JZAR JOURNAL OF ZOO AND AQUARIUM RESEARCH
www.jzar.org

Research article

The academic, career and personal benefits of zoological internships: A 10-year evaluation of a dolphin research internship

Eszter Mátrai[1,2], Shaw Ting Kwok[1], Daniel Grainger[3], Michael Boos[1] and Ákos Pogány[2]

[1]Research Department, Ocean Park, Hong Kong, 180 Wong Chuk Hang Road, Aberdeen, Hong Kong
[2]Department of Ethology, Eötvös Loránd University, Pázmány Péter sétány 1/c, H-1117 Budapest, Hungary
[3]Danny Grainger Copy,1879 Yarramalong Road, Yarramalong, NSW, Australia, 2259

Correspondence: Eszter Mátrai, email; eszter.matrai@oceanpark.com.hk

Keywords: academic impact, employment impact, hands-on experience, marine mammal, personal impact

Article history:
Received: 12 Jan 2021
Accepted: 14 Jan 2022
Published online: 31 Jan 2022

Abstract
Internship programmes have grown in popularity in many academic fields, including marine mammal science. These programmes provide invaluable opportunities for early-career scientists to obtain practical and hands-on experience with a rare insight into the day-to-day operation of a research team. Working in the field of marine mammal science requires a wide range of skills, many of which can only be acquired with first-hand practical experience. The current study evaluated the academic, employment and personal impacts on participants of an ex-situ research internship programme at Hong Kong's Ocean Park over the past 10 years. The survey included 175 evaluations submitted by interns that joined and successfully completed the programme between September 2010 and December 2020. The programme received positive evaluations on all three assessed aspects and was rated 'above expectation' by 67% of the respondents. The participants indicated that they gained both transferable and research-specific skills. Benefits of the experience were reported in regard to academic trajectory (91%), personal life (98%) and employment (91%). Based on experience and the feedback from the participants, an improved set of best practice recommendations is provided. Research, conservation and education are considered significant pillars of contemporary animal management. Through academic internship programmes, modern zoos and aquariums contribute to the cultivation of future generations of scientists, conservationists, educators and animal care professionals.

Introduction

Zoological and aquarium settings enable marine mammal scientists to better understand animal behaviour (e.g. Highfill and Kuczaj II 2007; Kuczaj et al. 2001; Kuczaj and Eskelinen 2014), physiology (e.g. Brook et al. 2000; Brook and Kinoshita 2005), cognition (e.g. Herman 2010; Pack 2010), genetics (e.g. Spielman et al. 2004), welfare (e.g. Clegg et al. 2015; Clegg and Delfour 2018) and conservation best practices (e.g. O'Brien and Robeck 2010). This is achieved by conducting research programmes that include observation, laboratory testing and experimental setups in collaboration with academic institutes, governmental organisations and NGOs. Despite the importance of this task, research in the field is limited due to accessibility, funding, high equipment costs, restricted opportunities for manipulative experiments and by the vastness of the task itself (Bowen 1997).

Marine mammal scientists, like any other scientists, must be passionate about science and discovery, able to think logically and creatively, be detail-oriented while keeping in mind the 'big picture' and able to communicate clearly (Crosby 2001; Reynolds 1999). An undergraduate or master's degree is normally required for a research assistant position and a doctoral or postdoctoral degree for a junior researcher position. Besides the level of education, candidates are also expected to have considerable practical experience (Crosby 2001).

Often described as a dream job, perceptions of the marine mammal research field have been heavily inspired by documentaries, media releases, movies and scientific literature (Lucrezi et al. 2018; Woolston 2014). However, junior marine mammal scientists soon realise that this career path comes with a significant number of professional and personal challenges. Marine mammal scientists are often required to work on weekends or holidays (especially in field

season) (Crosby 2001) and at remote locations, which makes work-life balance challenging to maintain. Moreover, early career researchers are often required to change location due to short-term contractual engagements. Good physical fitness for transporting equipment, multiple languages for communicating with local communities and authorities, and boating and SCUBA licenses are often essential skills for junior researcher positions. Photo identification and handling of audio capture hardware and software are also essential skills when observing marine mammals in the field (Hillman et al. 2003). Moreover, having basic electrical engineering skills and the capacity to use power tools safely can be useful when needing to repair faulty research equipment quickly (personal observation). Finally, in some cases, researchers must have animal training skills (Woolston 2014). Researchers must remember that working with wild animals carries a certain degree of risk, therefore, an ethological knowledge (not restricted to the investigated species) and following strict safety protocols are crucial in this field (Crosby 2001).

Even with such a broad skill set, job openings in research are limited and highly competitive. In many cases, direct hands-on experience gained through internship programmes is a deciding factor when employers and organisations are evaluating job applications. Internship programmes (also termed 'volunteer programmes') offer insights into the daily logistics of operating a research programme and valuable opportunities for students and young scientists to gain practical, hands-on experience (D'Abate et al. 2009; Hynie et al. 2011). Marine mammal internships provide unique platforms for participants to learn about and use cutting-edge research technologies, e.g. hydrophones, sound traps and underwater cameras (National Research Council 2010), which may be inaccessible outside of these programmes. Acoustic recording devices are expensive and due to their highly specialised applications are often only manufactured on demand. Interns may be allowed to enter restricted marine parks, to which only certain research groups have access. They may participate in visual or acoustic observations (above water or underwater) of extremely rare and endangered species. Most importantly, interns may use these learning opportunities to make significant decisions regarding their education and career path.

As stated by the Association of Zoos & Aquariums (AZA), research, conservation and education are considered significant pillars of contemporary animal management. Zoos and aquariums provide invaluable opportunities for zoologists and researchers to conduct both in-situ and ex-situ research programmes (Hopper 2017, Maple and Segura 2015, Packer and Ballantyne 2010) and contribute to conservation efforts through community engagement and education programmes (Jensen 2014, Moss et al. 2015, Pearson et al. 2014). The ex-situ research programme at Ocean Park Hong Kong focuses on sensory (Hoffmann-Kuhnt et al. 2015, Matrai et al. 2019a) and cognitive research (Matrai et al. 2019b, 2020, 2021a, b). Interns receive intensive hands-on experience by participating in all aspects of ongoing research and laboratory activities, including assistance in daily research sessions with the dolphins *Tursiops aduncus*, data processing and analysis and assisting with administrative and maintenance requirements.

