Teacher training on climate change and fisheries educational resources in Vanuatu

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Introduction

The country of Vanuatu consists of a Y-shape archipelago of 83 islands and their associated reefs. Located in the South Pacific ring of fire and cyclone belt – at latitude 13–21°S and longitude 166–172°E in the western Pacific Ocean – "Vanuatu is among the countries in the Pacific region that are most vulnerable to the impacts of climate change and climate variability" (National Advisory Committee on Climate Change 2005). Vanuatu has been categorised by the United Nations University's 2012 World Risk Report as a country that is highly vulnerable to natural disasters.

The main objective of Vanuatu's Ministry of Education and Training is to provide access to quality education in a safe learning environment. Indeed, the Education in Emergency policy (Government of Vanuatu 2010) states that "schools should be a safe and secure place for learning and students should know what action to take in the event of a disaster". Knowing what action to take implies that climate change and disaster risk management concepts need to be introduced into classrooms in order to build a more resilient ni-Vanuatu population. Climate change education will enhance students' "ability to anticipate, absorb and accommodate or recover from the effects of a hazardous event in a timely and efficient manner" (IPCC 2012).

The islands have a wide range of marine resources that are exploited at the subsistence, artisanal and industrial levels. The current domestic fisheries production trend will not be sufficient to meet a swiftly growing local population. Furthermore, the slow and rapid onset of climate change and natural disasters (e.g. sea level rise, ocean acidification, tropical cyclone and storm surges) may have substantial effects on marine and freshwater ecosystems. Alternative measures for sustainable fisheries, introduced through educational resources, are critical for enabling proper fishery management and guaranteeing food security for future generations.

Empowering teachers is the most effective way to disseminate knowledge, skills and attitudes in schools and communities, and will consequently promote food security and reduce vulnerability to extreme weather events and natural disasters.

Educating people on key concepts of climate change adaptation and fisheries management is by far the best way to mitigate and adapt to these ongoing environmental events. In fact, the Vanuatu National Curriculum Statement, in the section "Environment and Sustainable Production" (Ministry of Education Vanuatu 2010, p. 41) states that:

"every child and student needs to know how human interventions contribute to such occurrences as climate change, soil erosion, or the death of reefs, which adversely affect the environment, and how these changes impact on human lives. We need to ensure that:

- *we harvest our land and sea in sustainable ways,*
- *we promote awareness of the fragility of the physical environment and how human activity affects it, and*
- *young people appreciate that the land and the sea are finite resources."*

"Promoting (improved access to and quality of) formal education as a way to increase people's adaptive capacity is further supported with respect to the negative effects of disasters on people's level of education, which in turn reduces their adaptive capacity, resulting in a vicious circle of increasing risk." (Wamsler, Brink and Rantala 2012: p. 9).

With this in mind, the Curriculum Development Unit (CDU) partnered with the Pacific Community (SPC) and the German Gesellschaft für Internationale Zusammenarbeit (GIZ), and identified four key resources that would empower educators to teach the elements of climate change, climate change adaptation, and fisheries management inside and outside of classrooms. The resources include: 1) "Learning about climate change the Pacific way",[1] 2) "Pou and Miri",[2] 3) "Cloud Nasara Animation"[3]and 4) "Teachers' Resource Kit on Fisheries for Vanuatu,[4] all of which were developed in consultation with the Curriculum Development Unit and were integrated in the current and reviewed Vanuatu national curriculum from Year 1 to Year 13.

[1] http://www.spc.int/wp-content/uploads/2017/01/Climate-change-vanuatu.pdf
[2] http://www.spc.int/wp-content/uploads/2017/01/Pou-and-Miri-learn-to-tackle-climate-change.pdf
[3] https://www.youtube.com/watch?v=AMthanwiOWE
[4] http://www.spc.int/coastfish/en/publications/information-sheets/kit-for-teachers/464-vanuatu-teachers-kit.html

The four resources are designed to encourage students to understand and behave in ways that promote a sustainable future, and are based on the five principles of Education for Sustainable Development:

- learning to know,
- learning to do,
- learning to live together,
- learning to be, and
- learning to transform oneself and society.

