Marine Ecology Enhancement Fund (MEEF)

Completion report

(2021-2022)

Project Title:	"Dolphin Messenger": Ocean Literacy Programme for the primary and secondary schools 「海．豚」傳訊者:中小學海洋素養啟航計劃
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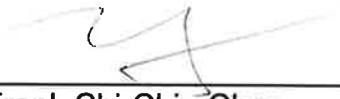
Signature of Co-Project Leader:	 Dr. Frank Chi-Chiu Cheang
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Executive Summary

The ocean provides habitats for numerous marine creatures and offers ecosystem services for humans. Nonetheless, the ocean is constantly facing threats from us, such as overfishing and marine pollution. To raise awareness of the interactive relationship between oceans and humans, the principles of Ocean Literacy were set up by the National Oceanic and Atmospheric Administration to offer references to educators. In light of the lack of marine education elements in formal education in Hong Kong, our program "Dolphin Messenger": Ocean Literacy Programme for primary and secondary schools was organised using Ocean Literacy as the theoretical framework. Education packages utilising Chinese White Dolphins (CWDs) as the flagship species were developed based on the primary and secondary schools' curricula in the subjects of General Studies, Geography and Biology to introduce marine education elements into the school curriculum. The analysis of the responses depicted by teachers conducting module test-running in their lessons supported that the education packages could improve students' knowledge of CWDs and the local marine environment. Teacher training and school talks were provided to enhance local teachers' and students' awareness of CWDs and the marine situation in Hong Kong. Furthermore, the project offered training and service-learning opportunities to the primary and secondary school students to become eco-docents on dolphin-watching boats in Tai O. Through the authentic experience of sharing information and knowledge about CWDs and marine conservation with the public, it did not only increase students' ecological knowledge about dolphins and ocean-related issues, but also stimulated students' empathetic attitudes towards dolphins when they reflected upon the human impacts deteriorating dolphins' habitat and promoted conservation messages to tourists in the programme.

Brief Description of the Project

Aimed at enhancing the "Ocean Literacy" of the local community, this project adopted the flagship-species approach as the overarching strategy, incorporated with various pedagogies, to develop teaching modules and materials on Chinese White Dolphins (CWDs) based on the primary and secondary schools curriculum in the subjects such as General Studies, Geography, and Biology. The project included school talks, teacher training and student eco-docent workshops for the primary and secondary schools to deepen the participants' understanding, as well as to nurture their pro-environmental attitudes and life values on the local marine environment and the CWDs. The project also offered opportunities for the students to become a docent, educating the general public with information and knowledge about CWDs and marine conservation through ecotourism.

Completed activities against the proposed Work Schedule

Due to pandemic-related measures such as school suspensions and social distancing policies, the Eco-docent training for primary and secondary school students and Eco-tours were postponed to provide face-to-face experience to participants. An extension of the period for school talks and module test-running was executed to provide sufficient time for schools to arrange the activities. The table (table 1) below provides an overview of the work schedule's specifics:

Table 1 - Work schedule

Phase	Proposed timeline	Actual timeline	Activity
N/A	April – August 2021	April – August 2021	Recruitment of schools & school teachers
	July – August 2021	July – August 2021	Recruitment of full-time project assistant and part-time research assistant
	August – September 2021	August – September 2021	Recruitment of pre-services teachers (student helpers)
I	October 2021 – March 2022	October 2021 – October 2022	30-40 minutes 40 school talks (face-to-face and/or online mode)
	October – November 2021	October – November 2021	School teacher training with 3 workshops (face-to-face and/or online mode)
	November 2021 – March 2022	November 2021 – November 2022	Schoolteachers will try out the module in their own lesson. Recruitment of student eco-docent, nominated by school teachers

II	March 2022	March 2022 - July 2022	"Dolphin Messenger" Eco-docent training for senior primary and senior secondary school students with 3 workshops (online mode)
	April 2022 – June 2022	July 2022 – August 2022	"Dolphin Messenger" Eco-tours
III	October 2021 -June 2022	October 2021 - January 2023	Establishment of the website and educational package publication

Descriptions on the completed activities

1. Development of teaching modules

- Three CWD-oriented teaching modules were developed based on the primary and secondary schools' curriculum in the subjects General Studies (Primary 4-6), Geography (Secondary 4-6) and Biology (Secondary 4-6).

- Each module includes four 40-minute lessons, with a dolphin-watching activity in Tai O. Not only do the contents feature facts about CWDs and the ocean, but also the environmental and life values together with attitudinal development through experiential reflective learning (i.e. field-based learning). The appendix 1 attachment contains the details of the teaching modules.

2. Schoolteacher training and module test-running

- 5 primary schools and 9 secondary schools in Hong Kong (Table 2) enrolled in our programme for the schoolteacher training. Among the participating schools, 6 secondary schools and 5 primary schools had completed the test-running of the modules.

