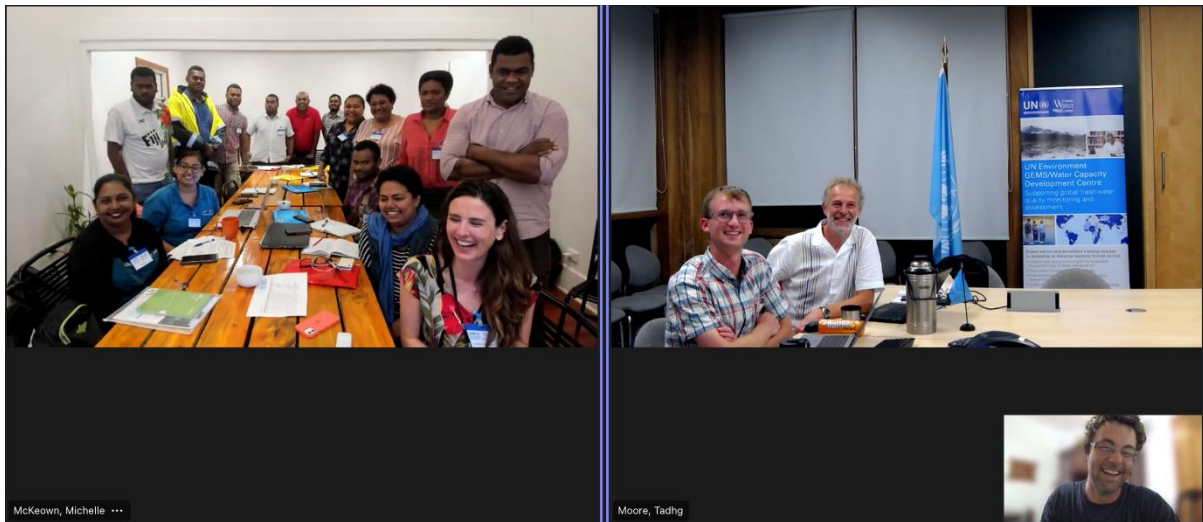




United Nations Environment Programme
GEMS/Water
Capacity Development Centre



Report on Summer School: 'UNEP GEMS/Water Biological and chemical monitoring of freshwater resources; Regional engagement in the Southwest Pacific.'

Report Date: September 7th 2022.

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UNEP GEMS/Water Capacity Development Centre, Final report for workshop on: 'Biological and chemical monitoring of freshwater resources; Regional engagement in the Southwest Pacific'

Background

This was the first UNEP GEMS/Water Summer School since 2019 that involved an in-person training component. The last UNEP GEMS/Water Summer School was held in late 2021 and was delivered solely in an online format. The location for this latest summer school was Suva, Fiji, and took place from August 22nd to August 24th inclusive in 2022. In-person training was facilitated by Dr Michelle McKeown, a lecturer at the School of BEES, UCC, who had previously worked at the University of the South Pacific (USP). Dr McKeown was scheduled to visit Fiji to conduct research during this period. This was seen as an opportunity to engage with the National Focal Point (NFP) of Fiji, Mosese Nariva, who works with the Water Authority of Fiji (WAF). Initial scoping meetings with the NFP indicated that further training around the utility of biological monitoring in freshwater monitoring and assessment was of particular interest to the WAF. Due to the accelerated timeline and logistics of coordinating a workshop in Fiji, the decision was taken for all participants to be in-person. This workshop duly took place at the Greenhouse Coworking, 33 Des Voeux Rd, Suva, Fiji on August 22-24th.

Objectives

To use classroom and fieldwork training to demonstrate and practice chemical and physical sampling, biological monitoring techniques and introduction to citizen science programmes involving both physiochemical and biological monitoring.



Figure 1 Summer school participants in Suva, Fiji listening to the introduction from Dr Timothy Sullivan in Cork, Ireland. Photo credit: Michelle McKeown.

