WFD Marine Direct Impact Risk Assessment Methodology

GUIDANCE ON THRESHOLD AND METHODOLOGY TO BE APPLIED IN IRELAND'S RIVER BASIN DISTRICTS

Paper by the Working Group on Characterisation and Risk Assessment

Surface water guidance document

This is a guidance paper on the application of a proposed **Marine Direct Impacts Assessment** methodology. It documents the principles to be adopted by River Basin Districts and authorities responsible for implementing the Water Framework Directive in Ireland. This is a working draft describing a method that will evolve as it is trialled, and will be amended accordingly.

REVISION CONTROL TABLE

Status	Approved by National Technical Coordination Group	WFD Requirement	Relevant EU Reporting sheets	Date
Final	12th November 2004 Amended 9th March 2005	Impacts and Pressures	SWPI 7 – Assessment of the impact of the significant pressures on surface water bodies	March 2005

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Marine Direct Impacts Risk Assessment

1. Introduction

This document outlines the methodology for the marine direct impacts risk assessment in the Republic of Ireland. This assessment was completed on a national basis on behalf of all River Basin Districts by the South-Eastern and the Shannon RBD Projects.

The assessment comprised two elements:

- Eutrophication, nutrient enrichment & organic enrichment
- Hazardous substances

The assessment applied the methodologies described below to all coastal and transitional water bodies. A four-category risk classification scheme was adopted, as agreed by the Risk Assessment Working Group. An additional 'no risk class given' category was introduced for situations where no impact data or inconclusive data was available. Risk categories are shown in Table 1 below. The final risk category of each water body was determined from consideration of the worst case findings of both assessments.

Table 1: General risk categories used in the marine direct impacts risk assessment

Risk Category	**Data Requirements**
1a – At risk	Evidence of impact, high confidence in data
1b – Probably at risk	Evidence of impact, low to moderate confidence in data
2a – Probably not at risk	Evidence of good quality, low to moderate confidence in data
2b – Not at risk	Evidence of good quality, high confidence in data
No risk class given	Inconclusive/No impact data

2. Nutrients/Organic Enrichment/Eutrophication

Datasets & Information Sources

- Urban Waste Water Treatment Regulations nutrient sensitive designations
- Results of the application by the EPA of the OSPAR Common Procedure

Methodology

The impacts of nutrient and organic loading often occur in combination and were therefore considered together in this risk assessment. Two aspects (a and b) were examined to determine water body risk category for this element of the risk assessment.

a) Firstly, any water body designated as sensitive under the UWWT Regulations was given a risk class of 1a, at risk.

b) The OSPAR Common Procedure provides a framework to identify water bodies at risk to eutrophication due to nutrient and organic enrichment whose criteria closely align with the DEFRA (2002) criteria to identify sensitive areas under the UWWT Directive. These criteria are based on the following 3 categories:

Category 1 Nutrient inputs, concentrations and ratios
Category 2 Phytoplankton biomass and macroalgae
Category 3 DO, fauna, toxic algae

The common procedure has been applied in Ireland (EPA - 1999 & 2001) and the results were related to risk categories for both transitional and coastal waters as outlined in Table 2 below.

Table 2: OSPAR common procedure designations and UWWT sensitive designations with corresponding risk categories

	a	**b**			
Risk Categories	**UWWT**	**OSPAR**	**Category 1**	**Category 2**	**Category 3**
1a At risk	sensitive	Problem area	+	+	+/-
1b Probably at risk	-	Potential problem area	+	-	-
No designation	-	Non-problem area	-	-	-

Following this matrix, each coastal and transitional water body was assigned a risk category.

Though not used in this assessment, the first stage of the OSPAR common procedure, the screening procedure, was carried out for the South-eastern and Shannon RBDs. The methods used are outlined in Appendix A.

3. Hazardous Substances

Datasets & information sources

- results of biota monitoring from the Marine Institute, 1997 – 2003

Methodology

Biota monitoring data were obtained from the Marine Institute for the years 1997-2003. The sampling locations were plotted to indicate national distribution. The sampling results dataset was divided according to RBD (River Basin District), with further sub-divisions indicating the coastal and transitional water body within which the point is located.

