

In search of answers: making a career in marine mammal science

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The first visuals from a drone flying over a surfacing blue whale are awe-inspiring. Can there be a more marvelous creature on our blue planet? Long before drones and YouTube® came into the picture, beach trips, dolphinariums, whale watch tours, diving, and nature documentaries inspired children to become marine biologists.

But what starts as a childhood dream, can remain fantastical unless there is a passionate drive, commitment, and desire to turn fantasy into reality. Becoming a marine mammal biologist is not easy, but neither is it impossible.

Today's professional workspace has changed remarkably. It is, therefore, necessary to reexamine and expand our understanding of what it means to work with and for marine mammals.

Here, we try to dispel myths and provide realistic notions of what the marine mammal biologist of today and the future will look like and how you can achieve your dream through myriad pathways.

Keeping in mind that planning has to happen early, we provide advice by age-groups.

Primary School (Age 8-14 years)

Parents - this is for you.

At this age, the best thing a parent can do is nurture curiosity for nature and science in the child.

Watching TV is fine! Science-focused nature documentaries from reliable sources, e.g., BBC Attenborough documentaries, Nature PBS, Mutual of Omaha's Wild Kingdom, Discovery Science (International), Watch Nebula, Curiosity Stream are attractive. Nature series such as WildKratz also provide learning opportunities. Best to avoid reality shows or imagined programming of how animals behave if placed in a fictional setting. While TV programs provide entertainment, they can never replace real interactions and experiences with wildlife or wild places.(put the TV segment at the end of the list)

Reading is important! Books encourage learning about all kinds of animals, not just marine mammals. Make reading fun. Encourage reading both fiction and nonfiction books on marine mammals. The onus should be on cultivating a habit to read and comprehend the story or topic. Public libraries, second hand book shops or book swaps provide low-cost opportunities to access varied literature. Books always make great gifts, and so do subscriptions to Nature focused magazines (give examples of young readers options)

Promote scientific curiosity! Let your kids ask questions. It is ok to admit ignorance, but don't curb their curiosity to ask questions. Why is sea water salty? Are mammals fish? Can I bring a sea lion pup home? There will be more of these types of questions but use Google wisely to respond to questions. Carry out experiments together that are useful to explain natural phenomena or scientific approaches.

Be one with nature! If you are able, then take them to experience nature in the raw. Camping, beach visits, zoo visits, whale-watching, museums, planetariums, safari trips or even trips to the local park or exploring your backyard are all par for the course. Get them excited about science and the wonders of land, oceans, and space exploration. Other ways to care for animals is to have a pet, visit an animal farm, or spend time watching critters around the house or the neighborhood. All these activities can be equally entertaining and nurturing. In short, get your kids thinking about and caring for animal life in a fun way -- It doesn't all have to be educational. Before working with marine mammals, let them gravitate towards environmental issues, e.g., understanding water scarcity or water quality issues, the importance of wetlands, how garbage is managed and where does it end up?

High School (Roughly, children aged between 15-18 years)

Focus on learning!

At your age, you have multiple technological and life distractions vying for your attention. So, what do you focus on as you begin your scientific careers? The best you can do is stick to tried and tested scientific basics.

Despite all the technological advances, nothing can replace an understanding of the tenets of science. A classic example is that despite the many missions NASA has orchestrated, Einstein and Newton's mathematical explications (developed more than 100 and 200 years ago, respectively) appear indestructible. Science is built on foundational scientific works and this is true for marine mammal science as well. The achievements and contribution of pioneering marine mammal scientists have enabled the research we do today.

Begin by learning your marine mammal scientific history and about the early marine mammal scientists who amassed troves of data and knowledge that we still rely on. Here's what you should focus on in these formative years.

