

Supplementary Materials for **Unveiling the role and life strategies of viruses from the surface to the dark ocean**

Elena Lara, Dolors Vaqué, Elisabet Laia Sà, Julia A. Boras, Ana Gomes, Encarna Borrull, Cristina Díez-Vives, Eva Teira, Massimo C. Pernice, Francisca C. Garcia, Irene Forn, Yaiza M. Castillo, Aida Peiró, Guillem Salazar, Xosé Anxelu G. Morán, Ramon Massana, Teresa S. Catalá, Gian Marco Luna, Susana Agustí, Marta Estrada, Josep M. Gasol, Carlos M. Duarte

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The PDF file includes:

- table S1. Mean, SE, median, minimum, and maximum values of viral abundance in each of the water masses identified in the mesopelagic layer (200 to 1000 m).
- table S2. Mean, SE, median, minimum, and maximum values of viral abundance according to the water masses in the bathypelagic layer (1000 to 4000 m).
- table S3. Results of the multivariate multiple regression analyses to explain variability of viral abundance in the epipelagic layer (0 to 200 m).
- table S4. Results of the multivariate multiple regression analyses to explain variability of viral abundance in the mesopelagic layer (200 to 1000 m).
- table S5. Results of the multivariate multiple regression analyses to explain variability of viral abundance in the bathypelagic layer (1000 to 4000 m).
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- fig. S1. Viral abundance with depth along the entire cruise visualized with Ocean Data View.
- fig. S2. VP_L and VP_{LG} and prokaryotic mortality due to viruses.

Other Supplementary Material for this manuscript includes the following:

(available at advances.sciencemag.org/cgi/content/full/3/9/e1602565/DC1)

- data file S1 (Microsoft Excel format). List of all the environmental and biological variables used in this study.

SUPPLEMENTARY INFORMATION

table S1. Mean, SE, median, minimum, and maximum values of viral abundance in each of the water masses identified in the mesopelagic layer (200 to 1000 m).

	Vol (%)	Mean (10⁶ vir ml⁻¹)	SE (10⁵ vir ml⁻¹)	Median (10⁶ vir ml⁻¹)	Min (10⁵ vir ml⁻¹)	Max (10⁶ vir ml⁻¹)
13EqAtl	1.9	0.90	1.93	1.07	2.51	1.66
13EqPac	6.0	2.21	5.93	1.26	1.45	13.50
AAIW	8.6	0.81	0.70	0.81	1.23	1.82
CMW_N Pac	2.8	1.32	2.53	1.20	6.76	3.02
ENACW	5.1	0.93	1.20	0.81	1.23	2.51
ICW_13	4.1	3.93	23.60	1.57	7.76	25.10
NPIW	6.5	1.00	1.45	0.80	1.86	3.47
SACW	1.6	1.66	4.56	1.69	0.85	3.24
SAMW	11.3	1.58	2.22	1.33	0.15	8.13
SPCW_20	0.3	2.39	7.70	2.39	1.62	3.16

table S2. Mean, SE, median, minimum, and maximum values of viral abundance according to the water masses in the bathypelagic layer (1000 to 4000 m).

	Vol(%)	Mean (10⁶ vir ml⁻¹)	SE (10⁵ vir ml⁻¹)	Median (10⁶ vir ml⁻¹)	Min (10⁵ vir ml⁻¹)	Max (10⁶ vir ml⁻¹)
CDW	27	0.60	0.79	0.41	0.05	6.31
NADW	20.5	0.53	0.78	0.47	0.36	4.79
AABW	5.8	0.35	0.92	0.23	0.68	0.83

table S3. Results of the multivariate multiple regression analyses to explain variability of viral abundance in the epipelagic layer (0 to 200 m). The biological and environmental variables used were: temperature, salinity, AOU (apparent oxygen utilization), Chlorophyll *a* concentration, total prokaryotic abundance and PHP (prokaryotic heterotrophic production), heterotrophic pico/nanoflagellates (HP), *Synechococcus*, *Prochlorococcus*, and picoeukaryote abundances. Only the significantly correlated variables are listed in the table. ALL (All data), ATL (Atlantic Ocean), IN (Indian Ocean), PAC (Pacific Ocean), AOU (Apparent Oxygen Utilization), Chl *a* (Chlorophyll *a* concentration), Syne (*Synechococcus* abundance), Prok (Prokaryotic abundance), PHP (Prokaryotic heterotrophic production), Pico (Picoeukaryote abundances).

