

# Thames Estuary Cockle Survey Report 2019



Inshore Fisheries and  
Conservation Authority

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## **Executive Summary**

This report gives an annual up-date assessment of all cockle stock surveys carried out by the Kent and Essex Inshore Fisheries & Conservation Authority (KEIFCA) during 2019. The data from these surveys are added to the previous annual surveys to provide current information which is used to assess the management strategy of the district's commercial cockle stocks.

NOT TO BE QUOTED WITHOUT PRIOR REFERENCE TO KEIFCA

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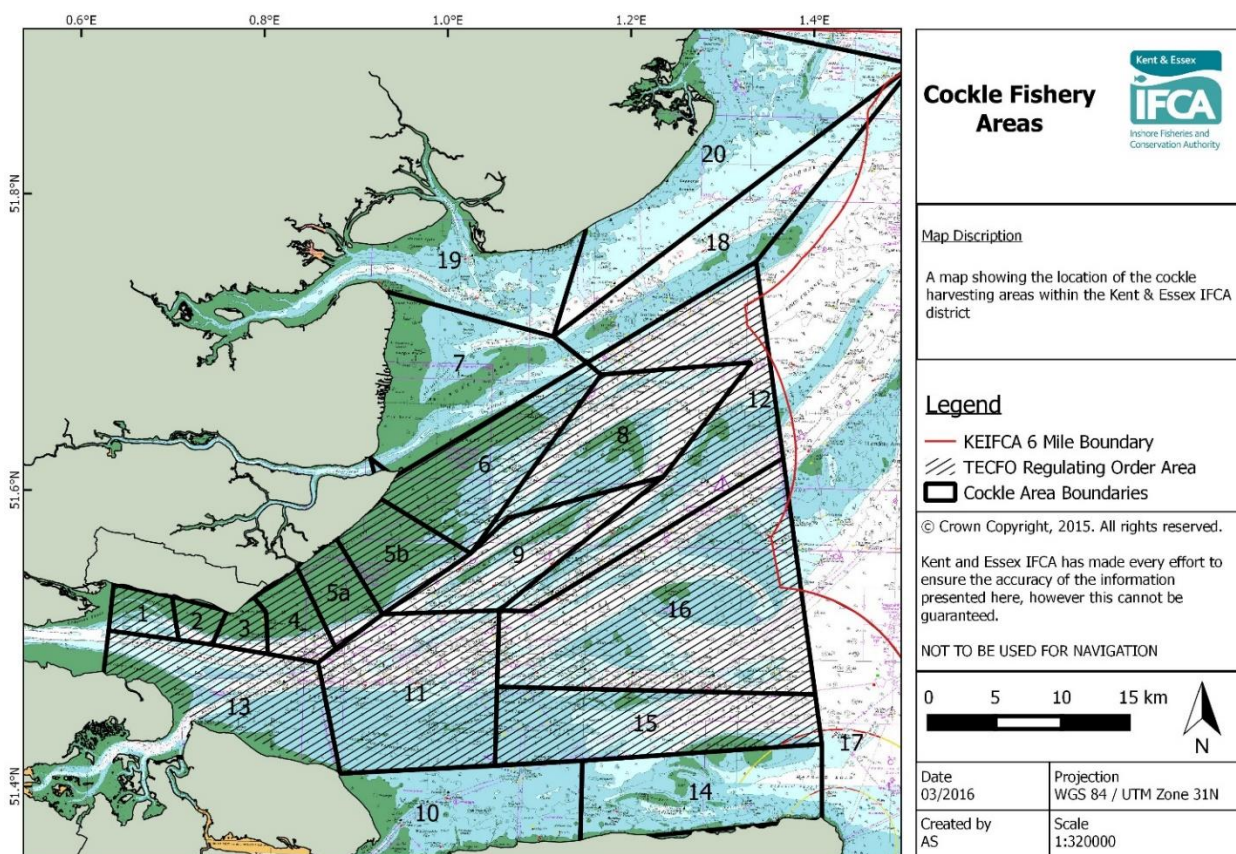
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# 1 INTRODUCTION

The Thames Estuary supports an important cockle fishery, and the commercial harvesting of the cockles is regulated by KEIFCA under the Thames Estuary Cockle Fishery Order, 1994 (TECFO) and byelaws. In order to successfully manage cockle (*Cerastoderma edule*) stocks and ensure a sustainable cockle fishery, the Authority has conducted annual surveys of the cockle beds within the Thames Estuary since 1988.

The sampling programme has been designed to allow for annual seasonal assessment of cockle stocks within the major commercial harvesting areas of the Thames Estuary. Cockle beds have been identified and the Thames Estuary has been divided into cockle management areas (Figure 1) within which stocks and fishing activity are assessed. The results of the stock assessment surveys are used to examine the distribution, density and age structure of cockles in the different areas, and to produce estimated values of population size and biomass. Cockle biomass values are used to set a total allowable catch (TAC) for the fishery which is divided between licence holders (for areas inside the TECFO area) or permit holders (for areas outside the TECFO area).

**Figure 1: Cockle management areas in the Thames Estuary**



**Chart area key:****Grounds within the area covered by the Thames Estuary Cackle Fishery Order 1994**

1. Marsh End & Chapman Sands
2. East of pier
3. West of Shoebury boom
4. East of Shoebury boom
- 5a. South Maplin
- 5b. Mid Maplin
6. North Maplin & Foulness Sands
8. East Barrow & Maplin Spit
9. West Barrow
11. East Cant, Middle & Red Sand
12. Sunk Sand
13. West Cant & Scrapsgate
15. North Margate Sand & Pan Sand
16. Shingles & Long Sand

**Grounds outside the area covered by the Thames Estuary Cackle Fishery Order 1994**

- 1a. Inner Estuary
7. Buxey Ray & Dengie Sands
10. Leysdown & Ham.
14. South Margate Sands
17. South Kent Coast to Dungeness
18. Gunfleet Sand
19. Blackwater Estuary
20. Wallet & North Essex Coast



## 2 METHODS

### 2.1 Survey methodology

#### 2.1.1 Sample collection from shore

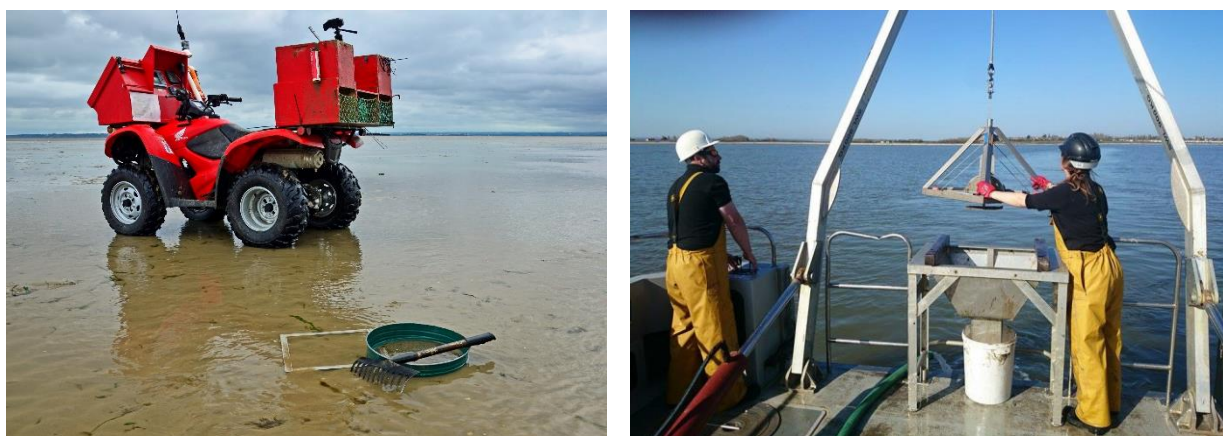
Intertidal sandflats, accessible from shore in areas 2, 3, 4, 5a, 5b and 6 were accessed using all-terrain vehicles (ATVs; Figure 2a) within 2 hours of low water. Sampling of these areas was conducted around the time of spring tides in April 2019 and was repeated for the main cockle harvesting areas; 4, 5a, 5b and 6, in September 2019 (Table 1). Samples were collected at each sample point in the survey grid (Figure 3) using a 0.1 m<sup>2</sup> quadrat. Sediment was removed from the upper 6 cm inside the 0.1 m<sup>2</sup> quadrat using a rake and sieved through a 5 mm square meshed sieve. Any cockles retained on the sieve were collected for further analyses.