1. **STEM Grooming** - Develop a firm grounding in Maths, Chemistry, Biology, and Physics. These subjects help you to think critically, problem-solve, and build your knowledge base in scientific theory and concepts. Be comprehensive in covering various topics with Science Technology Engineering Mathematics - STEM courses.
2. **Build a strong foundation in the biological sciences** - evolution, physiology, biochemistry, molecular/cell biology, genetics, animal behavior, ecology, environmental science are all important subjects to learn about even if superficially. The key is to know what's out there and what piques your interest the most.
3. **Build communication and interpersonal skills (soft skills) and continuously work on improving these skills** - Learn to speak and write clearly in English or your native language plus English on technical and non-technical matters. Learn to work with teams and independently. Learn to lead and to follow. Learn to share knowledge and skills. Learn to listen and observe. Working with people of different backgrounds, values, and cultures is key to solving many marine mammal conservation problems. Therefore, developing people-management skills is just as important.
4. **Be curious and seek vicarious knowledge** - Appreciate science. Learn about anthropology, economics, paleontology, social science, engineering, and information technology. Expose yourself to a variety of topics. If you are able, then seek international experiences to broaden your perspective and attitudes to marine science research and conservation. In short, be a generalist -- this will allow you to adapt to changing work environments, help you determine what excites you the most and what you are good at, and finally, you improve your chances of getting a job in different sectors, not just marine science.
5. **Beyond schoolwork** - Become a volunteer at an animal hospital, research lab, or wildlife park. Concentrate on picking up skills that take you out of your comfort zone. Do something you are afraid of, but please do not compromise your health and safety! Start building your experiences through a mix of volunteer work and paid internships. If you have the support at home, financially and otherwise, seize all available opportunities at school, student workshops, and non-school related events. You may not realize it now, but these early experiences will build character, team-building spirit, and the desire to learn and improve.

Undergraduates

If you are reading this, you are already passionate about marine mammals and the marine environment. You are half-way there!

Continue your reading

1. Read classic marine mammal books (e.g., Handbook of Marine Mammals, Cetacean Societies - Field Studies of Dolphins and Whales, Hawaiian Spinner Dolphin, Sperm Whales: Social Evolution in the Ocean, Dolphin Societies - Discoveries and Puzzles, The Bottlenose Dolphin, Marine Mammals - Evolutionary Biology, and many more). Write to your favorite marine mammal scientist and tell them about the work they've done that impacted or inspired you and ask them for other book suggestions and reading material. Read the early literature in marine mammal science (e.g., Würsig and Würsig 1977 (dolphin photo-identification), Wu et al. 1974 (dolphin echolocation)) before searching for the newest scientific works to complete your class assignment or project. Start at the beginning!

Do a gap analysis of strengths, weaknesses

1. Marine mammal conservation problems are complex and interdisciplinary. Focus on skill acquisition. Have you learned something new each semester or year? Some areas where you can develop skills: bioacoustics, ocean engineering, veterinary medicine, microbiology, parasitology, physiology, anatomy, histology, toxicology, molecular biology/genetics, physical, chemical, biological oceanography, climatology, oceanographic sampling, terrestrial or marine field data collection and analysis, social science, economics, creative writing, science communication (take accredited writing and public speaking courses), Geographic Information Systems, systems modeling, programming languages (R, Python, C++, Java, etc.), Artificial Intelligence (AI) tools, wildlife photography, diving certifications (optional), statistics (Bayesian and Frequentist)/statistical modeling.

2. Continue to strengthen your core biology/ecology knowledge. Expand your learning in whatever you are currently specializing in e.g., animal physiology, biochemistry, ethology, behavioral ecology, neurobiology, anatomy, evolution & systematics, genetics, molecular biology, and population dynamics.
3. Assess your skill set. Are you more quantitatively inclined, prefer field-based vs. lab-based work? Have you sought experiences that enhance these skills?
4. Can you write well? Writing popular or scientific contributions requires experience. Scientific writing is an acquired skill and takes years of practice. Be ready and willing to accept and learn from writing errors. Can you write complete sentences with proper grammar and sentence construction? Can you analyze complex material, synthesize information, and present it in a succinct manner for scientific and non-scientific audiences? Continue to read non-academic literature about marine mammals and the environment. Notice when something is well put. Why did it affect you? Study how good communicators use language to get their point across powerfully.
5. Have you taken the right set of quantitative ecology courses? These days, there are many software and tools to enhance your quantitative skills. So, don't shy away from quantitative coursework. Quantitative analysis is standard practice for most research analyses. You don't have to be a maths or statistical wizard, but enroll in courses that teach you at least the basic skills. If you are keen, enroll in advanced courses and certifications. In fact, seeking advanced certifications, courses, or degree programs in concurrence with your standard courses will make you competitive.
6. Seek diverse skills that build on your core interests and strengths. Both terrestrial and marine, as well as field and lab experiences can help advance your career, so don't limit yourself to one system/form or the other. A combination of specialized and taxa or system transferable skills will vastly improve your chances to obtain graduate school admissions and improve your job prospects.
7. Attend different conferences, not just marine mammal conferences. Expand your personal and professional network to include people from different cultures, backgrounds, and specializations.
8. Don't accept the status quo. Peer-pressure or family pressure can be hard things to overcome. If you can, test your boundaries and deviate. Try something that none of your peers have experienced. Build unique skills and work hard to be really good at what you do.