Despite the popularity of internship programmes in various fields, the effectiveness of these programmes is rarely investigated (Narayanan et al. 2010). Regular evaluation and feedback are essential for the improvement of the field collectively, and also facilitate individual development. The importance of feedback is highlighted by Dr Robin W. Baird (2021), research biologist with Cascadia Research, in his advice for people interested in a career studying marine mammals on the website of Cascadia Research Collective: "If you are volunteering, ask for feedback on what you can do to learn more, improve your performance etc. It is amazing how few volunteers ever ask for feedback/suggestions. Note this also applies to jobs you are being paid for—ask for feedback on a regular basis."

This study aimed to investigate the impact of an ex-situ research internship programme from multiple career and educational aspects. Participating students from the past 10 years were asked to evaluate their experience using an online questionnaire. Their responses were assessed to reveal the impact of the internship programme on their academic achievements, employment prospects and personal lives. Our findings assess the value of zoological internship programmes, contributing towards the educational role modern zoos and aquariums play in the cultivation of the next generation of life-science professionals capable of improving welfare and conservation efforts.

Table 1. Detailed summary of the three internship positions.

Position	Established	Working hours	Duties
Full-time, On-site	2010	Mon–Fri, 0900–1730	Research planning Preparation and execution of the research sessions Data collection Data management Data analysis Scientific communication Equipment design and maintenance
Part-time, On-site	2010	Min. of 1.5 weekdays/ week	Preparation and execution of the research sessions Data collection Data management Data analysis Equipment maintenance
Part-time, Off-site	2019	Min. of 1.5 weekdays/ week	Behavioural coding Data analysis

Materials and Methods

The internships took place in Ocean Park, Hong Kong (OPHK). OPHK is a non-profit organisation located on the southern coast of Hong Kong Island. It aims to provide an entertaining and educational environment promoting life-long learning and conservation advocacy. OPHK's research internship programme offers opportunities for students and young scientists to gain hands-on experience of the marine mammal research field.

The programme included three different intern positions: full-time on-site; part-time on-site and part-time off-site (Table 1). The minimum commitment was three months for all three positions. The programme was open all year round, thus included four three-month blocks with a one-week overlap between the outgoing and incoming teams. After successful completion of the three-month minimum period, interns could extend further and stay on with the next team. During the internship period, multiple (1–10) interns were recruited to attend on the same day.

The positions were advertised on multiple publicly available websites and shared by local and international universities on their own websites. Recruitment was conducted in two selection

Table 2. Demographics of the 175 respondents.

Factors	Categories	Values
Age	Between 16 and 51 years (mean±SD=21±3 years)	
Gender	Females	73%
	Males	27%
Origin	68% local (Hong Kong)	32% international (15 nationalities)
Education level	Hing School	3%
	College	6%
	Polytechnic	6%
	Undergraduate (BSc)	74%
	Honours degree	3%
	Master's degree (MSc)	2%
	Seeking work after BSc (Hons)	1%
	Gap year	3%
	Already working	3%

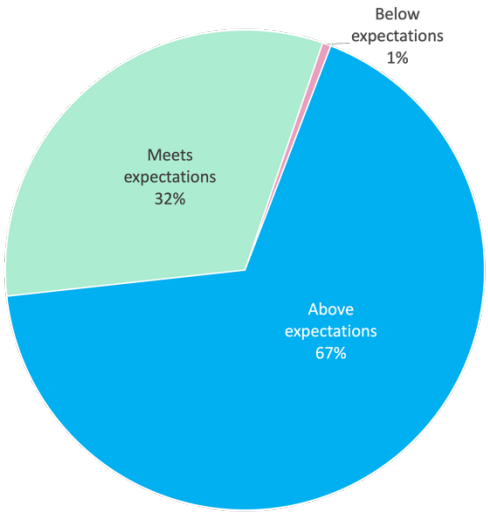

Figure 1. The overall internship experience according to feedback from the 175 respondents.

rounds. The applicants were required to submit their CV, letter of interest, academic records and reference letters. Following review of the submitted documents, potential students were invited for an online (international applicants) or on-site (local applicants) interview.

The internship programme survey was sent to 217 interns that joined and successfully completed the programme between September 2010 and January 2020 and 175 (81%) responses were received. The demographic data of the 175 respondents is summarised in Table 2.

The online questionnaire was created using Google Forms for the purpose of evaluating the overall internship experience, academic impact, employment impact and personal impact. The respondents were contacted via email and messaging apps. Depending on the length of the answers, the respondents could complete the survey in 5–10 minutes. The questionnaire included single-choice questions, multiple-choice questions and three open-ended questions (Appendix 1). While the general experience (thirteen questions) and personal impact (three questions) could be evaluated for all participants, academic (three questions) and employment (three questions) were restricted to a subset of the participants. Academic impact could be assessed in participants that were still active in their academic career, such as graduating from or applying to academic institutions at the time of completing the questionnaire. The employment impact could only be assessed in former interns who started seeking employment (including both related and unrelated fields) following the internship programme. Personal impact was analysed for each of the relevant three questions separately.

