* n. sp., a new species of pygmy false catshark (Chondrichthyes: Carcharhiniformes: Pseudotriakidae), with a revised diagnosis of the genus and key to the family. *Marine Biodiversity*, 49: 1321-1341.
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Appendix B. External Grants, Fiscal Year 2019-2020
(ref. SJSURF Annual Report 2020)
**MLML-SJSU Tenure-Track Faculty*

Ivano W. Aiello*

Participation of Scientists Based at U.S. Institutions in the IODP on Expedition 385
Columbia University: \$58,461

Ivano W. Aiello* and Ryan Portner

Acquisition of X-Ray Diffraction Instrumentation for Mineralogical Research
National Science Foundation: \$144,158

Elkhorn Slough Foundation Project - Advanced Geospatial and Geotechnical Services and Development of Materials to Inform On-Going Estuarine
Elkhorn Slough Foundation: \$155,000

Joseph J. Bizzarro

Applications of Life History and Fisheries Data for Improved Management of Skates
UC San Diego: \$55,261

Holly A. Bowers and G. Jason Smith

Advancing Portable Detection Capabilities of Harmful Algal Bloom Species in California Waters

University of Southern California: \$77,571

Dustin Carroll

ECCO -Dar win Model Exploration of Physical and Biogeochemical Interactions in the Land-Sea Continuum

Jet Propulsion Laboratory: \$153,924

Ross P. Clark

Agreement Number 15446 - Developing and Validating Assessment Tools for Ephemeral Streams

Southern California Coastal Water Research Project: \$49,661

Spatial Representativeness of Bioassessment Results for Channels with Engineered Features

Southern California Coastal Water Research Project: \$20,000

Thomas Connolly*, Kenneth H. Coale, and G. Jason Smith

CeNCOOS: Long-Term Monitoring of Environmental Conditions in Support of Marine Area Management in Central and Northern CA

Monterey Bay Aquarium Research Institute: \$61,000

Rocio Illiana Cooley

A Novel Approach to Identify Sources, Transfer and Impact of Domoic Acid in Marine Food Webs

UC San Diego: \$74,514

Colleen A. Durkin

Linking Sinking Particle Chemistry and Biology w/ Changes in the Magnitude and Efficiency of Carbon Export into Deep Ocean

Skidmore College: \$76,126

Luke Gardner, Michael Graham*, and Scott L. Hamilton*

Sea Feeds: Identification and Culture of Californian Marine Macroalgae Capable of Reducing Greenhouse Gas Production from Ruminant Livestock

UC San Diego: \$205,759

Jonathan B. Geller*

Metagenetic Analysis of Zooplankton of Port Valdez Alaska

Prince William Sound Regional Citizens Advisory Council: \$8,022

Michael Graham*

MLML15 Tank Setup & Seaweed Growth Testing

Google, Inc.: \$35,519

H. Gary Greene and Joseph J. Bizzarro

Biological and Essential Fish Habitats Assessments of Marine Fauna in the Vicinity of the Monterey Bay Aquarium Seawater Intake Pipelines

Monterey Bay Aquarium Research Institute: \$16,325

Scott L. Hamilton*

Evaluating Performance of California's MPA Network through the Lens of Sandy Beach and Surf Zone Ecosystems

UC Santa Barbara: \$64,077

Scott L. Hamilton* and Richard M. Starr

California Collaborative Fisheries Research Program - Monitoring and Evaluation of California Marine Protected Areas

UC San Diego: \$1,000,000

James Harvey

RV Use for Monthly Water Samples

Applied Marine Sciences Inc.: \$80,000

Waterfowl Ecology and Management Suisun Marsh

Suisun Resource Conservation District: \$560,695

James Harvey and Brian Ackerman

Carl Moyer Program Grant Contract

Association of Monterey Bay Area Governments: \$199,416

James Harvey and Jonathan Mike Prince

Auxiliary General Purpose Oceanographic Research (AGOR) Support Services

Office of Naval Research: \$161,209

Wesley A. Heim

DWR-46-9668: Mercury and Methylmercury Sampling and Analysis

California State Department of Water Resources: \$19,980

DWR Yolo Bypass Mercury Studies

California State Department of Water Resources: \$369,199

Wesley A. Heim and Autumn L. Bonnema

Contract No: 1287 - San Francisco Estuary Institute/Aquatic

San Francisco Estuary Institute: \$73,333

SWRCB Agreement Number: 17- 023-270

California State Water Resources Central Board: \$232,620

Birgitte McDonald*

Enhanced Stranding Response and Training for the Future on the Central California Coast

UC Santa Cruz: \$3,539

Heart Rate Logging in Deep Diving Toothed Whales; a New Tool for Assessing Responses to Disturbance

Office of Naval Research: \$28,954

The Hidden Lives of Emperor Penguins: Cameras and Movement Loggers Provide Insight into Foraging of an Antarctic Icon

National Geographic Society: \$26,004

The Hidden Lives of Emperor Penguins: Cameras and Movement Loggers Provide Insight into Foraging of an Antarctic Icon

SeaWorld & Busch Gardens Conservation Fund: \$10,000

UC Davis Agreement #32751-Support for California Sea Lion Unusual Mortality Even

UC Davis: \$62,750

Kimberly A. Null and Ross P. Clark

Characterizing Shallow Groundwater Nutrient Sources in Central Coast Sloughs
UC San Diego: \$77,960

Marco A. Sigala

USACE Ogliuga Island Remedial Investigation, Ogliuga Island, AK
Ahtna Environmental Inc.: \$20,000

San Francisco Estuary Regional Monitoring Program For Water Quality In San Francisco Bay

San Francisco Estuary Institute: \$183,136

G. Jason Smith

The Alliance for Coastal Technologies (ACT): National-Scale Efforts Toward Verification and Validation of Observing

University of Maryland Center for Environmental Science: \$200,000

Richard M. Starr

Monitoring and Evaluation of Mid-Depth Rocky Reef Ecosystems in the MLPA Marine Protected Area Network

UC San Diego: \$2,400,000

Diana L. Steller

Minimizing Disturbance Impacts by California Vessel Mooring Systems on Living Rhodolith Benthos in Catalina MPAs: an Experimental Assessment

UC San Diego: \$40,580

Alison Stimpert

Data Analysis of Passive Acoustic Data (PAM) from Rockfish Behavioral Response Study

U.S. Department of Commerce: \$35,000

Soundscape Characterization in the National Marine Sanctuaries Using Passive Acoustic Monitoring

Naval Postgraduate School: \$31,613

Nicholas A. Welschmeyer*

DNV GL Kurita Ballast Project

California Maritime Academy: \$423,290

PIA- Evoqua Ballast Project

California Maritime Academy: \$97,181

PIA - Gensys/Oscar Ballast Project

California Maritime Academy: \$423,290

Mark Yarbrough

Marine Optical Buoy (MOBY) Operations and Technology Refresh.

University of Miami: \$2,310,000

Jenifer Zeligs

Investigating Sea Lion Locomotion

West Chester University: \$15,000

