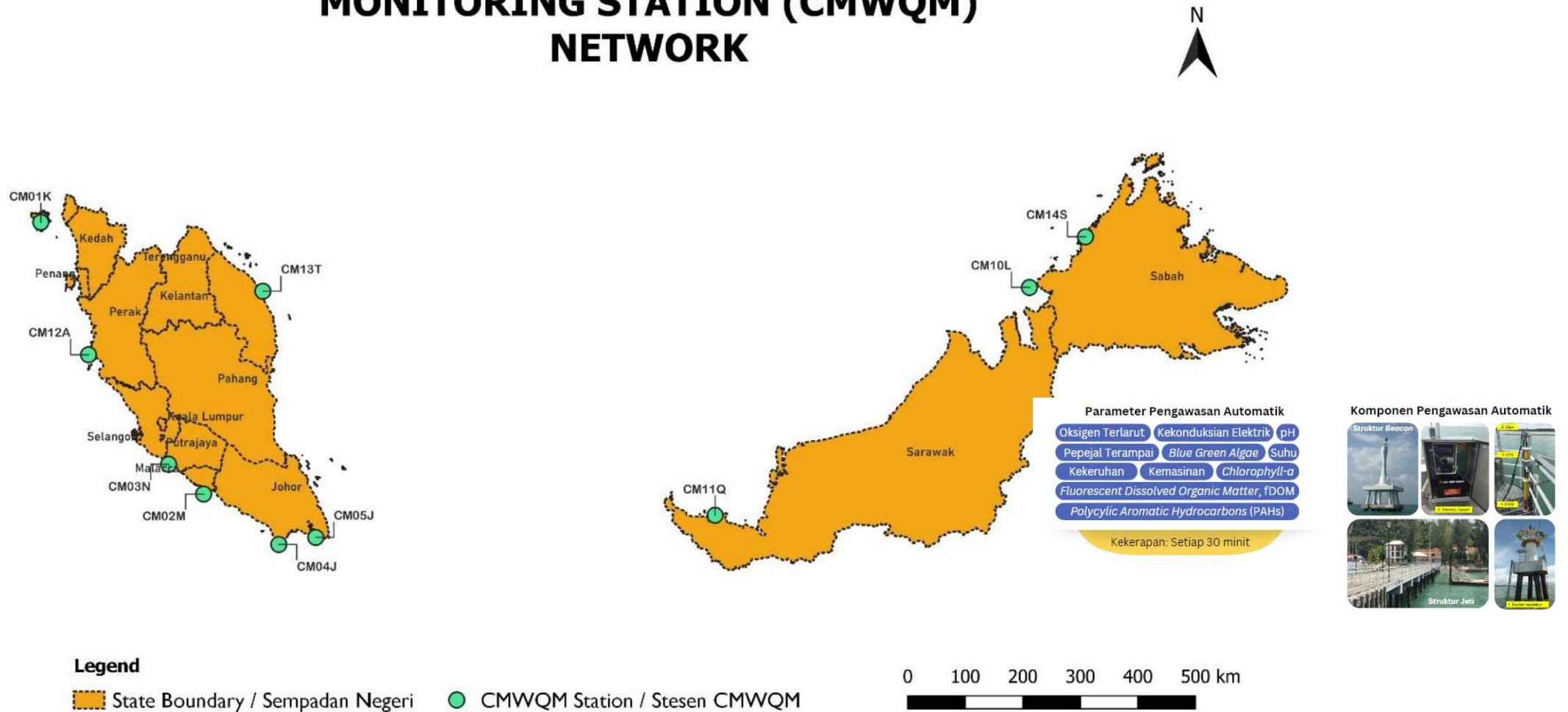




Penerimaan Data Nilai Negative bagi parameter chlorophyll-a,
kekeruhan dan fDOM yang dicerap dengan mengguna
Multiparameter Sonde YSI EXO2

Latar Belakang

CONTINUOUS MARINE WATER QUALITY MONITORING STATION (CMWQM) NETWORK



The Sensors



Quinine sulfate



styrene-divinylbenzene
copolymer beads



Rhodamine WT

Reported Value = Raw Signal – Calibration Baseline

The EXO2's fDOM sensor employs a 370 nm LED to excite aromatic organic compounds, primarily humic and fulvic acids, with fluorescence detected at 460 nm. The raw signal follows:

$$S_{\text{raw}} = \Phi \cdot I_{\text{LED}} \cdot [\text{fDOM}] \cdot e^{-(\alpha_{\text{water}} + \alpha_{\text{CDOM}})d}$$

where Φ is quantum yield, I_{LED} is excitation intensity, and α terms represent water and CDOM absorption over pathlength d . In ultra-clear waters (CDOM absorption $< 0.1 \text{ m}^{-1}$ at 370 nm), S_{raw} approaches the system's detection limit of 0.03 RFU, amplifying calibration artifacts

