

## MOLLUSCAN WORKING GROUP - COCKLE MORTALITY BRIEFING

Historical spring settlement of cockle spat in the Burry Inlet estuary, therefore fishery prospect, can be described:

### Index of Burry Inlet cockle spat (0+) settlement

1999	🐚🐚🐚🐚🐚	
2000	🐚	🐚 = < 1,000 million
2001	🐚🐚🐚🐚	🐚🐚🐚 = 3 – 4,000 million (Average)
2002	🐚🐚🐚	🐚🐚🐚🐚 = > 5-10,000 million
2003	🐚🐚🐚	🐚🐚🐚🐚🐚 = > 10,000 million
2004	🐚🐚🐚🐚🐚	
2005	🐚🐚🐚🐚	
2006	🐚🐚🐚	

*Source : CEFAS annual November survey over a standard survey area.*

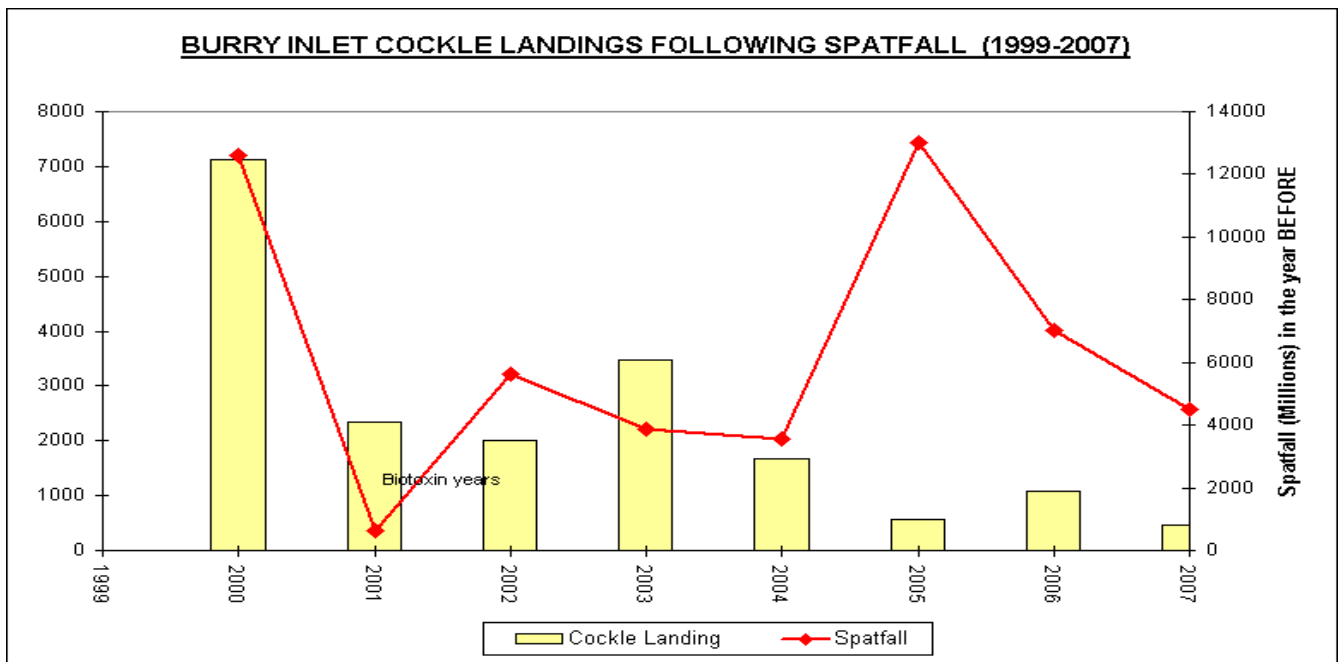
NB 1 In 2004 and 2006 cockles settled heavily seaward of the survey area as well producing the largest spatfalls in living memory and not fully reflected by the above.

