EMODnet

European Marine Observation and Data Network

EMODnet Thematic Lot n°4 – Chemistry

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Data management proposal for seafloor litter images and videos at European level

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Contents

Introduction 4

Seafloor images, status of the art and best practices at EU and Global Level 5

- Jamstec experience 5
- Ramoge cruise data by IFREMER and ISPRA: 7
- ISPRA institute example 9

EMODnet Chemistry seafloor images data management proposal 11

- CDI format for metadata 12
- Seafloor images data format 13

References 16

Annexes 17

- Annex A: Ramoge cruise example 17
- Annex B: Ispra example 17
- Annex C: EMODnet Chemistry, background table for data management 18

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1. Introduction

The EU marine data management experience of EMODnet Chemistry continues on its 4th phase (2019-2021). The focus has been further expanded with data access and gathering for new marine litter datatypes. In fact, after consultation with relevant EU stakeholders (JRC, TG-ML, RSC's, ...), new marine litter datatypes are now considered, enlarging the marine litter data management challenge to include:

- seafloor litter images and videos
- microlitter in sediment
- floating macro litter

These will integrate the beach litter, seafloor lotter and floating microlitter databases already handled.

The data management involves further population of the EMODnet Chemistry CDI (Common Data Index) Data Discovery and Access service, as well as updating and refining the data products (validated data collections) and their visualizations in a dialogue with the board of MSFD experts.

This document provides background information about the status of the art and management strategy for seafloor litter images and video. In particular, it provides information on how to deal with marine litter data related to seafloor videos and images under EMODnet Chemistry, the formats for gathering, and how EMODnet Chemistry network should manage this kind of marine litter data sets.

2. Seafloor images, status of the art and best practices at EU and Global Level

The principle of EMODnet Chemistry to face the new litter topics, is to analyse in detail the best practices already developed by consolidated communities and then propose a format able to handle all the available information with a focus on the European and global perspective.

Thanks to the interactions with the stakeholders, the seafloor litter dedicated workshops organized by JRC (to provide an overview of the data management status for seafloor litter images), and Oceanobs '19 conference Marine Debris breakout session, the following EU and global experiences have been highlighted.

Jamstec experience

During the seafloor litter workshop organized by JRC (AWI, Germany, May 2018) and the Oceanobs '19 breakout session on Marine Debris (Oceanobs '19 conference, Honolulu, 2019), EMODnet Chemistry gained a set of fruitful interactions with relevant actors in the marine debris data management. One of these relevant contacts is JAMSTEC -Japan Agency for Marine-Earth Science and Technology. They have the first (and unique) example of seafloor debris images and videos online accessible database (http://www.godac.jamstec.go.jp/catalog/dsdebris/e/). Their service visualizes a list of debris classified by shapes/materials where litter items are categorized and linked to their videos and photos.

A list of litter/debris categories with a thumbnail of the litter image is provided with some general information (type, date, area, depth, seabed, organisms (presence: yes/no), and link to the map). Through the thumbnail it is possible to access to further information like:

- type of sediment
- area
- coordinates
- submersible & Dive No.
- biological information
- link to images and video

