FAO Reference Centre for Bivalve Sanitation workshop on the development of bivalve production in Africa

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Combining and Assessing desk based and field survey data

Michelle Price-Hayward

Food and Agriculture Organization of the United Nations

Centre for Environment, Fisheries & Aquaculture Science

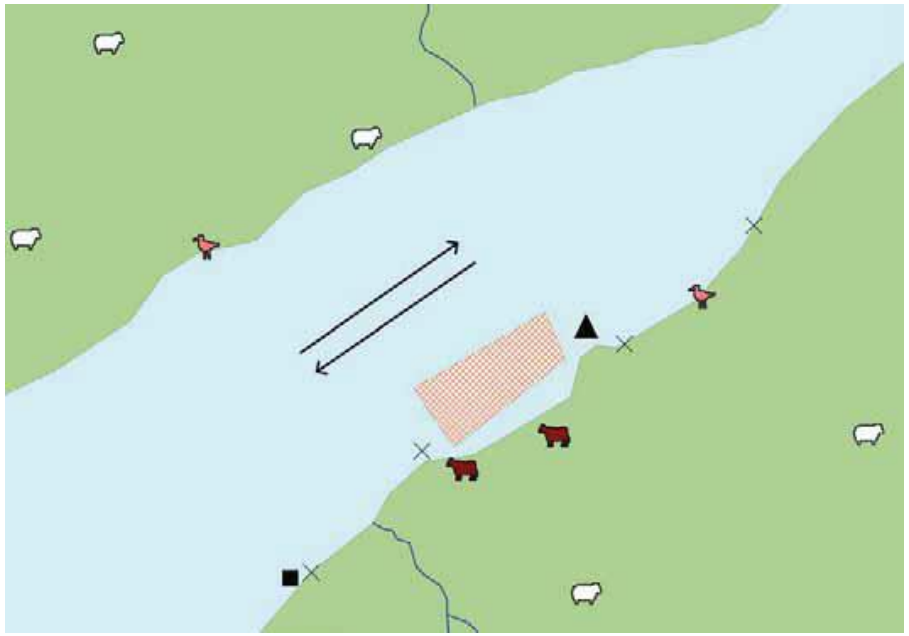
Indicator/Hazard Survey

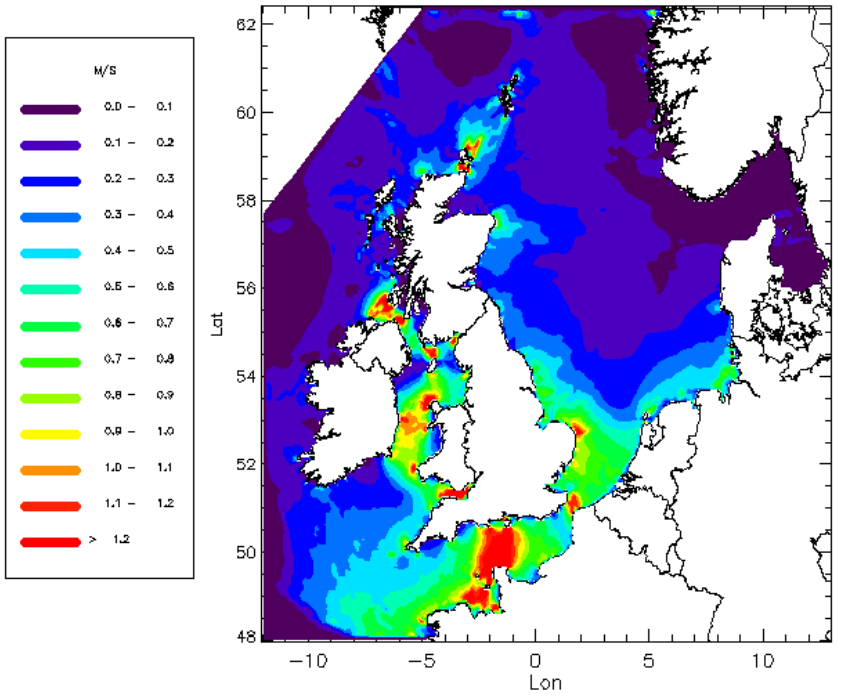
Additional data on presence of indicators and/or hazards, in water or bivalves

- Locations based on desk phase information
- Timing and frequency dependent on target
  - Seasonality
  - Conditional dependence
- For general microbiological indicators
  - At least 3 occasions
  - At least 2 weeks between
  - At least 1 sample during shoreline survey

Data Analysis and Assessment

- Descriptive/Qualitative
  - Simplest means of assessment
  - Uses descriptive information
  - Relies on expert judgement
  - May be dictated by lack of data
- Semi-quantitative
  - Uses ranking with loading score
  - Based on level of risk
- Quantitative
  - Source estimation
  - Transport estimation