Table 2 - Information of participating schools

Participating schools	Subject
The Methodist Lee Wai Lee College	NSS Biology
TWGHs Li Ka Shing College	
CCC Kei Long College*	
Yan Chai Hospital Lim Por Yen Secondary School*	
Tung Chung Catholic School*	
Yan Chai Hospital Tung Chi Ying Memorial Secondary School*	
San Wui Commercial Society Secondary School*	

Lok Sin Tong Ku Chiu Man Secondary School*	NSS Geography
Delia Memorial School (Hip Wo)	
Baptist Rainbow Primary School*	General Studies
PLK Horizon East Primary School*	
Sau Mau Ping Catholic Primary School*	
Evangel College*	
Ng Wah Catholic Primary School*	

*schools completed module test-running

- The training was held from October to December 2021 to enrich teachers' marine and CWDs-associated expertise, and practical skills for teaching. (Table 3) 18 schoolteachers from the participating primary and secondary schools, accompanying 11 pre-service teachers (EdUHK students from teacher education and environmental studies, including General Studies, Geography and Science education in major) participated in the training.

Table 3 - Schedule of the Schoolteacher Training

Date	Activity
2021/10/29	Online workshop on Hong Kong's marine environment, Chinese White Dolphins and pedagogies of environmental education
2021/11/6	Field trip to Tai O
2021/11/12	Online workshop on Biology
2021/11/19	Online workshop on General Studies
2021/11/26	Online workshop on Geography
2021/12/11	Dolphin-watching trip

- Within the training, a 3-hour knowledge-based online workshop was conducted to introduce the concepts of Ocean Literacy, local marine environment, knowledge about CWDs and their conservation status in Hong Kong, as well as the teaching strategies related to flagship species approach and the other experiential pedagogies. (Picture 1)

- Three separate pedagogical workshops were tailor made for the teachers who teach General Studies, Geography, and Biology respectively. The lectures were delivered by the experienced lecturers from EdUHK in the field of geographical and environmental education and outside experts on CWDs.

Picture 1 - Screenshot of the knowledge-based online workshop

- Two field-based workshops were carried out. On the field trip to Tai O, participants went on a boat trip to observe CWDs (Picture 2), learn about their attributes, and acquire insight into the local fisheries and marine environment. Participants had the opportunity to visit a stilt house with a local villager to explore more about the fishing culture of Tai O (Picture 3).

Picture 2 - Photo of boat trip to observe dolphins in Tai O

Picture 3 - Photo of stilt house visit

- In the dolphin watching trip, experts on dolphins were invited to introduce the marine environment of the Hong Kong western waters, habits and characteristics of CWDs, as well as the threats that they encounter (Picture 4 and Picture 5).

Picture 4- Group photo of dolphin-watching trip

Picture 5- Photo of dolphin-watching trip

- Following the training, teachers adopted the modules in their schools through online or face-to-face lessons in General Studies, Biology and Geography or as extra-curricular activities. A total of 121 secondary school students and 171 primary school students participated in the module test-running (table 4).

Table 4 - Information of the module test-running

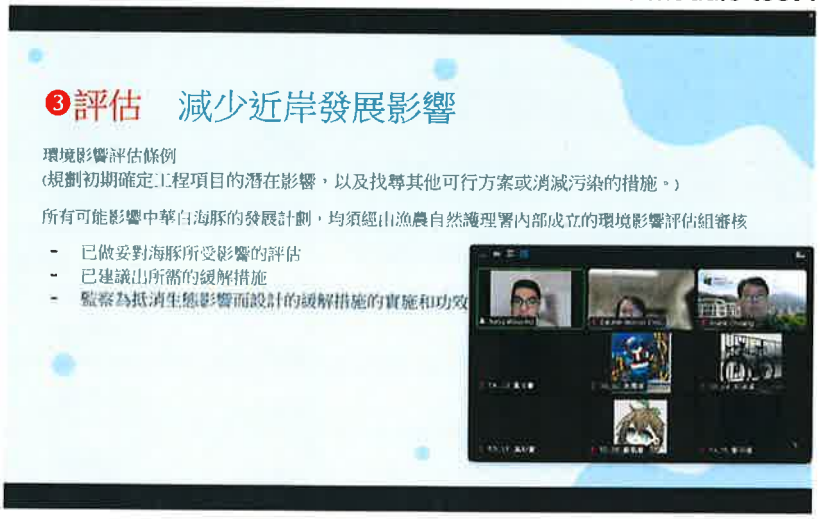
Subject	Schools participated in the module test-running	No. of students	Mode
NSS Biology	CCC Kei Long College	28	Face-to-face
	Yan Chai Hospital Lim Por Yen Secondary School	15	Face-to-face
	Tung Chung Catholic School	17	Online
	Yan Chai Hospital Tung Chi Ying Memorial Secondary School	15	Online
	San Wui Commercial Society Secondary School	20	Online
NSS Geography	Lok Sin Tong Ku Chiu Man Secondary School	26	Online

General Studies	Baptist Rainbow Primary School	22	Online
	PLK Horizon East Primary School	80	Face-to-face
	Sau Mau Ping Catholic Primary School	22	Face-to-face
	Evangel College	15	Online
	Ng Wah Catholic Primary School	32	Online

- Lesson observations were carried out to understand the actual situation of adopting the modules, such as the hardships that teachers may confront when demonstrating the lesson activities in the modules and the reaction of the students in the lessons (picture 6 -8).
- Through interviews and surveys, feedback from teachers was collected to propose modifications to the content of modules and further refine them from the perspective of an education practitioner.