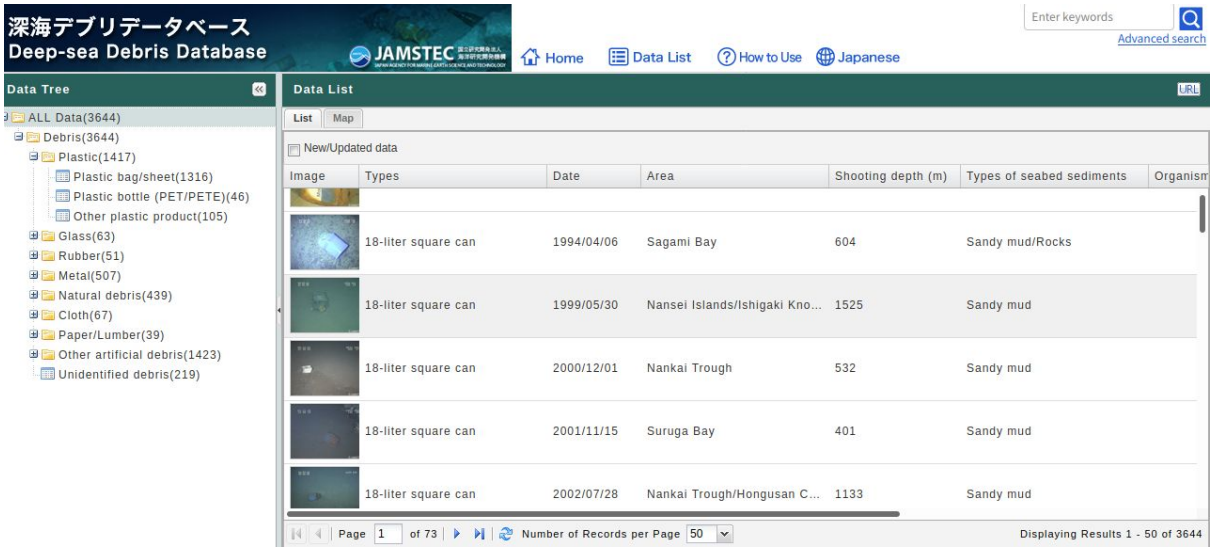


Fig. 1. list of general information on marine debris

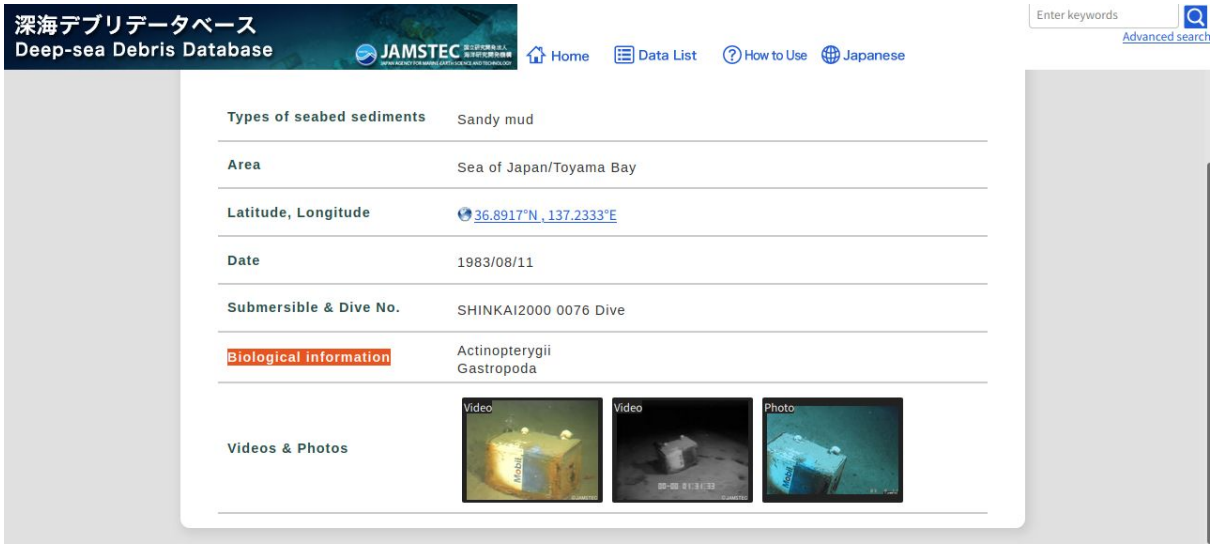


Fig 2. Jamstec specific information on marine debris items

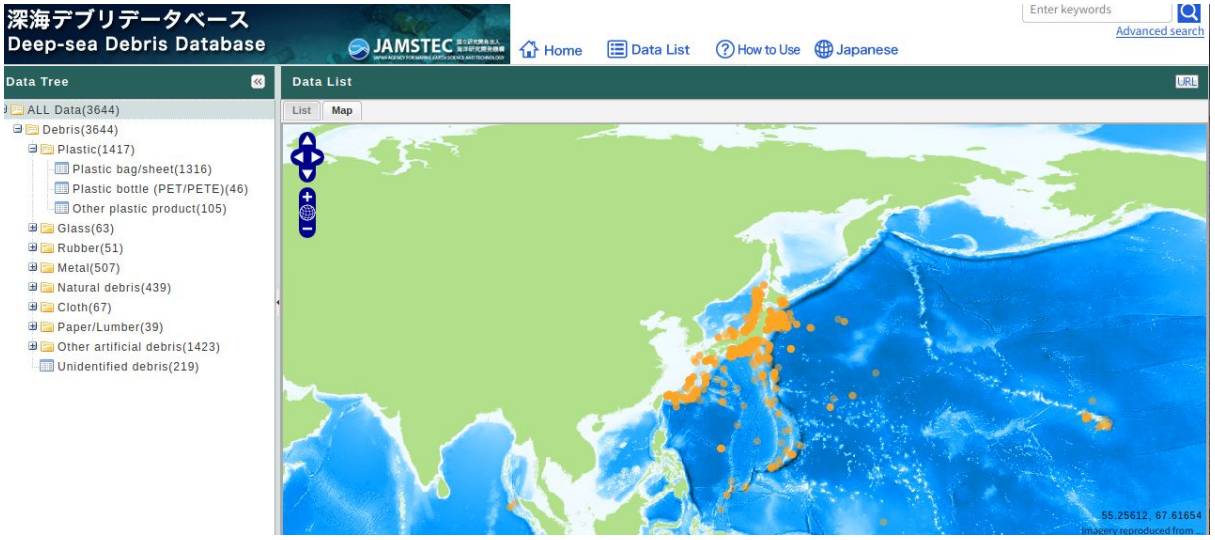


Fig. 3. Location of marine debris items

JAMSTEC has handled data from deep-sea research submersibles since 1982. They have encoded video tapes to digital files and archived them on online storage since 2002. The total amount of videos and photos is approximately 350TB over 38 thousand hours of videos and 1.5 million photos.

They have a magnetic tape library system used in combination for long-term backup and regular access.

Additionally, the seafloor litter workshop, organized by JRC, highlighted two further EU examples of seafloor images datasets, which is described below.

Ramoge cruise data by IFREMER and ISPRA:

IFREMER (France) and ISPRA (Italy) participated to the "Ramoge" cruise where seafloor litter/debris images and videos were taken and the following information (Annex A) were extrapolated in a data sheet:

- dive number
- number of video
- time
- picture number and code
- camera code
- comments
- coordinates
- depth

- cape
- altitude
- number(class of number) and type of litter items (specified using TG-ML list)
