Annex C : Estuarine Classification Scheme for Scotland

Class	Description	Aesthetic Condition	Fish Migration	Benthic Community and/or Bioassay	Resident Fish	Persistent Substances (Biota) (Note 14)	Water Chemistry (Note 15)	
							Dissolved Oxygen (DO)	EC Red List and Dangerous Substances
A	Excellent	Unpolluted (Note 3)	Water quality allows free passage (Note 7)	Normal (Notes 9, 12 & 13)	Resident fish community normal (Table 2)	<2X National background (Table 3)	Minimum DO >6mg/l (Note 16)	100% compliance of samples (Note 17)
B	Good	May show signs of contamination (Note 4)	Water quality allows free passage (Note 7)	Normal (Notes 9, 12 & 13)	Resident fish community normal (Table 2)	> or = 2X National background but < substantially elevated (Table 3)	Minimum DO < or = 6 mg/l but > 4 mg/l (Note 16)	Annual compliance of samples (Note 17)
C	Unsatisfactory	Occasional observations or substantiated complaints of pollution (Notes 1 & 5)	Water quality restricts passage (notes 7 & 8)	Modified (Notes 9, 10, 12 & 13)	Resident fish community modified (Table 2)	> or = substantially elevated but < grossly elevated (Table 3)	Minimum DO < or = 4mg/l but >2mg/l	One or more List II substances fail to comply. List I and Red List all comply (Note 17)
D	Seriously polluted	Frequent observations or substantiated complaints of pollution (Notes 2 & 6)	Water quality allows NO passage (Note 7)	Impoverished or severely modified (Notes 9, 10, 11 & 12)	Resident fish community impoverished (Table 2)	> or = Grossly elevated level (Table 3)	DO < 2mg/l	One or more List I or Red List substances fail to comply (Note 16)

Estuary Classification Notes

(1) Occasional = Presence observed on less than 20% of visits or samples.

(2) Frequent = Presence observed on 20% or more of visits or samples.

Aesthetic Conditions

(3) Sewage and petroleum residues absent, but traces of items in Section B of Table 1 may be present.

(4) Presence of **traces** of sewage derived solids or petroleum residues, or conspicuous accumulations of other materials. See Table 1.

(5) Presence of **conspicuous** accumulations of sewage derived solids or petroleum residues, or smell nuisance, or gross accumulations of other materials. See Table 1.

(6) Gross, **offensive** accumulations of sewage solids or petroleum residues, or smell nuisance.

Fish Migration

(7) The absence of a physical barrier to migration is assumed. Infrequent restriction of passage or isolated minor fish kills directly attributable to prolonged drought/low river flows should be ignored in classifying an estuarine area.

(8) Evidence for the migration of salmonids and eels will be sufficient provided there is no reason (see below) to suspect fish migration problems. Data on the migration of other species should be used if available and should be collected if this is thought to be necessary by SEPA.

Reasons include:-

(a) The presence of substantial discharges or other sources of pollution.

(b) Reliable observations of migratory problems for any appropriate fish species, (excepting note 7).

(c) Absence of spawning fish in most of the suitable spawning areas in catchment.

Resident Biota

(9) Fauna and flora consistent with physical and hydrographical conditions (e.g. level on shore or sub-tidal location, sediment characteristics, tidal and other currents and salinity), and unaffected by organic enrichment or toxic pollution.

For data analysis methods, etc see Rees et al (1990), MAFF (1993 a & b) and Elliott and O'Reilly (1991).

Estuarine biotic indices are currently (1994) under development.

(10) Modified fauna and flora characterised by a decline in numbers of species, a faunal distortion or a clearly defined toxic or sublethal response but, in the case of organic enrichment, accompanied by extremely abundant populations of opportunistic species (see Pearson & Rosenberg 1978).

(11) Fauna or flora absent or poor in expected species, abundance or biomass;

AND/OR

Beggiatoa mats present.

