

Measuring light absorption properties by particulate material in  
sea water

Latin American Regional Project  
Instituto del Mar del Peru  
IMARPE  
Lima, Peru  
6 to 10 February, 2017



Workshop Report

## “Measuring light absorption properties by particulate material in sea water”

The workshop “Measuring light absorption properties by particulate material in sea water” (Lima Workshop), was carried out in the framework of the last phase of the NANO Latin American Regional Project (LA-NANO). The workshop took place from 6 to 10 February 2017 and it was held at the Instituto de Mar del Peru, in Lima, Peru.

The Latin America NANO Regional Project began in 2012 with the objective of implementing pigment analysis using HPLC in the ANTARES network time-series stations. After the achievements obtained regarding pigment analysis, it was considered of great importance the need for measuring the light absorption coefficient by particles and especially by phytoplankton. To do so, it was necessary to train people from the network to do so. The main objective of this workshop was then to teach to the Antares members and personal from IMARPE how to measure the light absorption coefficient by the particulate material using the method of Mitchell *et al.* (2000). The workshop was attended by 19 participants (Table 1) who received the course provided by Dr. Adriana Gonzalez, who is the current coordinator of the LA-NANO project.

To exemplify the different conditions that can be found in the marine environment samples from three different sites located around IMARPE institute were collected. The first place with a high content of detrital particulate material. The second place with a relative balance between particulate detrital material and phytoplankton. Finally the last sampling was taken from a microalgae cultivation of *Nannochloropsis*, which had no detrital material.

In general, the workshop consisted of:

1. Working sessions where all the participants of the meeting listened the classes imparted by Dr. Adriana Gonzalez.
2. Visit to IMARPE laboratories and laboratory analysis.
3. Project 2017-2018 action plan imparted by Jesus Ledesma.

**Table 1. List of the participants of the workshop carried out in Lima (Peru).**

Name	Antares Station	Country
<b>Adriana Gonzalez Silvera</b>	Ensenada	Mexico
<b>Abraham Saavedra</b>	Ensenada	Mexico
<b>Mariana Larios</b>	Ensenada	Mexico
<b>Jaimie Rojas</b>	CARIACO	Venezuela
<b>Mayza Pompeu</b>	Ubatuba	Brazil
<b>Christian Naranjo</b>	Manta	Ecuador
<b>Maria Tapia</b>	Libertad	Ecuador
<b>Liseth Arregoces</b>	Cartagena	Colombia
<b>Guillermina Ruiz</b>	EPEA	Argentina
<b>Jesus Ledesma</b>	IMARPE	Peru
<b>Georgina Flores</b>	IMARPE	Peru
<b>Mario Polar</b>	IMARPE	Peru
<b>Sonia Sanchez</b>	IMARPE	Peru
<b>Luis Escudero</b>	IMARPE	Peru
<b>Aby Bernales</b>	IMARPE	Peru
<b>Wilson Carhuapoma</b>	IMARPE	Peru
<b>Elcira Delgado</b>	IMARPE	Peru
<b>Victor Aramayo</b>	IMARPE	Peru
<b>Michelle Graco</b>	IMARPE	Peru
<b>Jose Mendosa</b>	IMARPE	Peru

## Workshop agenda

### Monday February 6

- Welcome by Jesus Ledesma and presentation of the hosts of the IMARPE station.
- Dr. Adriana Gonzalez gave lectures to explain about the bio-optical properties in sea water.  
Subject of the lectures were:

1. Concepts in ocean Bio-Optics.
2. Characteristics of light absorption by phytoplankton.
3. Bio-optics and ocean color remote sensing.
4. Methods for measuring light absorption by particulate material including sampling techniques.



Figure 2. Introducing the workshop to all participants

Tuesday February 7

- Explanation about the method of measurement of the absorption coefficient of light by the particulate material. Firstly it was explained the difference between the "case 1" and "case 2" waters and comparison between *in situ* measurements and remote sensing data. Finally it was explained how the spectrophotometer works and the mathematical equations used to calculate the absorption coefficient using Mitchell's method.
- After the morning classes we went to the dock in front of the Institution to take samples for laboratory measurements (Figure 4).

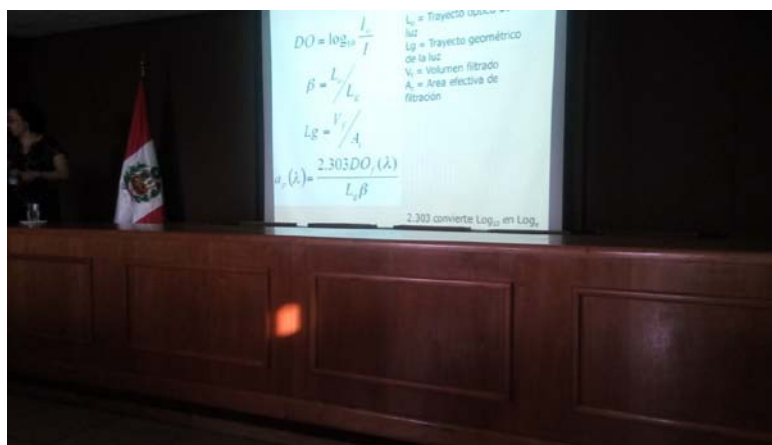


Figure 3. Explanation about equations used for calculation of the light absorption coefficient by particles.