Picture 6 & 7 - Photos of the face-to-face lessons in the module test-running

Picture 8 - Screenshot of the online lesson in the module test-running



3. School talks

- School talks were delivered for students and schoolteachers from local schools to learn about the general marine environment in Hong Kong, the knowledge about CWDs, and their relationship with people. The school talk lasted for around 40-60 minutes, delivered by the project assistant and the experienced student helpers (pre-services teachers).

- Besides the schools that joined the teacher training and the module test-running, the school talk has also been advertised to all local primary and secondary schools through fax, email, website and social media of the Centre and the Department.

- There are 19 school talks of which 9 of them were face-to-face (Picture 9) while 10 of them were online (Picture 10). A total of 2826 students participated in the school talks. (Table 5)

Table 5 - The information of school talks delivered

No.	Date	Participating schools	No. of participants	Mode
1.	2021/10/28	Delia Memorial School (Hip Wo)	16	Face-to-face
2.	2021/10/29	St. Paul's School (Lam Tin)	313	Face-to-face
3.	2021/11/12	Queen Elizabeth School Old Students' Association Branch Primary School	130	Online
4.	2021/12/6	The Methodist Lee Wai Lee College	35	Online
5.	2021/12/8	Christian and Missionary Alliance Sun Kei Primary School (Ping Shek)	20	Face-to-face
6.	2021/12/14	Our Lady's College	100	Face-to-face
7.	2022/1/6	Shanghai Alumni Primary School	240	Face-to-face
8.	2022/1/6	Toi Shan Association Primary School.	30	Online
9.	2022/1/11	Baptist (Sha Tin Wai) Lui Ming Choi Primary School	300	Online
10.	2022/1/13	Baptist (Sha Tin Wai) Lui Ming Choi Primary School	300	Online
11.	2022/1/21	Yan Chai Hospital Lim Por Yen Secondary School	50	Face-to-face
12.	2022/2/16	T.W.G.Hs Li Ka Shing College	300	Online
13.	2022/2/22	Evangel College	450	Online
14.	2022/2/23	Baptist Rainbow Primary School	194	Online
15.	2022/3/8	The Church of Christ in China Kei Long College	30	Online
16.	2022/3/17	Lok Sin Tong Ku Chiu Man Secondary School	30	Online

17.	2022/3/29	San Wui Commercial Society Secondary School	21	Face-to-face
18.	2022/6/28	Ng Wah Catholic Primary School	117	Face-to-face
19.	2022/8/2	Po Leung Kuk Horizon East Primary School	150	Face-to-face

Picture 9 - Photo of face-to-face school talk

Picture 10 - Screenshot of online school talk

4. 'Dolphin Messenger' Eco-docent for students

- A lecture-based and field-based training, together with a service-based learning opportunity to become an eco-docent to promote the understanding and conservation of CWDs and ocean conservation, were provided to 33 senior primary and secondary school students.

- In the training phase (table 6), two knowledge-based online workshops were illustrated to primary and secondary schools students respectively (picture 11 & 12). In the first workshop, the CWDs and Hong Kong marine-related knowledge, along with the eco-docent guiding skills were introduced to the students. In the second workshop, there is a VR field trip which attributes the gain of wisdom on the marine environment and the

culture of Tai O. Further, it helps with the acquaintance with the docent venue and prepares students for the eco-docent service.

- Moreover, students participated in a half-day field trip in Tai O which included a dolphin watching boat trip operated by the local villagers to practise docent techniques (picture 13 & 14). They also engaged in a stilt house tour guided by local villagers to learn more about the fishery in Hong Kong and the traditional culture of Tai O, as well as a visit to the mangrove forest to gain more knowledge about coastal ecology.

Table 6 - Schedule of the eco-docent training

Training	Date	Time
Online workshop (1) - Hong Kong marine ecology, CWD and docent skills (Primary school)	5/3/2022	9:30-12:30
Online workshop (1) - Hong Kong marine ecology, CWD and docent skills (Secondary school)	5/3/2022	14:00-17:00
Online workshop (2) - Tai O VR field visit and docent practice (Primary school)	12/3/2022	9:30-12:30
Online workshop (2) - Tai O VR field visit and docent practice (Secondary school)	12/3/2022	14:00-17:00
Field trip to Tai O (Primary school)	18/6/2022	9:30-13:00
Field trip to Tai O (Secondary school)	25/6/2022	9:30-13:00

Picture 11 & 12 - Screenshots of the online workshop

Picture 13 & 14 - Photos of the dolphin-watching boat trip


- The students were then granted a service-learning opportunity to provide authentic guiding services to the tourists who joined dolphin-watching tours in Tai O (picture 15 & 16). These tours were designed to promote a greater understanding of CWDs and ocean conservation among the general public. 71 tours have been organised, serving 745 tourists in total (table 7).