- entanglement information(interaction with organisms, type of impact, number of species affected, type of species, comments)

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
	Méjan														EMMELEMENT / ETRANGLEMENT				
	Dive number	Numéro plongée video	time code	incrementation_photo	Code_picture	code camera	comment on photo	lat dd.dec	Long DD.dd	depth	cape	altitude	number of litter	Type	interaction with organisms	Type of impact	nb of species affected	species affected	comment
		RAMOGE08	23:01:47	1	RAMOGE08	180923225252_01_photo	1			914.29			1	specify type using TGML list					
			23:02:13	2	RAMOGE08	180923225252_01_photo	2			914.57			1						
			23:12:03	3	RAMOGE08	180923225252_01_photo	3			887.73			10	pile					
		RAMOGE08	23:31:57	1	RAMOGE08	180923232252_01_photo	1			797.68			1						
		RAMOGE08	23:55:26	1	RAMOGE08	180923235253_01_photo	1			761.5			1						
		RAMOGE08	rien										0						
		RAMOGE08	1:10:22	1	RAMOGE08	180924005254_01_photo	1			595.91			1						
						if more than 1 camera													
																injury			
													0= NO litter		1= yes, 0 = No	entanglement			
													1= One item			substrate			
													2= 2 to 10			etc. use TGML types of injuries			
													10= more than ten (accumulation)						
								If transect are used without poisitionning system , results must be reported by nb items/ distance											

