

Introduction

The recent CEFAS study was technically thorough and scientifically wide-ranging and was clearly carried out with skill and commitment. However there appear to be some omissions in the report and points of conflict between the raw data and its interpretation. Some of the data can be interpreted in quite different ways but the forthright tone of the report does not reflect any doubt or possibilities of subjectivity or omission. This critique examines some of these points.

1. Methods used

It is unfortunate that the study used methods which were not comparable with those used to analyse the dredged material. No attempt has been made to compare contaminants found in the sea-bed samples with any detected in the dredged material despite techniques being available for determining precise “signatures” of some organic contaminants such as poly-aromatic hydrocarbons (PAHs).

2. Errors and paucity of data

The spoil ground has been in use for some considerable time so, unsurprisingly, there are some gaps in the data which illustrate the marine community in its natural state. However, some references are made to data over 60 years old and others to the time when sewage was dumped in Plymouth Sound. The relevance of using these comparisons is questionable. In particular, we should not put too much reliance on the strong claim made in the report that sewage outfalls are to blame for some of the adverse environmental effects seen. Until such sources are identified and assessed (local information suggests they do not exist) we need to keep a more open mind.

Some data presented is compared with a dump site near Newcastle on Tyne. Whether it is valid to compare a rural location in the English Channel with an industrial one on the North Sea is open to question. The report’s conclusions tend to overlook the respective attributes of the two areas, as seen by the local and wider communities, particularly the importance of Whitsand Bay’s “clean image” to tourism and local recreation.

3. Conflicts between data obtained and conclusions drawn

3i. Effects on biodiversity

The overall view expressed in the report, that things are fine in Polhawn Cove is seriously at odds with the data presented in Fig 27 (p49).

These show a paucity of marine life, the range of species present in the environs of Polhawn being severely depleted compared to areas further away from the spoil ground. Species diversity in the Cove is less than that found in the spoil ground itself. The depleted marine community could be explained however, by looking at the elevated levels of toxic chemicals found in the Polhawn locale by the study: pesticides, poly chlorinated bi-phenols, arsenic, heavy metals and (PAHs) all show elevated levels compared to other areas.

Table 1. Levels of heavy metals and arsenic near to Polhawn Cove

Values shown are averages of 3 representative sampling sites, in mg/kg.

Source: Table 10 p57.

	As	Cd	Cr	Cu	Hg	Ni	Pb	V	Zn
Area adjacent to Polhawn Cove (1)	48	0.48	175	65	2.30	52	205	130	161
Spoil Ground (2)	43	0.32	92	133	0.68	44	157	128	243

(1) An average of the 3 CEFAS sampling stations RH4, RH5 and G13,

(2) An average of the 3 sampling stations G16, G18 and G19.

In most cases, levels of heavy metals are well in excess of those found (after extensive tidal dispersion) in the spoil ground. Especially worrying are the elevated levels of chromium, mercury and lead as these are extremely persistent and tend to accumulate in the food chain. The report does not explain how this situation came about but rather glosses over the possible involvement of dumped material by broadly saying the pollutants are derived from Plymouth Sound (more on this later in the critique).

3ii. Effects on viability

The report concludes that there is “*strong supporting evidence for the absence of any contaminant induced impacts on marine animals*”. However, the raw data shows a considerable effect of the sediments, killing a large proportion of some of the animals exposed in the bioassay quoted (pp50/51). The amphipod substrate surface-dwelling *Corophium* and the subterranean worm *Arenicola* were used in the bioassays. Although the effects seen were not statistically significant at 95% confidence levels (CL), a marked trend is seen by grouping the data (Table 2).

Table 2. Extra deaths of *Corophium* in sediment samples compared to control samples* of “normal water”. (Data derived from that in Table 8 in the report, *control mortality was 20%.)

Source of the sediment	Extra deaths *
Spoil ground (average of 2 sites: G18 & G19)	20%
Edge of spoil ground adjacent to Polhawn Cove (G13)	28%
Sample site nearest to Polhawn Cove (G3)	12%

Corophium succumbed to the sediments whereas the lugworms survived - an interesting and perhaps *qualitatively significant* result, perhaps telling us about the qualities of the sediments (low oxygen content?) and the bio-chemical activities going on within them. A “hot-spot” of toxic sediment is indicated at the sampling site near to the Cove (G13), coinciding with elevated contaminant levels and in the region where local divers have seen such dire effects on the sea bed and marine life. It is worrying that no associations were drawn and such a large effect was simply disregarded as being statistically insignificant (at 95 % CL) with little further comment or consideration.

3iii. Bacterial mats

The presence of *Beggiatoa* has been acknowledged in the report but not properly explained. In particular, there is no recognition that dumped material may be involved in the problem, by perhaps at times covering vegetation such as the kelp beds in silt, causing their death and thence a heavy biochemical oxygen demand leading to the anoxic environment which enables *Beggiatoa* to thrive and stifle other organisms?

The report hints consistently that a source of sewage may be causing problems in the Bay, with no similarities between dumped dredged material and other high oxygen-consuming organic wastes (such a sewage) being recognised.

4. Tidal flushing

The main thrust of the report proposes that spoil cannot build up in the Bay. However, data in Figure 19 (p44) clearly indicates that spoil released at the NE part of the spoil ground can find its way onshore and specifically Polhawn Cove, at certain states of the tide. This is overlooked in both the discussion of the tidal data and the assessment of its impact on the transport of contaminants in the evaluation and final conclusions.

The mathematical model used to show dumped material being swept out of the Bay is reliant on several variables giving somewhat ideal dispersal conditions.

These include:

- State and cycle of the tide (ebb/flow, springs/neaps).
- Wind direction and strength (with resultant effect on waves and sea build up).
- Dredger position (navigation accuracy and being static whilst releasing).

Many of these variables have been questioned both by local observation and in part, in the report but the evaluation section and the conclusions reached never question the solid tenet that all spoil is transported out from the Bay and Cove. On a related belief held strongly by the report, the mechanism by which contaminants from Plymouth Sound (but not those from the spoil zone which is much nearer) build up in Polhawn Cove, is not made clear.

An alternative scenario?

It is well recognised that the smaller fractions of mixed-particle aggregates tend to clump together and may well be under-represented in the sizing technique used (hence the need for checks using microscopy). It is also known that many chemical species tend to accumulate on smaller particles and extremely large energy inputs are needed to encourage their subsequent physical release. We could envisage a scenario where significant levels of contaminants could build up and be represented by a tiny fraction of the substrate. Such effects could be quite local, being dependent on low flushing rates and a depleted, anoxic marine environment where contaminants are cycled through a limited number of tolerant organisms and undergo change into more toxic forms. Many studies have shown the build up of pollutants through the food chain, with some relatively inert substances being changed to active, organic forms in the process (especially in anoxic conditions). Such a scenario could explain some of the effects local divers have seen such as diseased and dying organisms and the marine community out of balance. Conjecture - yes, but probably of similar merit to some of the conjecture shown in the CEFAS report. I would liked to have seen a more questioning approach, with a more open mind when interpreting the data gathered and more emphasis on what may have caused the biological effects seen. In conclusion, I feel that some very broad assumptions and un-critical evaluation of some data from the study makes certain key conclusions in the report highly questionable.

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