Academic impact was considered positive if the respondent answered 'yes' to the question 'Did the internship experience help with your academic career?'. The employment impact was considered positive if the respondent answered 'yes' to the question 'Did the internship experience help with your career?'. The internship experience was considered effective on an individual level if a respondent rated the overall experience positively (above or meets expectation). The internship experience was considered effective if a significant difference was achieved between the number of students indicating a positive answer and those indicating a negative answer. The answers to the open-ended questions were categorised into sub-groups based on their main points and each group analysed for their relative frequencies. The answers to the first open-ended question 'How did the internship experience change your view regarding the scientific research' were categorised into four subgroups: 1. Improved understanding of the research field, 2. Improved understanding of welfare under human care, 3. Improved understanding of both research field and animal welfare under human care and 4. Others. The answers to 'What did you like about our internship/volunteer program?' were also categorised into four sub-groups: 1. Woking with animals, 2. Working environment, 3. Research experience and 4. Living in Hong Kong. Finally, the answers to 'How can we improve?' were categorised into five sub-groups: 1. None, 2. Comments on application procedure, 3. Comments regarding training of interns, 4. Comments regarding protocols and 5. Requests for increased animal interactions. During the analysis, descriptive statistics were used for most of the questions. Overall experience was assessed by the frequency of each potential answer (above/meets/below expectation) and compared using a binomial test. The skill sets acquired by part-time and full-time interns were compared using a two-sample Mann-Whitney U-test in Microsoft Excel (version 16.16.13).

Results

Overall internship experience

The number of interns who considered the internship experience above expectation was significantly higher than that for the other two possible responses (67%, binomial test P<0.001, Figure 1). Out of the 175 respondents, 174 (99%) indicated that the experience exceeded or met expectations.

The number of students joining the programme and responding to the questionnaire increased over the years, with the highest (42 interns) in 2020. While the number of full-time students remained consistent with an average of nine students a year (2010 is omitted as it was not a full year), the number of part-time local students showed a gradual increase (Figure 2). More than half of the applicants (62%) learned of our internship programme through their educational institutions, and a quarter (25%) by web search. The remaining 13% indicated that the programme

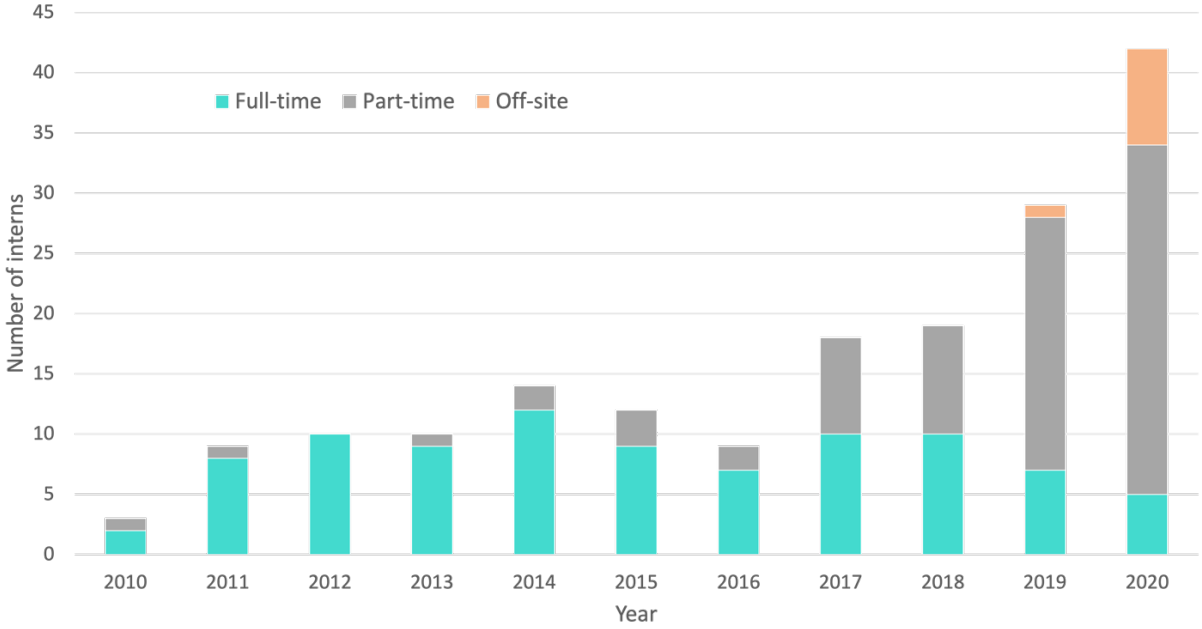

Figure 2. The yearly distribution of interns in the three internship positions over the 10-year period.

was recommended to them by a friend. Most interns (74%) joined the programme during their undergraduate studies. The majority of the interns completed the full-time (51%) and part- time (44%) positions, while 5% completed the off-site position. The proportion of full-time and part-time positions changed over the years (Figure 2). The majority of the international participants chose the full-time position (91% full-time and 9% part-time), while locals preferred the part-time position (32% full-time, 61% part-time and 7% off-site).

The leading reason for joining the programme was to gain more experience/out of self-interest (98%) while 13% of the interns had associated school requirements. According to the survey, the