#### 2.1.2 Sample collection at sea

Surveys of intertidal cockle beds not accessible from shore were carried out from KEIFCA's vessel 'FPV Tamesis' during periods of high tide in April 2019. Samples were collected using a 0.1 m<sup>2</sup> Day grab which was lowered from the vessel via a hydraulic winch (Figure 2b). The contents of the day grab were emptied and sieved through a 5 mm square meshed sieve. Any cockles retained on the sieve were collected for further analyses.

The 2019 survey included new sample locations in areas 9 and 12. These locations represented an area of the Knob Gat bordering the Mouse Channel. During the 2018 season the cockle fleet discovered a population of cockles in this area which has now been incorporated into the spring survey.

As a result of political uncertainty around Brexit, and reallocation of KEIFCA resource away from survey work, during the spring of 2019 surveys on the Kent coast were not conducted in Areas 10, 14 and 17. These areas are covered under the permit fishery outside of the area covered by TECFO, and based on previous years stock data were considered unlikely to contain adequate stock for harvesting during the 2019 season. These sites will be returned to the survey in 2020.



**Figure 2: Sample collection methods; (a) ATV, quadrat, rake and sieve; and (b) day grab deployed from vessel**

### 2.1.3 Biomass and stock size measurements

Cockles from each sample point were separated into year classes, identified by the number of growth rings visible on the outside of the shell. The cockles were enumerated and cockles from each sample point in each year class were combined for each cockle management area. Cockles from each age class in each area were sorted into 3 size classes (<14 mm, 14 – 16 mm and >16 mm) using 14 mm and 16 mm sorting riddles. 16 mm is the minimum landing size for cockles within the KEIFCA district, and the measurement relates to the smallest dimension of the cockle. The total weight and number of cockles in each year and size class for each cockle management area were measured and used to estimate the total stock size and biomass of each age and size class of cockles.

## 2.2 Survey schedule

Sampling of the cockle beds commenced on the 2<sup>nd</sup> April 2019, with the final cockle survey completed on the 1<sup>st</sup> September 2019. All surveys, areas and sampling methods are shown in Table 1.

**Table 1: Date and survey method, Thames Estuary, 2019**

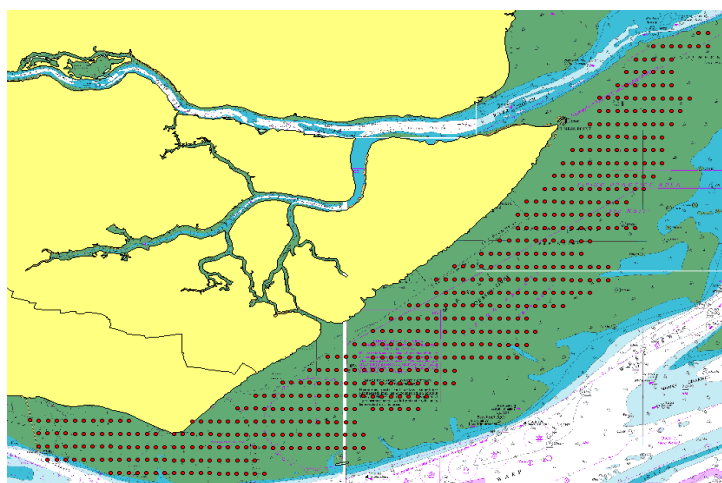
Survey Area	Survey Date	Survey Method
Area 1 – Marsh End	30/04/2019	Grab Sampling
Areas 2 & 3	22/04/2019	Vehicle Sands Survey
Areas 4, 5 & 6 (Spring)	19/04/2019 - 21/04/2019	Vehicle Sands Survey
Areas 4, 5 & 6 (Autumn)	30/08/2019 – 01/09/2019	Vehicle Sands Survey
Area 7 – (N. Foulness)	19/04/2019	Vehicle Sands Survey
Area 7 – Ray Sand	03/04/2019 - 08/04/2019	Grab Sampling
Area 7 – Dengie	02/04/2019	Grab Sampling
Area 7 – Buxey	02/04/2019 - 03/04/2019	Grab Sampling
Area 8 – East Barrow	17/04/2019	Grab Sampling
Area 9/12 – Mouse/Knob	29/04/2019	Grab Sampling
Area 10 – Leysdown & Ham	-	Grab Sampling
Area 13 - Scrapsgate	12/04/2019	Grab Sampling
Area 14 – Minnis Bay	-	Grab Sampling
Area 17 – Pegwell Bay	-	Grab Sampling

## 2.3 Survey Array

Intertidal sand and muddy sand areas were surveyed using a predetermined sampling grid. The sampling grid consisted of a series of parallel transect lines which were evenly spaced across the cockle beds. Samples were taken at predetermined points along each transect line. All samples were taken at positions recorded by GPS to be within 10 m of the target transect position, unless otherwise recorded.

The majority of the surveys utilised a sample grid consisting of one quarter of a minute latitude by one quarter of a minute longitude (464 m by 290 m) apart. During the interim autumn survey of the Maplin sands (areas 4, 5 & 6); a sample grid of one half minute latitude by one quarter of a minute longitude was used.





**2.4 Figure 3: Cockle survey sampling positions in the main cockle harvesting areas; 2, 3, 4, 5a, 5b and 6**

#### Area covered by survey

A total of 1158 samples were taken during the 2019 surveys, covering an area of 125.4 km<sup>2</sup> (not including additional surveys in areas which were surveyed multiple times) (Table 2)

**Table 2: Number of samples taken and area of cockle beds surveyed in the Thames Estuary in 2019**

Area	Number of samples	Area surveyed (km <sup>2</sup> )
Area 1 Marsh End (Spring)	37	2.5
Area 2 (Spring)	49	6.6
Area 3 (Spring)	52	7.0
Area 4 (Spring)	76	10.2
Area 4 (Autumn)	41	10.2
Area 5 (Spring)	227	30.5
Area 5 (Autumn)	111	30.5
Area 6 (Spring)	115	15.5
Area 6 (Autumn)	49	15.5
Area 7 Ray Sand	99	13.3
Area 7 Dengie	52	7.0
Area 7 Buxey	111	14.9
Area 7 Foulness North (Spring)	14	1.9
Area 8 East Barrows	62	8.5
Area 9/12 Mouse/Knob	48	6.5
Area 10 Leysdown & Ham	-	-
Area 13 Scrapsgate	15	1.0
Area 14 Minnis Bay	-	-
Area 17 Pegwell Bay	-	-
<b>Total</b>	<b>1158</b>	<b>125.4</b>

#### 2.5 Data analysis

The mean density of cockles in a given cockle management area, together with the size of the area (km<sup>2</sup>) is used to calculate the number of each year class of cockles in that area. The number of cockles and the mean weight of cockles in each age class are used to calculate the biomass of each year and size class of cockles within each cockle management area. The proportion of cockles above and below 16 mm is used to calculate the biomass of each year class cockles in that area above and below 16 mm.