Fig. 4. Example of data format from Ramoge Cruise

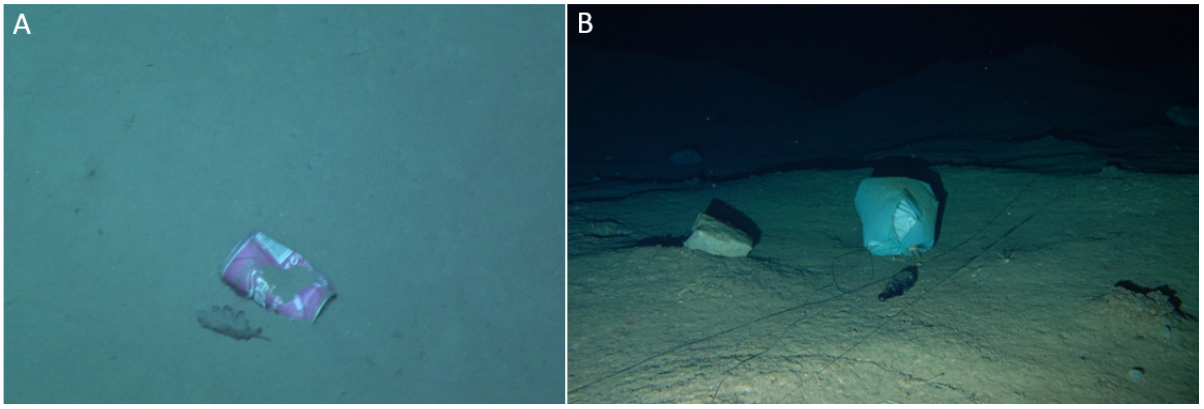


Fig. 5. Examples of litter laying on the bottom: A) Can laying on the bottom; B) Discarded sac and bottle and line laying on the bottom. Photo A) by ROV VICTOR/ IFREMER, Cruise RAMOGE 2018 and by Simonepietro Canese; B) Photo by ROV Pollux III / ISPRA, Cruise Red Coral 2012.

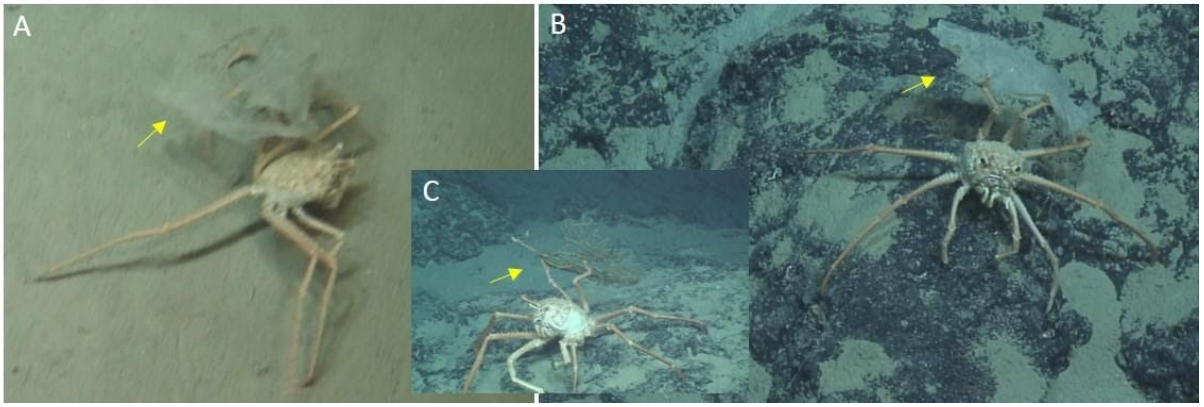


Fig. 6. Examples of Adaptive behavior. A-B) The crab Paromola cuvieri was observed carrying plastic on its exoskeleton (yellow arrow), instead of usual sponges or gorgonians (7C, yellow arrow). Photo by ROV VICTOR/ IFREMER, Cruise RAMOGE 2018.

