SDG Indicator 6.3.2 Technical Guidance Document No.7: Macroplastics

This document introduces the SDG Indicator 6.3.2 macroplastics methodology. This is a companion document to Introduction to SDG Indicator 6.3.2[1] and Technical Document Level 2 Monitoring[2] that can be found through the SDG Water Quality Hub[3].

This document outlines the rationale for monitoring macroplastics and describes how the data generated can be used for SDG Indicator 6.3.2 reporting as well as feed into national and regional reporting processes and frameworks aimed at reducing plastic pollution.

Why Macroplastics monitoring is necessary

Monitoring macroplastics supports efforts to address plastic pollution by providing information on potential sources and transport pathways. Of all plastic pollution, macroplastics represent the most substantial portion by mass. Their impact extends far beyond mere presence; macroplastics directly harm fauna and flora through entanglement, ingestion, and habitat destruction. Furthermore, the economic consequences are substantial, affecting fisheries, tourism, and coastal communities. Weathering and fragmentation of macroplastics into micro and nano plastics pose further risks to both ecosystem and human health.

Long-term monitoring programs provide valuable data on sources, distribution patterns, and degradation rates of macroplastics. This information is crucial for informing the design and implementation of targeted interventions. By providing a comprehensive understanding of the macroplastic pollution landscape, monitoring efforts enable the development of effective and sustainable solutions to this pervasive challenge. This data-driven approach is essential for evaluating the efficacy of implemented strategies and for adapting mitigation efforts to changing circumstances. In essence - macroplastic monitoring is a critical component of a holistic approach to tackling the complex and multifaceted issue of plastic pollution.

Alignment with the SDG Indicator 632 Methodology

Below is a summary of how this macroplastics methodology aligns with that of SDG Indicator 6.3.2 monitoring and reporting framework.

SDG Level 1 and Level 2 Reporting

Within the SDG Indicator 6.3.2 reporting framework there are two levels of reporting: Level 1 is the mandatory component that ensures the global comparability of the indicator by prescribing the measurement of standardised basic core parameters (nitrogen, phosphorus, pH, salinity and oxygen); whereas Level 2 is an additional option that provides countries with the flexibility to report including parameters that reflect pressures that may be of national or regional

[1] https://wwqa.info/knowledge-center/sdg632/SDG632_Introduction-to-the-Methodology/
[2] https://wwqa.info/knowledge-center/sdg632/SDG632_Technical Guidance-Document-No4-Level-2-Reporting
[3] https://sdg632hub.org/

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relevance. Examples of Level 2 reporting include additional parameters such as heavy metals, or using alternative approaches to monitoring such as satellite-based Earth Observation or biological approaches.

'Plastics' are listed as a Level 2 sub-indicator, and this technical document is concerned with macroplastics only. Other fractions of plastics are currently not included in this technical document.

Target value concept

SDG Indicator 6.3.2 uses a target-based approach to classify water quality. This means that the measured values are compared against numerical values that represent 'good ambient water quality'. These targets may be water quality standards that are defined by national legislation or they may be derived from knowledge of the natural or baseline status of water bodies.

Targets can be nation-wide values, or alternatively they can be water body-specific or even site-specific. The more specific a target, usually the better it is at identifying potential pollution problems. Currently, there are no established permissible limits or 'targets' for macroplastics for fresh waters, and setting a target of zero plastic may possibly be detrimental to plastic reduction efforts as in many cases, this target is unrealistic in the short to medium-term.

Water Body Classification

Water bodies are classified as either 'good or 'not good' based on the 80 per cent compliance of monitoring data compared to the respective target data.

- If 80 per cent more of the monitoring data meet their respective target data, the water body is classified as 'good'.
- Below 80 per cent and the water body is classified as 'not good'.
- This binary classification is only needed to meet the requirements of SDG reporting.

Macroplastics Methodology

This method is based on a visual counting method developed by WWQA Plastics Workstream.