### 3 RESULTS

#### AREA 2

##### 3.1 Area 2 stock assessment (spring survey)

The spring survey of area 2 was conducted on the 22<sup>nd</sup> April 2019. A total of 49 sites were sampled covering a total area of 6.6 km<sup>2</sup>. The mean density, total stock, mean weight and biomass of each year class of cockles are presented in Table 3 and a summary of the stock assessment is presented below.

**Table 3: Area 2 stock parameters, spring 2019**

	# samples	Area size	Year Class			
			2018	2017	2016	2015
Area 2	38	5.1				
Mean Density			672.0	3.9	16.9	0.4
Stock (millions)			4431.1	25.6	111.7	2.7
Mean Weight (g)			0.5	2.3	3.8	3.0
Biomass (tonnes)			2344.0	58.2	421.2	8.1
Biomass below 16 mm			2344.0	39.8	250.3	4.0
Biomass 16 mm and above			0.0	18.5	170.9	4.1

##### Summary of stock assessment for Area 2 (spring survey)

The final stock assessments, based on the survey area of **6.6 km<sup>2</sup>** are as follows:

Total number of cockles

Total number of 2018 year class

**4431.1 million**

Total number of 2017 and older year class

**139.9 million**

Total stock biomass

Total stock (all cockles)

**2831.5 tonnes**

Total stock biomass - cockles below 16mm

**2638.1 tonnes**

- cockles 16mm and above

**193.4 tonnes**

## AREA 3

### 3.2 Area 3 assessment of stock (spring survey)

The spring survey of area 3 was conducted on 22<sup>nd</sup> April 2019. A total of 52 sites were sampled covering a total area of 7.0 km<sup>2</sup>. The mean density, total stock, mean weight and biomass of each year class of cockles are presented in Table 4 and a summary of the stock assessment is presented below.

**Table 4: Area 3 stock parameters, spring 2019**

Area 3	# samples	area size	Year Class			
			2018	2017	2016	2015
	<b>52</b>	<b>7.0</b>				
Mean Density			375.4	66.0	55.2	1.9
Stock (millions)			2626.6	461.5	386.2	13.5
Mean Weight (g)			0.4	2.3	4.4	5.4
Biomass (tonnes)			1153.2	1062.6	1703.8	72.7
Biomass below 16 mm			1153.2	959.0	755.0	0.0
Biomass 16 mm and above			0.0	103.6	948.8	72.7

### Summary of stock assessment for Area 3 (spring survey):

The final stock assessments, based on the survey area of **7.0 km<sup>2</sup>** are as follows:

#### Total number of cockles

Total number of 2018 year class

**2626.6 million**

Total number of 2017 and older year class

**861.2 million**

#### Total stock biomass

Total stock (all cockles)

**3992.3 tonnes**

Total stock biomass - cockles below 16mm

**2867.2 tonnes**

- cockles 16mm and above

**1125.1 tonnes**

## AREA 4

### 3.3 Area 4 assessment of stock (spring survey)

The spring survey for Area 4 was conducted between 19<sup>th</sup> and 21<sup>st</sup> April 2019. A total of 76 sites were sampled covering a total area of 10.2 km<sup>2</sup>. The mean density, total stock, mean weight and biomass of each year class of cockles are presented in Table 5 and a summary of the stock assessment is presented below. The distribution of each year class is presented in Figures 3.1 – 3.6.

**Table 5: Area 4 stock parameters, spring 2019**

Area 4	No. Samples	Area km <sup>2</sup>	Year Class			
			2018	2017	2016	2015
	<b>76</b>	<b>10.2</b>				
Mean Density			442.1	183.7	65.9	6.7
Stock (millions)			4521.2	1878.5	674.1	68.6
Mean Weight (g)			0.4	1.3	3.5	6.1
Biomass (tonnes)			1959.2	2363.3	2380.7	420.8
Biomass below 16 mm			1959.2	2249.8	1452.7	47.9
Biomass 16 mm and above			0.0	113.4	927.9	372.9

### Summary of stock assessment for Area 4 (spring survey)

The final stock assessments, based on the survey area of **10.2 km<sup>2</sup>** are as follows:

Total number of cockles:

Total number of 2018 year class	<b>4521.2 million</b>
Total number of 2017 and older year class	<b>2621.2 million</b>

Total stock biomass

Total stock (all cockles)	<b>7123.9 tonnes</b>
Total stock biomass - cockles below 16mm	<b>5709.6 tonnes</b>
- cockles 16mm and above	<b>1414.3 tonnes</b>

## AREA 4

### 3.4 Area 4 assessment of stock (autumn survey)

An interim survey of Area 4 was also undertaken in autumn 2019 to supplement the existing programme of annual surveys. The main objectives of the autumn survey being to assess spat settlement and abundance, along with the distribution of the remaining cockles. During the period from June 2019 to this survey date, the grounds were subject to controlled commercial fishing activity.

The autumn survey was carried out between 30<sup>th</sup> August and 1<sup>st</sup> September 2019. The mean density, total stock, mean weight and biomass of each year class of cockles are presented in Table 6 and a summary of the stock assessment is presented below. The density and distribution of spat is presented in Figures 3.1 – 3.6.

**Table 6: Area 4 stock parameters, autumn 2019**

Area 4	No. Samples	Area km <sup>2</sup>	Year Class			
			2019	2018	2017	2016
	<b>41</b>	<b>10.2</b>				
Mean Density			17.1	379.8	95.4	7.6
Stock (millions)			174.6	3883.6	975.3	77.3
Mean Weight (g)			0.3	1.4	3.3	6.3
Biomass (tonnes)			47.4	5537.3	3181.1	488.9
Biomass below 16 mm			47.4	5537.3	2463.3	22.4
Biomass 16 mm and above			0.0	0.0	717.8	466.4

### Summary of stock assessment for Area 4 (autumn survey)

The final stock assessments, based on the survey area of **10.2 km<sup>2</sup>** are as follows:

#### Total number of cockles

Total number of 2019 year class	<b>174.6 million</b>
Total number of 2018 and older year class	<b>4936.2 million</b>

#### Total stock biomass

Total stock (all cockles)	<b>9254.7 tonnes</b>
Total stock biomass - cockles below 16mm	<b>8070.4 tonnes</b>
- cockles 16mm and above	<b>1184.3 tonnes</b>



## AREA 5

### 3.5 Area 5 assessment of stock, spring survey

The spring survey for Area 5 was conducted between 19<sup>th</sup> and 21<sup>st</sup> April 2019. A total of 227 sites were sampled covering a total area of 30.5 km<sup>2</sup>. The mean density, total stock, mean weight and biomass of each year class of cockles are presented in Table 7 and a summary of the stock assessment is presented below. The distribution of each year class is presented in Figures 3.1 – 3.6.

**Table 7: Area 5 stock parameters, spring 2019**

Area 5	No. samples	area km <sup>2</sup>	Year Class			
			2018	2017	2016	2015
	<b>227</b>	<b>30.5</b>				
Mean Density			141.1	103.7	46.2	5.4
Stock (millions)			4310.0	3167.5	1411.5	164.2
Mean Weight (g)			0.4	2.2	4.4	6.4
Biomass (tonnes)			1806.0	7009.9	6255.8	1046.9
Biomass below 16 mm			1806.0	6847.9	2536.1	10.8
Biomass 16 mm and above			0.0	162.0	3719.7	1036.1

### Summary of stock assessment for Area 5 (spring survey)

The final stock assessments, based on the survey area of **30.5 km<sup>2</sup>** are as follows:

#### Total number of cockles

Total number of 2018 year class

**4310.0 million**

Total number of 2017 and older year class

**4743.2 million**

#### Total stock biomass

Total stock (all cockles)

**16118.6 tonnes**

Total stock biomass - cockles below 16mm

**11200.8 tonnes**

- cockles 16mm and above

**4917.8 tonnes**

### 3.6 Area 5 assessment of stock, autumn survey.

An interim survey of Area 5 was also undertaken in autumn 2019 to supplement the existing programme of annual surveys. The main objectives of the autumn survey being to assess spat settlement and abundance, along with the distribution of the remaining cockles. During the period from June 2019 to this survey date, the grounds were subject to controlled commercial fishing activity.