Workshop content

This course comprised a series of lectures, roundtable discussions and local field trips. Lecture and discussion topics included principles of environmental monitoring, physical & chemical monitoring

techniques, and a strengths, challenges, opportunities and threats (SCOT) analysis for Fiji water quality, citizen science, and using macroinvertebrates for biological monitoring, climate change impacts on freshwater in Fiji, data storage and quality assurance for biological monitoring, science communication and groundwater monitoring. The first field trip was focused on physical monitoring of streams such as measuring discharge and using citizen science methods (FreshWaterWatch kits) to measure nitrate and phosphate concentrations in freshwater. The second fieldtrip focused on collecting, identifying, and recording macroinvertebrates at river sites for the purposes of biological assessment of freshwaters.



Figure 2 One of the Summer School participants uses the FreshwaterWatch kits to test for nitrates in the stream water. Photo credit: Michelle McKeown.



Figure 3 One of the participants carrying out a kick sample to collect a macroinvertebrate sample as part of the training in biological monitoring. Photo credit: Michelle McKeown.

Background of Participants

A total of 14 participants signed up for the Summer School in August 2022. All participants were from Fiji, 13 worked within the Water Authority of Fiji and 1 worked within the Environment Division of the Mineral Resources Department. Of the 14 participants, 10 were male and 4 were female.

Synopsis of Pre-course survey

Prior to attending the Summer School, participants were sent a survey which they were asked to complete. Of the 14 attendees, 10 completed the survey. The highest level of academic training was a Bachelor's degree for 5 respondents, 2 had a Master's degree, 2 had a post-graduate diploma and 1 had a diploma (Figure 4). A total of 90 % (n=9) of respondents had none to some experience with using macroinvertebrates for biological monitoring of freshwaters (Figure 5), while 80 % (n=8) had little to no knowledge of Citizen Science programs (Figure 6).

What is your highest level of academic training?

10 responses

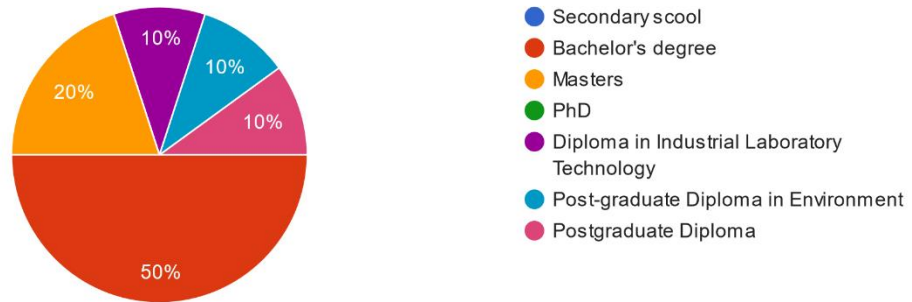


Figure 4 Summary of attendee's answers (n=10) to the question "What is your highest level of academic training?"

Rank your experience with freshwater biological monitoring with macro-invertebrates.

10 responses

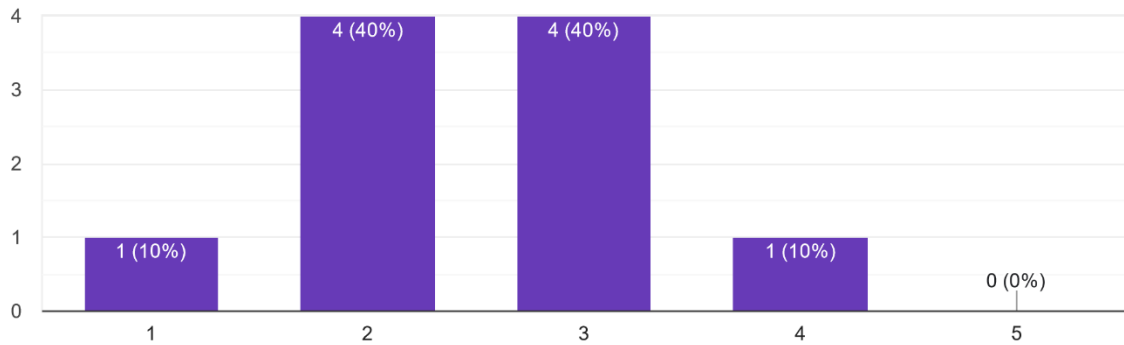


Figure 5 Summary of attendee's answers (n=10) to the question "Rank your experience with freshwater biological monitoring with macroinvertebrates". 1 being no experience and 5 being highly experienced.