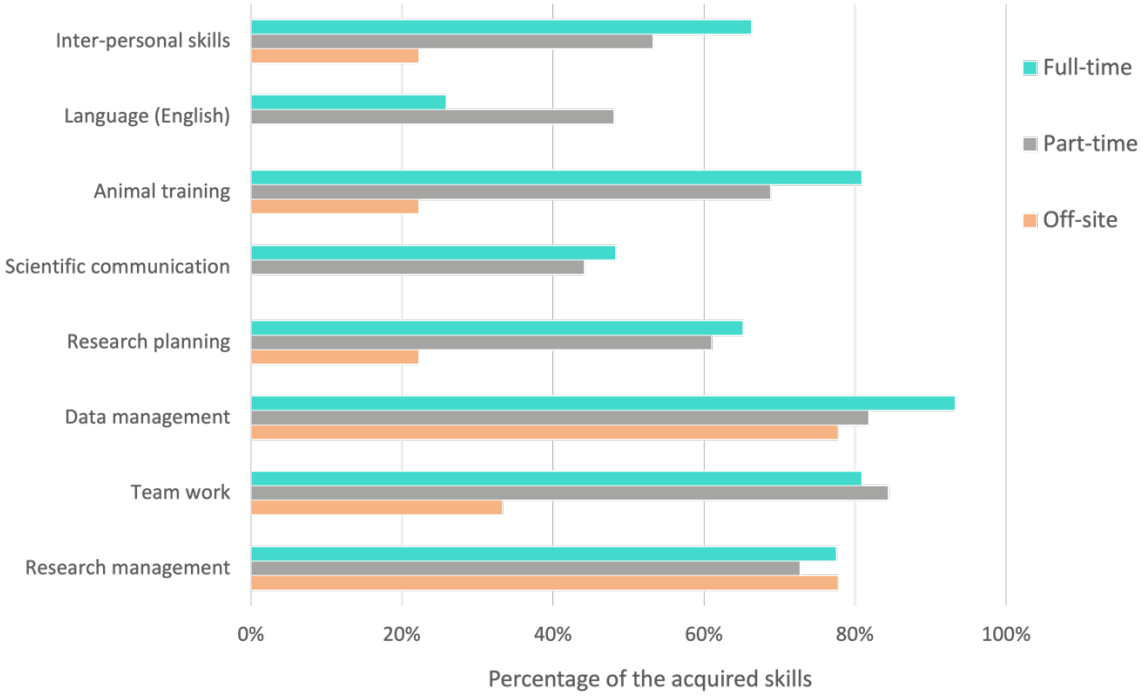

Figure 3. Skills acquired by part-time and full-time interns during their internship based on self-reporting.

Journal of Zoo and Aquarium Research 10(1) 2022
https://doi.org/10.19227/jzar.v10i1.660

three main reasons the programme was preferred over others was working with animals (70%), working in a day-to-day research environment (63%) and gaining experience in behavioural and cognitive research (53%). All respondents indicated that they learned at least one new skill during their internship; on average, five (SD±2) new skills were listed by the interns. Research management (75%), data management (67%), teamwork (61%) and animal training (59%) were the four most frequently listed newly acquired skills. There was no significant difference between the acquired skill set of the part-time and the full-time interns (two sample Mann-Whitney U-test Z=−0.315, P=0.752; Figure 3). The most apparent differences between full-time and part-time interns were in the frequency of reported improvements in English language skills (26% versus 48% respectively) and interpersonal skills (66% versus 53%). Off-site interns indicated comparable development in research management and data management to on-site interns, however, due to the novelty of the off-site position, the data only allow limited comparison (Figure 3).

Overall, 92% of the respondents indicated that they had obtained a greater understanding of the concepts, theories and skills of their course of study as a result of the internship experience and 92% found the responsibilities challenging and stimulating. Altogether 97% felt that the responsibilities assigned had been appropriate and 82% indicated that they received additional responsibilities as their experience increased. A total of 95% of the respondents felt that they had been provided with sufficient learning opportunities and 87% indicated that they had been allowed to take the initiative to work beyond basic requirements. Lastly, 98% indicated that the supervisors were supportive and available for questions.

When asked if the internship experience had changed their view of scientific research 87 (50%) answered 'yes'. Their main reasons were better insight to the field of scientific research (75/87) and/or better understanding of the connection between animal welfare and research (7/87). The remaining respondents (5/87) did not specify their reasons. When 175 of the respondents were asked what they liked about the internship, more than half (58%) indicated that the research experience itself, being involved in the day-to-day practice, was rewarding. The working environment, the teamwork and the atmosphere were also mentioned by 51% of the respondents, as well as working with animals (49%) and the first-time experience of living in Hong Kong (2%). When 175 respondents were asked how the internship experience could be improved, 32% were happy with their experience and offered no suggestions and 26% offered suggestions related to the training of interns and additional information that could be provided to enhance the experience. Logistic arrangements related to uniforms, application procedure and daily routine were suggested by 21% and 14% provided suggestions regarding protocols and work arrangements. Finally, 6% suggested an increase in animal interactions, while 2% recommended the establishment of an alumni group.

Personal impact

Of the 175 respondents, 171 indicated a good working relationship with their co-workers and peers. Most of the interns (93%) made new friendships during their time in the park, and 70% indicated that they had established long-lasting mentorship with their supervisors.

Academic impact

While 24 respondents (14%) had completed their academic career by the time they joined the programme, 85% (129/151) of the remainder found the internship helpful for their academic career. Out of the 124 students who had completed one step in their education (for example getting into an MSc programme after finishing a BSc), 123 (99%) felt that the internship helped them achieve that. Of the 58 who furthered their studies, 57 (99%) thought that the internship helped them to be accepted in a new institution.

Employment impact

From the 175 respondents, 88 indicated that they had sought employment in a related field (academic/research/veterinary) at some point after the internship and 80 (91%) noted that the internship was helpful for their career. From those who took positions in unrelated fields, 75% (68/91) found the internship experience helpful for their applications.

Discussion

The evaluation form was shared with 217 former interns, of which 175 completed the evaluation. The internship experience was considered effective on both personal and professional levels, with a consistent positive impact for the candidates who participated in the programme over the past 10 years. Due to social unrest in 2019 and 2020 (Shek 2020) and later with the additional pressure of the novel COVID-19 outbreak in Hong Kong (Cheng et al. 2020), the programme received fewer international applicants. Meanwhile, the number of local participants in the part-time programme increased, which might be due to improved communication with local universities. Nonetheless, the evaluation of the internship programme remained positive.

Most participants joined the programme during their undergraduate studies to gain more first-hand experience in marine mammal research. These findings support the importance of internship programmes in the early career stage (D'Abate et al. 2009, Hynie et al. 2011), as practical experience during undergraduate and postgraduate studies was documented to provide real-life context and help students prepare for future challenges at work (Heiskanen et al. 2016). When asked why they preferred this programme over others, the majority of former interns indicated that their choice was driven by the opportunity to work with animals in the cognitive science field on a daily basis. This statement was further confirmed when 58% of the respondents mentioned the insight into daily research activity as one of the highlights of their experience. Seymour et al. (2004) gathered student interviews at four participating liberal arts colleges (Grinnell, Harvey Mudd, Hope and Wellesley). These students, similarly to those in the current study, indicated that their internship experience was the most beneficial in the areas of personal/professional gains relating to the process of 'becoming a scientist' (Seymour et al. 2004).