A four-day training was organised on Vanualava island, in Torba Province to "teach teachers" on how to use these four resources. The training involved participants from four schools: Arep bilingual in Vanualava, Martin school at Hiu in Torres, Robin school at Toga in Torres and Bagaveguey school at Toga in Torres.

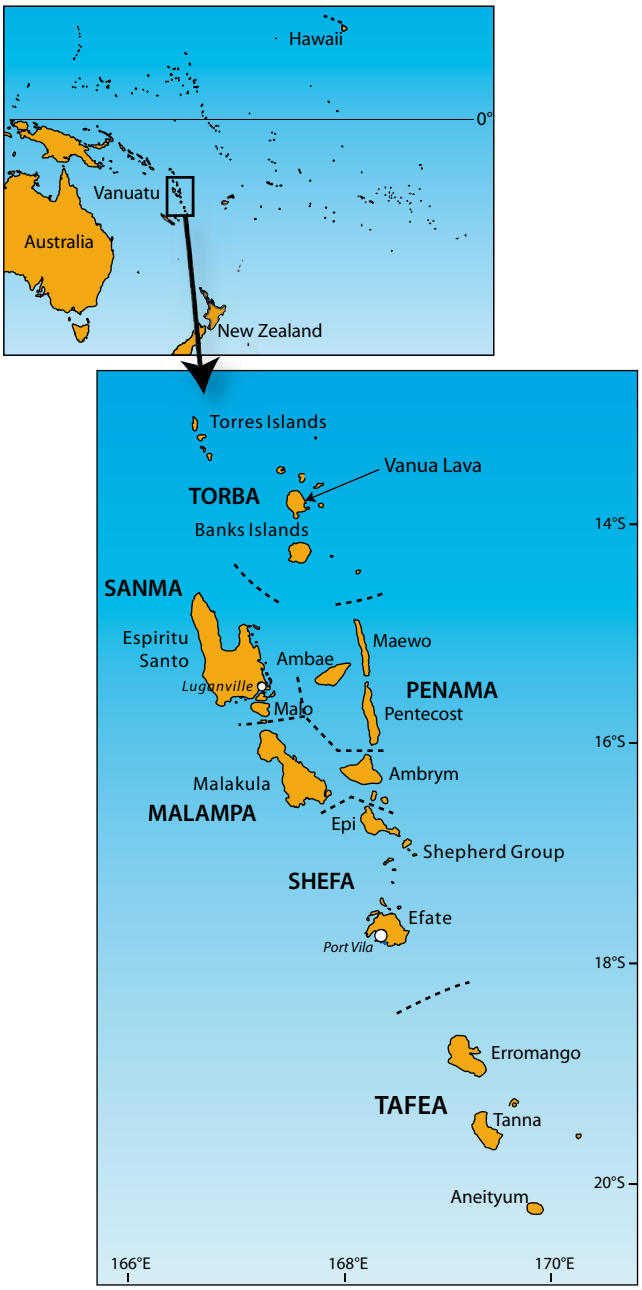
Training objectives

The CDU, under the Vanuatu Ministry of Education and Training, is mandated to carry out two components of the Education in Emergency policy in regards to integrating climate change and disaster risk management concepts into the formal curriculum, and training teachers in the use of emergency education curriculum themes. CDU is currently reviewing the formal curriculum and integrating these concepts and fisheries management themes in several subject syllabi. Moreover, CDU has developed climate change and fisheries information resources in partnership with donor partners; in the midst of the development process, learning outcomes are identified in the current and reformed national curriculum, and are aligned with the main topics in the climate change and fisheries resources.

Nevertheless, based on surveys carried out in schools, many useful resources developed by non-governmental organisations and other institutions are left stacked on shelves and not utilised by teachers. In fact, the primary cause of this is the distribution of resources with no proper training. Hence, an implementation procedure is paramount to allowing the appropriate and sustainable use of the resources developed. Indeed, a teacher training strategy is critical to facilitating the implementation of these teaching and learning resources in classrooms.