Rank your knowledge of Citizen Science programs.

10 responses

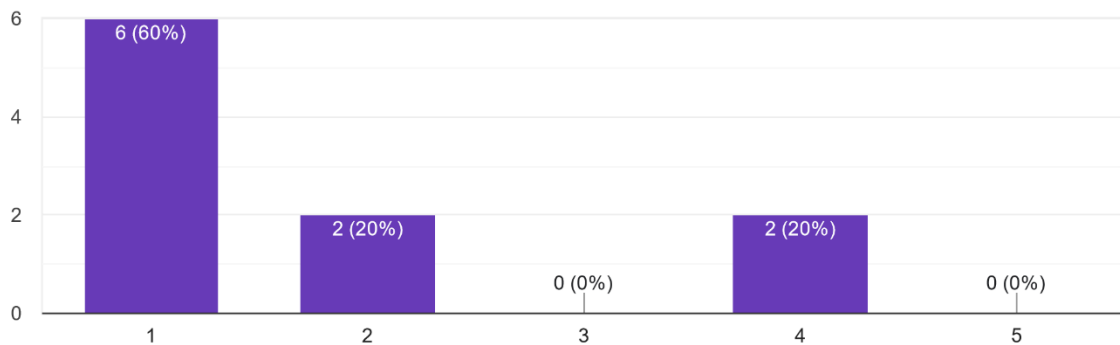


Figure 6 Summary of attendee's answers (n=10) to the question "Rank your knowledge of Citizen Science programs". 1 being poor and 5 being excellent.

Q. What do you hope to gain from this workshop?

Table 1 Attendee (n=10) responses to the question "What do you hope to gain from this workshop?".

Water Quality Index from Sampling of Creeks for Invertebrates'

A better understanding of freshwater monitoring

To learn more about freshwater biological monitoring and analysis.

expand my knowledge of freshwater biology

Fresh water sampling methods and accuracy

To hence my knowledge on standardised methodology of chemical monitoring and bio indicator species of water quality monitoring.

To have a clear and better understanding of freshwater biological monitoring with macroinvertebrates.

1. Gather knowledge and practical skills on how to identify and differentiate macro invertebrates within Fiji freshwater ecosystem 2. To understand and easily identify the environment (including chemical and physical characteristics) supporting different macro invertebrates 3. Learn what Citizen Science is 4. Learn ways or methods to maintain a healthy freshwater environment and how these methods can be implemented in Fiji - identifying different approaches to address local issues concerning fresh water 5. What are the appropriate tools to use in fresh water monitoring - applicable to Fiji 6. What methods to use in freshwater monitoring - applicable to Fiji

I hope to at least have an understanding of Biological and Chemical Monitoring of freshwater resources

To learn more in depth & practical knowledge on biological monitoring

Synopsis of Course feedback

Attendees had to complete a questionnaire at the end of the summer school. This comprised of responding to 10 statements and marking how much they disagree to agree with the statement on a 5-point Likert scale. Also, the participants were asked to respond to 6 general questions and an option to add any further comments or suggestions. The participant comments for each question are summarised below (n=14).

Overall, attendees agreed that the workshop was relevant, useful and well organised. The biological monitoring and citizen science subjects were the most common themes of the workshop that people found of particular interest. One of the attendees found the physical and chemical monitoring of little interest since they do it every day. There were a couple of things which people found difficult about the workshop, slide size on some of the slides, identifying the macroinvertebrates and access to one of the river sites for sampling. Overall the information provided was adequate. Attendees said that identifying and using macroinvertebrates to classify water quality and gaining knowledge on bioindicators was what they gained the most. Feedback on how to improve the content of the workshop was for there to be more sites to visit, inclusion of more local data, generally more field work, and also the inclusion of other potential local stakeholders in the workshop (e.g. Ministry of Health/Agriculture, USP). In further comments and suggestions, attendees enquired about further courses in these topics, with interest expressed in a workshop on the impacts of climate change, inclusion of a hand lens for macroinvertebrate sampling and further training opportunities in this area.