Recent studies show that undergraduates who participate in research obtained a variety of cognitive, behavioural and affective outcomes, including the development of research and communicative skills (Bauer and Bennett 2003, Kardash 2000, Lopatto 2004, Russell et al. 2007). In the current study, the majority of interns reportedly gained skills specific to scientific research, such as data management, research management and planning or animal training, which supports the importance of the internship experience for career development. Moreover, the survey participants also reported considerable gains in transferable skills such as teamwork, English language and interpersonal skills, which are beneficial in any working environment. The differences in the skills gained by full-time and part-time students may reflect the differences in challenges faced by local and international applicants. Local applicants may know each other, and since they had previous experience visiting OPHK, they probably felt more at home. While Hong Kong has three official languages, Cantonese, Mandarin and English (Civil Service Bureau 2018), Cantonese is considered as the common tongue. Thus, working in an international, English-speaking research environment provided

good opportunities for local applicants to practice and improve their everyday and scientific English. International applicants joined the programme from various countries in Asia, Europe and North America. For these interns, living abroad (potentially in a different cultural environment) contributed significantly to the internship experience, thus explaining the higher rate of inter-personal skills improvement.

Most of the survey participants (92%) indicated that they had obtained a greater understanding of the concepts, theories and skills of their course of study as a result of the internship experience. The importance of linking theoretical and practical learning has been demonstrated in several fields including pharmaceutics (Katajavuori et al. 2006), medicine (Littlewood et al. 2005, Skår 2010), sustainability (Heiskanen et al. 2016) and animal science (Peffer 2012). Furthermore, the importance of practical learning has been emphasised and suggested to be rewarded with academic credits (Young and Baker 2004). The research department of OPHK collaborated with both local and international institutions providing opportunities for student internship experience fulfilling school requirements. In all cases, the first author (EM) acted as the company supervisor during their experience. The survey participants indicated that they had a good relationship with their supervisor who was available to provide guidance and answer questions during their internship. Research mentors not only provide guidance regarding conducting scientific experiments and methods but also play an important role when it comes to socialisation with the scientific community and may provide personal and emotional support (Thiry and Laursen 2011). Thus, a good relationship between students and supervisors is a key part of the experience.

At the end of their internship, interns were encouraged to reach out to OPHK in the future if they needed help or advice or to share their progress in life. Some interns visited OPHK after their internship during return trips to Hong Kong. When asked, interns were provided with recommendation letters for scholarships or job applications. These efforts were reflected in the evaluation as 70% of the respondents have a long-lasting relationship with their supervisor/mentor. The personal impact of the internship experience was measured by the respondents' relationship with their peers and supervisors. Most of the interns (93%) gained new friendships during their time at OPHK. While during the internship these new relations provided good camaraderie, these acquaintances could facilitate future socialisation into professional practice (Hunter et al. 2007).

The academic impact of the internship experience was assessed using feedback from students who completed one step in their education or were accepted to further their studies. The high percentage of positive feedback (85%) supports the importance of hands-on practical research experience in academic development. The employment impact of the internship experience was assessed using feedback from those who have applied for positions in related and unrelated fields. In both cases, the majority of the survey participants indicated that the internship experience provided an advantage during their employment applications. These results outline the importance of obtaining not only research-related but also transferable skills, such as teamwork and participation in a multicultural international group.

While the students' feedback was collected via structured evaluation forms for this manuscript, feedback from interns was welcomed throughout the whole 10-year period. Suggestions for improvements were gradually incorporated into the protocol and are included in the summary for recommendations for best practice in Table 3.

Aquariums and zoos provide unique opportunities to educate the general public on environmental and conservation issues (Ballantyne et al. 2007, Patrick and Caplow 2018, Patrick et al.

Table 3. Proposal for best practice

Steps	Points of recommendation
1. Recruitment	Develop relationships with internship coordinators at local and international universities for creating a better exposure for your internship programme
	Create a website for your research with comprehensive information on the various projects and the internship programme to attract the most appropriate candidates
	Create a multi-step application process with written application and personal interview for better, more thorough selection
	Use a standard set of interview questions that are developed over the years to better assess the candidates' preparedness and their ability to cope with challenges that may arise during their internship. Asking the same questions also facilitates an easier and more objective comparison of the candidates before selection.
	If possible, offer off-site positions too, improving inclusivity for those who are unable to participate in on-site programmes
2. Training of new interns	Provide new interns with a research overview and safety briefing on their first day
	If possible, set the internship periods with some overlap between the 'old' and new teams, thus allowing gradual training of the new interns
	Provide reading materials: manuals, research papers and reports
3. During the internship	Provide daily briefings to clarify workflow and allocation of roles
	Provide post-experimental discussions focusing on the short- as well as the long-term progress keeping the objective of the study in mind
	Encourage open communication, critical thinking, and discussion
	Communicate not only on the group but on the individual level. Encourage students to approach you and ask questions
	If possible, provide short lecture or discussion sessions on related topics
	Provide feedback, accentuate the good! If mistakes occur, don't focus on the mistake but investigate together with the interns whether the protocol was followed appropriately and how to avoid making the same mistake again in the future
	Create a working environment where students with special interests may develop their skills further by assigning special tasks to them
	Allow flexibility, let experienced interns divide tasks by themselves, provide guidance by double-checking the completion of the tasks at the end of the day
4. After the completion of the internship	Recognition of the students' efforts by certificates, their name added to the list of alumni on our website and with a one-on-one evaluation
	If possible, work with universities for providing credits for the students for their efforts
	Create an alumni group for future communication and information sharing
	Implement a review procedure scheduled right after the completion of the programme

experience was above expectation and 50% felt that the internship experience changed their view of scientific research, supports OPHK's mission and goals as an educational institution, promoting life-long learning and conservation advocacy.

At the end of the survey respondents were asked what they liked most about the internship. The answers concentrated around three main aspects: working with animals, having a friendly and inspirational working environment and gaining insight to the daily work of a research team. Responses included the following:

"Research was a big blanket term for me before. I have now gained an appreciation about what research is like day to day."

"It was my first experience with research, so it was an eye-opener to how experiments are planned, how data is collected and analysed."