Oceans	n	R ²	F-ratio	Parameter	Coefficients	Prob > t	Std Beta
ALL	494	0.29	49.1	Intercept	8.92	<0.0001	0
				Salinity	-0.06	<0.0001	-0.17
				AOU	-0.001	0.001	-0.14
				Chl <i>a</i>	0.38	<0.0001	0.38
				Syne	0.11	<0.0001	0.28
ATL	199	0.53	42.65	Intercept	7.85	<0.0001	0
				Temperature	0.01	0.005	0.17
				Salinity	-0.1	<0.0001	-0.19
				Chl <i>a</i>	0.41	<0.0001	0.44
				Prok	0.41	<0.0001	0.25
				Syne	0.08	0.002	0.21
IN	151	0.32	17.23	Intercept	6.050	<0.0001	0
				Temperature	-0.030	0.002	-0.31
				Chl <i>a</i>	0.210	0.005	0.23
				PHP	0.110	0.006	0.2
				Prok	0.300	0.0002	0.27
PAC	159	0.34	19.94	Intercept	5.07	<0.0001	0
				Temperature	0.04	<0.0001	0.52
				AOU	0.001	0.0007	0.41
				Syne	0.11	0.0006	0.28
				Pico	0.12	0.003	0.23

table S4. Results of the multivariate multiple regression analyses to explain variability of viral abundance in the mesopelagic layer (200 to 1000 m). The biological and environmental variables used were: temperature, salinity, AOU (Apparent Oxygen Utilization), total prokaryotic abundance, PHP (Prokaryotic Heterotrophic Production) and heterotrophic pico/nanoflagellates abundance (HP). Only the significant correlated variables are listed in the table. ALL (All data), ATL (Atlantic Ocean), IN (Indian Ocean), PAC (Pacific Ocean), Prok (Prokaryotic abundance), PHP (Prokaryotic heterotrophic production), HP (Heterotrophic protists).

Oceans	n	R ²	F-ratio	Parameter	Coefficients	Prob > t	Std Beta
ALL	157	0.33	25.39	Intercept	2.94	<0.0001	0
				PHP	0.13	0.002	0.22
				HP	0.23	0.03	0.16
				Prok	0.57	<0.0001	0.46
ATL	76	0.36	20.63	Intercept	2.75	<0.0001	0
				PHP	0.13	0.02	0.23
				Prok	0.67	<0.0001	0.51
IN	60	0.17	12.18	Intercept	6.34	<0.0001	0
				AOU	-0.005	<0.0001	-0.41
PAC	47	0.40	9.40	Intercept	2.83	<0.0001	0
				PHP	0.27	0.02	0.31
				HP	0.40	0.04	0.26
				Prok	0.58	0.0002	0.50

table S5. Results of the multivariate multiple regression analyses to explain variability of viral abundance in the bathypelagic layer (1000 to 4000 m). The biological and environmental variables used were: temperature, salinity, AOU (Apparent Oxygen Utilization), total prokaryotic abundance, PHP (Prokaryotic Heterotrophic Production) and heterotrophic pico/nanoflagellates abundance (HP). Only the significant correlated variables are listed in the table. ALL (All data), ATL (Atlantic Ocean), IN (Indian Ocean), PAC (Pacific Ocean), AOU (Apparent Oxygen Utilization), Prok (Prokaryotic abundance).