Summary and key findings from Participant feedback

Table 2 Mean attendee's responses on a 5-point Likert scale for each statement where 1 = Disagree and 5 = Agree.

Statement	Mean (1=Disagree, 5=Agree)
The objectives of the workshop were clear	5
The content of the workshop was relevant to you	5
Field exercises were interesting	5
Field exercises were relevant	5
Field exercises were well organised	5
The material provided was useful	5
Information and schedule for the workshop were adequate	5
The workload associated with the workshop was appropriate	5
The teaching staff invested time and effort in this workshop	5
Overall, the workshop was well organised	5

Free form questions:

Table 3 Attendees (n=14) responses to the question " Did you find any part of the workshop of particular interest?".

Yes, gauging water quality through biomonitoring
I found the field exercises to be very interesting especially the CSSI
Yes, biological monitoring part - testing NO4 and phosphate kits on site.
Yes the idea of citizen science

Yes , the whole 3-day workshop was very interesting and very informative: macroinvertebrates, methods, data storage

Yes. It was the Citizen Science programme. It made me understand and determine ways we can include communities in Ambient Water monitoring and assessment

Well understanding the lecture tutorials and the field work were helpful in identifying the adequate methodology in monitoring, sampling and preserving and analysis of sample collected.

I find the Biological Testing as interesting

Classroom and field blend well to achieve objectives

Biomonitoring

This is a first for Fiji on invertebrate monitoring and data collection. However, we need more of this kind of workshop, so stakeholders put these ideas around for practical monitoring of our waters

The venue is very good with good facilities. Field trip was very interesting

Identification of macroinvertebrates, citizen science, communication in freshwater science

The whole 3-day workshop was very interesting and informative. I learnt a lot from the workshop

Table 4 Attendees (n=14) responses to the question "Did you find any part of the workshop of little interest?"

None

None

No, actually the 2-day field trip was interesting

Biological indicators of ambient water

None

No

No

All were interesting

No

Physical and chemical monitoring since we do it every day

All were good

None

No

Nope

Table 5 Attendees (n=14) responses to the question "Did any part of the workshop cause you difficulty?"

No

Visual presentation - few of the slides were hard to read or too small

No

Overall. I understood what has been taught in the workshop

No

No
It was all clear and relevant to my field work.
Identifying the good and bad guys indicators of water quality
No
The site visit to Colo-i-Suva was a bit of a struggle
No
None
Understanding the field test kit nitrates and phosphates
Identification of species in Fiji context

Table 6 Attendees (n=14) responses to the question “Was the information supplied for the workshop adequate?”

Yes
Information supplied was sufficient and very informative
Yes
Yes
Yes
Yes. Notes and presentation linked very well with the field activities that was done.
Yes
-
Yes
Yes
Yes
yes, very adequate
Yes
Ok

Table 7 Attendees (n=14) responses to the question “What did you gain most from the field exercises?”

Water quality analysis through sample analysis and identification
Experience in water quality monitoring and assessment
Very informative, in which it can be implemented to our team
How to identify biological indicators
Give a clear and clarity on what we done on site; Comparison of methods used and find test results are similar
Understanding ways or methods to conduct freshwater monitoring and assessment. The countries may have different accessibility to their ambient water, but methods applied do no differ and may be slightly different, but both allows for proper determination of Water Quality

Identifying these species that indicates the quality of the water
 yes it is
 Classification of macroinvertebrates to assess freshwater quality
 Knowledge on Bioindicators
 Its another level of water quality monitoring rather than focusing
 on physical/chemical or microbiological monitoring
 -
 Identification of species, methods of sampling, teamwork
 Understanding the monitoring, data collaboration, and QC

Table 8 Attendees (n=14) responses to the question “In your opinion, how could the content of the workshop be improved?”