Table 7 - Information of the eco-docent service

Date	No. of tours	No. of tourists
10/7/2022	8	54
16/7/2022	3	17
23/7/2022	13	172
24/7/2022	7	56
31/7/2022	6	59
7/8/2022	4	45
13/8/2022	7	58
14/8/2022	7	89
21/8/2022	9	127
28/8/2022	7	68

Picture 15 & 16 - Photos of students working as eco-docents on a dolphin-watching boat


5. "Dolphin Messenger" webpage & publication

- A webpage (appendix 2) was established to provide information related to CWD, Hong Kong's marine environment and Ocean Literacy, serving as an online platform and resource for the local education practitioners and the general public.
- The webpage includes a Tai O VR field trip with annotations and supplementary photos at different spots. It consists of a boat tour introducing CWDs and the Hong Kong western waters, a Tai O cultural tour visiting the canal and stilt house, and a mangrove tour. It can serve as a teaching material for teachers, as well as for the general public to learn more about Hong Kong's marine resources.
- The educational package developed was published on the webpage and in hard copies, and delivered to all primary and secondary schools in Hong Kong. Positive feedback was received from teachers.

Evaluation of the project effectiveness

Objectives of the project

- To develop a set of educational packages about Chinese White Dolphins (CWDs) and local marine conservation under the principles of ocean literacy and related life values for the schoolteachers and education practitioners in Hong Kong
- To increase the awareness and knowledge of school teachers, students and the general public on the interconnection between CWDs, ocean and people.
- To nurture the pro-environmental attitudes and life values of schoolteachers, students and the general public towards the CWDs and the ocean

Development of educational packages

- Schools were invited to adopt the modules in their lessons and questionnaires were distributed to teachers to collect feedback.
- From the results of the questionnaires (appendix 3), all respondents agreed that the module could increase students' knowledge on the current situation of the CWD and Hong Kong's marine ecology, and raise students' awareness on marine conservation. Over 80% of the respondents consented that teaching units could be integrated into the General Studies, Geography or Biology curriculum and the lesson activities could engage students in the lesson.
- A teacher pointed out that 'as it is well organised by professionals with sufficient and useful information, it saves a lot of time for teachers to prepare.', while another teacher suggested that 'students like the CWD. Taking it as an example, students can deeply understand the crisis it faces and the importance of conservation.'

School talks

- After the school talk, questionnaires were given out to the teachers responsible for arranging the talk in the school to gather their feedback.
- From the results of the questionnaires (appendix 3), all the respondents agreed that the talk allowed students to learn more about Hong Kong's marine environment and CWD. Over 90% of the respondents acknowledged that the talk could develop students' attention to ocean conservation and cogitate on the relationship between humans and nature.
- A respondent has indicated that 'the explanation is clear and easy to understand, it increased students' understanding and awareness of the marine environment and the CWD. I hope that similar programs can be organised continuously.'

'Dolphin Messenger' Eco-docent for students

- The eco-docent training and eco-tour service offered authentic experiences for students to promote ocean conservation. Semi-structured interviews were conducted to investigate the experiences and learning outcomes of 18 students after joining the programme.
- The results inferred that the programme increased students' ecological knowledge about dolphins and ocean-related issues. In the interview, many students mentioned they received knowledge related to CWDs, for example, their habits, echolocation of CWDs, and threats faced by CWDs (e.g. marine debris, coastal infrastructure). The interview also put forward the comprehension of coastal ecology (e.g. mangrove, fiddler crab) and coastal landforms (e.g. sea cave). On the other hand, some interviewees noted the culture and history of Tai O as a fish village, such as stilt houses and the dragon boat.
- Furthermore, the program stimulated students' empathetic attitudes toward dolphins when they reflected on the human impacts that deteriorated dolphins' habitats and promoted conservation messages to tourists in the programme. An interviewee expressed that 'Human activities caused the loss of habitats of CWDs and even deaths. The number of CWDs is decreasing rapidly. I think that they are very pitiful and miserable.' Many interviewees implied that they would like to promote the conservation of CWDs and the environment. One of them conveyed that ' After my personal experience in carrying out the docent service, the feeling is more profound and the thoughts of protecting them (CWDs) are stronger'.
- The authentic experience of facing tourists during the eco-tours facilitated their personal growth. Many interviewees indicated that they became more confident after being eco-docents and learnt to communicate and interact with different people. Some interviewees suggested that they learnt to become more innovative when experiencing transitions or challenges.

Summary and Way Forward

Involving the flagship-species approach in teaching modules and materials based on CWDs, the participants can deepen their understanding of the marine environment of Hong Kong and the CWDs, as well as nurture their pro-environmental attitudes. The impacts are especially significant for students participating in the service-learning to promote the conservation of CWD in the eco-docent tours. However, as the contents of the teaching materials are limited, it only covers principle 5 (the ocean supports a great diversity of life and ecosystems) and principle 6 (the ocean and humans are inextricably interconnected) among the seven principles of the Ocean Literacy. Marine education elements concerning other topics of Ocean Literacy should be addressed in the school curriculum in Hong Kong.