This method focuses on floating, visible plastic items that are counted for a specified period of time. It does not include bank-side or submerged items, or any fractions of plastic that are not visible.

A single **monitoring event** is the collection of data from a single monitoring location on a particular day. The data generated from the monitoring event is recorded as macroplastic flux as 'items per hour' (items h^{-1}). This is calculated as the mean of **three** sequential **five minute** replicate counts. Rivers wider than 20 m require multiple observers or multiple observation points across the river with the observer measuring from each in sequence and data summed from each river section to calculate the overall 'measurement'.

Below is a detailed description of the SDG macroplastics methodology. This methodology must align with core concepts of SDG Level 1 methodology in terms of:

- **Water body types**: of the three water body types (rivers, lakes and groundwaters), the macroplastics methodology is relevant for rivers only.
- **Target value concept**: macroplastic count data are compared to site-specific level targets once they have been established during Year 1 of a project.
- **80 per cent compliance**: 80 per cent of measurements must meet the targets for a positive water quality classification.
- **Binary classification** (good vs not good): although more nuanced information is generated by the methodology, it must translatable into a 'good' versus 'not good' classification at the water body level.

Macroplastics Monitoring Programme Implementation

This macroplastics methodology can be integrated into the monitoring programmes of national authorities with the mandate to monitor their nation's rivers as it is these organisations that have the responsibility to report on this indicator for each Member State. This methodology can also be adopted by other organisation such as citizen science groups, NGOs or private sector and if applied consistently, the data generated can be combined with that of the national authority national authority and contribute to the national indicator submission.

Baseline, Initiation and Operational Phases

There are three phases of project implementation are 'baseline phase', 'initiation phase' and an 'operational phase'. The difference between the three phases in terms of data use and target setting are described in Figure 1 below.

Figure 1: Schematic of three phases of project implementation

Table 1 below provides detail of the phased nature of project implementation and illustrates which data are used to calculate the target and the which for the indicator.

Table 1: Schematic of how each year's data are used for target setting (blue) and indicator calculation (orange) across the three project phases

Project Phase	Year 1 Data	Year 2 Data	Year 3 Data	Year 4 Data	Year 5 Data	Year 6 Data	Year 7 Data
Baseline Phase: Year 1							
Initiation Phase 1: Year 2							
Initiation Phase 2: Year 3							
Operational Phase 1: Year 4							
Operational Phase 2: Year 5							
Operational Phase 3: Year 6							

Operational Phase 4: Year 7							

Note: Considering both target setting data, and indicator calculation data over the three-year period rather than a single year, means that the trend information generated is more robust. This is because the indicator is calculated from 36 measurements rather than twelve, so any inter-annual variation will be smoothed – for example if there was a particularly wet or dry year.

Water Body Classification

To meet the requirements of SDG Indicator 6.3.2 reporting, water bodies must be classified as either 'good or 'not good' based on the 80 per cent compliance of monitoring data compared to the respective target data. But, in addition to the binary classification, the per cent compliance generated by the indicator allows more nuanced information to be generated that can be used to track progress of efforts to reduce plastic pollution.

Figure 2 below shows how over time, the per cent compliance score for 12 monitoring locations changes. Within the SDG framework, only when the per cent compliance reaches 80, would the water body be classified as good, but as illustrated, the progressive degradation followed by improvement can be tracked, which in turn makes clear when the 'good' water quality threshold has been reached.

Annex 1 details an example of how the macroplastics methodology guidelines could be implemented by a national agency operating the methodology in a single river basin where an ambient water quality monitoring programme was already in operation.