The EXO2's turbidity sensor employs a 860 ± 15 nm infrared light-emitting diode (LED) to illuminate water samples, with a photodetector positioned at a 90° angle to quantify scattered light intensity. This configuration adheres to ISO 7027 standards for formazin nephelometric units (FNU), where zero FNU corresponds to ultrapure water. The sensor's output follows the relationship:

$$\text{Turbidity} = k \cdot \frac{I_{\text{scattered}}}{I_{\text{reference}}}$$

Optical sensors require periodic zero-point calibration using certified standards. The EXO2 platform's calibration routine establishes a baseline by correlating raw sensor output to known reference values

The chlorophyll-a sensor utilizes a 460 nm LED to excite chlorophyll molecules, with emitted fluorescence detected at 680 nm. The raw fluorescence signal (S_{raw}) follows:

$$S_{\text{raw}} = \Phi \cdot I_{\text{LED}} \cdot [\text{Chl-a}] \cdot e^{-(\alpha_{\text{water}} + \alpha_{\text{CDOM}})d} + B_{\text{dark}}$$

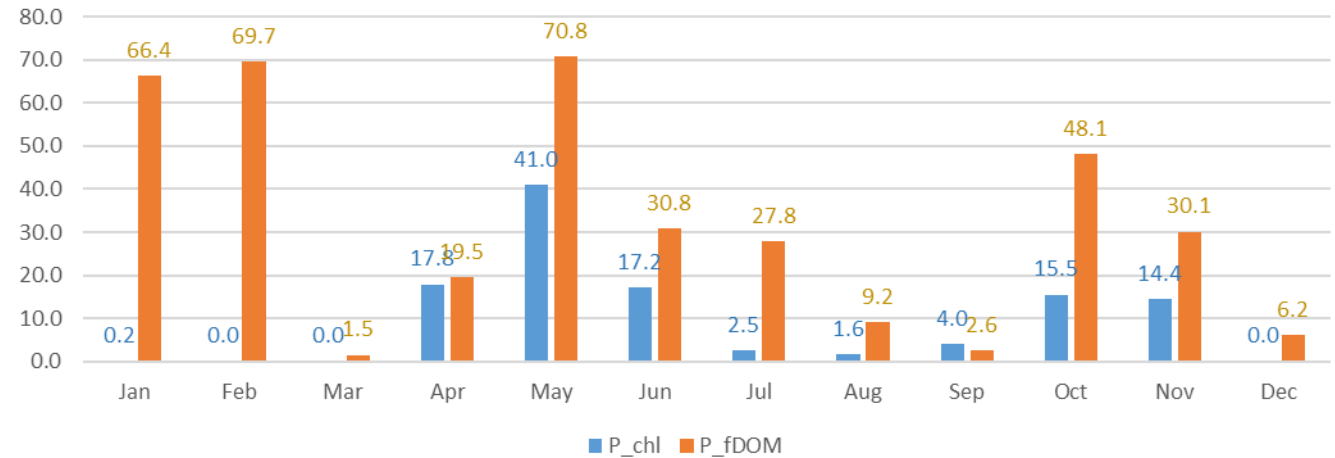
where Φ is quantum yield, I_{LED} is excitation intensity, and B_{dark} represents the sensor's electronic noise floor.