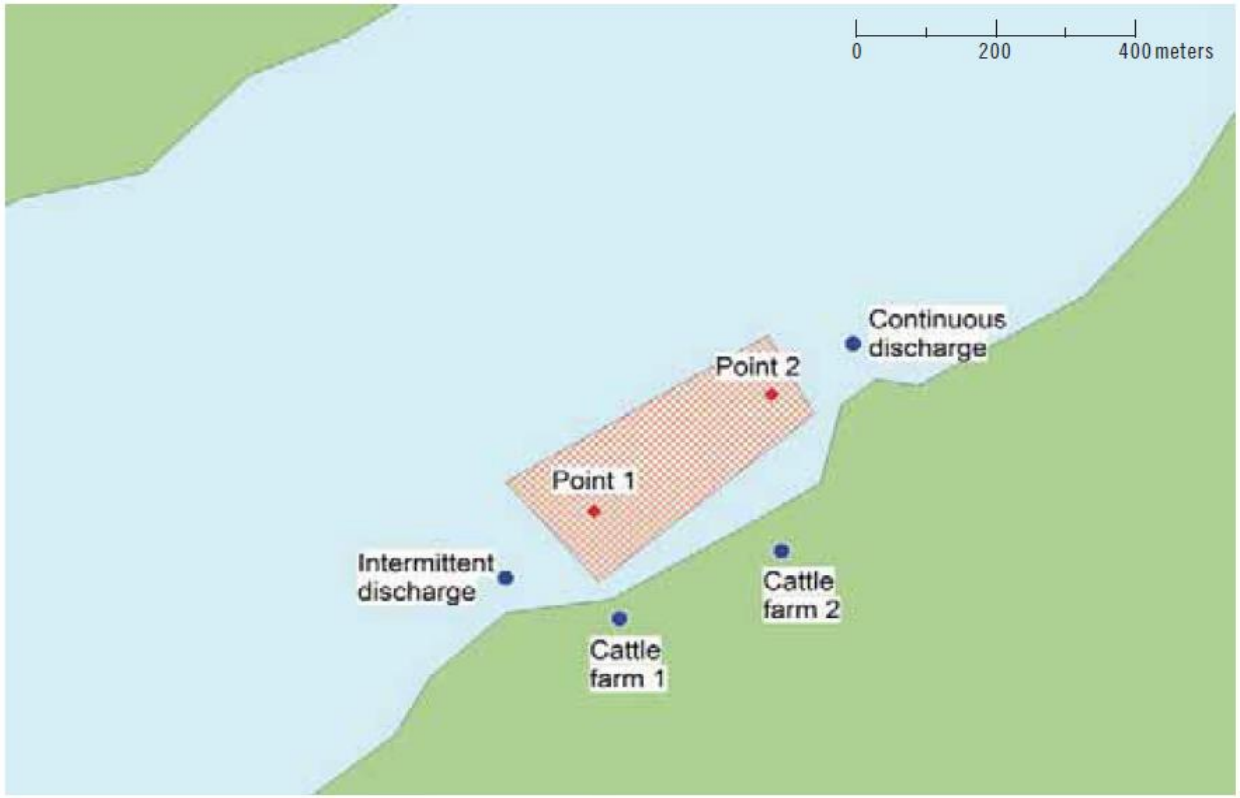


Semi-quantitative assessment

Uses a ranking method for estimating impacts based on:

- Loading (greatest potential contribution)
- Occurrence frequency
- Proximity to shellfish resource

Estimated impact = (Occurrence x Proximity) x Relative loading



ASSESSMENT POINT 1

SOURCE	RELATIVE LOADING	OCCURRENCE	PROXIMITY	IMPACT
Continuous discharge	2	3	3	18
Intermittent discharge	3	1	5	15
Cattle farm 1	1	1	5	5
Cattle farm 2	1	2	4	8
Total				41

Quantitative assessment

Quantitative source estimation
- Estimated loadings (e.g. bacteria/day)
- Variability – likely range
- Uncertainty estimation

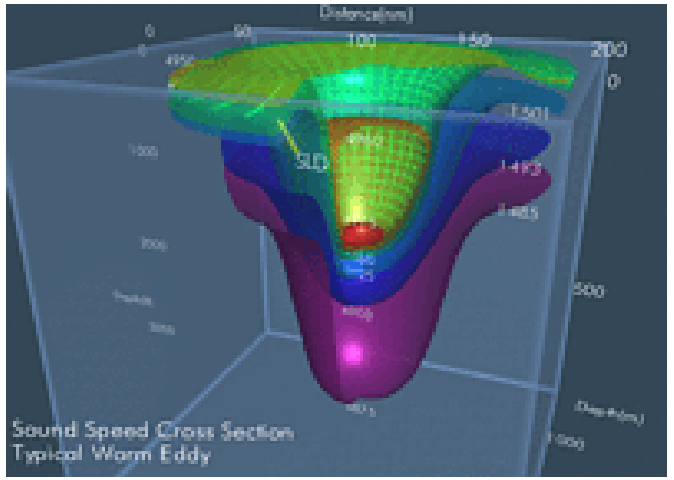
Quantitative transport estimation
- Dilution calculations
- Tidal streams (transport distance)
- Tracer studies
- Hydrodynamic modelling