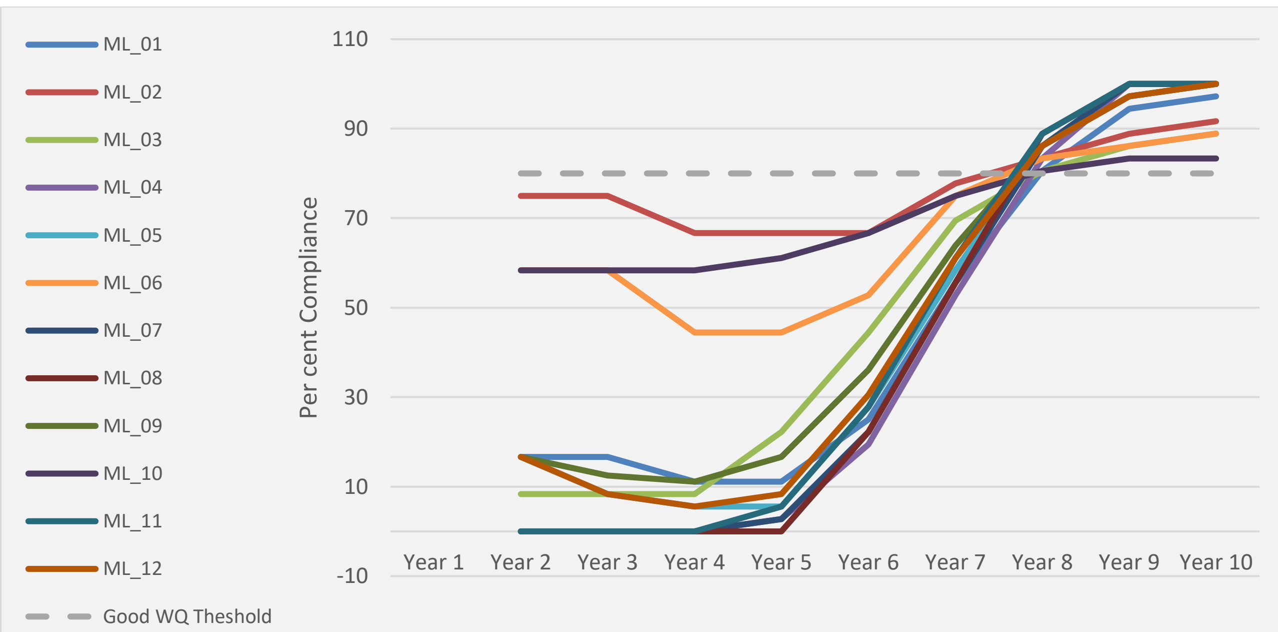

Figure 2: Per cent compliance of macroplastic indicator over a ten-year period

Additional Information Generated

In addition to the indicator score which is based on the binary classification only, much more information can be generated from this indicator methodology that can be used for management.

Five-point classification: Applying the binary approach, a water body that has a per cent compliance of 79 would be classified the same as one that scores 5 – 'not good'. But if the same per cent compliance data were applied to a five-point classification system (Figure 3), greater insight into suitable management approaches aimed at either restoring or protecting the water body can be applied.

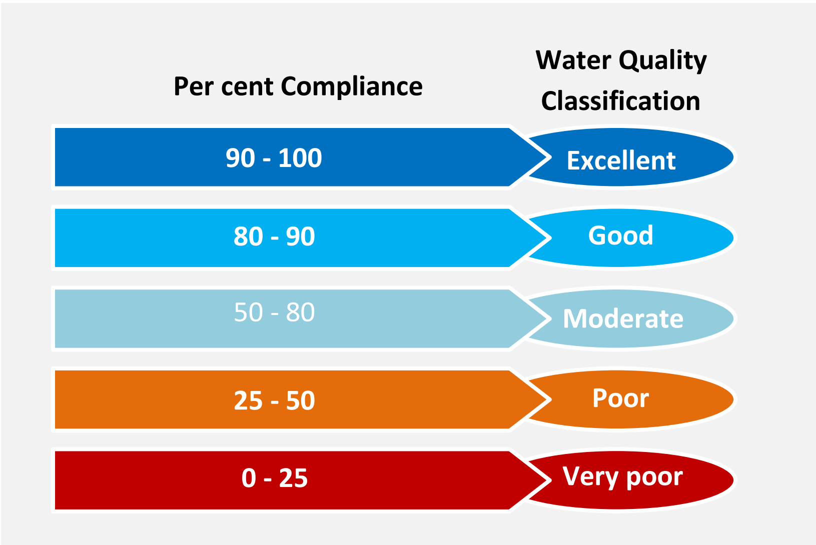

Figure 3: Alternative five-point classification system based on water body per cent compliance