The Stations

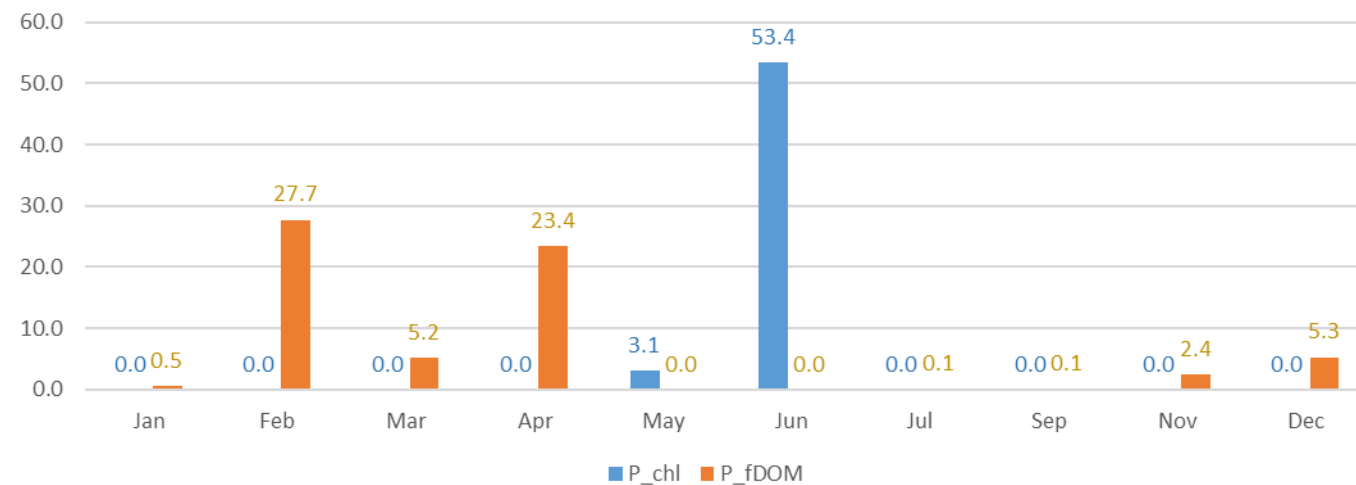
2024

Station	Count of -ve Chlorophyll a	Count of -ve fDOM
CM01K	2 (0.01%)	676 (03.86%)
CM02M	48 (0.27%)	822 (04.69%)
CM03N	2 (0.01%)	367 (02.09%)
CM04J	813 (4.64%)	930 (05.31%)
CM05J	2 (0.01%)	567 (03.24%)
CM10L	7 (0.04%)	953 (05.44%)
CM10S	4 (0.02%)	930 (05.31%)
CM11Q	4 (0.02%)	40 (0.23%)
CM12A	43 (0.25%)	16 (0.09%)
CM13T	1644 (9.38%)	5511 (31.46%)
CM14S	6 (0.03%)	3534 (20.17%)
Grand Total	2575 (1.47%)	14346 (8.19%)