"Very friendly working environment, great team work demonstrated, I felt comfortable asking questions, I was trusted with tasks."

"The internship experience changed my view about scientific research, as working with animals requires tremendous new techniques and approach. This new technique taught me that research requires extensive planning and effective management beforehand."

"I never had any experience with research before this programme. It introduced me to how research actually works and how important teamwork is."

Limitations and recommendations

This study was conducted using self-reported impacts that are difficult to validate by other means, so subjectivity is certainly a limitation of the study. Moreover, as the evaluations were completed retrospectively, certain memories of the experience might have altered with time (Bauhoff 2011). Incorporation of the evaluation procedure at the end of the internship could reduce the potential impact of delayed memory retrieval.

Out of the 217 candidates, 175 filled out the questionnaire. As some of the candidates were involved many years before the evaluation was carried out, it is possible that their contact email addresses were out of use, thus they may not have received the questionnaire. However, it cannot be ruled out that some of the former interns simply preferred not to participate in the evaluation.

The lack of existing literature on the topic makes it difficult to evaluate findings in comparison to other similar zoological internship programmes (Connelly 2013). Thus, some of the findings might be influenced to an unknown extent by the location of the programme, the animal species involved or the personal characteristics of the supervisors leading the programme. More research on the impact of research internship programmes would certainly allow a more objective evaluation of the topic. Furthermore, repeated sample collection in the future could provide a certain degree of validation of the current findings and provide additional information on the long-term impact of the internship experience.

Lastly, the research team only had two (three for a short period) members of staff, thus one-on-one intern-supervisory time was heavily influenced by the available free time of the two supervisors. Although the results suggest positive outcomes are achievable even with limited staff time, if institutional resources and priorities allow, a bigger team and the employment of a designated internship coordinator could certainly further improve the internship experience.

As the programme and the research developed over time, different positions targeting different aspects of the experience were established, including part-time and off-site positions. Given the relative novelty of the off-site position, there were not enough data to evaluate its impact. However, for future direction of internship experiences, off-site positions seem a good way to improve inclusivity. They allow the involvement of those who may not be able to afford to spend weekdays as unpaid interns and/or travel to the internship location and could also be very useful in limited social contact situations such as during the peaks of the COVID-19 pandemic. Research projects conducted in zoos and aquariums only include on-site work for a small portion of the time; much of the work is done afterwards for example through video, literature or acoustic data analysis. Off-site interns work independently, thus have full control over their time and schedule from the comfort of their home while still contributing significantly to the research project and learning valuable hands-on skills.

Despite the limitations, these findings provide strong support for zoological research internship programmes. These programmes provide benefits to both interns and host institutions. With the help of interns, zoos and aquariums can incorporate research practices that are beneficial to the animals into their operation, while interns obtain valuable research experience. As an example, a behavioural study focusing on activity monitoring (live or video analysis) could offer important contributions to the husbandry and consequently to the welfare of animals while students learn the principles of behavioural coding and the use of ethograms (e.g. Matrai et al. 2020). Another example linking welfare, research and education is the design and use of cognitive enrichment (e.g. Clark et al. 2017, Matrai et al. 2021a). These enrichment devices improve the wellbeing of animals and allow researchers to investigate their cognitive abilities. Interns involved in testing gain insights into research planning, designing equipment and behavioural data analysis.

Conclusion

In conclusion, zoos and aquariums worldwide are in a unique position to facilitate life-long learning opportunities for all ages and academic levels through tailor-made in-house educational, conservation and research programmes. Consequently, internship programmes offered by zoos and aquariums contribute to the cultivation of the next generation of scientists, conservationists, educators and animal care professionals, thus improving animal welfare, training and handling best practices and optimising conversation efforts. Based on the feedback from previous interns, the OPHK internship programme provides additional benefits in terms of valuable transferable and research-specific skills within marine mammal science. Continued investigation into the direct and indirect impacts of professional and career development is required to further identify the full benefits of an internship programme to the participants. Based on 10 years of experience and evaluation of feedback from the participants, improved best practice guidelines for zoos and aquariums considering starting or improving an internship programme is provided.

Acknowledgements

We thank all interns for their help and support over the years, and two anonymous reviewers for their suggestions to improve the manuscript.

Declarations

This research did not receive any specific grant from funding agencies in the public, commercial or not-for-profit sectors. ÁP was supported by the János Bolyai Research Scholarship of the Hungarian Academy of Sciences and the ÚNKP-19-4 New

National Excellence Programme of the Ministry of Innovation and Technology, Hungary. All participants consented to the use of their survey data. During the recruitment for the internship programme, all participants signed the intern application and registration forms. The project was approved by the Animal Welfare, Ethics and Care Committee of Ocean Park Corporation. Ocean Park gained accreditation from the Association of Zoos and Aquariums (AZA). It is also a member of the World Association of Zoos and Aquariums (WAZA). The animal welfare standards at the Park were approved by American Humane under its Humane Conservation™ programme.

References

Baird R. (2021) Advice for People Interested in a Career Studying Marine Mammals. Cascadia Research Collective. https://www.cascadiaresearch.org/staff/robin-baird/advice [Accessed 27 November 2021]

Ballantyne R., Packer J., Hughes K., Dierking L. (2007) Conservation learning in wildlife tourism settings: Lessons from research in zoos and aquariums. Environmental Education Research 13(3): 367–383. doi:10.1080/13504620701430604

Bauer K.W., Bennett J.S. (2003) Alumni perceptions used to assess undergraduate research experience. *The Journal of Higher Education* 74(2): 210–230. doi:10.1080/00221546.2003.11777197

Bauhoff S. (2011). Systematic self-report bias in health data: impact on estimating cross-sectional and treatment effects. *Health Services and Outcomes Research Methodology* 11(1): 44-53. doi:https://doi.org/10.1007/s10742-011-0069-3

Bowen W.D. (1997) Role of marine mammals in aquatic ecosystems. *Marine Ecology Progress Series* 158: 267–274. doi:10.3354/meps158267

Brook F.M., Kinoshita R., Brown B., Metreweli C. (2000) Ultrasonographic imaging of the testis and epididymis of the bottlenose dolphin, *Tursiops truncatus aduncas. Journal of Reproduction and Fertility* 119: 233–240.