Self-evaluate your career goals and passion

Some of you might know what you want from the get-go. But a vast majority might struggle to find a chosen field of expertise. The best way to identify your career direction is to experiment and experience. Do not be afraid to try different experiences. If you take up a lab project, do a field project next time. If you did marine ecology, do an anthropology or economics project. Learn from each experience, and constantly quiz yourself about what excites you and gets your attention.

Sadly, many of the field internship positions for marine mammal or wildlife biology work remain unpaid opportunities. As enticing as they may be, please aim for paid positions or ensure you have an alternate source of income before embarking on marine mammal-focused field internship projects. If unpaid, make sure that your accommodation and food are paid for. Check out SMM's [page](#) on internships to determine if an internship is good or not. Never forget that you do not necessarily need to travel abroad or far from home to undertake useful internships, look for internships local to your area that you can get involved with on a regular basis, so that you have less concerns about financial aid. You may also find that by doing local internships over time you are thought of for future job opportunities.

This is a good time to ask yourself whether you want a job immediately after graduation or whether to accumulate experiences in preparation for graduate school and subsequently, a professional career. After a Bachelor's degree, assume that your salaries will be variable and commensurate to your experience. Don't feel pressured to rush into a graduate program (Masters or Doctoral Program) immediately. If you have the financial means and parental or familial support, continue building volunteer hours in marine mammal science or some other vastly different undertaking.

However, be careful in what volunteer opportunities you choose. While an international experience is rewarding and well-worth pursuing, do not spend thousands of your hard-earned currency without gaining a skill or strengthening your research or fieldwork credentials. Do your research. Ask the following questions: Is there a tangible outcome or deliverable associated with that experience? Will you pick a new skill or strengthen your foundational skills? Can you obtain a much better experience in your country or region?

Remember, undergraduate degrees are no longer enough to land you a well-paying job in the marine science profession or for the matter any other. The mantra today is high-skilled labor. With the technology boom, low-skill work will be easily accomplished by machines, including big data analysis. But a strong and specialized foundation in the STEM fields, as well as complementary and diverse skill sets, will continue to be attractive to employers. Therefore, while accumulating much-needed experience, develop an acute awareness of the job market, economy, and the changing skills and workforce demands. Understand that the changing workscapes driven by globalization will automatically affect the type of skilled labor needed to

tackle specific conservation or research problems. At this stage in your education, it is normal to be unsure of your final career path. Instead focus on acquiring and assessing your abilities, skills, and interests, not just academically.

Resource example

Erasmus/ Erasmus+

If you are a student in Europe then you may be eligible to apply for the Erasmus programme or Erasmus plus programme. These enable students to participate in an intercultural experience. There are around 30 different European countries involved in the programme, which you can attend during or on completion of your degree. If you are taking part in the completion of your degree, you must remain registered at your home University during the time of your Erasmus plus, however, you are not required to pay tuition fees. The great part of the Erasmus programme is that it provides you with a grant to help cover costs and you can attend an institution where you may take courses or you may be able to get involved in the research.

<https://www.erasmusprogramme.com/post/start-here>

Graduates/Post-graduates/post-docs

The beginning of the grind!

If you are contemplating graduate studies, which you should if you want to, regardless of your ultimate career goal, here are some things to help you along.

Decide early on what your preferred career path will look like. Are you planning to embark on a career in academia or outside of it?

If you are unsure and want to explore both pathways, then you need to exceed thresholds for pursuing an academic or non-academic career. What are these thresholds?

Remember that embarking on postgraduate studies, particularly PhD programs, is not something you should do because 'you cannot find a paid job'. These projects become huge parts of your life and are often very stressful, don't be put off them, but make sure you choose the right topics and supervisors before you embark on the journey.