NB 2 The above are actual returns and therefore reflect mortality events in previous years. Cockle settlement is density dependent and adversely affected by large cockle biomass present from the previous years eg in 2000. It follows that had mortality not taken place then spatfall in subsequent years might have been very different.

### Fishing activity

Hand gathered cockles would normally be fished over a 2- 3-year period a year after settlement. For example 1999 settled cockle spat would support fishing in 2000 (say 30%), 2001 (say 60%) and 2002 (say 10%).

Figure 1 below reflects actual fishery landing the year following cockle settlement as an indicator of fishery prospect:



The following factors determine the economic value of local hand gathered cockles:

- Stock size (tonnage present)
- Total annual catch that the SWSFC allows to be taken and the minimum cockle size. A range of factors determines this.
- Cockle size (larger cockle principally in their 2<sup>nd</sup> and 3<sup>rd</sup> summer are the most “meaty” and command the best price advantage over smaller usually suction dredged cockle from the Thames and Wash estuaries.)
- Supply and demand across Europe affects market price.

### Burry Inlet mortality events and economic links

2003 - The biotoxin (atypical DSP) induced fishery closures ran into 2003. During one such closure in July a very heavy mortality of cockles of the 2001 and 2002 year classes (yc) was noted upon industries return to fishing. Prices in Europe were very high at £890 – 1000, peaking at £1300/ tonne for large (3 year old) cockle

2004 - The mortality of larger sized cockle (19mm +) seen in the peak of the summer in 2003 arose again. 2001 & 2002 settled cockle mainly died the year before and the fishery was reliant on 2003 settled cockle (an average settlement) until that too died at c 17.5mm in size. In July 2004 SWSFC took measures to allow fishing at School beds (south side) on dense cockles below even 17.5mm size, but these died before most could be taken. Fishing therefore virtually finished from September as 2004 settled cockle were too small

Mortality in 2003 & 2004 involved 1 year and old cockle and took place during periods of warm but not excessively hot weather from May – July.

### 2005

2003 and 2004 mortality events gave rise to an exceptionally low biomass of adult cockles. Yet the 2004 spring spatfall was massive and widespread (largest in living memory) thereby originating from a very low spawning stock of 1 year old (only) cockle. These were due to reach fishable size in 2005 and 2006. Cockle landings were therefore dependant upon the extent to which SWSFC allowed undersized cockles of the 2004 yc to be taken after May when they became marketable.

For the third year running, “adult” ( ie yc1 <17.5mm) cockle again began to die during warmer weather in late May especially seemingly in high-density areas on dry sands. In late June into July further mortality was noticed during periods of hot weather and (? mainly) neap tides. By late July temperatures of both the water and sands were very high, particularly when incoming shallow water flooded over baked sands. A massive and widespread die-off of the largest settlement of cockles in living memory occurred. The smell of decaying cockles spread for miles inland.

It was later learned that heavy discharges of sewage from Llanelli (north side) from at least mid June onwards, coincided with the bulk of the die-off. (Llanelli south beach closed to bathers in the 2<sup>nd</sup> week of June; break & temporary repairs of main Llanelli sewer 23 – 29 June; opening of the Delta lake to sluice the stagnant water on 15 July)

CEFAS November 2005 survey indicates a die-off of 99.5% and 96% (north & south shore respect) between May and November surveys.

### 2006

Starting point as per 2005– no adult cockles of fishable size. Annual fishery entirely dependent upon 2005 spawned cockle the spatfall from which was above average and had survived the winter very well.

SWSFC “hedged bets” allowing fishing of even <17.5mm MLS cockle (21mm size) from May to reduced numbers of Licenceholders still wishing to gather.

By May end cockle of even 13/15mm size on dry ground was dying especially on the south side. SWSFC biologist reported that the die-off was steady, not density dependent, with no obvious mass mortality events. Almost total mortality occurred by August end as industry again moved to small cockle at School beds (south side) before switching to cockle spat itself (heavy 2006 settlement) where it had grown well (eg Middle bank.)