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Baptist Rainbow Primary School, Mr. Yip Shun Pong
Evangel College, Ms.Lo Man Yee
Ng Wah Catholic Primary School, Ms.Lo Hoi Wan
PLK Horizon East Primary School, Ms.Mak Lai Yan, Ms.Leung Yan Ling
Sau Mau Ping Catholic Primary School, Mr. Chau Tsz Chun
CCC Kei Long College, Mr. Wong Wing Kei
Lok Sin Tong Ku Chiu Man Secondary School, Mr. Yang Wing Ho
San Wui Commercial Society Secondary School, Ms.Chui Shui Fan
Tung Chung Catholic School, Mr. Wong Ying Cheong, Mr. Chan Chiu Kwong
TWGHs Li Ka Shing College, Mr. Ng Wai Ki, Ms.Liu Hiu Hoi
Yan Chai Hospital Lim Por Yen Secondary School, Ms. Lam Luen Ying
Yan Chai Hospital Tung Chi Ying Memorial Secondary School, Mr. Tong Cho Shun

Student helpers from EdUHK: Ms. Man Wing Wa, Ms. So Yuen Yi, Ms. Tam Ka Fung, Mr. Zheng Yuk Yeung, Laughing, Mr. Sung Ka Chun, Mr. Lee Chi Fung, Mr. Mok Pak Sing, Ms. Lo Ying Tung, Ms. Tsui Cheuk Lam, Mr. Yuen Yiu Ting, Mr. Cheung Wai Lap, Mr. Choy Tak Lai, Ms. Mak Kar Tung, Mr. Wong Lai Shun, Ms. Li Phoebe, Ms. Xu Shu Yan, Rean, Ms. Lee Wing Yi, Ms. Lee Ching Suet, Ms. Chuang Tsz Yin

Photographs provision: WWF Hong Kong, Ocean Park Conservation Foundation, Hong Kong, Mr. Yiu Wai Hong
Guest speaker of the workshops: Dr. Stephen C.Y. Chan
Graphic illustration: Ms. Yeung Lok Yin

Declaration

I hereby irrevocably declare to the MEEF Management Committee and the Steering Committee of the relevant Funds including the Top-up Fund, that all the dataset and information included in the completion report has been properly referenced, and necessary authorisation has been obtained in respect of information owned by third parties.

I hereby irrevocably declare, warrant and undertake to the MEEF Management Committee and the Steering Committee of the relevant Funds including the Top-up Fund, that I myself, and the Organisation:

1. do not deal with, and are not in any way associated with, any country or organisation or activity which is or may potentially be relevant to, or targeted by, sanctions administered by the United Nations Security Council, the European Union, Her Majesty's Treasury-United Kingdom, the United States Department of the Treasury's Office of Foreign Assets Control, or the Hong Kong Monetary Authority, or any sanctions law applicable;

2. have not used any money obtained from the Marine Ecology Enhancement Fund or the related Top-up Fund (and any derived surplus), in any unlawful manner, whether involving bribery, money-laundering, terrorism or infringement of any international or local law; and

3. have used the funds received (and any derived surplus) solely for the studies or projects which further the MEEF Objectives and have not distributed any portion of such funds (including any derived surplus) to members of the Recipient Organisation or the public.

Signature: _____

Name of Project Leader: Professor John Chi-Kin Lee

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Name of Co-Project Leader: Professor Eric Po-Keung Tsang

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Name of Co-Project Leader: Dr. Frank Chi-Chiu Cheang

Official chop: _____

Date: 18 MAY 2023

Disclaimer:

Any opinions, findings, conclusions or recommendations expressed in this report do not necessarily reflect the views of the Marine Ecology Enhancement Fund or the Trustee.

Appendix 1 - contents of the teaching modules

Primary school General Studies module

Teaching module	Lesson Objectives in the teaching module	Content corresponding to the G.S. curriculum Strand 2: People and Environment
Lesson 1	Describe the history of dolphins in Hong Kong, their characteristics in growth and development	• to know the major process of the life cycle of living things
	Explain how dolphins hunt and communicate with their peers	• to recognise living things in different environments and the interdependence among living things
	Identify dolphins as mammals	• to classify living things according to their biological characteristics
	Cultivate interest in appreciating dolphins	• to appreciate the wonder of the nature and show interest in exploring our environment
Lesson 2	Point out the overlap of dolphins' habitat and human activities (in terms of reclamation and marine traffic)	• to recognise the interdependence between living things and their environment
	By combining information from charts and data, identify potential reasons of the migration of dolphins and the reduction in their numbers	• to recognize patterns of datasets on maps and other graphical representations
	Reflect upon how human activities affects the life of dolphins	• to respect and care for living things and show concern for endangered species • to show concern for local and national environmental issues
Lesson 3	Describe different ways to protect dolphins and the ocean	• to understand people's responsibility of environmental conservation, treasure and make good use of resources of the Earth
	State the definition of sustainable development	• to arouse students' concern for the environment and its sustainable development
	Identify different kinds of plastic waste for recycling	• to make good use of natural resources and practise green living
	Reflect upon how to live with dolphins peacefully	• to respect and care for living things
Lesson 4	State the definition of sustainable development	• to arouse students' concern for the environment and its sustainable development