The monitoring results were then compared with the OSPAR EAC's (Ecotoxicological Assessment Criteria) or BRC's (Background Reference Concentration) values for biota. Only twelve parameters available from the Marine Institute monitoring had an OSPAR EAC or BRC value. Therefore, the risk assessment was limited to these twelve parameters which had a comparison value. These parameters were as follows:

1. Cd- Cadmium
2. Pb- Lead
3. Cu-Copper
4. Hg-Mercury
5. Zn- Zinc
6. CB 153
7. Dield-Dieldrin
8. DDE- Dichlorodiphenyldichloroethylene
9. ANT- Anthracene
10. Fluo- Fluoranthene
11. Pyr- Pyrene
12. BAP- Benzo[a]pyrene

Monitoring results for these parameters were analysed to ascertain compliance with the OSPAR biota values. In this risk assessment any samples with recorded chemical concentrations which were above the EAC values were deemed failures, and any samples with recorded chemical concentrations above twice the BRC values were also deemed failures. Each transitional/coastal water body with available monitoring data was then assigned a risk category according to the criteria summarised in Table 3.

Table 3: Methodology for marine risk assessment for hazardous substances based on biota monitoring from Marine Institute for the years 1997-2003

Risk Number	**Risk Category**	**Reason**
1a	At Risk	Any number of samples, any failures, any parameter
2a	Probably not at risk	1 - 4 years sampling data, no failures
2b	Not at risk	> 4 years sampling data, no failures
-	No risk class given	Inconclusive/no impact data

In addition, the results of a Marine Institute TBT study in dogwhelks and periwinkles were considered for this risk assessment. The results of specimens which were collected from six bays and estuaries around Ireland showed levels of contamination unlikely to have detrimental effects. Consequently, inclusion of this dataset did not result in the risk categories of any areas being upgraded.

For the March 22 2005 Article 5 report minor amendments were made to this element of the risk assessment due to expert input. These amendments are outlined in Appendix B.

4. Determining Water Body Risk Category

The outcome of the above methodologies for nutrient and hazardous substances were combined using the worst case assessment i.e. the highest risk class associated with each water body was assigned to that water body. Water bodies which had inconclusive or no impact data were not assigned a risk class. The overall risk to transitional and coastal water bodies from nutrients and hazardous substances is mapped in Figure 1.

5. Supporting Documentation

- Anon (1999) Screening Procedure for Irish Coastal Waters with regard to Eutrophication Status. Final Report on the Outcome on the Screening procedure. Environmental Protection Agency, Richview, Dublin 14.
- Anon (2001) An Assessment of the Trophic Status of Estuaries and Bays in Ireland. Environmental Protection Agency, Johnstown Castle, Wexford.
- The EPA annual reports on urban waste water discharges in Ireland
- The EHS guidance documents on the risk assessment for Northern Irish transitional and coastal waters. (in preparation)
- Minchen, D. (2003) Monitoring of Tributyl Tin Contamination in Six Marine Inlets using Biological Indicators. MEHS Series No. 6. Marine Institute, Galway.

Appendix A: OSPAR Screening Procedure Methodology

Annual nutrient loads arising from point and diffuse sources were calculated on a subcatchment basis using the following methodology drawn from a number of sources. The resulting loads were compared with average annual measured loads from the OSPAR Riverine and Direct Inputs Study (1995 to 2001) to ensure that estimates were accurate.

1. Wastewater Treatment Plants (WWTP)

Population equivalents (Local Authority WWTP registers) times assumed nutrient production loading times reduction factors due to treatment (HARP guidelines).

Total N	9.0 g $person^{-1}$ day^{-1}
Total P	2.7 g $person^{-1}$ day^{-1}

Level of treatment	N reduction factor	P reduction factor
Raw	1.000	1.000
Preliminary treatment	0.900	0.900
Primary treatment	0.727	0.667
Secondary treatment	0.545	0.467
Additional nutrient removal	0.300	0.100

2. Unsewered Industries

Loads from Section 4 licensed industries and IPC activities which discharge directly to watercourses were estimated as 25% of maximum allowable discharge i.e. 0.25 times maximum flow times maximum allowable nutrient concentrations (HARP Guidelines).

3. Agriculture

Loads for cattle, sheep, pigs and poultry (Agricultural Census 2000) times factors (1999 Screening Procedure).

N losses from agriculture	0.20 of total agricultural N load
P losses from agriculture	0.04 of total agricultural P load

4. Forestry

Area under forestry (CORINE 2000) times standard coefficients (M. C. O'Sullivan, Three Rivers Baseline Report, 1999).