## 2007

Essentially a repeat of 2005 and 2006. 2006 yc settlement was heavy and widespread (akin to 2004) and had over wintered very well. A big fishery was in prospect provided they survived beyond July. They didn't. Cockle was observed dying in May especially it seems in dry (not especially hot) weather on neap tides seemingly on weekends. "Flushes" of mortality were seen on the north side, the last of which occurred c 2/3rd June after which nearly all north side cockle bar spat had died. Some existed on the south side in reasonable densities but a "drip drip" steady mortality has been observed throughout the summer before they even reached 17.5mm minimum size.

The mortality appeared earlier in the year – possibly related to a prolonged period of fine weather during the early part of April.

### Three Rivers estuary mortality events

2005 - In July 12,000t of mainly 2004 settled cockle were present that might have expected to grow to around 18,000t by Sept end. Some estimated 6000t of 2003 & 2004 yc died at Llanstephan, between 22 – 29<sup>th</sup> July yet areas of denser cockle of 2004 yc only in the Gwendraeth survived. Cockle at Laugharne were believed to have shown mortality in the April – June period.

2006 – Cockle stocks were mainly centred upon Gwendraeth (2004 settlement not fished in 2005, and small 2005 settlement) and at Laugharne (3 year classes – as this area was not fished in 2005)). A fishery of c 1000t was in prospect.

Cockles died at Laugharne from April onwards, with a "flush" event in early June that led to a Public Health closure being implemented from 9<sup>th</sup> June.

No fishery took place due to the die – off. Virtually no cockle from the 2004 or 2005 settlement (small anyway) survived the summer in the Gwendraeth. Remnants were present at Laugharne from a heavier stock to start with. Wet stormy weather at the year end also coincided with further losses, including mussel at St Ishmaels.

2007 - Laugharne beds saw further limited mortality from ? February? including for the first time 2006 settlement (ie , not yet 1 year old) , some of which might have been washed-out as a result of prevailing wet conditions to March end.

2006 settlement was widespread. A fishery of c 4000t (September tonnage estimate) was in prospect from Laugharne, Gwendraeth and Llanstephan.

Laugharne cockle seemed to die-off from April onwards. Gwendraeth and Llanstephan situated cockle from May, (although drip – drip mortality was seen in the 15 – 20 April cockle survey) again peaking with a "flush" in early June.

### Patterns?

Early warning of cockle mortality can be gained by monitoring mid tide cockle possibly in dry sand at Laugharne and Burry Inlet north side (eg Pwll) from March onwards, concentrating on those faster growing individuals.

## 2. Consequences

### a) Economic costs

First sale losses to industry are circa £11.96 – 20.77m depending on various assumptions (See Annexe)

## b) Ecological considerations

Burry Inlet and Three Rivers estuaries are designated under various EU and National conservation designations eg SAC, SPA and SSSI where maintenance of “favourable conservation status” is the aim.

CCW raise great concern as to the possible impact of fishing operations on designated site features but have paid little attention to the causes of large scale die-off of cockle with potentially serious consequences eg for bird food or estuarine ecological function. They suggest no remedy, but have contributed c £9k to a scoping study.

Both estuaries / local beaches are designated as being of “sensitive water quality” under various EU legislation (eg Urban Waste Waters, Shellfish Directive, Bathing Waters, Shellfish Health Directive. Also the Water Framework Directive where “good ecological status” is the requisite benchmark. The Environment Agency is the competent authority for most of these, but has done little to investigate the cockle die off - nor whether the cause might have implication for migratory fish for which they have responsibility.

Responsibility for ecological and economic fishery function lies with SWSFC and the WAG. Little has been done by either body to implement any sort of investigatory programme. WAG (through the then Minister Carwyn Jones AM) has suggested that the Burry Inlet licence holders fund their own study!