Oceans	n	R ²	F-ratio	Parameter	Coefficients	Prob > t	Std Beta
ALL	210	0.11	12.27	Intercept	3.69	<0.0001	0
				Temperature	0.05	0.02	0.16
				Prok	0.37	<0.0001	0.27
ATL	89	0.13	13.4	Intercept	2.45	0.005	0
				Prok	0.7	<0.0001	0.36
IN	63	0.22	8.64	Intercept	59.46	<0.0001	0
				Salinity	-1.57	0.0002	-0.49
				AOU	0.005	0.001	0.33
PAC	58	0.12	7.81	Intercept	3.00	0.002	0
				Prok	0.53	0.007	0.35

table S6. Values of VPL and VPLG. Values of lytic and lysogenic viral production: mean (10^6 viruses $\text{ml}^{-1} \text{d}^{-1}$), standard error (10^5 viruses $\text{ml}^{-1} \text{d}^{-1}$), median (10^6 viruses $\text{ml}^{-1} \text{d}^{-1}$), minimum (10^5 viruses $\text{ml}^{-1} \text{d}^{-1}$) and maximum (10^7 viruses $\text{ml}^{-1} \text{d}^{-1}$); virus-mediated mortality (VMM) and protist-mediated mortality (PMM) as percentages of the prokaryotic standing stock (PSS) in the surface, DCM (Deep Chlorophyll Maximum) and bathypelagic layers at 11 selected stations: 4 in the Atlantic, 3 in the Indian Ocean, and 4 in the Pacific.

		LYSIS					LYSOGENY					VMM (%PSS)					PMM (%PSS)				
		Mean	SE	Median	Min	Max	Mean	SE	Median	Min	Max	Mean	SE	Median	Min	Max	Mean	SE	Median	Min	Max
SURFACE	ATL	1.84	7.80	0.56	2.32	0.82	4.51	13.60	6.32	0.05	90.90	6.02	2.42	2.15	0.45	25.82	25.00	3.71	27.00	12.00	43.00
	IN	20.40	103.00	17.50	0.12	6.79	60.00	324.00	0.32	0.05	20.70	36.72	18.40	0.46	0.02	121.82	3.00	0.30	3.00	2.70	3.30
	PAC	8.23	18.60	6.75	7.15	1.96	10.50	44.70	3.43	5.23	3.74	30.69	4.48	33.53	10.85	57.09	27.36	7.42	19.50	5.90	61.00
	ALL	9.12	0.30	2.98	0.12	6.79	22.40	100.00	3.43	0.05	207.00	22.76	5.33	13.03	0.02	121.82	23.61	3.97	19.50	2.70	61.00
DCM	ATL	18.50	69.40	4.34	1.73	6.14	22.70	156.00	3.79	1.85	14.20	14.40	3.47	12.94	0.75	36.52	20.04	4.45	18.00	8.30	40.00
	IN	0.56	2.05	0.44	0.12	0.13	9.13	57.10	4.91	0.11	3.66	31.57	10.04	27.52	0.54	60.85	47.16	46.84	47.16	0.32	94.00
	PAC	1.80	32.50	15.70	41.40	3.57	7.79	37.00	2.97	0.40	2.53	18.80	4.06	11.96	6.46	46.53	41.88	4.97	39.50	21.00	67.00
	ALL	14.70	32.60	6.01	0.12	6.14	14.30	66.00	3.38	0.11	14.20	19.59	3.03	13.66	0.54	60.85	33.51	5.69	33.00	0.32	94.00
BATHYPELAGIC	ATL	1.28	3.50	1.14	0.03	0.36	0.05	0.47	0.00	0.00	0.01	16.91	5.25	12.88	0.00	52.91	0.31	0.04	0.32	0.16	0.42
	IN	0.15	0.23	0.17	0.46	0.02	2.39	9.63	3.19	0.85	0.48	4.72	1.00	4.00	1.77	8.78	0.28	0.10	0.28	0.09	0.50
	PAC	7.49	29.10	2.24	10.60	2.34	1.11	6.25	0.24	0.46	0.31	54.06	20.80	22.90	5.99	166.96	0.39	0.20	0.22	0.08	1.20
	ALL	3.44	12.90	1.25	0.03	2.34	1.36	4.88	0.16	0.004	0.48	26.56	8.58	8.81	0.00	167.00	0.33	0.07	0.29	0.09	1.20

table S7. Mean and SE of the estimated C, N, and P released by viruses and that incorporated by grazers in the three layers (surface, DCM, and bathypelagic).