The main objective of this training was to increase teachers' knowledge of climate change education and fishery management, and to develop their professional skills on climate change science, climate change adaptation and sustainable fisheries, and become main drivers in building resilience and promoting food security in the education sector.

The training was carried out with two main goals in mind. The first goal was to get teachers to have a competent understanding of climate change, mitigation and adaptation, and fishery management. Although climate change is a current issue worldwide and seems to be a priority on the agenda of many decision-makers, there are actually many misconceptions in schools and at the community level. Confusion surrounding the terminology and concepts is but one of the major barriers in building resilience and promoting sustainable fisheries. Therefore, adequate knowledge is key for a transformative adaptation in the school environment.



The training took place in the nothernmost province of Vanuatu, Torba, which includes the Torres and Banks Islands (illustration SPC).

The second goal was to mainstream climate change, disaster risk and fisheries concepts into teaching programmes. Teachers should be able to identify the subjects with

specific topics and subtopics in which the resources will be integrated. The key messages conveyed in the resources need to be aligned with specific learning outcomes in the teaching programmes. Teachers will have to produce collaborative, inquiry-based student activities using innovative teaching methodologies in order to foster students' knowledge on these sensitive topics.

The subjects include:

- sciences, social sciences and language at the primary level;
- sciences, social sciences, agriculture at the junior secondary level; and
- development studies, earth science, geography and agriculture at the senior secondary level.

Learning outcomes

By the end of the training, participants were expected to be able to:

- incorporate climate science, climate change adaptation and fisheries concepts into teaching programmes;
- actively disseminate knowledge about climate change, disaster risk management (basic climate change science, environmental, social and cultural impacts, mitigation and adaptation measures) and sustainable fisheries, and judge their relevance to their learning context, homes and community; and
- develop an action-oriented learning programme associated with climate change adaptation and fishery management that is relevant to their educational environment, homes and community.

Overview of the training

As an example, we detail below the training that was conducted from 21–25 November 2016 at Arep bilingual school, Sola in Vanualava, which involved two trainers and 10 trainees.

The training targeted both Anglophone and Francophone secondary teachers. The training content included a deductive approach to enable trainees to analyse a specific condition from an overall situation. Analytical and experimental approaches were also used to develop the analytical mind of trainees, as well as "learning by doing" through hands-on activities that not only confronted teachers with the actual evidence of climate change on their environment, but also stimulated their curiosity to make it possible to mitigate and adapt to the ongoing onsets of climate change and fisheries resource reduction.

The first two days of training were allocated to climate change educational resources, and the following two days were devoted to the fisheries resource kit. In order to achieve the training objectives, the training package was carefully developed and adjusted in a way that suited all of the different professional backgrounds and knowledge of the participants, taking into account their language of instruction, subject areas and years of teaching experience.

We briefly describe here the sessions and activities related to climate change and fisheries management that took place over the four-day workshop.

Learning about climate change

The country-specific information kit "Learning about climate change the Pacific way"[5] includes 16 colourful pictures that illustrate the causes of climate change, the mitigation measures to reduce the emission of greenhouse gases at the local level, and adaptation measures to cope with the adverse effects of climate change. It also includes a guide with a description for each picture, suggested learning outcome, suggestions for teaching and learning activities, definitions and background information. The resource already outlines the links between the learning outcomes in the school curriculum and the topic illustrated in the pictures. It was used to animate most of the following activities.

Activity 1: Cooperative grid

This first activity was carried out to introduce the topic of climate change by arousing participants' curiosity on the causes and impacts of climate change, and the appropriate mitigation and adaptive measures. The activity was done primarily to assess participants' level of understanding of climate change and climate change adaptation.

Activity 2: Shrinking island

Participants were asked to draw a map of their island, showing different features and infrastructures. The teachers stood on their maps and imagined different scenarios affecting their island: a tropical cyclone, coastal erosion, sea level rise, land slide. For each of these events, participants had to fold in their maps. At one stage, inhabitants were forced to move out from the island due to death or lack of space on the island.