SWSFC has documented events, collected limited samples for *ad hoc* CEFAS analysis, and working with fishing industry, has sought to identify funds for more intensive investigations and has generally raised the profile – as is a purpose of this document.

### Possible causes - the need for studies?

Pathological analysis by CEFAS (Weymouth) of periodic cockle samples in 2004, 2005, 2006 and 2007 has not identified any obvious cause of mortality.

CEFAS investigation in 2004 showed the presence of high levels of 2 parasite types in the foot muscle and gills in particular. It was postulated at the time that these events may be linked to the mortality as cockles with impaired breathing and /or burrowing would be prone to desiccation and predation.

Samples in later years show the presence of parasites but these were not widespread or at especially high levels. Moreover the die off is mostly of all adult cockles (not spat) and not all adult cockles have high parasite burdens, yet they still died. Parasite burden may therefore be a symptom or even a contributory cause but are unlikely to be the whole story.

Others speculate a role for:

Plankton

Sewage discharges (allegedly high since c 2004)

Heat exhaustion and desiccation

Oxygen depletion

Mild winters (? food deficiency, reduction in condition)

Post spawning stress (especially upon 1 year old cockle which would not normally spawn)

Viruses

Bacteria

Diffuse pollution (eg sheep dip)

Excessive cockle numbers

It seems most likely that the cause is multi-factorial. Furthermore there may be different circumstances prevailing in different years. These all require further investigation and monitoring.

Some factors might apply more widely than just the Burry Inlet / 3 Rivers estuaries. What is it about these areas that predispose cockles to this condition?

S&WWFC Ltd Association (supported by SWSFC) have succeeded in obtaining some limited grant from CCW and SFIA which along with match funding in kind will enable a Researcher to be employed for a few months.

This will at least enable past events to be documented, a search of the literature as to possible causes and a listing of sources of environmental data that may be relevant. It may also be possible to identify some further trials or monitoring. The aim will be to alert authorities to the need for future monitoring and requirement for further targeted grant to studies / data collection.

P J Coates, Director  
10 September 2007.

## Annexe

### Historical fishery landings and potential losses

#### Cockle Landings 2001 – 2007

<u>Burry Inlet</u>	<u>2007</u>	<u>2006</u>	<u>2005</u>	<u>2004</u>	<u>2003</u>	<u>2002</u>	<u>2001</u>
Actual Landings	ca 455t	1077t	557t	1469t	3400t	2006t	2538t
Value (£)	£180,800	£376,770	£299,400	£936,000	£2.9m	£1.9m	£390,000
Price / tonne*	£400	£350	£537	£637	£853	£947	£153

\* These are first sale prices (ie to the gatherer on the beach) and do not reflect processed value which may be x4 – x5 more (on average).

From 2003 to 2006 the demand for large cockles was high and hence prices per tonne were high.

#### Estimated losses

								<u>Totals</u>
Long term <u>3500t</u> av	<b>£1.98m</b>	<b>£1.21m</b>	<b>£1.76m</b>	<b>£1.42m</b>	<b>£90k</b>	-	-	<b>£6.46m</b>
& av prices for 2yr cockle								

Based on expectation

of stock, & av prices	<b>£3.6m</b>	<b>£3.9m</b>	<b>£3.85m</b>	<b>£1.42m</b>	<b>£1.5m</b>	-	-	<b>£14.27m</b>
for 2 yr cockle**								

\*\* Crude assessment. It would be possible to model growth & depletion based on historical data making allowances for future density dependant settlement and value of cockles to the resultant size profile.

<u>Three Rivers</u>	<u>2007</u>	<u>2006</u>	<u>2005</u>	
Actual landings	ca410t	Nil	8,200t	
Value	£205,000		£4,600,000	
<u>Estimated Losses</u>	<b>£2m</b>	<b>£0.5m</b>	<b>£3- 4m</b>	<b>£5.5-6.5m</b>
	(4000t x £500/t)	(1000t x £500/t)	(6000t x £650)	