	CARBON RELEASED BY VIRUSES ($\mu\text{g C L}^{-1} \text{d}^{-1}$)	CARBON INCORPORATED BY GRAZERS ($\mu\text{g C L}^{-1} \text{d}^{-1}$)	NITROGEN RELEASED BY VIRUSES ($\mu\text{g N L}^{-1} \text{d}^{-1}$)	NITROGEN INCORPORATED BY GRAZERS ($\mu\text{g N L}^{-1} \text{d}^{-1}$)	PHOSPORUS RELEASED BY VIRUSES ($\mu\text{g P L}^{-1} \text{d}^{-1}$)	PHOSPORUS INCORPORATED BY GRAZERS ($\mu\text{g P L}^{-1} \text{d}^{-1}$)
SURFACE	1.15 (\pm 0.25)	1.15 (\pm 0.19)	0.22 (\pm 0.05)	0.22 (\pm 0.04)	0.04 (\pm 0.008)	0.04 (\pm 0.0003)
DCM	0.94 (\pm 0.17)	1.83 (\pm 0.33)	0.18 (\pm 0.03)	0.35 (\pm 0.06)	0.03 (\pm 0.005)	0.06 (\pm 0.004)
BATHYPELAGIC	0.15 (\pm 0.05)	0.002 (\pm 0.001)	0.03 (\pm 0.008)	0.0005 (\pm 0.0002)	0.005 (\pm 0.002)	0.00005 (\pm 0.00004)

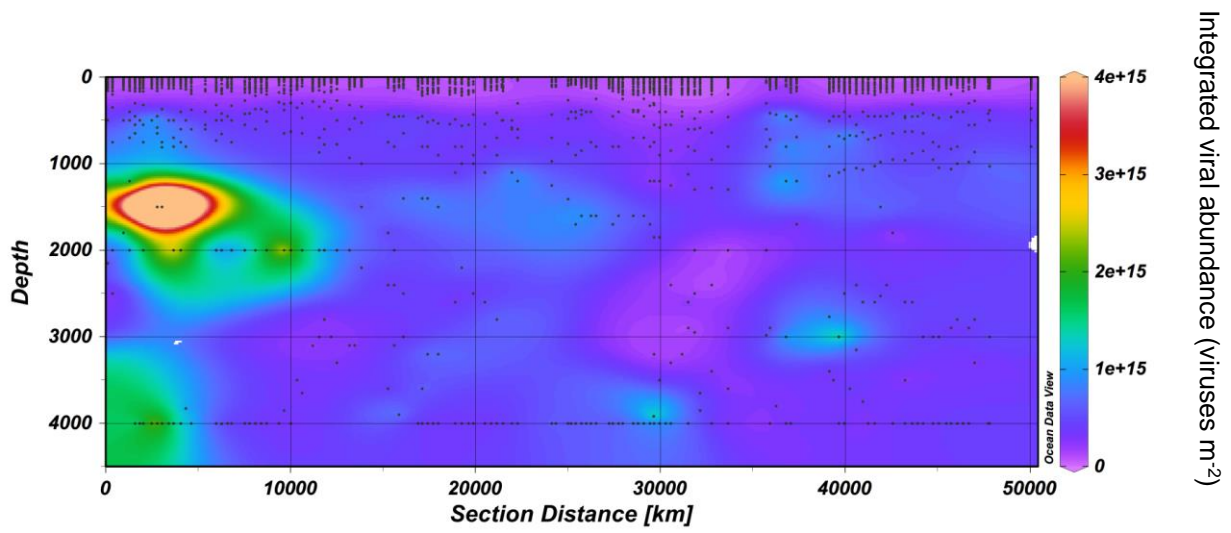


fig. S1. Viral abundance with depth along the entire cruise visualized with Ocean Data View. The track is separated in the oceanic regions indicated in Figure 1A. Small dots indicate sampling points.