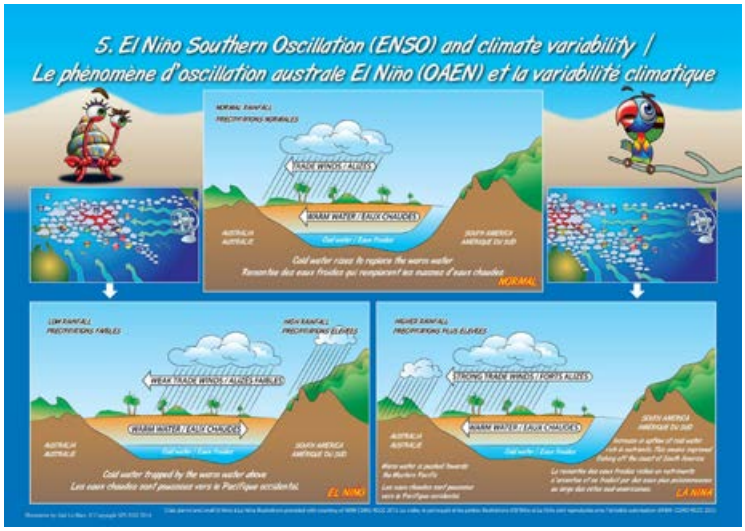
Activity 3: Misconceptions about climate change

Participants were given statements such as "climate change is the same as global warming", or "global warming is caused by a hole in the ozone layer, which allows more solar radiation to reach the earth") and asked to tell

[5] http://www.spc.int/wp-content/uploads/2017/01/Climate-change-vanuatu.pdf

Standing on a hand-drawn map of a "shrinking island" (image: James Melteres).

Pasifika, one of the small posters included in the publication "Learning climate change the Pacific way" (illustration: Jipé Le-Bars, SPC).



The El Niño image from the publication "Learning climate change the Pacific way" (illustration: Jipé Le-Bars, SPC).

if they were correct or false. If false, participants had to say why and rephrase the statement. An open discussion followed and participants were asked to come up with a simple definition of climate change.

Activity 4: General discussion

Using the image of Pasifika, which depicts the general aspects of all Pacific Islands, participants first identified the general aspects of Vanuatu shown in the picture. By carefully analysing the picture, they had to identify human activities that may be destructive to the island. They also had to identify possible risks as a result of climate change and unsustainable practices, and explain why they may be destructive to the island over time.

Activity 5: Water cycle

The water cycle simulation was carried out inside a classroom. Teachers were invited to act as water molecules and act out the process of evaporation, condensation and precipitation in the water cycle. Then the water cycle song was introduced using the tune of "Clementine".

Activity 6: El Niño

Participants looked at the illustrations in picture 5 and drew a diagram showing what happens in El Niño and La Niña years.

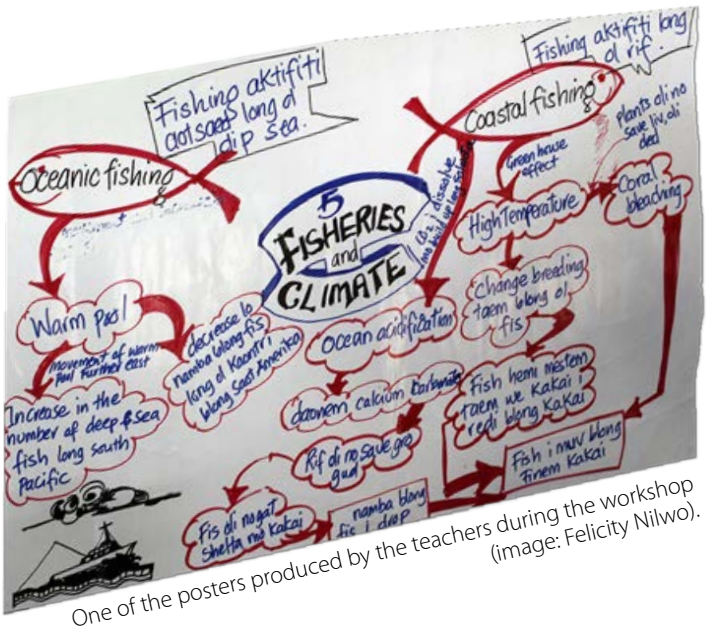
Despite participants being exposed to the information on climate change, and some having seen the "Cloud Nasara" video clip, participants still lacked an understanding of the El Niño Southern Oscillation (ENSO). This was clarified during an activity where participants had to explain to others in the form of an illustration. During the process, they assisted other participants who were still struggling with the notion of ENSO by correcting, clarifying and explaining it to them thoroughly.