CR13T Pulau Kapas Terengganu



CR04J Pulau Kapas Terengganu

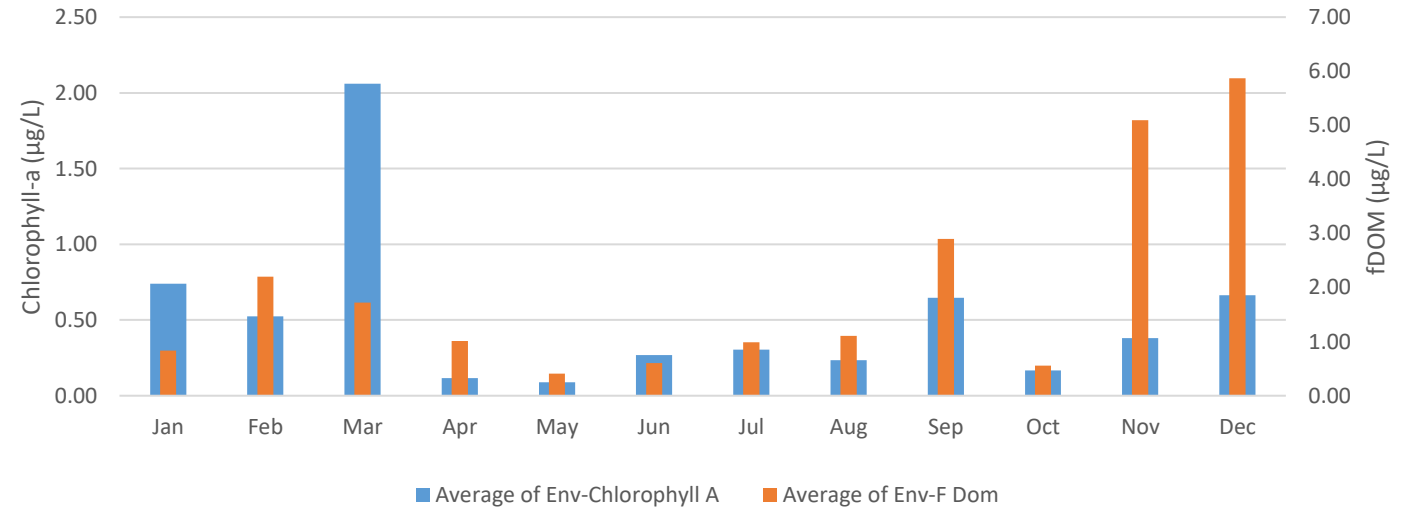




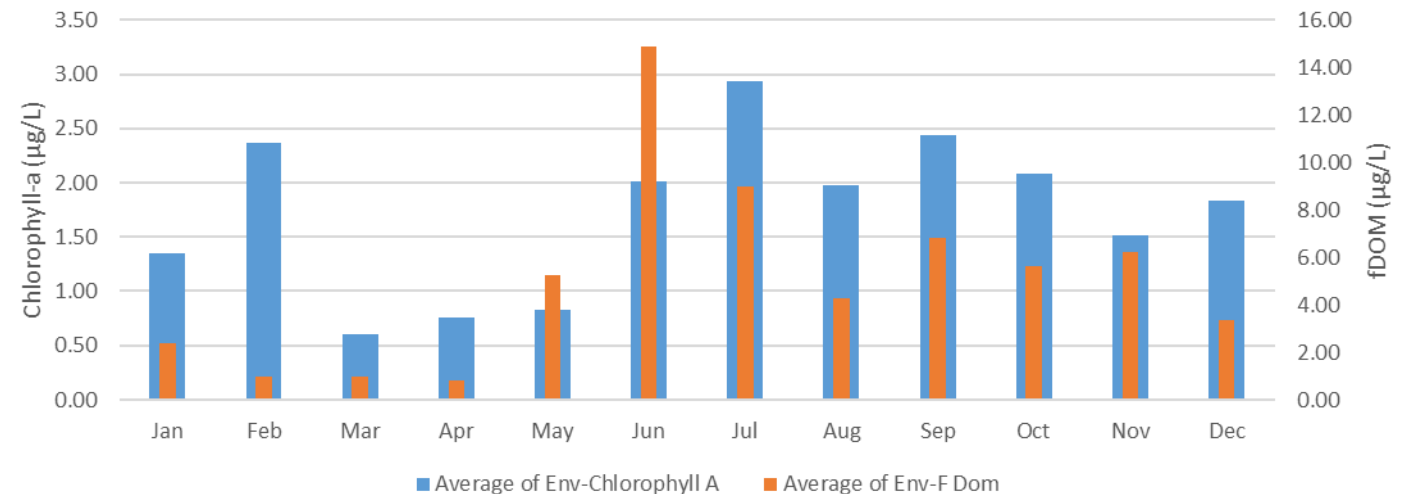
CR13T Pulau Kapas Terengganu

2024

STATION	Average Chlorophyll a (µg/L)	Average fDOM (µg/L)
CM01K	2.12	2.18
CM02M	0.60	5.47
CM03N	0.68	4.09
CM04J	1.71	5.28
CM05J	1.41	4.61
CM10L	0.81	2.86
CM10S	1.44	1.39
CM11Q	1.00	11.89
CM12A	0.93	2.35
CM13T	0.56	2.22
CM14S	1.37	3.97
Grand Total	1.14	4.55



CR04J Pulau Kapas Terengganu



February 23, 2024

TO WHOM IT MAY CONCERN:

YSI, a Xylem brand, is the manufacturer of EXO multiparamter sondes and associated titanium-body digital smart sensors.

Optical EXO Sensors, including FDOM, turbidity, and Total Algae, can report measurement values of less than zero (0). This is an intentional feature in order to capture and understand sensor performance during measurement.

As stated in the published spec, the EXO FDOM sensor features a minimum detection limit of 0.1 ppb. This means the sensors cannot “see” FDOM values below 0.1 ppb; values smaller than this are understood to be zero. However, EXO firmware and software allow measurement values to be reported down to 0.01 ppb; this is the resolution of the sensor.

It is considered normal behavior for a brand new, perfectly performing FDOM sensor to report negative values of a small proportion in pristine conditions. Anything below 0.10 ppb is effectively zero. Because the sensor can report values at a greater resolution than it can actually see, values below 0.10 ppb represent noise – the electrical signal or “hum” of the sensor during operation. A distribution of noise about zero should contain equal parts positive and equal parts negative; that is considered normal operation.

If you have any questions or concerns regarding FDOM sensor performance in very low concentrations, please feel free to contact me directly. I am happy to meet to explain this in greater detail.

Best Regards,



Zack Henderson
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Xylem Analytics
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	Chlorophyll-a	FDOM
Minimum value in database	-2	-7.12
1 percentile	-1.06	-5.1
Saranan	-1	-5

Syor

- Nilai bagi FDOM dalam julat 0.01 hingga -5 dianggap sebagai 0
- Nilai bagi chlorophyll-a dalam julat 0.01 hingga -1 dianggap sebagai 0