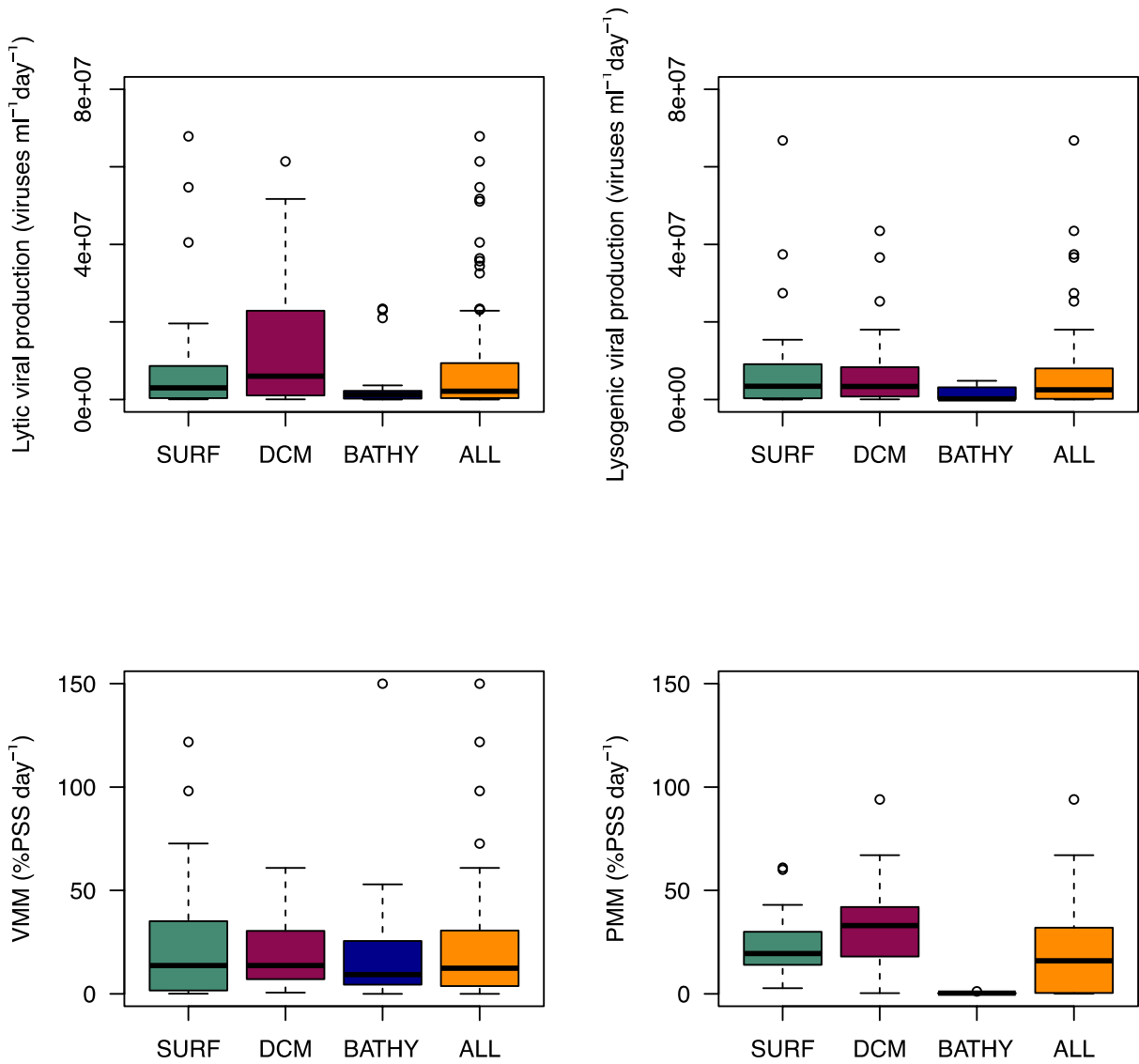


fig. S2. VPL and VPLG and prokaryotic mortality due to viruses. Lytic and lysogenic viral production at (A, B) the surface, the DCM (Deep Chlorophyll Maximum) and 4,000 m depth in 11 selected stations: 4 in the Atlantic, 3 in the Indian Ocean and 4 in the Pacific. Virus-mediated mortality (VMM) and protist-mediated mortality (PMM) expressed as percentages of the prokaryotic standing stock per day (PSS) at (C, D) the surface, DCM and bathypelagic layers. Also presented, all the data summarized from all the Tropical and Subtropical Ocean as ALL.