ISPRA institute example

Ispra provided a dataset as an example of their experience on seafloor images information. In the example the following information are provided (Annex B):

- year
- campaign
- place
- dive
- picture n.
- date
- time
- latitude
- longitude
- depth
- litter items

3. EMODnet Chemistry seafloor images data management proposal

The comparison between the previous experiences of seafloor images campaigns together with data management and suggestions from relevant experts highlighted a set of significant information to be managed:

- Date and time
- Position (lat, lon)
- Depth
- Substrate (EN ISO 14688-1 classification- Particle size fractions and categories of seabed substrate for visual surveys of the seabed from “Water quality - Visual seabed surveys using remotely operated and/or towed observation gear for collection of environmental data” or SeaDataNet vocabularies:
    - GS3 (lithology classes):https://vocab.seadatanet.org/v_bodc_vocab_v2/search.asp?lib=GS3
    - GS5(grains descriptor): https://vocab.seadatanet.org/v_bodc_vocab_v2/search.asp?lib=GS4
    - GS6 (grains descriptor): https://vocab.seadatanet.org/v_bodc_vocab_v2/search.asp?lib=GS6)
- Litter information:
    - Items list/protocol (TG-ML litter reference list, compatible with all RSCs lists)
    - Litter item type
    - Litter item number
- Entanglement information:
    - Entanglement yes/no
    - Entanglement type (vocabulary tbd)
    - Entanglement species (SeaDataNet vocabulary S25, BODC parameter semantic model biological entity names)
    - Entanglement n. of organisms
- Link to picture
- Link to movie
- Instrument (SeaDataNet vocabularies L05 or L22, depending if the information will be described on the metadata or on the data format or both)
- Originator Institute (EDMO catalogue)
- Collator Institute (EDMO catalogue)
- Data policy (SeaDataNet vocabulary L08, Data Access Restriction Policies)
- Comments

As for the previous experiences, the principle is to adopt and adapt (if necessary) the available formats to manage the highlighted information. Otherwise a new format based on the best practices is produced.
The present proposal is to:

- handle all the possible metadata with the Common Data Indexes for online metadata publishing
- handle the data with a xls type file to avoid modifying the litter ODV format (details below)

CDI format for metadata

CDI format (https://www.seadatanet.org/Standards/Metadata-formats/CDI) is already used to manage and publish on line the metadata of the other data types. It would fit well also for seafloor images. The comparison with the recent CDI format reveals that all the mandatory and some of the not-mandatory fields can be filled.

CDI MANDATORY FIELD (mandatory in **bold**)
START AND END DATE (AND TIME)
GEOGRAPHICAL COVERAGE (LAT/LON)
MINIMUM/MAXIMUM DEPTH OF OBSERVATION
INSTRUMENT (L05)
ORIGINATORS OF THE DATASET **Role = originator (fixed) (EDMO)**
METADATA CREATING ORGANISATION **Role = pointOfContact (EDMO)**
DATASET ACCESS RESTRICTIONS (L08)
MEASURING AREA TYPE
DATUM OF COORDINATE SYSTEM
NAME/ALTERNATIVE NAME OF THE DATASET
DATASET-ID
ABSTRACT ON DATASET
ORGANISATION MANAGING THE DATASET **Role =custodian (EDMO)**
PARAMETERS P02:SLIT; Sea-floor litter; abundanceSeaFloorLitterParameters describing the abundance and nature of litter data collected on the seabed
PLATFORM (L06)
STATION NAME and/or CRUISE NAME

ORGANISATION DISTRIBUTING THE DATASET **Role ="distributor" (EDMO)**
DATAFORMAT

Of the previous mandatory fields:

- area type needs to be clarified (points or trajectories)
- the platform type needs to be clarified (ship, underwater vehicle)

Seafloor images data format

For the data handling a first comparison with the litter ODV format has been done. The results are:

- all the mandatory ODV default fields can be easily filled
- there is a number of mandatory fields in ODV microlitter (net opening, mesh size,...) that are specific for floating microlitter surveys and it is not possible to fill them
- not all the additional/optional litter ODV fields can be filled