The autumn survey was carried out between 30<sup>th</sup> August and 1<sup>st</sup> September 2019. The mean density, total stock, mean weight and biomass of each year class of cockles are presented in Table 8 and a summary of the stock assessment is presented below. The density and distribution of spat is presented in Figures 3.1 – 3.6.

**Table 8: Area 5 stock parameters, autumn survey 2019**

Area 5	No. samples	Area km <sup>2</sup>	Year Class			
			2019	2018	2017	2016
	<b>111</b>	<b>30.5</b>				
Mean Density			13.3	118.5	88.5	10.0
Stock (millions)			407.3	3618.6	2702.3	305.5
Mean Weight (g)			0.3	1.6	3.7	6.3
Biomass (tonnes)			137.6	5800.8	10130.6	1914.7
Biomass below 16 mm			137.6	5800.8	6367.5	52.2
Biomass 16 mm and above			0.0	0.0	3763.0	1862.5

#### Summary of stock assessment for Area 5 (autumn survey)

The final stock assessments, based on the survey area of **30.5 km<sup>2</sup>** are as follows:

##### Total number of cockles

Total number of 2019 year class

**407.3 million**

Total number of 2018 and older year class

**6626.4 million**

##### Total stock biomass

Total stock (all cockles)

**17983.7 tonnes**

Total stock biomass - cockles below 16mm

**12358.1 tonnes**

- cockles 16mm and above

**5625.6 tonnes**

## AREA 6

### 3.7 Area 6 assessment of stock, spring survey

The spring survey for Area 6 was conducted between 19<sup>th</sup> and 21<sup>st</sup> April 2019. A total of 115 sample sites were surveyed covering an area of 15.5 km<sup>2</sup>. The mean density, total stock, mean weight and biomass of each year class of cockles are presented in Table 9 and a summary of the stock assessment is presented below. The distribution of each year class is presented in Figures 3.1 – 3.6.

**Table 9: Area 6 stock parameters, spring 2019**

Area 6	No. samples	Area km <sup>2</sup>	Year Class			
			2018	2017	2016	2015
	<b>115</b>	<b>15.5</b>				
Mean Density			40.8	50.6	68.4	4.1
Stock (millions)			631.1	783.1	1059.0	63.2
Mean Weight (g)			0.3	1.7	3.1	4.7
Biomass (tonnes)			192.4	1329.4	3265.1	297.9
Biomass below 16 mm			192.4	32.4	2716.2	59.0
Biomass 16 mm and above			0.0	1297.0	548.9	238.9

### Summary of stock assessment for Area 6 (spring survey)

The final stock assessments, based on the survey area of **15.5 km<sup>2</sup>** are as follows:

#### Total number of cockles

Total number of 2018 year class

**631.1 million**

Total number of 2017 and older year class

**1905.4 million**

#### Total stock biomass

Total stock (all cockles)

**5084.9 tonnes**

Total stock biomass - cockles below 16mm

**3000.1 tonnes**

- cockles 16mm and above

**2084.8 tonnes**

### 3.8 Area 6 assessment of stock, autumn survey

An interim survey of Area 6 was also undertaken in autumn 2019 to supplement the existing programme of annual surveys. The main objectives of the autumn survey being to assess spat settlement and abundance, along with the distribution of the remaining cockles. During the period from June to this survey date, the grounds were subject to controlled commercial fishing activity.

The autumn survey was carried out between 30<sup>th</sup> August and 1<sup>st</sup> September 2019. The mean density, total stock, mean weight and biomass of each year class of cockles are presented in Table 10 and a summary of the stock assessment is presented below. The density and distribution of spat is presented in Figures 3.1 – 3.6.

**Table 10: Area 6 stock parameters, autumn 2019**

Area 6	No. samples	Area km <sup>2</sup>	Year Class			
			2019	2018	2017	2016
	<b>49</b>	<b>15.9</b>				
Mean Density			24.3	39.2	62.0	12.2
Stock (millions)			375.8	606.3	960.0	189.5
Mean Weight (g)			0.4	2.0	4.5	5.1
Biomass (tonnes)			142.1	1193.7	4345.5	963.4
Biomass below 16 mm			142.1	1181.1	3268.6	221.4
Biomass 16 mm and above			0.0	12.6	1076.9	741.9

#### Summary of stock assessment for Area 6 (autumn survey)

The final stock assessments, based on the survey area of **15.5 km<sup>2</sup>** are as follows:

##### Total number of cockles

Total number of 2019 year class

**375.8 million**

Total number of 2018 and older year class

**1755.9 million**

##### Total stock biomass

Total stock (all cockles)