Brook F.M., Kinoshita R.E. (2005) Controlled unassisted breeding of captive Indo-Pacific bottlenose dolphins, *Tursiops aduncus*, using ultrasonography. *Aquatic Mammals* 31(1): 89–95. doi:10.1578/AM.31.1.2005.89

Cheng V.C.C., Wong S.C., Chen J.H.K., Yip C.C.Y., Chuang V.W.M., Tsang O.T.Y., Sridhar S., Chan J.F.W., Ho P.L., Yuen K.Y. (2020) Escalating infection control response to the rapidly evolving epidemiology of the coronavirus disease 2019 (COVID-19) due to SARS-CoV-2 in Hong Kong. *Infection Control & Hospital Epidemiology* 41(5): 493–498.

Civil Service Bureau (2018) Official Languages Division. The Government of the Hong Kong Special Administrative Region of the People's Republic of China. https://www.csb.gov.hk/english/aboutus/org/scsd/1470.html [Accessed 27 November 2021]

Clark F.E. (2017) Cognitive enrichment and welfare: Current approaches and future directions. *Animal Behavior and Cognition* 4(1): 52–71. doi:10.12966/abc.05.02.2017

Clegg I.L.K., Borger-Turner J.L., Eskelinen H.C. (2015) C-Well: The development of a welfare assessment index for captive bottlenose dolphins (*Tursiops truncatus*). *Animal Welfare* 24(3): 267–282. doi:10.7120/09627286.24.3.267

Clegg I.L.K., Delfour F. (2018) Can we assess marine mammal welfare in captivity and in the wild? Considering the example of bottlenose dolphins. *Aquatic Mammals* 44(2): 181–200. doi:10.1578/AM.44.2.2018.181

Connelly L.M. (2013). Limitation section. *Medsurg Nursing* 22(5): 325.

Crosby O. (2001) Wild jobs with wildlife: Jobs in zoos and aquariums. *Occupational Outlook Quarterly* 45: 2–15.

D'Abate C.P., Youndt M.A., Wenzel K.E. (2009) Making the most of an internship: An empirical study of internship satisfaction. *Academy of Management Learning & Education* 8(4): 527–539. doi:10.5465/amle.8.4.zqr527

Heiskanen E., Thidell Å., Rodhe H. (2016) Educating sustainability change agents: The importance of practical skills and experience. Journal of Cleaner Production 123: 218–226. doi:10.1016/j.jclepro.2015.11.063

Herman L.M. (2010) What laboratory research has told us about dolphin cognition. *International Journal of Comparative Psychology* 23(3): 310–330.

Highfill L.E., Kuczaj II S.A. (2007) Do bottlenose dolphins (*Tursiops truncatus*) have distinct and stable personalities? *Aquatic Mammals* 33(3): 380–389. doi:10.1578/AM.33.3.2007.380

Hillman G.R., Würsig B., Gailey G.A., Kehtarnavaz N., Drobyshevsky A., Araabi B.N., Tagare H.D., Weller D.W. (2003) Computer-assisted photo-identification of individual marine vertebrates: A multi-species system. *Aquatic Mammals* 29(1): 117–123.

Hoffmann-Kuhnt M., Ho A., Hari V., Chitre M.A., Matrai E., Tse A. (2015) *Buzz that Rod! Acoustic Analysis and Patterns of the Echolocation Signals of a Blindfolded Bottlenose Dolphin Performing a Horizontal and Vertical Angular Resolution Task.* 21st Biennal Conference on the Biology of Marine Mammals, Society for Marine Mammalogy. December 2015, San Francisco, USA.

Hopper L.M. (2017) Cognitive research in zoos. *Current Opinion in Behavioral Sciences* 16: 100–110. doi:10.1016/j.cobeha.2017.04.006

Hunter A.B., Laursen S.L., Seymour E. (2007) Becoming a scientist: The role of undergraduate research in students' cognitive, personal, and professional development. *Science Education* 91(1): 36–74. doi:10.1002/sce.20173

Hynie M., Jensen K., Johnny M., Wedlock J., Phipps D. (2011) Student internships bridge research to real world problems. *Education + Training* 53(1): 45–56. doi:10.1108/00400911111102351

Jensen E. (2014) Evaluating children's conservation biology learning at the zoo. *Conservation Biology* 28(4): 1004–1011. doi:10.1111/cobi.12263

Kardash C.M. (2000) Evaluation of undergraduate research experience: Perceptions of undergraduate interns and their faculty mentors. *Journal of Educational Psychology* 92(1): 191–201. doi:10.1037/0022-0663.92.1.191

Katajavuori N., Lindblom-Ylänne S., Hirvonen J. (2006) The significance of practical training in linking theoretical studies with practice. *Higher Education* 51: 439–464. doi:10.1007/s10734-004-6391-8

Kuczaj S., Tranel K., Trone M., Hill H. (2001) Are animals capable of deception or empathy? Implications for animal consciousness and animal welfare. *Animal Welfare* 10(1): 161–173.

Kuczaj S.A., Eskelinen H.C. (2014) Why do dolphins play? *Animal Behavior and Cognition* 1(2): 113–127. doi:10.12966/abc.05.03.2014

Littlewood S., Ypinazar V., Margolis S.A., Scherpbier A., Spencer J., Dornan T. (2005) Early practical experience and the social responsiveness of clinical education: Systematic review. *BMJ* 331: 387–391. doi:10.1136/bmj.331.7513.387

Lopatto D. (2004) Survey of Undergraduate Research Experiences (SURE): First findings. *Cell Biology Education* 3(4): 270–277. doi:10.1187/cbe.04-07-0045

Lucrezi S., Milanese M., Danovaro R., Cerrano C. (2018) 'Generation Nemo': Motivations, satisfaction and career goals of marine biology students. *Journal of Biological Education* 52(4): 391–405.