Consequently, in order to avoid the modification of either ODV or ODV microlitter formats to fit this new data type, the proposal is to generate a new format (based on xls) that contains the following information:

field	content	mandatory (y/n)	comments
Date		y	
Position	(lat/lon/datum)	y	
Depth		y	
Substrate		n	(EN ISO 14688-1 classification- Particle size fractions and categories of seabed substrate for visual surveys of the seabed from "Water quality - Visual seabed surveys using remotely operated and/or towed observation gear for collection of environmental

			data" or SND vocabularies GS 3 or 5 or 6)
Litter protocol/list		y	(TG-ML list or other lists)
Litter item code		y	
Number of items		y	class of numerosity like Ramoge example or number of items?
Entaglements/interactions	yes/no	n	
Entaglements/interactions	type	n	
Entaglements/interactions	nb of species	n	
Entaglements/interactions	species	n	(SDN vocabulary S25 BODC parameter semantic model biological entity names)
Link to pictures		y/n	
Link to movies		y/n	
Link to map?		y	
instrument	L0?! vocab	y	(SDN vocabulary L05 or L22 depending if the information will be managed in CDIs or data format)
originator	edmo	y	(EDMO catalogue)
collator	edmo	y	(EDMO catalogue)
data policy	sdn vocab	y	(L08 SeaDataNet Data Access Restriction Policies vocabulary)
comments		n	

The proposal is to develop a central database at OGS for the storing, management and access to the relevant information while access to pictures from the seafloor and access to the related videos will be responsibility of the data providers, as well as to keep up to date the link to reach the information.

It seems a good compromise to leave the storing and access of the images and videos to the data providers, who will be responsible for storing and giving access to data and to keep up to date the link to reach it.

Information about entanglement has been included as optional fields because it is not the main scope of EMODnet Chemistry infrastructure. Nevertheless if available it could be managed.

A comparison with Dali (http://doc.e-is.pro/dali/) strategy for seafloor images data management has been suggested. Unfortunately, the information is still under development and will not be available before the first months of 2021.
If the relevant groups of interest (TWG,...) accept this proposal , EMODnet Chemistry will further develop the plan with a detailed description of the data management through a centralized database (like for beach and seafloor litter).

This choice of centralized data management, compared to the distributed solution of usual SDN/EMODnet infrastructure, shows pros and cons.
The workload (especially in the starting phase when format, database, validation tools and guidelines need to be set up) will be high and concentrated in a single NODC (OGS), thus requiring a team of skilled/experienced people to deal with it. Nevertheless, the centralized approach provides a quick flexibility which is very relevant in the starting phase. Additionally, the central database provides the chance to adapt the outputs to the needs of specific stakeholders (JRC example for beach litter baselines). Having the images and video stored at the data centers keeps the distributed approach for the “data” and overcomes possible policy issues,

References

Galgani, F., Hanke, G., Werner, S., Oosterbaan, L., Nilsson, P., Fleet, D., Kinsey, S., Thompson, R., Van Franeker, J., Vlachogianni, T., Scoullos, S., Mira Veiga, J., Palatinus, A., Matiddi, M., Maes, T., Korpinen, S., Budziak, A., Leslie, H., Gago, J., Liebezeit, G., 2013b. Monitoring Guidance for Marine Litter in European Seas. MSFD GES Technical Subgroup on Marine Litter (TSG-ML). Final report, 120 pages. https://mcc.jrc.ec.europa.eu/documents/201702074014.pdf