**6644.7 tonnes**

Total stock biomass - cockles below 16mm

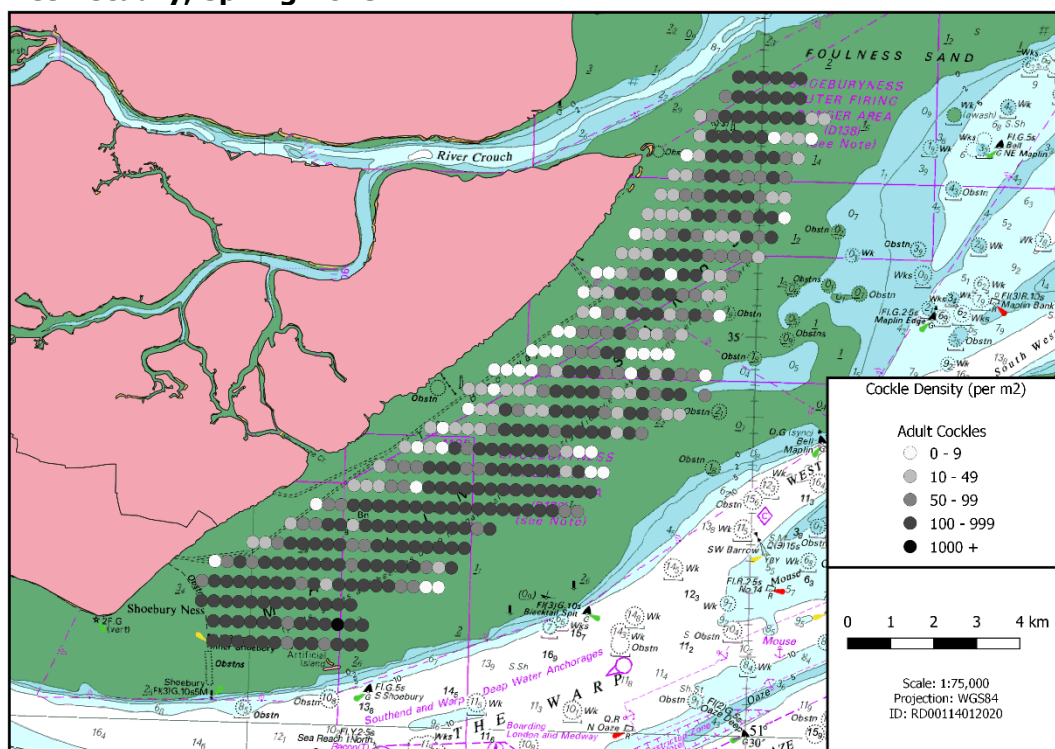
**4813.2 tonnes**

- cockles 16mm and above

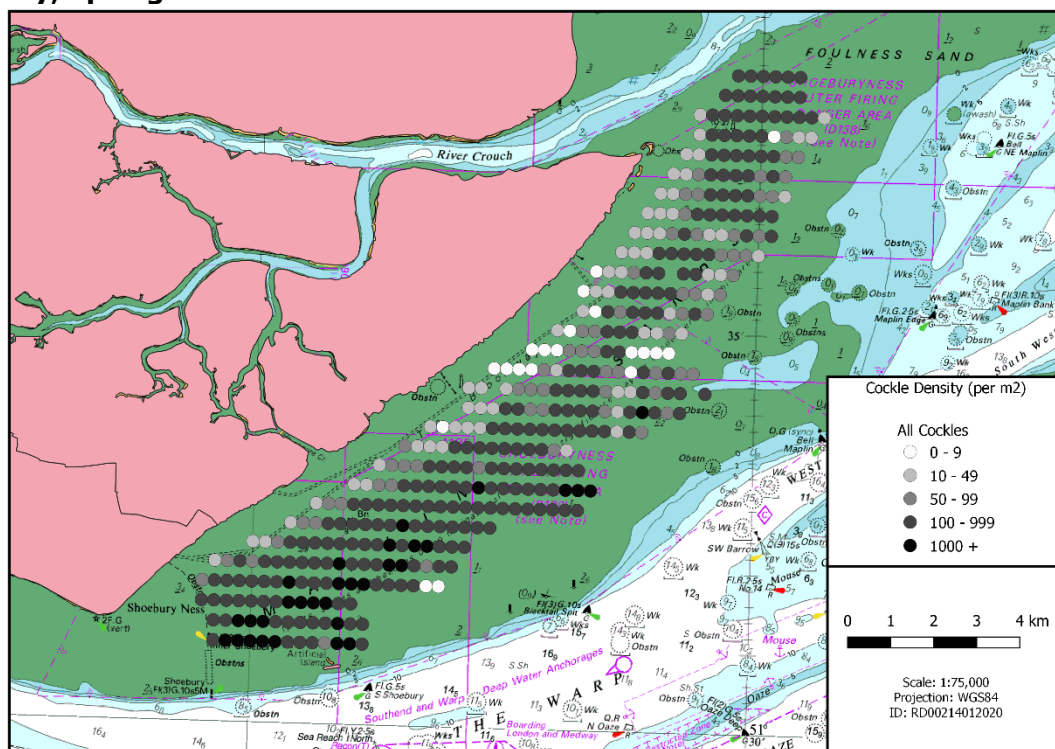
**1831.5 tonnes**

### 3.9 Distribution of cockles in areas 4, 5 & 6

**Figure 3: Distribution of 2017+ (adult) year class cockles in areas 4, 5 & 6, Thames Estuary, spring 2019**

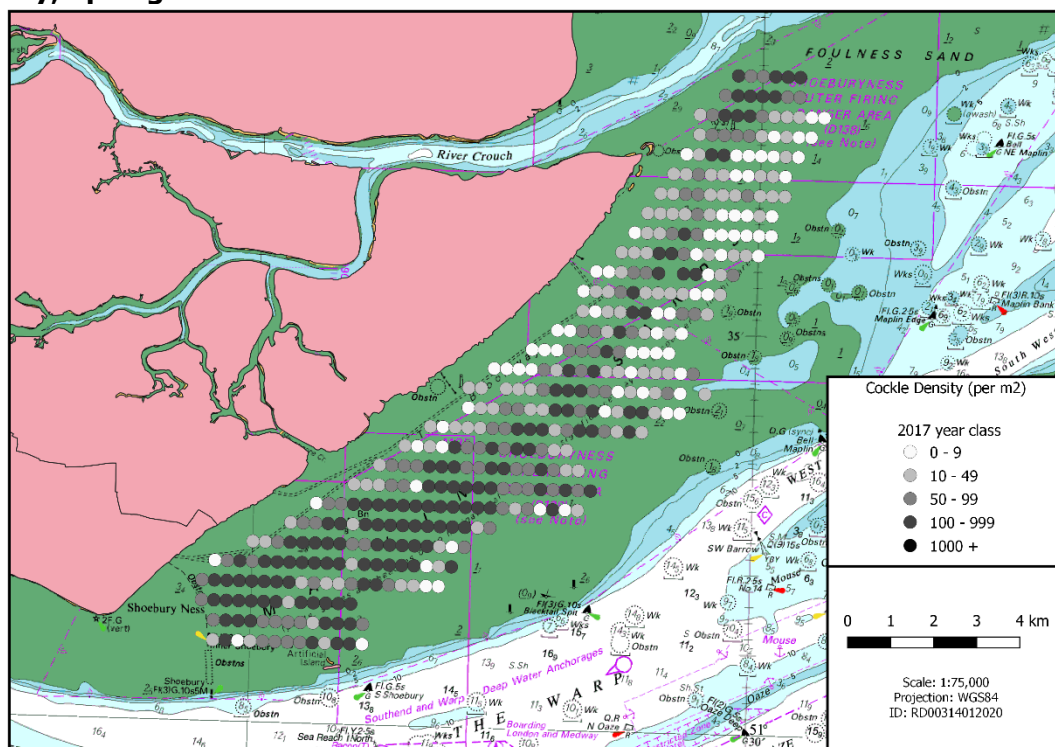


**Figure 4: Distribution of all cockles (2018+) areas 4, 5 & 6 of the Thames Estuary, spring 2019**

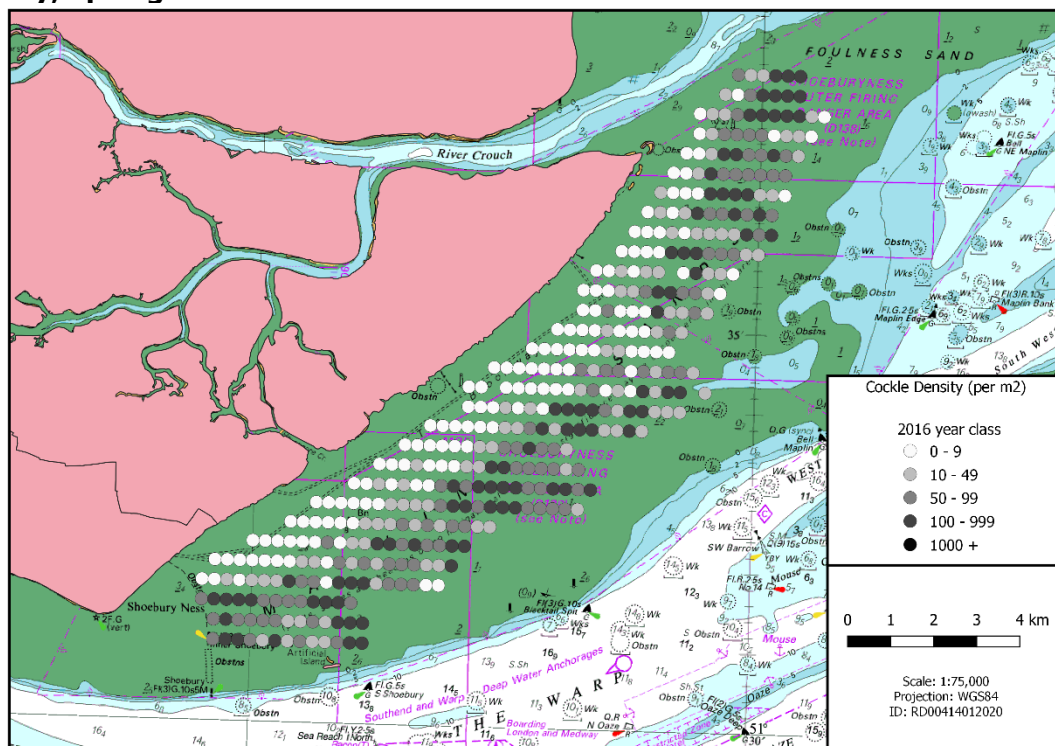




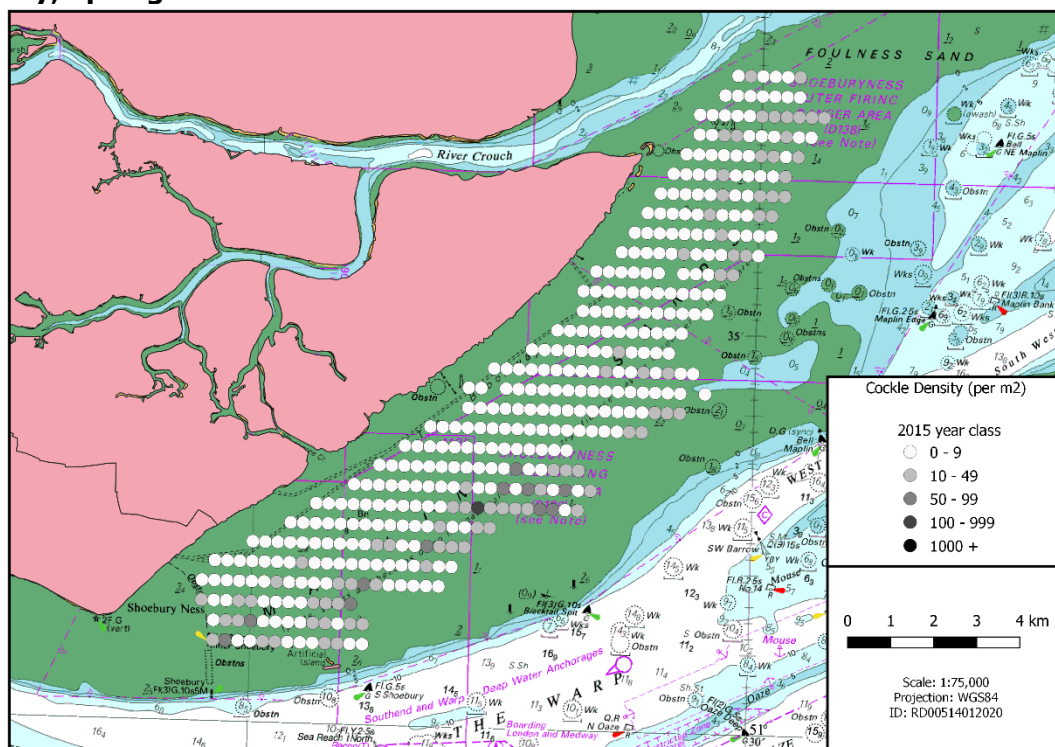
**Figure 5: Distribution of 2017 year class cockles in areas 4, 5 & 6 of the Thames Estuary, spring 2019**



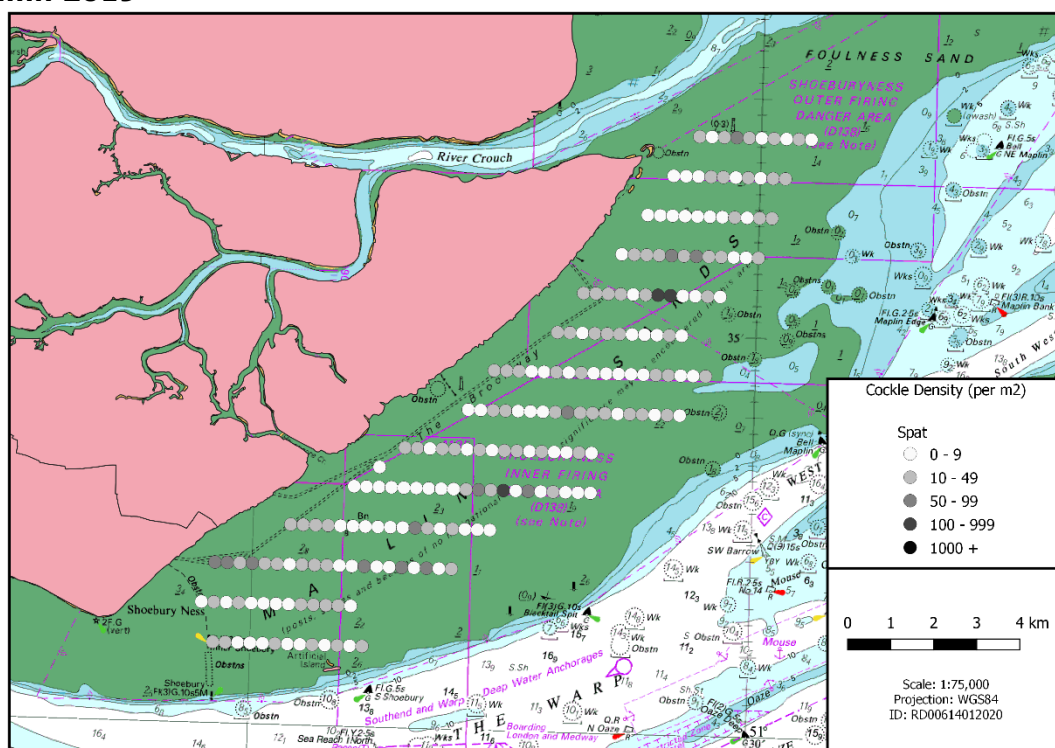
**Figure 6: Distribution of 2016 year class cockles in areas 4, 5 & 6 of the Thames Estuary, spring 2019**



**Figure 7: Distribution of 2015 year class cockles in areas 4, 5 & 6 of the Thames Estuary, spring 2019**



**Figure 8: Distribution of cockle spat in areas 4, 5 & 6 of the Thames Estuary, autumn 2019**



## AREA 1

### 3.10 Area 1 – Marsh End assessment of stocks

Marsh End was surveyed on the 30<sup>th</sup> April 2019. A total of 37 sampling stations were surveyed covering an area of 2.5 km<sup>2</sup>. The survey was completed by grab sampling from the Authority's patrol vessel 'Nerissa'. The mean density, total stock, mean weight and biomass of each year class of cockles are presented below in Table 11, and a summary of the stock assessment is presented below.