Spatial patterns: mapping and comparing macroplastic rates against catchment characteristics such as population density can help provide evidence for mitigation measures.

Temporal trends: the data collected can be used to identify temporal, such as seasonal trends as well as inter-annual trends.

Flow/Discharge data: given the relationship between macroplastic pollution and river discharge (macroplastic tends to increase with river discharge as items are mobilised), collecting simultaneous flow or discharge data is highly recommended and can be used to calculate plastic loads from various river sections.

Mass calculation: if count method includes a characterisation component (bottle, bag etc). It is possible to calculate a mass per unit time, and if combined with flow/discharge also, a mass per volume is possible.

Variability: analysing the variability of the can be checked to see if the plastic pollution is relatively constant or more episodic.

Monitoring Programme Design

Monitoring Locations

A checklist will help support monitoring location selection. Criteria should include:

- alignment with existing water quality monitoring and hydrological programmes (flow/discharge data) where practical;
- ease of access and health and safety;

- located at the lower reaches of a river water body or just upstream of a river confluence;
- if resource constraints apply, fewer sites with greater data collection should be prioritised;
- prioritise data collection within a single river basin; and,
- locations should be selected to include both impacted and unimpacted sites.

Monitoring Frequency

A minimum monitoring frequency of monthly is proposed, yet if feasible, greater monitoring frequency is advised. As a general rule, the more variable the macroplastic flux (items/h), the greater the monitoring frequency required to establish robust data. This is because of the relationship between macroplastic flux and flow – if regular measurements are collected without any targeting of base or peak flow conditions – over time, the data collected will be representative of all flow conditions.

Additional Methodology Considerations and Comments

Highly polluted sites may require a narrower observation width or a shorter observation time to ensure observer is able to count the items reliably. Recommended observation width is 20 m which should be adaptively decreased in highly polluted rivers. In addition, the observation width can be related to the distance between observer location on the bridge and the water surface. So if bridge is 15 metres above surface, the observation width is around 15 metres.

For wide rivers, divide width of river into segments and multiple surveyors should collect data simultaneously, or alternatively, if only one observer is available, each segment can be surveyed consecutively within a maximum of a one-hour period.

For sites that have very low levels of pollution, consider increasing the count time to 20 minutes rather than 5 minutes.

The Reporting Process for SDG Indicator 6.3.2

This methodology generates annual macroplastics data. Data can be reported to UNEP on an annual basis or alternatively, to align with the SDG reporting three-year cycle, data can be reported every three years.

As per the SDG Indicator 6.3.2 Level 2 Technical Guidance document[4], based on the requirements of the country, the macroplastics data can be considered a standalone indicator, or alternatively, where co-located data are available, combination with other water quality data such as the basic Level 1 indicator is recommended.

Combination with other water quality data should follow the ‘one out, all out’ approach for overall water body classification. For a water body to be classified as ‘good ambient water quality’, each component must return a ‘good’ classification.

Summary

Macroplastics data provides an important addition to standard water quality monitoring programmes. A three-phase approach is prescribed to ensure that meaningful, site-specific targets are generated and that robust trend data are generated as soon as is practicable.

Although macroplastics data alone can provide valuable information to help understand spatial and temporal trends, greater benefit is attained if pollution data are matched against measures aimed to reduce plastic reduction so that the efficacy of these measures can be tracked.

