Within the MARLIN project the UNEP/IOC synthesis method was implemented as a pilot initiative to test its adequacy for the Baltic Sea region. One of the main outputs of the MARLIN project is that a harmonised method has been used for the very first time in the Baltic Sea – with data that is comparable on a global scale. Summary of lessons learned during the project and how the project has adapted the guidelines to Baltic Sea conditions (without changing its advantage of being comparable to other parts of the world), is outlined in this appendix according to the initial structure of UNEP/IOC methodology.

RECRUITMENT AND MANAGEMENT OF STAFF AND VOLUNTEERS

The MARLIN project outlined a concept already at the beginning of the project with emphasis on the awareness raising aspect of monitoring itself. From the project’s experiences – monitoring can be implemented together with participants in different age groups and different interest groups without any previous knowledge regarding marine litter or environmental monitoring.

1) The MARLIN project has mainly used trained monitoring teams with strong local connection. The teams have been in regular contact with the national coordinator and have been composed of representatives of local NGO’s, schools or local municipality.

2) The other option has been open involvement of the public on a local level, which has the advantage of broader dissemination of awareness. During the beach litter monitoring, the national coordinator (i.e. project partner) had to be present, leading the monitoring. The project consortium encourages public involvement and grassroots participation.

FRAMEWORK FOR SELECTING SURVEY LOCATIONS/REFERENCE BEACHES

UNEP methodology gives precise, though laconic, guiding for selecting survey locations, stating that locations should be selected with reference to regional management or resourcing arrangements as well as their utility in providing meaningful data about litter dynamics. Within the project, taking into account its role in further efforts to develop marine litter monitoring system in Baltic Sea area, multiple other criteria were also listed:

• Different usage of beaches
• Balance among urban, peri-urban and rural beaches
• Inclusion of beaches with multiple impacts like neighbouring sea routes, port activities, river inputs or active currents
• Inclusion of country specific beach types (archipelago areas)

Besides mentioned criteria the geographical spread is important and has to be taken into account as well.

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1 UNEP/IOC Guidelines on Survey and Monitoring of Marine Litter: UNEP Regional Seas Reports and Studies, No. 186; IOC Technical Series No. 83: xii + 120 pp.
Litter measurement protocol

Marine litter is defined as all waste, discarded or lost material, which is found on the beach as a result of human activities. This definition does not encompass natural elements such as branches, seaweed etc. The classification system consists of two levels: firstly one that identifies which material the item primarily consists of, secondly one that identifies the type of item and its primary usage. The classification system in UNEP/IOC consists of nine different material classes, including an “other” class, and a total of 77 different types of litter. MARLIN have chosen to expand the classification system with the material class “organic waste”, and have also added another four types of litter (snuff portions, feces (excrement), leftovers from fruit, food, pastries, sweets and ice-cream, and other organic litter). Disposable barbecues have also been added under the material type “metal”.

Tide data is not registered in the Baltic Sea due to the fact that the impact of tides is very small in the region. The protocols have also been supplemented with questions about number of beach visitors, number of rubbish bins within the measurement area, which sea the beach is adjacent to, any dead animals, camping and/or café/restaurant facilities that are adjacent to the beach, as well as information about cleaning measures taken.

Protocols BC01, BC02:1, BC02:2 and BC02:3 are in accordance with UNEP/IOC’s proposed protocols for comprehensive beach litter assessment, but with some additions. BC01 is in accordance with BC01 in UNEP/IOC’s protocols for comprehensive beach litter assessment. BC02:1 includes the proposed protocol ML01 (large items). BC02:2 is the protocol for the registration of litter within measurement area 1 (cigarette butts and snuff portions), and BC02:3 is the protocol for registration of litter within measurement area 2. The protocols have been simplified to some extent with a number of multiple-choice questions. Protocol items cover all the material categories and items. During the project some observations have been made concerning the protocols:

- Large amounts of cotton bud sticks have been found and to include cotton bud sticks as a separate item could be of interest, especially due to fact that this item is not directly connected with beach usage and could be a good indicator for poor waste water management.
- Category PL24 (Plastic, other) still accounts for a considerable amount of all the plastic collected, and sometimes the amount of items put under the PL24 can be minimised if clearer guidance of recognizing the parts of items would be given. For example, it should be clarified whether an identifiable plastic piece that is part of plastic cup, can be put under PLXX instead of PL24.
- Recognising materials, particularly packaging, is sometimes very subjective, due to mixed composition materials. This problem applies particularly to paper, laminated paper and composite material, cardboard and packaging, where the dominant material type can not always be identified on site.
- The protocol has two kinds of categorisation that is embedded in it – first the material approach (plastics, paper etc) and secondly the usage approach (construction materials, hygienic products). In some cases it leads to overlap.
Quantification of items