Activity 7: Natural and enhanced greenhouse effects

Participants studied picture 6, entitled "Causes of climate change" and followed the step-by step explanation of the greenhouse effect. Then they drew a diagram to show and explain natural and enhanced greenhouse effects. This activity was essential to explain that the greenhouse effect is a natural phenomenon that is being accelerated by human activities.

Activity 8: Interrelationship between the land, the atmosphere and the ocean and impacts of climate change

Teachers were asked to choose a human activity depicted in one of the resource posters and discuss how humans are having a negative effect on their environment and how climate change will make these effects worse.



One of the posters produced by the teachers during the workshop (image: Felicity Nilwo).

Teachers further elaborated on the impacts of coastal changes and sea level rise, ocean acidification, coral bleaching and coral reef damage on the coastal ecosystem. They discussed food security during drought, salt water infiltration into a freshwater lens, and soil and extreme storms damaging crops. They stressed that human actions can increase the vulnerability of our island ecosystems to climate change. It has been identified that if we protect our environment from pollution and waste, we can reduce the stress on ecosystems and increase our resilience to climate change.

Activity 9: Discussion and carousel presentation

Each group of teachers studied a picture and discussed what it shows and how we can get students to carry out some of the activities shown. The groups then prepared a poster to show its findings to others. This activity was designed in a way that will enable participants to explain a particular situation to other teachers. Trainers closely monitored knowledge on the topics.

Activity 10: Discussion

Using pictures 1 and 16, teachers discussed new adaptations to the way of life in Pasifika that had been made. They identified the sustainable practices and described which ones could be put in place to support their schools, and the steps to follow in order to do so.

Activity 11: Pou and Miri

The comic book "Pou and Miri tackle climate change"[6] was used to drive this activity. Teachers identified the key messages in the comic book. They described the problems Pou observes on the island, and identified the causes and consequences of those problems. Using the knowledge gained from the previous resource, teachers described the mitigating and adaptive measures that could be put in place.

Activity 12: Cloud Nasara DVD animation

The third resource, "Cloud Nasara"[7] is a toolkit and a DVD animation on the science of El Niño and La Niña, and their impacts. This resource was developed in three languages: English, French and Bislama. El Niño and La Niña events significantly affect the islands of Vanuatu, triggering very dry or very wet conditions. In fact, these conditions, in conjunction with extreme weather events, can have tremendous impacts on water quality, food security, infrastructure, livelihoods and health.

Activity 13: Early warning, early action

Each group took one of the following scenarios and decided how to prepare for the situation in either a school or a community.

- Average rainfall period
- Less than average rainfall period
- Cyclone season
- High winds and seas warning
- Tropical cyclone warning