(12) The sediment bioassay using the amphipod *Corophium sp* is the recommended method. The protocol is described in ICES (1994). The following guidelines apply (taking account of the frequent high mortality in controls):-

<30% mortality = Class A & B
30-70% mortality = Class C
>70% mortality = Class D

(13) Where there are known or suspected sources of TBT (tributylin), or the degree of imposex in dogwhelks has been measured, then the following guidelines will apply:-

<10% imposex = Class A
10-40% imposex = Class B
>40% imposex = Class C

Persistent Substances (Biota)

(14) The appropriate component of the biota should be used, as circumstances dictate and bearing in mind the comments of Bryan et al (1985) with regard to the indicator ability of various taxa. In view of the year on year variability of single site samples a 5 year running mean

should be used where possible. Where there is information on the adverse effects of chemicals or biota not cited in Table 3, this should be applied using the best knowledge currently available.

Water Chemistry

(15) Normally depth averaged values (at given locations) should be used.

(16) If 20 or more samples are collected then a 95%ile daily mean, taken over a calendar year, applies to the lower limit of each class. If less than 20 samples are collected then all must be over the lower limit.

(17) The testing of substances listed under the UK Red List EC Dangerous Substances Directive is not necessary if there is no reason to suspect their presence.

Note:-

100% compliance means all samples must be below the EQS.

Annual compliance means only the annual average must be below the EQS.

TABLE 1

Aesthetic Criteria

Section A - Sewage and Petroleum derived solids and materials

Human faeces

Animal faeces

Grease, scum of sewage origin

Sanitary towels

Contraceptives, tampon applicators

Other sewage debris (hair, toilet paper, sludge, floc, etc)

Sewage smells

Oil

Tar

Smell of petroleum

Section B - Other Materials (Refuse and other solid wastes)

Fishing gear

Plastic wastes

Refuse from ships

Refuse from terrestrial sources

Builders waste

Mineral waste

TABLE 2

Resident Fish

Class A - Resident fish fauna consistent with physical and hydrographical conditions and not restricted in usage of estuary by water quality.

Class B - As Class A.

Class C - Resident fish fauna not consistent with physical and hydrographical conditions with a reduction in species richness. Evidence of occasional restriction in usage of estuary by water quality factors.

Class D - Resident fish fauna showing marked reduction in species richness which is not consistent with physical and hydrographic regime. Evidence of frequent restriction inusage of estuary by water quality factors.

Notes

The major water quality factory limiting usage of estuaries by fish is usually dissolved oxygen. Where DO falls below 4 mgl^{-1} for extended periods, effects on resident fish populations can be expected. Where industrialised estuaries have a history of poor water quality, reductions in species richness have commonly been observed. In upper estuarine areas, fish species indicative of good water quality can include sparling (*Osmerus eperlanus*) and twaite shad (*Alosa fallax*). In lower estuarine areas, the presence of range of marine adventitious marine juvenile and marine seasonal species in addition to a variety of estuarine resident species would also be indicative of good water quality.

TABLE 3A

"National Background", "Substantially Elevated" and "Grossly Elevated" Contaminant Levels in the Common Mussel, *Mytilus edulis,* Analysed in Accordance with ICES Guidelines

Substance	"National Background"	"Substantially Elevated"	Grossly Elevated"	Unit
Mercury	0.15	1.5	3.0	mg/kg dry
Cadmium	1.0	10	20	mg/kg dry
Chromium	2.0	15	40	mg/kg dry
Copper	6.0	20	45	mg/kg dry
Lead	4.0	25	50	mg/kg dry
Nickel	1.5	15	30	mg/kg dry
Zinc	90	400	600	mg/kg dry
DDT[1]	20	100	200	µg/kg wet
HCB	1.0	10	20	µg/kg wet
HCH[2]	1.0	10	20	µg/kg wet
Dieldrin	2.0	20	50	µg/kg wet
PCBs[3]	10	50	100	µg/kg wet

[1]DDT expressed as the sum of the three p, p-isomers;

[2]HCH expressed as the √-isomer;

[3]PCBs expressed as 2.5 times the sum of the seven 'IUPAC' congenors, numbers 28, 52, 101, 118, 138 153 and 180, to give an Arochlor equivalent.

TABLE 3B

Fucus vesiculosus/F. spiralis mg/kg dry weight

Substance	**"National Background"**	**"Substantially Elevated"**	**"Grossly Elevated"**
Mercury	0.02	0.2	0.4
Cadmium	1.0	8	16
Arsenic	10	100	240
Chromium	1.0	6	12
Copper	3.5	35	70
Lead	1.0	10	20
Nickel	4.0	40	80
Zinc	35	350	700