**Table 11: Marsh End stock parameters**

Area 1	No. Samples	Area km <sup>2</sup>	Year Class			
			2018	2017	2016	2015
	37	2.5				
Mean Density			881.4	16.2	47.3	0.0
Stock (millions)			2194.0	40.4	117.7	0.0
Mean Weight (g)			0.4	4.9	5.6	0.0
Biomass (tonnes)			982.3	198.5	654.6	0.0
Biomass below 16 mm			982.3	63.9	62.6	0.0
Biomass 16 mm and above			0.0	134.6	592.1	0.0

### Summary of stock assessment for Area 1 – Marsh End

The final stock assessments, based on the survey area of **2.5 km<sup>2</sup>** are as follows:

#### Total number of cockles:

Total number of 2018 year class	<b>2194.0 million</b>
Total number of 2017 and older year class	<b>158.1 million</b>

#### Total stock biomass

Total stock (all cockles)	<b>1835.4 tonnes</b>
Total stock biomass - cockles below 16mm	<b>1108.8 tonnes</b>
- cockles 16mm and above	<b>726.6 tonnes</b>

## AREA 7

### 3.11 Area 7 – Ray Sands assessment of stocks

The Ray Sands was surveyed between 2<sup>nd</sup> to the 8<sup>th</sup> April 2019. A total of 99 sampling stations were surveyed covering an area of 13.3 km<sup>2</sup>. The survey was completed by grab sampling from the Authority's patrol vessel 'Tamesis'. The mean density, total stock, mean weight and biomass of each year class of cockles are presented below in Table 12, and a summary of the stock assessment is presented below.