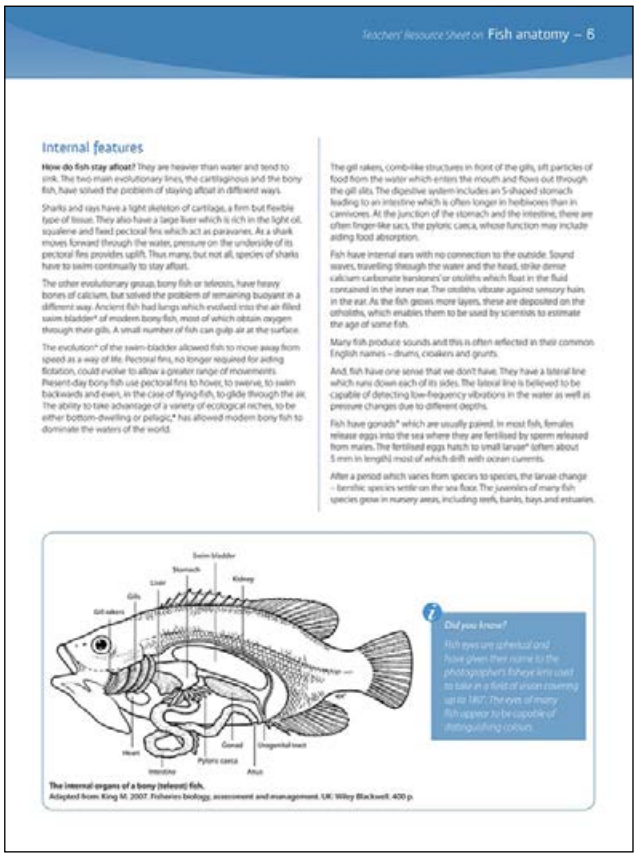
Teachers' Resource Kit on Fisheries for Vanuatu

The "Teachers' Resource Kit on Fisheries for Vanuatu"[8] includes 23 information sheets and a teacher's guide. The link between fisheries and the national curriculum is integrated in the guide. The resource kit also includes suggestions for activities suitable for both younger and older students from the primary level to the secondary level, taking into account their respective learning outcomes. The resource is expected to be used as a supplement to teach fisheries management inside and outside of classrooms, using local knowledge and expertise.

The 23 sheets were categorised by the trainers into five major topics:

1. Species
2. Aquaculture
3. Impacts on fisheries
4. Mitigation and adaptation
5. Job pathways

[6] http://www.spc.int/wp-content/uploads/2017/01/Pou-and-Miri-learn-to-tackle-climate-change.pdf
[7] https://www.youtube.com/watch?v=AMthanwiOWE
[8] http://www.spc.int/coastfish/en/publications/information-sheets/kit-for-teachers/464-vanuatu-teachers-kit.html


Teachers' Resource Sheet on Fish anatomy – 6

Internal features

How do fish stay afloat? They are heavier than water and tend to sink. The two main evolutionary lines, the cartilaginous and the bony fish, have solved the problem of staying afloat in different ways.

Sharks and rays have a light skeleton of cartilage, a firm but flexible type of tissue. They also have a large liver which is rich in the light oil, squalene and fixed pectoral fins which act as paravanes. As a shark moves forward through the water, pressure on the underside of its pectoral fins provides uplift. Thus many, but not all, species of sharks have to swim continually to stay afloat.

The other evolutionary group, bony fish or teleosts, have heavy bones of calcium, but solved the problem of remaining buoyant in a different way. Ancient fish had lungs which evolved into the air filled swim bladder* of modern bony fish, most of which obtain oxygen through their gills. A small number of fish can gulp air at the surface.

The evolution* of the swim-bladder allowed fish to move away from speed as a way of life. Pectoral fins, no longer required for aiding flotation, could evolve to allow a greater range of movements. Present-day bony fish use pectoral fins to hover, to swerve, to swim backwards and even, in the case of flying-fish, to glide through the air. The ability to take advantage of a variety of ecological niches, to be either bottom-dwelling or pelagic,* has allowed modern bony fish to dominate the waters of the world.

The gill rakers, comb-like structures in front of the gills, sift particles of food from the water which enters the mouth and flows out through the gill slits. The digestive system includes an S-shaped stomach leading to an intestine which is often longer in herbivores than in carnivores. At the junction of the stomach and the intestine, there are often finger-like sacs, the pyloric caeca, whose function may include aiding food absorption.