UNEP/IOC methodology describes and mentions pros and cons of two ways of quantifying litter – counting and weighing. A combination of these two is the best option for the most reliable and interpretable data. MARLIN project has occasionally tried both separately and in combination. But the usual method for quantification has been counting. Quantification by counting faces the problems that when the size range of litter items differs considerably, the data does not give the exact picture of the situation. Also, there are cases, when the details/pieces/fragments of a single object are counted as individual items due to the level of degradation. As the surveys are carried out during different seasons, the weighing is much harder to apply since there is a high probability that the fall and spring monitoring are made under difficult weather conditions like after storms and rain. In such conditions the fractions are of course wet and weight as an indicator is useless. Transporting litter to appropriate facilities with purpose of drying it and weighing it afterwards is both complicated and costly and doesn’t necessarily provide any additional information or clarity.

SURVEY OPERATIONAL GUIDELINES

Beach characterisation and sampling units

Beach characterisation and taking into account the geographical profile and location is of utmost importance not only for latter data analysis, but also for comparison of data. Experience from the project show that litter flux levels are to some degree dependent on beach characterisation. Therefore additional information regarding recent weather conditions might be needed to be included. The impact on the monitoring results due to weather conditions are drastic and without referring to the weather situation during and before the survey, the data might be harder to use later. This refers not only to post-storms situations, when much more litter can be brought to the coast, but also to situations of high winds that can cover litter on sandy beaches. According to the UNEP/IOC method, the amount of litter is only to be reported per meter of beach. This key figure can however be misleading, since different beaches are of differing width. Consequently, as a supplement to this key figure, MARLIN have also chosen to report the amount of litter per square meter.

Sampling frequency and flux rate issue

UNEP/IOC recommends that measurements should be carried out every third month, in other words once during each season of the year. Considering the nature of the Baltic climate, MARLIN monitoring program has decided to limit the number of assessments to three per year. Spring (shortly after the snow melts and spring storms), summer (during peak of season and a lot of visitors) and autumn (after last autumn storms).

During one of the projects awareness raising activities (Latvian campaign ‘My Baltic Sea’) it was proved that such an approach is objective and provides enough data clarity. At-site monitoring of 30 beaches was carried out and the results from those assessments corresponded to the data from the five Latvian reference beaches.

The flux rate method to estimate amounts of litter has raised a concern due to several reasons. Firstly, there are limited possibilities to refer decisively to the date and time of previous cleaning activities on the beach. Most of the beaches included in the project (and this might be specific for the Baltic Sea) were public beaches owned and managed by municipality or a municipally appointed company. Nevertheless, outside the season the clean-up schedules are not fixed and will have impact on the
results. Within the summer season the clean-up schedule in many countries is not always respected by authorities due to understaffing. Also many on-going voluntary clean-up initiatives and local ad-hoc clean-up is carried out without giving any notice to the authorities. Using flux rate as an indicator stating the situation of marine litter must be researched further.

Quality assurance and data management
The quality assurance of the monitoring results is the core for further use of data. Within the project two methods were used. First option included workshops and training with local organisations to set up local monitoring teams. The workshops have included on site experience and familiarisation with the guidelines. The national coordinator has been in regular contact with the monitoring teams via telephone meetings and at site. The second option has been that the national coordinator participated during the monitoring and has guided e.g. school children on-site and that the group of children might have changed from monitoring to monitoring.

The protocols have been sent to the national coordinator, who has been responsible to report the data into the MARLIN database. The database provides a wide range of comparison and statistical tools and could be further developed to serve data management needs on both local, national and a Baltic Sea regional level.

FURTHER CONSIDERATIONS REGARDING DEVELOPMENT OF UNEP/IOC METHODOLOGY

Source and input analysis within UNEP methodology
The question was raised several times in the project, how the data provided can be further used in analysing the sources as it is done in methods like OSPAR. Despite that analysis of the litter sources are not part of UNEP/IOC methods, there are definitely at least some categories that serve as reliable and precise indicator categories of single source and probably analysis of sources can be built around that. In the EU-funded project ‘Case Study on the Plastic cycle and its loopholes in four European regional seas areas’ a model of identifying the sources has been developed. The MARLIN data can be used to further analyze the sources of marine litter in the Baltic Sea, according to this method.

Enhancement in methodology
Number of possible future enhancements have been raised by project team for discussion and consideration in the future as sand sieving (not only surface sand) in area 1 and inclusion of micro litter survey field in area 1 (50x50cm).