[4] https://wwqa.info/knowledge-center/sdg632/SDG632_Technical-Guidance-Document-No4-Level-2-Reporting

Further Information

- UNEP 2021 report: https://www.unep.org/resources/report/monitoring-plastics-rivers-and-lakes-guidelines-harmonization-methodologies
- NBI Action Plan – to be added when available through NBI website
- SDG Indicator 6.3.2 Introductory document: https://wwqa.info/knowledge-center/sdg632/SDG632_Introduction-to-the-Methodology/
- SDG Indicator 6.3.2 Level 2 Technical document: https://wwqa.info/knowledge-center/sdg632/SDG632_Technical-Guidance-Document-No4-Level-2-Reporting
- Academic article: Frontiers | Toward a Harmonized Approach for Monitoring of Riverine Floating Macro Litter Inputs to the Marine Environment
- Academic article: Uncertainties in Visual Observations of Floating Riverine Plastic | ACS ES&T Water
- Academic article: Riverbank macro litter in the Dutch Rhine–Meuse delta – IOP science

For all queries about this indicator please contact UNEP's SDG 632 Help Desk at sdg632@un.org.

Annex 1: Example of Macroplastics Monitoring Programme Implementation

Below is an example of how the macroplastics methodology guidelines could be implemented.

Project Set-up

A national agency identified a single river basin to initiate the macroplastic monitoring programme where an ambient water quality monitoring programme was already in operation that was used to report for SDG Indicator 6.3.2 for Level 1 reporting.

Thirty river water bodies (sub-catchments or sections of river along the main channel) had been delineated in the river basin that are routinely monitored for physico-chemical Level 1 parameters.

For the new macroplastics monitoring programme, only 12 of the 30 existing monitoring locations were deemed suitable for macroplastics data collection - each had a suitable bridge location that could be safely used by the observer.

All monitoring locations represent river sections that are less than 20 metres in width and could be monitored by a single observer each.

Year 1 – Baseline Phase

Baseline Data Collection

- Monthly data were collected on the first Monday of each month.
- Each month, at each monitoring location, three replicate counts were recorded, and the mean of the three was recorded as the measurement for that month.

Target Setting

- The data collected were used to define the site-specific targets based on the 80th percentile for each monitoring location.

Table 2: Example of monthly monitoring data for 12 monitoring locations and the 80th percentile site-specific targets

	Monthly Mean Counts (items hour^{-1})												
Monitoring Location	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**80th Percentile**
ML_01	18	19	21	30	10	8	5	10	19	12	12	16	19
ML_02	52	35	100	60	35	25	19	18	17	24	28	32	48.6
ML_03	25	25	35	48	24	26	17	16	15	18	16	19	25.8
ML_04	5	3	2	5	8	10	8	6	4	6	5	7	7.8
ML_05	11	16	18	15	9	6	0	6	5	4	8	7	14.2
ML_06	19	18	32	58	45	32	24	19	17	19	15	14	32
ML_07	2	5	2	3	4	6	8	1	3	0	5	3	5
ML_08	10	15	12	13	16	18	10	11	13	10	15	13	15
ML_09	35	38	34	39	31	30	29	28	26	21	19	25	34.8
ML_10	65	48	59	87	85	54	48	42	45	38	29	24	63.8
ML_11	15	20	22	21	19	18	14	15	16	18	12	11	19.8
ML_12	2	5	12	13	15	6	8	1	3	0	5	3	11.2

Year 2 – Initiation Phase 1: First SDG Data

- At the end of Year 2, sufficient data were collected to calculate the SDG Indicator.
- Year 2 data were compared against the site-specific targets generated from Year 1 data.
- Table 3 below shows the monthly comparison of Year 2 data to Year 1 targets. A '1' denotes that the target was met, and a '0' that is was not.

- The annual per cent compliance for each site was calculated and the binary classification of 'good' or 'not good' was applied based on attainment of the 80 compliance.
- All water bodies were classified as 'not good' because all failed to achieve the 80 per cent compliance.