	Explain the rationale of different stakeholders' take on development and conservation	• to be open-minded and objective towards different views
	Reflect upon the relationship and life values of humans and dolphins	• show concern for endangered species • to recognise the importance of environmental conservation, and to actively participate in it

Secondary school NSS Biology module

Teaching module	Lesson Objectives	Content corresponding to the Biology curriculum II. Genetics and Evolution (in green) III Organisms and Environment (in blue) VI Applied Ecology (in red)
Lesson 1	Describe the levels of organization in ecological studies	• Be aware that organisms and their environment are studied at different levels of organisation
	Illustrate three domains of Ecology	• Understand the efficiency of energy transfer in an ecosystem • Understand the cycling of materials in an ecosystem • Be aware of the interactions between the biotic community and the abiotic factors of an ecosystem
	Introduce the characteristics and growth of the Chinese white dolphin	• Appreciate the existence of various life forms in the world, and the different ways through which organisms adapt to their habitats
	Identify the ecosystems in Hong Kong	• Appreciate the existence of a variety of ecosystems in the local environment
	Distinguish abiotic factors in a habitat and explain their influences	• Identify the abiotic factors of a habitat and explain their effects
	Be aware of the importance of protecting the ecological environment through the understanding of the mutual relationships between creatures and the environment	• Recognise their responsibility for conserving, protecting and maintaining the quality of the environment
Lesson 2	State the definition of habitat and niche	• Identify the abiotic factors of a habitat and explain their effects • Be aware of the interactions between the biotic community and the abiotic factors of an ecosystem.
	Apply the concept of species diversity that depends on species richness and relative abundance to measure biodiversity	

	Explain the reasons why there is a rich marine biodiversity in Hong Kong	• Identify the abiotic factors of a habitat and explain their effects • Be aware of the interactions between the biotic community and the abiotic factors of an ecosystem • Appreciate the existence of a variety of ecosystems in the local environment
	Identify marine habitats in Hong Kong	
	Describe the relationships between organisms in an ecosystem	• Describe the different types of relationships between organisms in a habitat
	Evaluate the influences of relationships between organisms on the survivorship of creatures and their impact to the environment	
	Develop the awareness of protecting biodiversity through understanding its significance.	• Recognise their responsibility for conserving, protecting and maintaining the quality of the environment
Lesson 3	Describe what ecosystem service is and its four main types.	• Understand the need for conservation
	State the influences of human activities on the ecosystem.	• Recognise the impacts of malpractices in fisheries and agriculture. • Recognise the effects of air and water pollution on the environment and human health • Explain the ecological impacts of land clearance and reclamation • Account for the accumulation of toxic substances along a food chain • Design and perform investigation to study air or water pollution
	Evaluate the impacts of human activities on the Chinese white dolphins, including reclamation, noise pollution under the sea, fisheries development, marine traffic, and marine debris etc..	
	Examine the possible impact of human daily habit on the ecological environment.	
	Using knowledge about the impact of human activities on the Chinese white dolphin, recommend conservation measures	• Discuss the roles of individuals and government in conservation.develop sensitivity and responsibility in striking a balance between the needs of humans and a sustainable environment
	Understanding what ecosystems benefit us, cherish nature for what it gives us.	• Recognise their responsibility for conserving, protecting and maintaining the quality of the environment
	Recognizing the negative impacts of human activities on nature, reflect upon the impact of daily activities on nature and areas for improvement.	
Lesson 4	Explain the measures of dolphin conservation in Hong Kong	• Be aware of the economic, ecological, aesthetic and moral issues related to conservation • Recognise the measures taken to preserve biodiversity
	Elucidate the measures to protect biodiversity	

	Describe the ecological survey method for dolphin	• Use appropriate instruments and proper techniques for carrying out practical work • Measurement of abiotic factors (e.g. light intensity, pH, wind, temperature, oxygen, humidity and salinity)
	Determine the appropriate ecological studying method in different environmental settings	
	Apply appropriate tools to measure the corresponding abiotic factors	
	Reflect upon the relationship between human beings and the creatures, developing an awareness of sustainable development.	• Develop sensitivity and responsibility in striking a balance between the needs of humans and a sustainable environment
	Identify own roles in ocean conservation and recognize the importance and significance of conservation.	• Recognise their responsibility for conserving, protecting and maintaining the quality of the environment

Secondary school NSS Geography module

Teaching module	Learning objectives	Content corresponding to the Geography curriculum C2. Managing River and Coastal Environments: A continuing challenge C4. Building a Sustainable City — Are environmental conservation and urban development mutually exclusive? C7. Climate Change — Long-term fluctuation or irreversible trend? E2. Weather and Climate E4. Regional Study of Zhujiang (Pearl River) Delta
Lesson 1	Identify the characteristics of the coastline of Hong Kong and its relationship with marine biodiversity	• Wave generation and characteristics (constructive and destructive waves) • Major erosion, transportation and deposition processes • Factors influencing the above processes • Major landform features, including sea cliff, sea cave, sea arch and stack, wave-cut platform, beach, spit and bar, tombolo
	Describe the characteristics of climate in Hong Kong and how it affects marine biodiversity	• A brief introduction of climate at a local, national and global scale • Seasonal occurrence of weather systems in Hong Kong and the Zhujiang Delta Region: formation and impact
	Describe how the seasonal oceanic current and Pearl River water affect the marine biodiversity	• Location of Zhujiang (Pearl River) Delta: site and situation