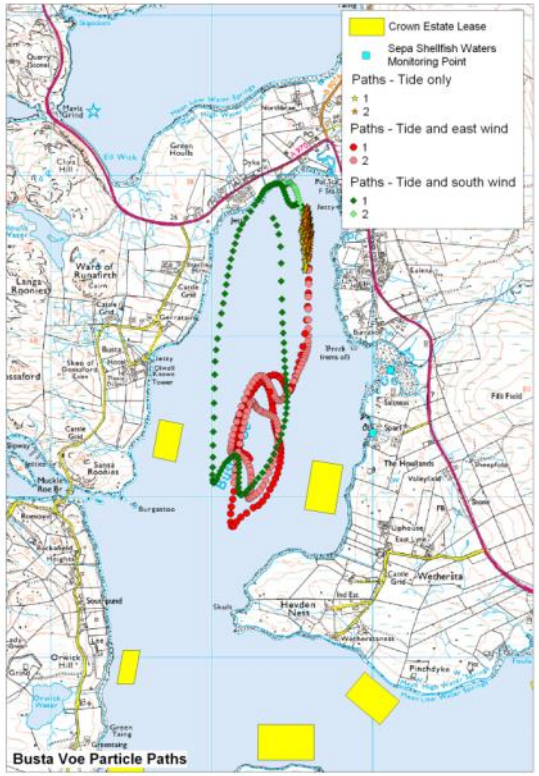
Quantitative impact estimation
- Average concentration, variability at assessment point(s) under range of conditions

Validation of data and outputs
- Sensibility check
- Data used separate from that used to support assessment itself
- Model validation – requires field measurement

Indicator organism	Base-flow conditions				High-flow conditions			
Treatment levels and specific types: Faecal coliforms	*n*[c]	Geometric mean	Lower 95% CI	Upper 95% CI	*n*[c]	Geometric mean	Lower 95% CI	Upper 95% CI
Untreated	252	1.7×10^{7} * (+)	1.4×10^{7}	2.0×10^{7}	282	2.8×10^{6} * (-)	2.3×10^{6}	3.2×10^{6}
Crude sewage discharges	252	1.7×10^{7} * (+)	1.4×10^{7}	2.0×10^{7}	79	3.5×10^{6} * (-)	2.6×10^{6}	4.7×10^{6}
Storm sewage overflows					203	2.5×10^{6}	2.0×10^{6}	2.9×10^{6}
Primary	127	1.0×10^{7} * (+)	8.4×10^{6}	1.3×10^{7}	14	4.6×10^{6} (-)	2.1×10^{6}	1.0×10^{7}
Primary settled sewage	60	1.8×10^{7}	1.4×10^{7}	2.1×10^{7}	8	5.7×10^{6}		
Stored settled sewage	25	5.6×10^{6}	3.2×10^{6}	9.7×10^{6}	1	8.0×10^{5}		
Settled septic tank	42	7.2×10^{6}	4.4×10^{6}	1.1×10^{7}	5	4.8×10^{6}		
Secondary	864	3.3×10^{5} * (-)	2.9×10^{5}	3.7×10^{5}	184	5.0×10^{5} * (+)	3.7×10^{5}	6.8×10^{5}
Trickling filter	477	4.3×10^{5}	3.6×10^{5}	5.0×10^{5}	76	5.5×10^{5}	3.8×10^{5}	8.0×10^{5}
Activated sludge	261	2.8×10^{5} * (-)	2.2×10^{5}	3.5×10^{5}	93	5.1×10^{5} * (+)	3.1×10^{5}	8.5×10^{5}
Oxidation ditch	35	2.0×10^{5}	1.1×10^{5}	3.7×10^{5}	5	5.6×10^{5}		
Trickling/sand filter	11	2.1×10^{5}	9.0×10^{4}	6.0×10^{5}	8	1.3×10^{5}		
Rotating biological contactor	80	1.6×10^{5}	1.1×10^{5}	2.3×10^{5}	2	6.7×10^{5}		
Tertiary	179	1.3×10^{3}	7.5×10^{2}	2.2×10^{3}	8	9.1×10^{2}		
Reedbed/grass plot	71	1.3×10^{4}	5.4×10^{3}	3.4×10^{4}	2	1.5×10^{4}		
Ultraviolet disinfection	108	2.8×10^{2}	1.7×10^{2}	4.4×10^{2}	6	3.6×10^{2}		

Source: Kay, D. et al (2008) Faecal indicator organism concentrations in sewage an effluents. *Water Research* 42, 442-454.





Any questions?

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Exercise: Interpret data and rank impacts

Using the data provided for the Pacific oyster growing area at Tobermory Bay and a semi-quantitative approach:

- Identify the principal sources of contamination
- Rank the sources based on relative loading, occurrence, and proximity
- Calculate the impact