Figure 4. Sampling

Wednesday February 8

- During this day laboratory analysis begun.
- Jaimie Rojas from CARIACO station (Venezuela) showed us the instrument used in her institution (Spectralon) to measure light absorption coefficient. Her aim at this workshop was also to measure and compare replicates samples using the Spectrascan radiometer regularly used at her laboratory and the spectrophotometer to make sure she will be able to continue measuring with the same accuracy as usual. Jaimie explained that CARIACO project is over now. Many of the equipment that they have been using so far will no longer be in the laboratory. Therefore, there is the need to start applying the spectrophotometric method again.
- Dr. Adriana Gonzalez explained the methodology for the following analysis (Figure 6). Mayza Pompeu (Brazil) supervised the filtration of samples indicating the most efficient technique (Figure 7).



Figure 5. Jaimie Rojas making a demonstration of the use of the spectroradiometer Spectralon.



Figure 6. Explanation of use of spectrophotometer



Figure 7. Explanation of filtering technique

Thursday February 9

- In this day we work on calculation of the absorption coefficient. This session was also the opportunity to talk about specific problems regarding the methodology, with the participation of those participants with more experience.

- Some discussion came out during the day. One important consensus among participants was that the “hands-on” modality of the workshop was highly fruitful for everyone. During the laboratory activities, IMARPE’s fellows Wilson Carhuapoma and Avy Bernales followed carefully the instructions of Prof. Adriana González Silvera and assisted her with the manipulation of the old spectrophotometer and glass material. Liseth Arregocés (collaborator from Cartagena, Colombia) could check her protocol for several practical “details” and go back to Cartagena having dissipated some important doubts.

- It was organized a visit to other laboratories at IMARPE.



Figure 8. Phytoplankton laboratory.



Figure 9. Geological oceanography laboratory.

### Friday February 10

- In this day some participant of the meeting talked about some articles concerning the measurement of the light absorption properties by particles as a way of share more information about different application of the type of data generated in the laboratory.
- Alumni with more experience in the group gave short presentations of their current work. For example, Guillermina Ruiz (Argentinean Alumnus since 2015 but also active participant since 2012) presented her recent results on spectral absorption by CDOM modelling.
- Taking in account Mayza Pompeu (USP, Brazil) presentation it was raised the discussion about a common methodology for light absorption coefficient measurements. However, at her institution the use of sodium hypochlorite instead of methanol for pigment extraction was due to the presence of small phytoplankton cells which are known to have pigments that are not completely extracted with hot methanol. Therefore, bleaching the pigments with sodium hypochlorite was the best option for them. This lesson was of special relevance to people from Cartagena (Colombia), who acknowledges the similarities of some cell types at Cartagena station.
- Jesus Ledesma, who will be the coordinator of the next NANO project, shared with the members the action plan for this next phase. One of the main agreements among members were the need for maintaining a strong communication based at least on the use of the available technology (such as Whatsapp).
- During this meeting it was decided to submit an article for the next NANO News, and Guillermina Ruiz (Argentina) proposed herself to take care of that. The article was sent to the editor just after we came back from Lima. We are waiting for its soon publication.



Figure 10. Mariana Larios from Mexico.





Figure 11. Guillermina Ruiz from Argentina.



Figure 12. Christian Naranjo from Ecuador.



Figure 13. Jaimie Rojas from Venezuela.



Figure 14. Mayza Pompeu from Brazil .



Figure 15. Action plan 2017-2018.

- As part of the project, Secchi Discs were elaborated in Ensenada (Mexico) and delivered to the Antares members in Lima. A certificate of participation was also given for each workshop participant.



Figure 16. Delivering the Secchi disc to Christian Naranjo from Ecuador.

- Some time was taken in the afternoon to do some sightseeing with the kindly support of Jesus Ledesma.



## Concluding Remarks

This workshop was a very fruitful meeting enriched by the participation not only from the LA-NANO project participants but also from people from Imarpe who were very interested in learning and knowing about the objectives of this initiative and the support given by organizations such as NANO, POGO and the Nippon Foundation. It is important to mention that this type of meeting have been essential for maintaining the collaboration among members and at the same time building capacities that will result on a better comprehension of the functioning of our coastal waters not only with a local but also with a large scale view.

## Appendix 1. Material and Agenda printed for participants

JUEVES 9 de Febrero			VIERNES 10 de Febrero		
<i>Desayuno</i>	Comedor IMARPE	7:00 a 8:00	<i>Desayuno</i>	Comedor IMARPE	7:00 a 8:00
<b>Captura y manejo de muestras</b>		8:30 a 10:00	<b>Discusión del proyecto LA-NANO</b>	Dra. Adriana González	10:00 a 10:30
<i>Coffee Break</i>		10:00 a 10:30	<b>Propuesta de seguimiento proyecto POGO-NANO</b>	Ing. Jesús Ledezma	
<b>Discusión general de resultados obtenidos</b>			<b>Clausura</b>		12:00
<i>Almuerzo</i>	Comedor IMARPE	12:00 a 13:00			
<b>Presentación de artículos leídos o trabajos individuales</b>					
<i>Coffee Break</i>		15:00 a 15:30			
<b>Presentación de artículos leídos o trabajos individuales</b>		15:30 a 17:30			
<i>Cena</i>	Centro de la ciudad	Salida 18:00			



Reunión Anual  
Lima, 2017



### Taller de medición de las propiedades de absorción de luz por el material particulado en el agua de mar

**Agenda de Trabajo**  
06 de Febrero al 10 de Febrero  
2017

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Reunión anual Proyecto LA – NANO

**Abraham Saavedra García**

Universidad Autónoma de Baja  
California  
Facultad de Ciencias Marinas

**México**






Figure 17. Example of printed material for each participant.



Figure 18. Example of certificate delivered to each participant of the workshop