Maple T.L., Segura V.D. (2015) Advancing behavior analysis in zoos and aquariums. *The Behavior Analyst* 38: 77–91.

Matrai E., Boos M., Pogany A. (2019a) *Fish in—fish out! I pull—you bite!* World Marine Mammal Conference. December 2019, Barcelona, Spain.

Matrai E., Hoffmann-Kuhnt M., Kwok S.T. (2019b) Lateralization in accuracy, reaction time and behavioral processes in a visual discrimination task in an Indo-Pacific bottlenose dolphin (*Tursiops aduncus*). *Behavioural Processes* 162: 112–118. doi:10.1016/j.beproc.2019.02.003

Matrai E., Ng A.K.W., Chan M.M.H., Gendron S.M., Dudzinski K.M. (2020) Testing use of a potential cognitive enrichment device by an Indo-Pacific bottlenose dolphin (*Tursiops aduncus*). *Zoo Biology* 39(3): 156–167. doi:10.1002/zoo.21536

Matrai E., Kwok S.T., Boos M., Pogány Á. (2021a) Cognitive enrichment device provides evidence for intersexual differences in collaborative actions in Indo-Pacific bottlenose dolphins (*Tursiops aduncus*). *Animal Cognition* 24: 1215–1225. doi:10.1007/s10071-021-01510-7

Matrai E., Kwok S.T., Boos M., Pogány Á. (2021b) Group size, partner choice and collaborative actions in male Indo-Pacific bottlenose dolphins (*Tursiops aduncus*). *Animal Cognition*

Moss A., Jensen E., Gusset M. (2015) Evaluating the contribution of zoos and aquariums to Aichi Biodiversity Target 1. *Conservation Biology* 29(2): 537–544. doi:10.1111/cobi.12383

Narayanan V.K., Olk P.M., Fukami C.V. (2010) Determinants of internship effectiveness: An exploratory model. *Academy of Management Learning & Education* 9(1): 61–80. doi:10.5465/amle.9.1.zqr61

National Research Council (2010) *Frontiers of Engineering: Reports on Leading-Edge Engineering from the 2009 Symposium*. Washington DC: The National Academies Press. doi:10.17226/12821

O'Brien J.K., Robeck T.R. (2010) The value of ex situ cetacean populations in understanding reproductive physiology and developing assisted reproductive technology for ex situ and in situ species management and conservation efforts. *International Journal of Comparative Psychology* 23(3): 227–248.

Pack A.A. (2010) The synergy of laboratory and field studies of dolphin behavior and cognition. *International Journal of Comparative Psychology* 23(4): 538–565.

Packer J., Ballantyne R. (2010) The role of zoos and aquariums in education for a sustainable future. *New Directions for Adult & Continuing Education* 2010(127): 25–34. doi:10.1002/ace.378

Patrick P.G., Matthews C.E., Ayers D.F., Tunnicliffe S.D. (2007) Conservation and education: Prominent themes in zoo mission statements. *The Journal of Environmental Education* 38(3): 53–60. doi:10.3200/JOEE.38.3.53-60

Patrick P.G., Caplow S. (2018) Identifying the foci of mission statements of the zoo and aquarium community. *Museum Management and Curatorship* 33(2): 120–135. doi:10.1080/09647775.2018.1438205

Pearson E.L., Lowry R., Dorrian J., Litchfield C.A. (2014) Evaluating the conservation impact of an innovative zoo-based educational campaign:'Don't Palm Us Off' for orang-utan conservation. *Zoo Biology* 33(3): 184–196. doi:10.1002/zoo.21120

Peffer P.A.L. (2012) Elements and analysis of an internship program in animal sciences. *NACTA Journal* 56(2): 2–8.

Reynolds III J.E. (1999) Surviving Professional Puberty in Marine Mammalogy: Things Mom and Dad Didn't Tell You. Retrieved from: http://www.marinemammalscience.org/wp-content/uploads/2015/06/Reynolds1999SAWPresentation.pdf

Russell S.H., Hancock M.P., McCullough J. (2007) Benefits of undergraduate research experiences. *Science* 316: 548–549.

Schwan S., Grajal A., Lewalter D. (2014) Understanding and engagement in places of science experience: Science museums, science centers, zoos, and aquariums. *Educational Psychologist* 49(2): 70–85. doi:10.1080/00461520.2014.917588

Seymour E., Hunter A.B., Laursen S.L., DeAntoni T. (2004) Establishing the benefits of research experiences for undergraduates in the sciences: First findings from a three-year study. *Science Education* 88(4): 493–534. doi:10.1002/sce.10131

Shek D.T.L. (2020) Protests in Hong Kong (2019–2020): A perspective based on quality of life and well-being. *Applied Research in Quality of Life* 15: 619–635. doi:10.1007/s11482-020-09825-2

Skår R. (2010) Knowledge use in nursing practice: The importance of practical understanding and personal involvement. *Nurse Education Today* 30(2): 132–136. doi:10.1016/j.nedt.2009.06.012

Spielman D., Brook B.W., Briscoe D.A., Frankham R. (2004) Does inbreeding and loss of genetic diversity decrease disease resistance? *Conservation Genetics* 5: 439–448. doi:10.1023/B:COGE.0000041030.76598.cd

Thiry H., Laursen S.L. (2011) The role of student-advisor interactions in apprenticing undergraduate researchers into a scientific community of practice. *Journal of Science Education and Technology* 20: 771–784. doi:10.1007/s10956-010-9271-2

Woolston C. (2014) Ocean biology: Marine dreams. *Nature* 516: 277–279. doi:10.1038/nj7530-277a

Yalowitz S.S. (2004) Evaluating visitor conservation research at the Monterey Bay Aquarium. *Curator: The Museum Journal* 47(3): 283–298. doi:10.1111/j.2151-6952.2004.tb00126.x

Young D.S., Baker R.E. (2004) Linking classroom theory to professional practice: The internship as a practical learning experience worthy of academic credit. *Journal of Physical Education, Recreation & Dance* 75(1): 22–24. doi:10.1080/07303084.2004.10608536