Table 3: Per cent compliance and SDG classification of data from 12 monitoring stations for Year 2, which were compared against site-specific targets generated from Year 1 data.

Site	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Sum	Count	Per cent Compliance	Classification 80 %
ML_01	0	0	0	0	0	1	1	0	0	0	0	0	2	12	16.7	Not good
ML_02	0	1	0	0	1	1	1	1	1	1	1	1	9	12	75.0	Not good
ML_03	0	0	0	0	0	0	0	0	1	0	0	0	1	12	8.3	Not good
ML_04	0	0	0	0	0	0	0	0	0	0	0	0	0	12	0.0	Not good
ML_05	0	0	0	0	0	0	1	0	0	1	0	0	2	12	16.7	Not good
ML_06	1	1	0	0	0	0	0	1	1	1	1	1	7	12	58.3	Not good
ML_07	0	0	0	0	0	0	0	0	0	0	0	0	0	12	0.0	Not good
ML_08	0	0	0	0	0	0	0	0	0	0	0	0	0	12	0.0	Not good
ML_09	0	0	0	0	0	0	0	0	0	1	1	0	2	12	16.7	Not good
ML_10	0	1	0	0	0	0	1	1	1	1	1	1	7	12	58.3	Not good
ML_11	0	0	0	0	0	0	0	0	0	0	0	0	0	12	0.0	Not good
ML_12	0	0	0	0	0	0	0	1	0	1	0	0	2	12	16.7	Not good

YEAR 3 – INITIATION PHASE 2: SECOND SDG DATA

- At the end of Year 3, two years of data were collated to calculate the SDG Indicator.
- Targets were generated from Year 1 plus Year 2 data. Again the 80th percentile at the site level was used.
- Data from Year 2 and Year 3 were compared to site-specific targets.
- Table 4 below shows the monthly comparison of Year 2/Year 3 data to Year 1/Year2 targets. A '1' denotes that the target was met, and a '0' that is was not.
- The annual per cent compliance for each site was calculated and the binary classification of 'good' or 'not good' was applied based on attainment of the 80 compliance.
- All water bodies were still classified as 'not good' because they all failed to achieve the 80 per cent compliance.

Table 4: Per cent compliance and SDG classification of data from 12 monitoring stations for Year 3, which were generated from Year 2 and 3 data and compared against site-specific targets generated from Year 1 and 2 data

Site	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Sum	Count	Per cent Compliance	Classification 80 %
ML_01	0	0	0	0	0	1	1	0	0	0	0	0	4	24	16.7	Not good
ML_02	0	1	0	0	1	1	1	1	1	1	1	1	18	24	75.0	Not good
ML_03	0	0	0	0	0	0	0	0	1	0	0	0	2	24	8.3	Not good
ML_04	0	0	0	0	0	0	0	0	0	0	0	0	0	24	0.0	Not good
ML_05	0	0	0	0	0	0	0	0	0	0	0	0	2	24	8.3	Not good
ML_06	1	1	0	0	0	0	0	1	1	1	1	1	14	24	58.3	Not good

ML_07	0	0	0	0	0	0	0	0	0	0	0	0	0	24	0.0	Not good
ML_08	0	0	0	0	0	0	0	0	0	0	0	0	0	24	0.0	Not good
ML_09	0	0	0	0	0	0	0	0	0	0	1	0	3	24	12.5	Not good
ML_10	0	1	0	0	0	0	1	1	1	1	1	1	14	24	58.3	Not good
ML_11	0	0	0	0	0	0	0	0	0	0	0	0	0	24	0.0	Not good
ML_12	0	0	0	0	0	0	0	0	0	0	0	0	2	24	8.3	Not good

Year 4 – Operational Phase

- At the end of Year 4, three years of data were collated to calculate the SDG Indicator.
- Targets were generated from Years 1, 2 and 3 data. Again the 80th percentile at the site level was used.
- Data from Years 2, 3 and 4 were compared to site-specific targets.
- Table 5 below shows the monthly comparison of Years 2, 3 and 4 data to targets. A '1' denotes that the target was met, and a '0' that it was not.
- The annual per cent compliance for each site was calculated and the binary classification of 'good' or 'not good' was applied based on attainment of the 80 compliance.
- All water bodies were still classified as 'not good' because they all failed to achieve the 80 per cent compliance.