Fish have internal ears with no connection to the outside. Sound waves, travelling through the water and the head, strike dense calcium carbonate 'earstones' or otoliths which float in the fluid contained in the inner ear. The otoliths vibrate against sensory hairs in the ear. As the fish grows more layers, these are deposited on the otoliths, which enables them to be used by scientists to estimate the age of some fish.

Many fish produce sounds and this is often reflected in their common English names – drums, croakers and grunts.

And, fish have one sense that we don't have. They have a lateral line which runs down each of its sides. The lateral line is believed to be capable of detecting low-frequency vibrations in the water as well as pressure changes due to different depths.

Fish have gonads* which are usually paired. In most fish, females release eggs into the sea where they are fertilised by sperm released from males. The fertilised eggs hatch to small larvae* (often about 5 mm in length) most of which drift with ocean currents.

After a period which varies from species to species, the larvae change – benthic species settle on the sea floor. The juveniles of many fish species grow in nursery areas, including reefs, banks, bays and estuaries.

Swim bladder
Stomach
Liver
Kidney
Gills
Gill rakers
Gonad
Urogenital tract
Heart
Pyloric caeca
Intestine
Anus

Did you know?

The internal organs of a bony (teleost) fish.
Adapted from: King M. 2007. Fisheries biology, assessment and management. UK: Wiley Blackwell. 400 p.

Topic 1: Species

Participants usually find this topic very interesting because their lives revolve around the sea. After each information sheet was presented, participants asked questions and sought clarification and additional information.

Sheets 6–13 of the kit were covered during this session, and referred to:

- fish anatomy,
- marine food web,
- ocean species,
- deep water snappers,
- bonefish,
- pearl oysters,
- fresh water species, and
- aquarium species.

Trainers explicitly detailed the content of the sheets, focusing on scientific knowledge, technical and contextualised concepts of fisheries.

Activity: Fish dissection

Prior to the dissection activity, trainers went through sheet 6 on fish anatomy, explaining the external and internal features of a fish. Participants worked in pairs, dissected a fish and identified its internal organs.


Using SPC's information sheet on fish anatomy, two teachers dissect a fish to identify its internal organs (image: Lensley Bani).

Topic 2: Aquaculture

Marine and freshwater aquaculture (sheets 17 and 18) were covered during this session. Trainers detailed the content of the sheets, focusing on scientific and technical knowledge related to marine and freshwater aquaculture. Teachers identified the different organisms that could be farmed in the sea or in ponds filled with sea- or freshwater. They also identified the resources necessary for mariculture or to farm freshwater fish or prawns.

Activity: School project

Teachers were asked to identify a potential project to be implemented in their school and carry out a SWOT (strengths, weaknesses, opportunities and threats) analysis of the project.

It is very interesting to note that during the proposed project activity, all groups chose tilapia farming as their school project activity. They stressed the need to reduce pressure on their marine resources by farming tilapia. SWOT analysis was a very new tool to some participants, and they indicated their gratitude, stressing how important it could be to them.


Freshwater ponds can be used for school project activities related to aquaculture (image: Céline Barré).

Topic 3: Impacts on fisheries

Activity: Collaborative presentation

Using sheets 5, 15, 19 and 20 – which cover fisheries and climate change, modern large-scale fishing techniques, fish spoilage, and fish poisoning and ciguatera – each group of teachers was given a sheet, explaining the different impacts on fisheries. They read through their respective sheet and identified the outcomes of each topic for younger and older students. Then they summarised each sheet in preparation for a presentation to the whole group.

Trainers closely monitored each presentation and gave feedback and additional information when needed.

Topic 4: Mitigation and adaptation

Six information sheets were grouped to cover this topic: 1) fisheries management, 2) no take areas, 3) fisheries assessment, 4) fisheries economics, 5) traditional fishing methods used in Vanuatu, and 6) fish aggregating devices (FADs). Trainers detailed the content of the sheets, focusing on scientific and technical knowledge, relating the concepts of mitigation and adaption to the local context, and detailing the measures that needed to be put in place to allow sustainable fisheries. Teachers identified the benefits of fisheries assessment in providing information for fisheries management. They described the aims of fisheries management and the different rules and regulations to protect seafood species.