**Table 12: Ray Sands stock parameters**

Area 7 - Ray	No. Samples	Area km <sup>2</sup>	Year Class			
			2018	2017	2016	2015
	<b>99</b>	<b>13.3</b>				
Mean Density			46.0	87.5	29.6	0.0
Stock (millions)			612.2	1165.3	394.3	0.0
Mean Weight (g)			0.8	2.2	2.8	0.0
Biomass (tonnes)			481.4	2610.9	1114.2	0.0
Biomass below 16 mm			481.4	2589.0	980.9	0.0
Biomass 16 mm and above			0.0	22.0	133.2	0.0

### Summary of stock assessment for Area 7 – Ray Sands

The final stock assessments, based on the survey area of **13.3 km<sup>2</sup>** are as follows:

#### Total number of cockles:

Total number of 2018 year class	<b>612.2 million</b>
Total number of 2017 and older year class	<b>1559.6 million</b>

#### Total stock biomass

Total stock (all cockles)	<b>4206.5 tonnes</b>
Total stock biomass - cockles below 16 mm	<b>4051.3 tonnes</b>
- cockles 16 mm and above	<b>155.2 tonnes</b>

## AREA 7

### 3.12 Area 7 – Dengie assessment of stock

The Dengie Flats was surveyed on 2<sup>nd</sup> April 2019. A total of 52 sampling stations were surveyed covering an area of 7.0 km<sup>2</sup>. The survey was completed by grab sampling from the Authority's patrol vessel 'Tamesis'. The mean density, total stock, mean weight and biomass of each year class of cockles are presented below in Table 13, and a summary of the stock assessment is presented below.

**Table 13: Dengie Flats stock parameters**

Area 7 - Dengie	No. Samples	Area km <sup>2</sup>	Year Class			
			2018	2017	2016	2015
	<b>52</b>	<b>7.0</b>				
Mean Density			61.2	30.8	6.9	0.0
Stock (millions)			428.1	215.4	48.0	0.0
Mean Weight (g)			0.6	2.6	4.3	0.0
Biomass (tonnes)			240.1	558.4	205.8	0.0
Biomass below 16 mm			240.1	558.4	75.5	0.0
Biomass 16 mm and above			0.0	0.0	130.3	0.0

### Summary of stock assessment for Area 7 – Dengie

The final stock assessment, based on the survey area of **7.0 km<sup>2</sup>** is as follows:

#### Total number of cockles:

Total number of 2018 year class	<b>428.1 million</b>
Total number of 2017 and older year class	<b>263.4 million</b>

#### Total stock biomass

Total stock (all cockles)	<b>1004.3 tonnes</b>
Total stock biomass - cockles below 16mm	<b>874.0 tonnes</b>
- cockles 16mm and above	<b>130.3 tonnes</b>



## AREA 7

### 3.13 Area 7 – Buxey Sands assessment of stocks

The Buxey Sands were surveyed between the 3<sup>rd</sup> and the 8<sup>th</sup> April 2019. A total of 111 sampling stations were surveyed covering an area of 14.9 km<sup>2</sup>. The survey was completed by grab sampling from the Authority's patrol vessel 'Tamesis'. The mean density, total stock, mean weight and biomass of each year class of cockles are presented below in Table 14, and a summary of the stock assessment is presented below.

**Table 14: Buxey Sands stock parameters**

Area 7 - Buxey	No. Samples	Area km <sup>2</sup>	Year Class			
			2018	2017	2016	2015
	<b>111</b>	<b>14.9</b>				
Mean Density			47.7	15.1	40.4	0.7
Stock (millions)			713.2	226.1	602.8	10.8
Mean Weight (g)			0.3	3.0	4.6	6.8
Biomass (tonnes)			211.7	676.8	2753.9	72.7
Biomass below 16 mm			211.7	625.7	1162.5	0.0
Biomass 16 mm and above			0.0	51.1	1591.4	72.7

### Summary of stock assessment for Area 7 – Buxey Sands

The final stock assessment, based on the survey area of **14.9 km<sup>2</sup>** is as follows:

#### Total number of cockles:

Total number of 2018 year class	<b>713.2 million</b>
Total number of 2017 and older year class	<b>839.7 million</b>

#### Total stock biomass

Total stock (all cockles)	<b>3715.0 tonnes</b>
Total stock biomass - cockles below 16mm	<b>1999.9 tonnes</b>
- cockles 16mm and above	<b>1715.2 tonnes</b>

## AREA 7

### 3.14 Area 7 – Foulness North assessment of stocks

Foulness North was surveyed on 19<sup>th</sup> April 2019. A total of 14 sampling stations were surveyed covering an area of 1.9 km<sup>2</sup>. The mean density, total stock, mean weight and biomass of each year class of cockles are presented below in Table 15, and a summary of the stock assessment is presented below.

**Table 15: Foulness North stock parameters**

Area 7 – Foulness North	No. Samples	Area km <sup>2</sup>	Year Class			
			2017	2016	2015	2014
	<b>14</b>	<b>1.9</b>				
Mean Density			93.6	42.1	99.3	14.3
Stock (millions)			176.3	79.4	187.0	26.9
Mean Weight (g)			0.3	1.9	3.4	3.9
Biomass (tonnes)			49.8	154.7	632.4	105.0
Biomass below 16 mm			49.8	154.7	495.2	49.8
Biomass 16 mm and above			0.0	0.0	137.3	55.2

### Summary of stock assessment for Area 7 – Foulness North

The final stock assessments, based on the survey area of **1.9km<sup>2</sup>** are as follows:

#### Total number of cockles:

Total number of 2018 year class	<b>176.3 million</b>
Total number of 2017 and older year class	<b>293.3 million</b>

#### Total stock biomass

Total stock (all cockles)	<b>941.9 tonnes</b>
Total stock biomass - cockles below 16 mm	<b>749.5 tonnes</b>
- cockles 16 mm and above	<b>192.4 tonnes</b>

## AREA 8

### 3.15 Area 8 – East Barrow assessment of stock

East Barrow was surveyed on 17<sup>th</sup> April 2019. A total of 62 sampling stations were surveyed using day grab from the survey vessel Tamesis covering an area of 8.3 km<sup>2</sup>. The mean density, total stock, mean weight and biomass of each year class of cockles are presented in Table 16 and a summary of the stock assessment is presented below.

**Table 16: East Barrow stock parameters**

Area 8	No. Samples	Area km <sup>2</sup>	Year Class			
			2018	2017	2016	2015
	<b>62</b>	<b>8.3</b>				
Mean Density			304.4	17.3	7.6	0.0
Stock (millions)			3880.5	220.0	96.7	0.0
Mean Weight (g)			1.2	6.2	7.9	0.0
Biomass (tonnes)			4601.8	1374.2	759.1	0.0
Biomass below 16 mm			4601.8	251.1	0.0	0.0
Biomass 16 mm and above			0.0	1123.1	759.1	0.0

### Summary of stock assessment for Area 8 – East Barrow

The final stock assessments, based on the survey area of **8.3 km<sup>2</sup>** are as follows:

#### Total number of cockles

Total number of 2018 year class

**3880.5 million**

Total number of 2017 and older year class

**316.7 million**

#### Total stock biomass

Total stock (all cockles)

**6735.2 tonnes**

Total stock biomass - cockles below 16mm

**4852.9 tonnes**

- cockles 16mm and above

**1882.3 tonnes**

## AREA 9/12

### 3.16 Area 9/12 – Mouse/Knob assessment of stock

Mouse/Knob was surveyed on 29<sup>th</sup> April 2019. A total of 48 sampling stations were surveyed using day grab from the survey vessel Tamesis covering an area of 6.5 km<sup>2</sup>. The mean density, total stock, mean weight and biomass of each year class of cockles are presented in Table 17 and a summary of the stock assessment is presented below.