N losses from forestry	5.42 kg ha^{-1} yr^{-1}
P losses from forestry	0.33 kg ha^{-1} yr^{-1}
N losses from woodland/woodland scrub	3.71 kg ha^{-1} yr^{-1}
P losses from woodland/woodland scrub	0.565 kg ha^{-1} yr^{-1}

5. Peatlands

Area under peatland (CORINE 2000) times standard coefficients (M. C. O'Sullivan, Three Rivers Baseline Report, 1999).

N losses from peatland	2 kg ha^{-1} yr^{-1}
P losses from peatland	0.325 kg ha^{-1} yr^{-1}

N losses from marshes	2 kg ha^{-1} yr^{-1}
P losses from marshes	0.2 kg ha^{-1} yr^{-1}

6. Urban Areas

Urban areas (CORINE 2000) times standard coefficients (M. C. O'Sullivan, Three Rivers Baseline Report, 1999).

N losses from urban area	5 kg ha^{-1} yr^{-1}
P losses from urban areas	0.86 – 2.15 kg ha^{-1} yr^{-1}
Discontinuous urban areas	0.86 kg ha^{-1} yr^{-1}
Continuous urban areas	1.4 kg ha^{-1} yr^{-1}
Industrial areas	1.88 kg ha^{-1} yr^{-1}
Construction sites etc	2.15 kg ha^{-1} yr^{-1}

7. Unsewered Rural Populations

Total population minus sewered population (Census of Population, 2002) times per capita nutrient emission values. (HARP Guidelines)

N loss from septic tanks	2.4 kg $person^{-1}$ day^{-1}
P loss from septic tanks	0.25 kg $person^{-1}$ day^{-1}
N loss from septic tanks remote	0.7 kg $person^{-1}$ day^{-1}
P loss from septic tanks remote	0.25 kg $person^{-1}$ day^{-1}

8. Aquaculture

$L = 0.01 \times (IC_i – PC_f)$ (HARP Guidelines)

L = P or N discharge to water body (tonnes yr^{-1})
I = feed used (tonnes yr^{-1})
C_i = P or N content in feed (%)
P = production plus standing stock (tonnes yr^{-1})
C_f = P or N content in produced organisms (%)

N content dry feed	7.2%	
P content dry feed	1.2%	
N content fish	3.0%	
P content fish	0.45%	(HARP Guidelines)

Trout, standing stock:production 1:2.5 (Allen Williams, DCMNR)

Salmon, weight when moved to sea = 0.05kg (Allen Williams, DCMNR)

Feed Conversion Ratio (FCR) = 1.2:1 (Jacqueline Doyle, MI)

9. Background Losses

Background losses originating in atmospheric deposition are accounted for in the background loss estimates. (HARP Guidelines)

N losses from background runoff	0.75 kg ha^{-1} yr^{-1}
P losses from background runoff	0.05 kg ha^{-1} yr^{-1}

10. Lake Retention

Nutrient retention factors were applied to catchments above lakes. (obtained during studies in Lee catchment, R. P. S. Cairns, 1995).

N retention factor	0.1
P retention factor	0.24

Appendix B: Hazardous Substances Amendments Explanatory Note

Following the initial application of the Marine Direct Impacts Risk Assessment a number of water bodies were assigned a 1a category due to hazardous substances. Following Marine expert review the Marine Direct Impacts Risk Assessment for Hazardous substances has been amended for the purposes of reporting under Article 5 in March 2005. It was felt that this assessment was too stringent in particular for shellfish waters which are known not too have problems and which have minimal significant pressures. Due to time constraints the following interim arrangements were proposed:

- All Oyster biota monitoring data were removed as the marine experts felt that the OSPAR BRC and EAC values for blue mussels were not appropriate for oysters, due to physiological differences. This monitoring data had subsequently resulted in 1a water bodies when this was not the case. This has meant that some water bodies which solely had oyster results were removed from this assessment. There were results for 19 coastal and transitional water bodies but after the removal of oyster monitoring 15 water bodies with results remained.

  These removed water bodies are as follows:
  SERBD: Bannow Bay, WRBD: Inner Clew Bay and Kilkieran Bay and ShRBD: Outer Tralee Bay

- Following expert review it was felt that the lack of confidence in the OSPAR BRC and EAC values and their method of application for this purpose was not adequate to assign 1a designations to these water bodies. Therefore, these were "manually" changed to 1b (except for the case of Cork Harbour/Ringaskiddy as this has a known risk). As a result these water bodies will be prioritised for further investigation during further characterization in the next stages of the river basin management cycle.