Today, a strong publication record combined with the ability to obtain extramural funding, and a proven experience of collaborating with domestic and foreign institutions carry greater weight. Social media presence may not necessarily propel research careers, rather a strong research record or publications will automatically lead to social media attention. Unless, you wish to pursue a different path altogether as a science writer, animal or environmental activist, or work for advocacy or nonprofit organizations. Periodical blogging, tweeting and making Vimeo videos do not automatically make you a science communicator. Science communication is a learned skill. Work with specialists and obtain dedicated training in communications, especially writing, and learn from the experts to nurture and refine your interests and skills.

Marine mammal careers can be incredibly diverse. Particularly with a graduate degree/Ph.D., you can work for the government, environmental consulting companies, management consulting companies (e.g., Booz Allen), museums, think tanks, academia, non-profit, zoos/aquaria, schools, media, Department of Defense/Navy, and international organizations such as Food and Agricultural Organization, UNESCO, United Nations Environmental Program, IUCN, International Whaling Commission, etc.

The nature of the agency or institution will dictate your job profile. You can be an applied ecologist, conservation biologist, policy analyst, a biologist in a regulatory office, environmental consultant, marine mammal field biologist, or scientific program manager.

Each job sector comes with its share of pros and cons. Also, depending on the employing institution, you may need a divergent skillset. Still, good academic credentials, collaborative spirit, experience, technical knowledge, leadership abilities, communication skills (oral and written), an aptitude for problem-solving and critical thinking will be an asset regardless of your job portfolio.

We cannot tackle all job possibilities here, but we pick a few to highlight further.

Government institutions are governed by legislative and political frameworks, and implementing those statutory or agency priorities for societal benefit is a core function. Research conducted, therefore, is used to support legislative mandates or conservation action. Similarly, if you decide to work for a nonprofit, their current campaigns (e.g., bycatch reduction in gill

nets), infrastructure, and resources will determine the nature of your work. While in academia, intra- and extra-mural grant sources, lab facilities, infrastructure, and scientific output may influence your work.

It is not a bad idea to explore different work environments and see what works best for you. If you find field research most rewarding, consider working as an independent contractor, e.g., field technician, marine mammal observer. If you become an independent contractor, assume jobs may be sporadic and contingent on funding. If you are good, you may find opportunities all-year-round. Often, opportunities for being a marine mammal observer may ebb and flow with the times. Field technician jobs may give you the freedom to be at sea for long periods of time, collect incredibly valuable marine mammal or ecosystem data, even with limited academic experience. However, options for career growth may be minimal unless you obtain more training or education or take a different position.

Professional positions in genetics/molecular biology, microbiology, ecological or statistical modeling, programming, acoustics, veterinary health are specialized occupations. The good thing is that regardless of whether you worked with land animals, seabirds, sea turtles, or fish species, or for the matter parasites or pathogens, the skills you acquire are easily transferable to the marine mammal field. Of course, specialized training in marine mammal research or working with marine mammals will make you more competitive. Similarly, disciplines such as paleontology, histology, physiology, again provide unique knowledge, skills, and abilities, which are easily applied and adapted to a marine mammal or non-marine mammal occupations.

If you want to work on applied science issues, consider working for the government, nonprofits, think tanks, or interdisciplinary institutions. Manage your expectations. The bureaucratic and administrative networks and practices in most places may not promote your scientific curiosities or predilections, regardless of whether it is academia, government, or the private sector. Be patient and flexible. Learn, adapt, and give things time. Avoid hopping from one appointment to another. Build relationships, learn and improve on the job, and advance your credentials. Learning never ends regardless of where you are in your scientific career.

Monetarily, an environmental consultant agency or government jobs may pay higher than an academic position. Although your pay will likely be commensurate to experience and which part of the world you are seeking a job. So, do not automatically assume a Ph.D. equals a higher salary than a Master's student. Experience in the position may carry greater weight.

Academic positions can be soft money appointments, which implies, you need to secure outside funding or may be offered a nine-month salary over a 12-month period, and expected to find funds to cover your summer salary and research projects. Academic positions require a different set of credentials, so ensure you have adequate teaching and research experience and an established publication record. Different universities will have different requirements. Positions are few and far between so, assume there will be heavy competition for the few teaching or research position slots.