FADs were introduced to teachers, detailing their components and the benefits they could provide by facilitating access to offshore marine resources, such as tuna. One of the probable impacts of climate change on the marine ecosystem is the decline and loss of coastal resources; therefore, access to an alternative source of seafood will become vital for coastal communities.

Activity: Collaborative presentation

Each group of teachers was given a sheet explaining different mitigating and adaptive measures to allow sustainable fisheries. Teachers read through the sheets and answered questions for presentation to the whole group.

Again, trainers closely monitored each presentation and gave feedback and additional information when needed.

Topic 5: Job pathways

Using sheets 21, 22 and 23 – which relate to sea safety, job opportunities in fisheries, and financial management of a small fishing business – trainers explained why a fishery is not just about fish, it is also about fishers who catch the fish, people who process and market the catch, and fisheries managers who ensure that fish stocks remain healthy. There are many exciting jobs that involve both inside and outside work. Teachers were asked to assess the different job opportunities the fisheries sector can offer. They also learned that this sector includes some of the most dangerous jobs in the world, globally causing more than 24,000 deaths per year. By using information sheet 21 on sea safety, trainers explained how important it is to pay extreme attention to sea safety, even on small outboard-powered skiffs. The concept of a small fisheries business was also introduced to participants. Since the Torba Islands are quite resourceful, this sheet will assist in educating teachers and students on how to manage a small fisheries business.

Each group of teachers were given a sheet and answered questions for presentation to the whole group.

Again, trainers closely monitored each presentation and gave feedback and additional information when needed.

Field trip

A field trip was organised with officers from the Department of Agriculture to visit the tilapia ponds, where officers provided further information on tilapia farming and how to establish a school project.

A second field trip was made to local tilapia farmers. Both visits stimulated teachers' curiosity about the actions that could be put into place to mitigate and adapt to ongoing aspects of climate change. This will, in turn, support teachers' capacity to integrate action-oriented learning in their teaching practices by adapting some of these measures in their respective schools and context. This field trip took an integrated approach to both fisheries and climate change themes.

Debriefing

The final session was a facilitated debriefing to capture participants' reflections on the fisheries management training. This was an essential part of the training and needed to be attended by all participants. The aim was to capture participants' key recommendations, build on achievements, and address weaknesses and opportunities to improve the training package on fisheries education. Teachers then filled in the evaluation form.

The workshop ended with the handout of copies of the information resources used during the workshop for all primary and secondary schools of Torba Province.

Acknowledgments

Our team for the Climate Change Adaptation and Fisheries Management training comprised Ms Angelinah Eldads-Vira and Ms Felicity Rogers-Nilwo from the Curriculum

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Last but not least, a warm thank you to our partners – SPC-GIZ and SPC's Division of Fisheries, Aquaculture and Marine Ecosystems – for the well-developed resources that were used during the four-day workshop. Such detailed educational resources will empower educators to teach the elements of climate change, climate change adaptation and fisheries management inside and outside of classrooms.

References

Government of Vanuatu. 2010. Vanuatu Education in Emergency Policy and Plan 2010–2015. Port Vila, Vanuatu.

IPCC (Intergovernmental Panel on Climate Change). 2012. Glossary of terms. Cambridge, UK and New York, NY, USA: Cambridge University Press.

Ministry of Education Vanuatu. 2010. Vanuatu national curriculum statement. Port-Vila, Vanuatu. 75 p.

National Advisory Committee on Climate Change. 2005. National Adaptation Programme for Action (NAPA). Port Vila, Vanuatu.

Wamsler C., Brink E. and Rantala O. 2012. Climate change, adaptation, and formal education: The role of schooling for increasing societies' adaptive capacities in El Salvador and Brazil. Ecology and Society 17(2):9–26.

Demonstration of a traditional fishing technique (image: Lensley Bani).