Table 5: Per cent compliance and SDG classification of data from 12 monitoring stations for Year 4, which were generated from Year 2, 3 and 4 data and compared against site-specific targets generated from Year 1, 2 and 3 data

Site	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Sum	Count	Per cent Compliance	Classification 80 %
ML_01	0	0	0	0	0	0	0	0	0	0	0	0	4	36	11.1	Not good
ML_02	0	0	0	0	0	1	1	1	1	1	1	0	24	36	66.7	Not good
ML_03	0	0	0	0	0	0	0	0	1	0	0	0	3	36	8.3	Not good
ML_04	0	0	0	0	0	0	0	0	0	0	0	0	0	36	0.0	Not good
ML_05	0	0	0	0	0	0	0	0	0	0	0	0	2	36	5.6	Not good
ML_06	0	0	0	0	0	0	0	0	0	0	1	1	16	36	44.4	Not good
ML_07	0	0	0	0	0	0	0	0	0	0	0	0	0	36	0.0	Not good
ML_08	0	0	0	0	0	0	0	0	0	0	0	0	0	36	0.0	Not good
ML_09	0	0	0	0	0	0	0	0	0	0	1	0	4	36	11.1	Not good
ML_10	0	1	0	0	0	0	1	1	1	1	1	1	21	36	58.3	Not good
ML_11	0	0	0	0	0	0	0	0	0	0	0	0	0	36	0.0	Not good
ML_12	0	0	0	0	0	0	0	0	0	0	0	0	2	36	5.6	Not good

Onward Operational Phases

- Continuous operation of the monitoring programme generated annual data at each of the 12 monitoring locations.
- Figure 4 below shows the change in per cent compliance over a ten-year period.
- Figure 5 below shows the recorded macroplastic flux at each of the site over the ten-year period.
- Note: Year 8 is when all water bodies are classified as 'good' water quality (Figure 4) which corresponds to the continued improvement in macroplastic flux across all sites (Figure 5).