If teaching is what excites you, work on building a strong teaching portfolio. Do not discriminate between community colleges, high schools, or universities -- ultimately, the experience is what counts and your passion for education.

Financial motivations are key factors. So, ask yourself if you want a well-paying job or if job satisfaction alone matters. Lucky individuals may obtain both job satisfaction and a good salary, but this may not always be the case. There will be trade-offs so, prepare to make them.

If research is not your thing, there are several positions in management and regulatory agencies, which focus on research consequences or allow for research to happen. Jobs may include the issuance of scientific research permits or authorizations, risk assessments, or preparation of environmental impact statements for research to occur or for an activity to proceed. These positions require strong analytical and writing skills, scientific training, as well as an understanding of marine mammal biology and ecology. Regulatory jobs, as well as environmental consultancy, can be full-time desk jobs but still have a significant impact on promoting marine mammal research or managing threats to the marine environment and marine mammals. These can also be well-paying jobs and allow you some work-life flexibility.

Other job options can include being a tour guide or naturalist on a whale-watching vessel or to operate your own tour operations. There are obvious start-up costs and vagaries of the economy to contend with but you will be right where the action is and the pivotal source of information to many research scientists. Being a naturalist can be a natural stepping stone to advancing academic prospects or working in nonprofits. Moreover, training as a naturalist, can improve your field observation skills and groom you holistically about different marine taxa. The same holds true if you decide to become a marine mammal or seabird observer. A penchant for working with the public or science communication might be enhanced

through a tour guide or naturalist positions. Increasingly, some naturalists or tour boats, use drone operators to accentuate the “viewing” experience. Drone operations are definitely a useful skill to add to your repertoire.

In short, expand your job search to include different sectors. What matters in the job market is not whether you have extensive marine mammal experience, what matters is the skills and expertise you bring and will gain through the appointment. Notwithstanding, there is no substitute for specialized experience and knowledge of marine mammals. So, consider completing short-term course work or specialized internships to know what it means to study marine mammals.

A pragmatic note - You cannot be an expert in everything. So, focus on a few trademark skills, which you are interested in and are good at. Throughout your career, opportunities may arise to enhance or complement your skillset and advance your training.

Network, network, network

Sometimes, when one door closes, another opens. And nothing is more true for the marine mammal world. The people you meet, the relationships you make will have a tremendous impact on your career choices and pathway to success. From your high school years to postgraduate studies, leave a solid impression with your peers and supervisors. An impressed colleague or supervisor, may connect you with your next posting, offer you a position in the lab, recommend you for a promotion, or be the winning ticket for a graduate position in a reputable lab. Significantly, your professional contacts may expose you to an entirely different aspect of marine mammal science that you hadn't thought about. Serendipitous meetings and opportunities early in your career can often lead to long-lasting and rewarding marine mammal science careers.

Cultivate good professional networks. You do not need to be a social butterfly but make an effort to get to know a wide variety of people in different job sectors or disciplines. Nurture and strengthen your relationships. Networking begins in high school and continues throughout your professional career. As you advance in the career ladder, your professional networks become increasingly valuable to help make the next career transition.

Last words...

Repeatedly assess your desires, interests, and career goals depending on your situation. Make decisions early in your degree program rather than waiting until you graduate to make a choice about your professional career. Decision-making never ends in any professional setting. It is therefore vital that you evaluate your goals, current, and future job scenarios, and adapt to the influx of technology pervading our lives. Marine ecosystems are dynamic and studying them requires matching dynamism. Develop a good understanding of the problems and threats facing our marine environment and consider what solutions may be needed to tackle impending threats.

Finally, pursuing marine mammal science careers is a marathon. Be prepared to stay in for the long haul. There is a certain exclusivity built in the field due to the nature of where marine mammals are found and the heavy investments needed to study them. Progress and success will be incremental and your journey may not always lead you to your end goal. So, do not be demoralized by your meandering career pathways or personal and professional setbacks. If your heart is set on a marine mammal science career, put in the concomitant effort and accept the pain with the pleasures of working with and for these beautiful animals. There are more ways than one to study, conserve, and admire these magnificent creatures.