Apart from invertebrate taxonomic identification we could also
 include other natural indicators to vouch for water quality
 To have a printout of the slides just to aid the visual presentation
 Trainings to be conducted for 2 weeks etc.
 I think the field visit should be more than two sites to assess,
 pristine and polluted rivers
 If it can cover the freshwater ecosystem indicators that would be
 great. Note the 3-day workshop is excellent
 It would be great if there were more local data or information
 included in this training. However, this all depends on the
 availability of these data locally which at the moment, Fiji fails to
 maintain or collate.
 If more field work can be done
 I gained conducting sampling and determining water quality using
 kits, tubes and bio indicator apart from using machine electric
 Length to be 1 week
 -
 More of field works so species/invertebrate identification to local
 level is well achieved
 How to sample using nets, how to identify the macroinvertebrates
 I think more in-depth training should be provided. More than 3
 days training and more field assessments. Also including more
 stakeholders in this training.
 More time for field work with more method and known sites

Table 9 Attendees (n=14) responses to the question “1. Have you any other comments or suggestions?”

Apart from water quality a climate change workshop could also be facilitated to
 understand its impact on our surrounding.
 Involvement of other relevant stakeholders: Ministry of Health, USP, Ministry of
 Agriculture
 More trainings like this conducted again
 Thank you for the opportunity given in learning the freshwater biological life in the
 citizens level of understanding
 I am very much interested in other ecosystem (H2O) indicators e.g. fish; Apart from
 macroinvertebrates and periphyton

No

Do your organization have active course where we can attend to upgrade our knowledge on the areas of studies.

It would be improved if it was longer and had presentations from participants to gauge how well they have understood the course.

No

-

Do your organization have online courses on these invertebrate/biological monitoring? Are there any forms of scholarships for these courses?

To include hand lens for the field trip as some macroinvertebrates were very tiny in size

No

Better to have similar training on a regular basis

Potential Opportunitites for improvement

- Having one instructor on the ground placed a lot of pressure on them to manage, facilitate and coordinate activities Ensuring that there is a better instructor to student ratio
- Recruitment process for attendees was unclear and due to time constraints resulted in a narrow pool of attendees (13/14 from WAF, 1 from the Ministry of Mineral Resources). Have a clear targeted workshop, with defined terms of reference and targeted audience, which is advertised well in advance to allow more time for logistical planning and material development for the Summer School
- “Summer School” label is perhaps confusing, it might be better to keep it simple e.g. “Workshop”
- Further conversion of self-directed materials (e.g. slides) into more presentation and participant engagement format.
- Integration of the use of sensors and sondes for water quality monitoring
- Add an additional day at the end of the workshop where local stakeholders are invited (e.g., Ministry of Health/Agriculture, local universities, etc.) and have a series of presentations and engagements between local water authorities and the relevant stakeholders
- Upon completion of the workshop, establish clear follow-ups, ideas for the next training event, further meetings with potentially relevant stakeholders etc
- Sharing of the schedule with participants
- Inclusion of data and examples from the local area

Overall summary and closing remarks

Feedback indicated that all participants enjoyed the workshop and generally found the material to be interesting and relevant to their area of work. The balance of the classroom based activities in the morning followed by local field trips in the evening worked well. There were high levels of engagement from the participants and they were keen to learn more and would like to have more courses of this nature. Following up from this workshop, The UNEP GEMS/Water CDC has also connected with people who work at the University of the South Pacific (Bindiya Rashni- PhD candidate, Freshwater macroinvertebrates, Periphyton, plankton and macrophyte specialist, and Dr Sarah Pene) who have ran similar workshops like this before and are potential candidates to lead a follow-up workshop with the WAF in the future. This workshop has also resulted in commencement of exploratory discussions around the adoption of UNEP GEMS/Water materials for potential use in a new MSc program and/or

establishment of training programs, similar to the Continuous Professional Development (CPD) courses.

Overall, the workshop had a high impact for the attendees and offers further opportunities for a local collaborative network to develop in focused training on water quality monitoring and assessment.