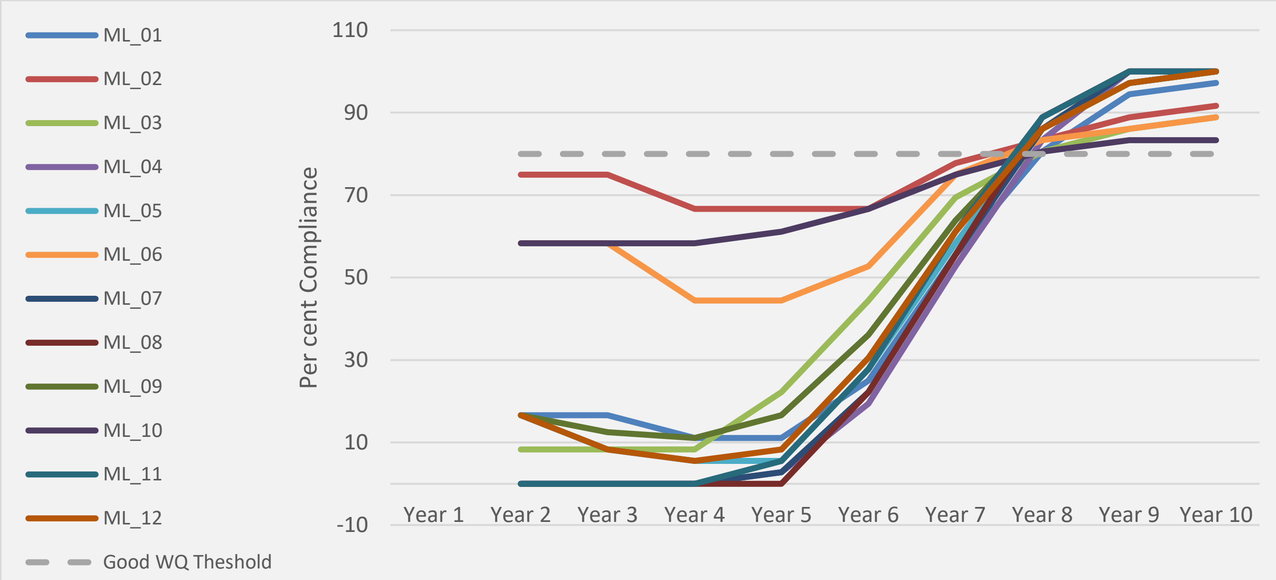

Figure 4: Per cent compliance of macroplastic indicator over a ten-year period at 12 monitoring locations

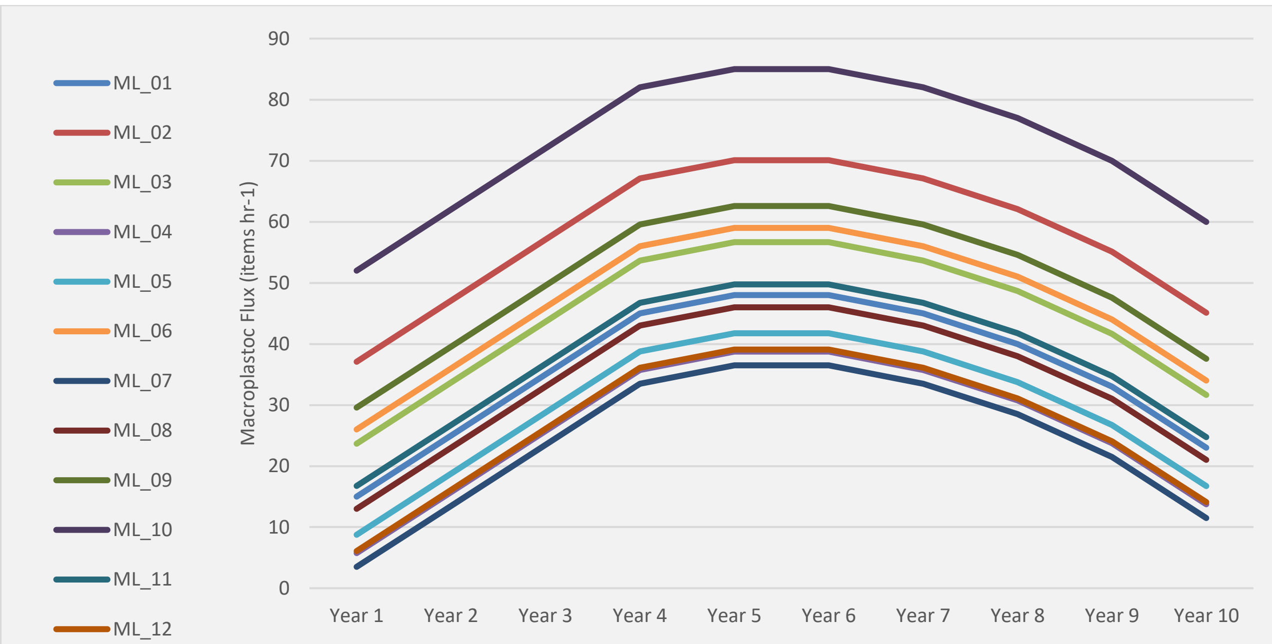

Figure 5: Macroplastic flux over a ten-year period at each of the 12 monitoring locations