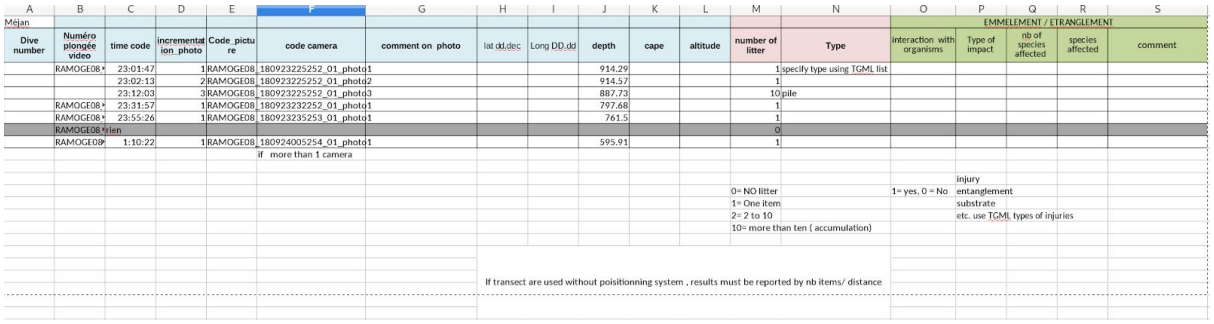
"Water quality - Visual seabed surveys using remotely operated and/or towed observation gear for collection of environmental data"

RAMOGE (ROUANET E., SCHOHN T., and all participants). Campagne océanographique d'exploration de canyons et monts sous-marins de la zone de l'Accord RAMOGE « RAMOGE EXPLO 2018 » Rapport final. Accord RAMOGE – Agence Française pour la Biodiversité & GIS Posidonie. 51 p + 5 annexes. http://www.ramoge.org/Medias/Abysses/RAMOGE_EXPLO_2018_Rapport_final.pdfRamoge Cruise...

Miquel Canals et al 2020. The quest for seafloor macrolitter: a critical review of background knowledge, current methods and future prospects Environ. Res. Lett. in press https://doi.org/10.1088/1748-9326/abc6d4

Annexes

Annex A: Ramoge cruise example



Dive number	Numéro plongée video	time code	incrementation_photo	Code_picture	code camera	comment on photo	lat dd.dec	Long DD.dd	depth	cape	altitude	number of litter	Type	EMMELEMENT / ETRANGLEMENT: interaction with organisms	Type of impact	nb of species affected	species affected	comment
Méjan																		
	RAMOGE08_	23:01:47	1	RAMOGE08_	180923225252_01_photo	1			914.29			1	specify type using TGML list					
		23:02:13	2	RAMOGE08_	180923225252_01_photo	2			914.57			1						
		23:12:03	3	RAMOGE08_	180923225252_01_photo	3			887.73			10	pile					
	RAMOGE08_	23:31:57	1	RAMOGE08_	180923232252_01_photo	1			797.68			1						
	RAMOGE08_	23:55:26	1	RAMOGE08_	180923235253_01_photo	1			761.5			1						
	RAMOGE08_	rien										0						
	RAMOGE08_	1:10:22	1	RAMOGE08_	180924005254_01_photo	1			595.91			1						
					if more than 1 camera													
															injury			
												0= NO litter		1= yes, 0 = No	entanglement			
												1= One item			substrate			
												2= 2 to 10			etc. use TGML types of injuries			
												10= more than ten (accumulation)						
						If transect are used without poisitionning system , results must be reported by nb items/ distance													