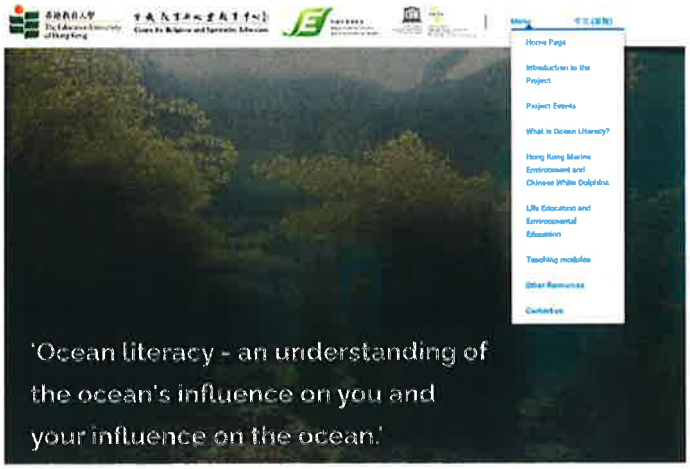
	Point out the distribution and abundance trend of Chinese White Dolphin in Hong Kong	• Problems arising from a growing city: Environment: waste, pollution, and the environmental health of the inhabitants
	Interpret and describe data, maps and graphs Master the ability to synthesize and present data Present ideas in a systematic, logical and concise manner	• Present and organize information and data, which involves the ability to: - use appropriate techniques for summarizing (e.g. descriptive statistics such as measures of central tendency and variability); - use appropriate formats, such as texts (e.g. reports, tables, summaries, etc.) and illustrations (such as maps, diagrams, models, sketches, and graphs) • Compare, analyze, synthesize and evaluate, in order to interpret information and data for making inferences and drawing conclusions, which includes: - the use of appropriate statistical techniques - analysis of spatial patterns using GIS
	Concern about marine biodiversity in Hong Kong	• Appreciate the beauty of nature
Lesson 2	Describe how the construction of large-scale near-shore infrastructure impact the Chinese white dolphins Describe the impacts of dredging and disposal of marine sediment, underwater noise, and vessel collision on Chinese white dolphins Describe the impacts of the development of the fishery industry on Chinese white dolphins	• Human activities on river and coastal environments: e.g. drainage, reclamation and recreation • Impacts and consequences: e.g. flooding, erosion and mass wasting, pollution, and disturbance / damage to the ecosystem
	Interpret and describe data, maps and graphs Master the ability to synthesize and present data	• Present and organize information and data, which involves the ability to: - use appropriate techniques for summarizing (e.g. descriptive statistics such as measures of central tendency and variability); - use appropriate formats, such as texts (e.g. reports, tables, summaries, etc.) and illustrations (such as maps, diagrams, models, sketches, and graphs) • Compare, analyze, synthesize and evaluate, in

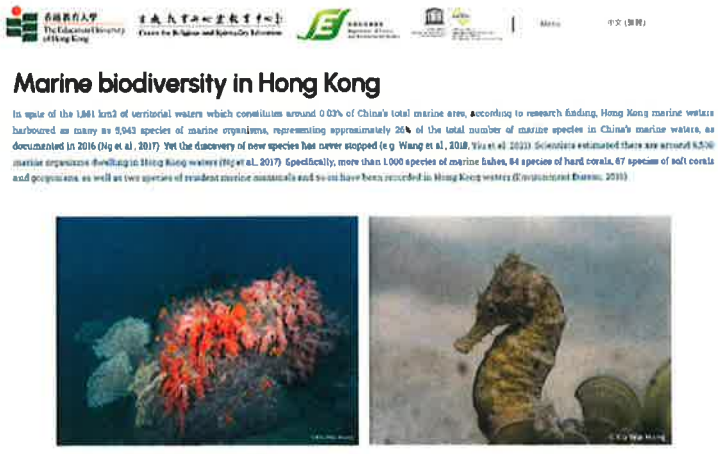
	Presenting ideas in a systematic, logical and concise manner	order to interpret information and data for making inferences and drawing conclusions, which includes: - the use of appropriate statistical techniques - analysis of spatial patterns using GIS
	Concern about the threats created by the human activities towards Chinese White Dolphins	• Be aware of the changing nature of our physical environment and its possible impact on human activities • Recognise the need for sustainable management of our physical environment
Lesson 3	Point out the source of water pollution in Hong Kong waters	• Problems arising from a growing city: Environment: waste, pollution, and the environmental health of the inhabitants • Environmental pollution in Zhujiang (Pearl River) Delta: causes, types, spatial distribution and variation over time • Impact: e.g. social costs (health, quality of life), economic loss (costs for "clean-up" programmes, moving away of firms and companies) and the impact on Hong Kong (air and water pollution)
	Describe and explain the impacts of water pollution towards Chinese White Dolphins	
	Point out the impacts of climate change on aquatic organisms and the potential threats to the Chinese white dolphin	• Consequences of climate change
	Interpret and describe data, maps and graphs	• Present and organize information and data, which involves the ability to: - use appropriate techniques for summarizing (e.g. descriptive statistics such as measures of central tendency and variability); - use appropriate formats, such as texts (e.g. reports, tables, summaries, etc.) and illustrations (such as maps, diagrams, models, sketches, and graphs) • Compare, analyze, synthesize and evaluate, in order to interpret information and data for making inferences and drawing conclusions, which includes: - the use of appropriate statistical techniques - analysis of spatial patterns using GIS
	Master the ability to synthesize and present data	
	Present ideas in a systematic, logical and concise manner	
	Concern about the threats created by the human activities towards Chinese White Dolphins	• Be aware of the changing nature of our physical environment and its possible impact on human activities • Recognise the need for sustainable