Annex B: Ispra example

anno	campagna	siti	dive	n foto	data	ora	lat	long	prof	rifiuti*
2009	Golfo di Napoli	punto_4_ischia	PR_04	DSC_4547	11/21/2009	5:29:49 PM	40,6893439	13,89370915	-117,67	reti
2010	Golfo di Napoli	Torre di Grado (Praiano)	COR_3a	DSC_7895	7/1/2010	10:05:17 AM	40,6072550615	14,5209537282	-93,27	bottiglia
2010	Golfo di Napoli	Scoglio D'Isca	COR_5a	DSC_8088	7/1/2010	4:22:00 PM	40,6055005000	14,5291315000	-83,63	reti
2010	Golfo di Napoli	Scoglio D'Isca	COR_5b	DSC_8154	7/1/2010	5:29:00 PM	40,6058714799	14,5282111999	-60,90	cima/ancora
2010	Golfo di Napoli	Punta S. Angelo (Ischia 2) fuori AMP	COR_9a	DSC_8610	7/3/2010	4:45:15 PM	40,6894938000	13,8938638000	-81,29000	reti
2011	Mar di Sardegna	Capo Boi	SAR2	DSC_4573	10/6/2011	4:48:05 PM	39,10773393	9,428877967	-185,57	reti/cestino plastica
2011	corallo rosso	SW Cavoli	SAR7	DSC_4826	10/7/2011	11:52:59 AM	39,06710792	9,497312083	-118,09	bottiglia
2011	corallo rosso	Porto corallo 5	SAR14	DSC_5358	10/12/2011	2:03:50 PM	39,4283508	9,792517033	-89,66	cima
2011	corallo rosso	Toro 1	SAR26	DSC_5917	10/18/2011	1:43:43 PM	38,834346848	8,4615748	-96,325	reti/nasse
2018	Tyrrhenian Sea	Marettimo Bank	D12	Capture0000 0614	7/16/2018	15:10:53	38°09'4.4''	12°06'19.2''	-237,1951141	lenze

2018	Tyrrhenian Sea	Marettimo Bank	D12	Capture0000 0752	7/16/2018	15:22:52	38°09'5.1''	12°06'21.0''	-237,1890564	lenze
2018	Tyrrhenian Sea	Marettimo Bank	D12	Capture0000 0851	7/16/2018	15:30:32	38°09'5.7''	12°06'21.5''	-239,5063324	lenze
2018	Tyrrhenian Sea	Marettimo Bank	D12	Capture0000 1035	7/16/2018	15:43:40	38°09'6.0''	12°06'21.2''	-235,0125275	cime
2018	Tyrrhenian Sea	Marettimo Bank	D12	Capture0000 1058	7/16/2018	16:50:40	38°09'7.5''	12°06'22.0''	-237,5575256	mattone/cime

Annex C: EMODnet Chemistry, background table for data management

field	content	comments
Date		
Position	(lat/lon/reference system)	
Depth		
Substrate?	vocab? list?	(Jamstec manages it) -from Francois pubblication EN ISO 14688-1 classification- Particle size fractions and categories of seabed substrate for visual surveys of the seabed or SDN-vocabs-GS 3-5-6??? http://seadatanet.maris2.nl/v_bodc_vocab_v2/browse.asp?order=conceptid&formname=search&screen=0&lib=gs3&v0_0=&v1_0=conceptid%2Cpreflabel%2Caltlabel%2Cdefinition%2Cmodified&v2_0=0&v0_1=&v1_1=conceptid&v2_1=3&v0_2=&v1_2=preflabel&v2_2=3&v0_3=&v1_3=altlabel&v2_3=3&v0_4=&v1_4=modified&v2_4=9&v0_5=&v1_5=modified&v2_5=10&x=53&y=31&v1_6=&v2_6=&v1_7=&v2_7=
Litter items, which protocol/list/codes?		(...seems that TGML list is used...)
Number of items		classes of numerosity like ramoge example?
Entaglements/interactions?	yes/no	(Jamstec seems doesn't manages it)...TGML type of entaglements/injuries!?
Entaglements/interactions?	type	(Jamstec seems doesn't manages it)...TGML type of entaglements/injuries!?

Entaglements/interactions?	nb of species	
Entaglements/interactions?	species	vocab? S25 biological entities? http://seadatanet.maris2.nl/v_bodc_vocab_v2/browse.asp?order=conceptid&formname=search&screen=0&lib=s25&v0_0=&v1_0=conceptid%2Cpreflabel%2Caltlabel%2Cdefinition%2Cmodified&v2_0=0&v0_4=&v1_4=modified&v2_4=9&v0_5=&v1_5=modified&v2_5=10&x=39&y=23&v1_6=&v2_6=&v1_7=&v2_7=
Link to pictures		(Jamstec manages it)
Link to movies?		(Jamstec manages it) how to handle videos?
Link to map?		(Jamstec manages it)
instrument	L0?! vocab	
originator	edmo	
collator	edmo	
data policy	sdn vocab	
comments		
Other…?		