		management of our physical environment
Lesson4	Evaluate the impacts of urban development in Hong Kong on the marine environment and Chinese white dolphins based on the content of previous classes and existing knowledge	• Problems arising from a growing city: Environment: waste, pollution, and the environmental health of the inhabitants
	Explain the policies and plans adopted by Hong Kong in building a sustainable city	• Management strategies: e.g. legislation, prevention, control, treatment, education (alternative life styles) and cross-border cooperation • Measures to alleviate or solve the urban problems, including: –Provision of public housing and building of new towns –Urban planning –Environmental conservation measures
	Determine whether the existing urban development plans in Hong Kong and their compensatory measures can achieve sustainable development goals	• Sustainable development and methods to solve the conflicts arising from urban problems • Methods of developing a city into a sustainable one, e.g. better and careful planning of the city, regenerating and re-imaging the city • Price for developing a sustainable city • Consequences of not developing a city in a sustainable way in the long run
	Demonstrate the ability to work in groups	• Discuss and present in groups: –the types of conflicts related to solving urban problems in Hong Kong; and –the methods for dealing with these conflicts.
	Present ideas in a systematic, logical and concise manner	• Present and organize information and data, which involves the ability to: - use appropriate techniques for summarizing (e.g. descriptive statistics such as measures of central tendency and variability); - use appropriate formats, such as texts (e.g. reports, tables, summaries, etc.) and illustrations (such as maps, diagrams, models, sketches, and graphs) • Compare, analyze, synthesize and evaluate, in order to interpret information and data for making inferences and drawing conclusions, which includes: - the use of appropriate statistical techniques

		- analysis of spatial patterns using GIS
	Understand and appreciate the importance of sustainable development	• Recognise the need for sustainable management of our physical environment
	Concern about the conservation of Chinese white dolphins	

Appendix 2 - Webpage - dolphinmessenger.eduhk.hk





Marine biodiversity in Hong Kong

In spite of the 1,061 km2 of territorial waters which constitutes around 0.03% of China's total marine area, according to research finding, Hong Kong marine waters harboured as many as 5,943 species of marine organisms, representing approximately 26% of the total number of marine species in China's marine waters, as documented in 2016 (Ng et al., 2017). Yet the discovery of new species has never stopped (e.g. Wang et al., 2018; Yin et al. 2021). Scientists estimated there are around 8,500 marine organisms dwelling in Hong Kong waters (Ng et al., 2017). Specifically, more than 1,000 species of marine fishes, 84 species of hard corals, 67 species of soft corals and gorgonians, as well as two species of resident marine mammals and so on have been recorded in Hong Kong waters (Environment Bureau, 2010).

Biology in Secondary School

1. Lesson 1 Marine Environment in Hong Kong Lesson Plan
2. Lesson 1 Marine Environment in Hong Kong PPT
3. Lesson 2 Marine Biodiversity in Hong Kong Lesson Plan
4. Lesson 2 Marine Biodiversity in Hong Kong PPT
5. Lesson 3 Relationship between Human and the Sea Lesson Plan
6. Lesson 3 Relationship between Human and the Sea PPT
7. Lesson 4 Dolphin Conservation Lesson Plan
8. Lesson 4 Dolphin Conservation PPT
9. Lesson 5 activity supplementary materials
10. Relation between the teaching module and the Biology curriculum

Every effort has been made to contact copyright holders, but in the event of any inadvertent oversight, We shall be pleased to come to a suitable arrangement with the rightful owner.

Appendix 3 - Results of the questionnaire for the teaching modules

Questionnaire results are not disclosed due to confidentiality reasons.

Appendix 4 - Results of the questionnaire for school talk

Questionnaire results are not disclosed due to confidentiality reasons.

Appendix 5- List of project assets

No equipment is purchased under this project.

Appendix 6 - Staff attendance record

Staff attendance records are not disclosed due to confidentiality reasons.

Appendix 7 - Staff recruitment record

Staff recruitment records are not disclosed due to confidentiality reasons.