**Table 17: East Barrow stock parameters**

Area 8	No. Samples	Area km <sup>2</sup>	Year Class			
			2018	2017	2016	2015
	<b>48</b>	<b>6.5</b>				
Mean Density			156.9	36.9	1.7	0.0
Stock (millions)			1013.2	238.2	10.8	0.0
Mean Weight (g)			1.7	2.0	12.5	0.0
Biomass (tonnes)			1698.1	477.7	134.6	0.0
Biomass below 16 mm			1698.1	477.7	0.0	0.0
Biomass 16 mm and above			0.0	0.0	134.6	0.0

### Summary of stock assessment for Area 9/12 – Mouse/Knob

The final stock assessments, based on the survey area of **6.5 km<sup>2</sup>** are as follows:

#### Total number of cockles

Total number of 2018 year class

**1013.2 million**

Total number of 2017 and older year class

**248.9 million**

#### Total stock biomass

Total stock (all cockles)

**2310.4 tonnes**

Total stock biomass - cockles below 16mm

**2175.8 tonnes**

- cockles 16mm and above

**134.6 tonnes**

## AREA 13

### 3.17 Area 13 - Scrapsgate assessment of stock

Scrapsgate was surveyed on the 12<sup>th</sup> April 2019. A total of 15 sampling stations were surveyed using day grab from the survey vessel 'Nerissa' covering an area of 1.0 km<sup>2</sup>. The mean density, total stock, mean weight and biomass of each year class of cockles' age presented in Table 18 and a summary of the stock assessment is presented below.

**Table 18: Scrapsgate stock parameters**

Area 13	No. Samples	Area km <sup>2</sup>	Year Class			
			2018	2017	2016	2015
	<b>15</b>	<b>1.0</b>				
Mean Density			76.0	250.0	8.0	6.7
Stock (millions)			76.7	252.3	8.1	6.7
Mean Weight (g)			0.9	1.4	6.1	10.5
Biomass (tonnes)			65.3	349.9	49.1	70.6
Biomass below 16 mm			65.3	349.9	0.0	0.0
Biomass 16 mm and above			0.0	0.0	49.1	70.6

### Summary of stock assessment for Area 13 - Scrapsgate

The final stock assessments, based on the survey area of **1.0 km<sup>2</sup>** are as follows:

#### Total number of cockles

Total number of 2018 year class

**76.7 million**

Total number of 2017 and older year class

**267.1 million**

#### Total stock biomass

Total stock (all cockles)

**534.9 tonnes**

Total stock biomass - cockles below 16mm

**415.1 tonnes**

- cockles 16mm and above

**119.8 tonnes**



### 3.18 Combined data for all surveys

In total, 125.4 km<sup>2</sup> of cockle beds were surveyed within the Thames estuary, with 1158 sites sampled, as shown in Table 21. Within the main harvesting areas (Areas 4, 5 & 6) a calculated total of 9269 million adult cockles were present during the spring survey, and a calculated 13318 million adult cockles upon completion of the autumn survey. The total biomass of cockles above 16 mm in the main harvesting areas was 8416 tonnes during the spring and 8641 tonnes in the autumn.

**Table 19: Survey area and cockle densities in the Thames Estuary, 2019**

Area	Area surveyed (km <sup>2</sup> )	Total number of samples		Total biomass of 1-3 yc cockles (tonnes)		Total biomass above 16mm (tonnes)		Total no. of 1-3 yc cockles (million)	
		Spring	Other	Spring	Other	Spring	Other	Spring	Other
1 Marsh End	2.5	37		853.1		726.6		158.1	
2 Southend	6.6	49		487.5		193.4		139.9	
3 Southend	7.0	52		2839.1		1125.1		861.2	
4 Maplin Sands	10.2	76	41	5164.7	9207.3	1414.3	1184.3	2621.2	4936.2
5 Maplin Sands	30.5	227	111	14312.6	17846.1	4917.8	5625.6	4743.2	6626.4
6 Maplin Sands	15.5	115	49	4892.4	6502.6	2084.8	1831.5	1905.4	1755.9
7 Ray Sands	13.3	99		3725.1		155.2		1559.6	
7 Dengie	7.0	52		764.2		130.3		263.4	
7 Buxey	14.9	111		3503.4		1715.2		839.7	
7 Foulness N	1.9	14		892.1		192.4		293.3	
8 East Barrow	8.3	62		2133.3		1882.3		316.7	
9/12 Mouse/Knob	6.5	48		612.2		134.6		248.9	
10 Leysdown	-	-		-		-		-	
13 Scrapsgate	1.0	15		469.6		119.8		267.1	
14 Minnis Bay	-	-		-		-		-	
17 Pegwell Bay	-	-		-		-		-	
<b>Total</b>	<b>125.4</b>	<b>957</b>	<b>201</b>	<b>40649.3</b>	<b>33556.0</b>	<b>14791.8</b>	<b>8641.4</b>	<b>14217.7</b>	<b>13318.5</b>

## Survival of cockles in areas 4, 5 & 6

Comparison of the mean cockle density calculated from the 2019 spring survey and the autumn survey results in 2018 indicate that the survival over the 2018/19 winter period was very good, although slightly lower than in the previous year, and is indicated in Table 22 below. Mean survival of all the 2018 year class was good at 68.4 % across areas 4, 5 & 6 over the 2018/19 winter. The 2017 and 2016+ year classes also showed good survival at 74.7 % and 83.7 %. When survival is assessed by individual areas it is apparent that area 6 does have a much lower survival rate than areas 5 and 4 for juvenile cockles.

**Table 20: Mean density and winter survival rates of cockles from 2018 to 2019 by year class in areas 4, 5 & 6**

				2018 Autumn Survey			2019 Spring Survey		
				mean density			mean density		
				2018	2017	2016+	2018	2017	2016+
AREA 6 (49 sites)				93.3	64.2	76.1	40.8	50.6	72.5
AREA 5 (111 sites)				179.5	134.6	61.5	141.1	103.7	51.6
AREA 4 (41 sites)				534.4	269.3	100.9	442.1	183.7	72.6
Cockle stock remaining (Area 6)							43.7%	78.8 %	95.3 %
Cockle stock remaining (Area 5)							78.6 %	77.0 %	83.9 %
Cockle stock remaining (Area 4)							82.7 %	68.2 %	72.0 %
						<b>Mean</b>	<b>68.4 %</b>	<b>74.7 %</b>	<b>83.7 %</b>

### 3.19 Long term trends in cockle populations within areas covered by the TECFO

**Table 21: Autumn cockle stocks (millions) excluding spat within areas covered by the TECFO between 1993 & 2019**

YEAR	AREA							
	1	2	3	4, 5 & 6	8	11	13	TOTAL
1993				4371	237			4608
1994			162	5721	287			6107
1995		1276	2783	6789	26			10874
1996		857	1064	4641	358			6920
1997		166	1053	3963	78			5260
1998		112	361	2154	77			2704
1999	246	1004	2087	13412	68			16817
2000		397	941	8117	18		655	10128
2001		256	582	4588	<1			5426
2002		395	445	3907	3	3228		7978
2003		529	1156	8104	0		420	5639
2004		448	1495	4312				6255
2005		797	1086	3420			90	5393
2006		405	545	6646	9	1278		11484
2007		755	1286	8966	8	4158		15173
2008	535	433	385	7960	8			9321
2009		618	1260	6976				8854
2010		1234	1126	5916	20		172	8468
2011		275	663	5084	11		61	6094
2012		198	480	3259			94	4031
2013	159	65	109	7561			85	7979
2014		30	127	5152				5309
2015				6026				6026
2016				3597				3597
2017				7589				7589
2018				12030				12030
2019				13318				13318

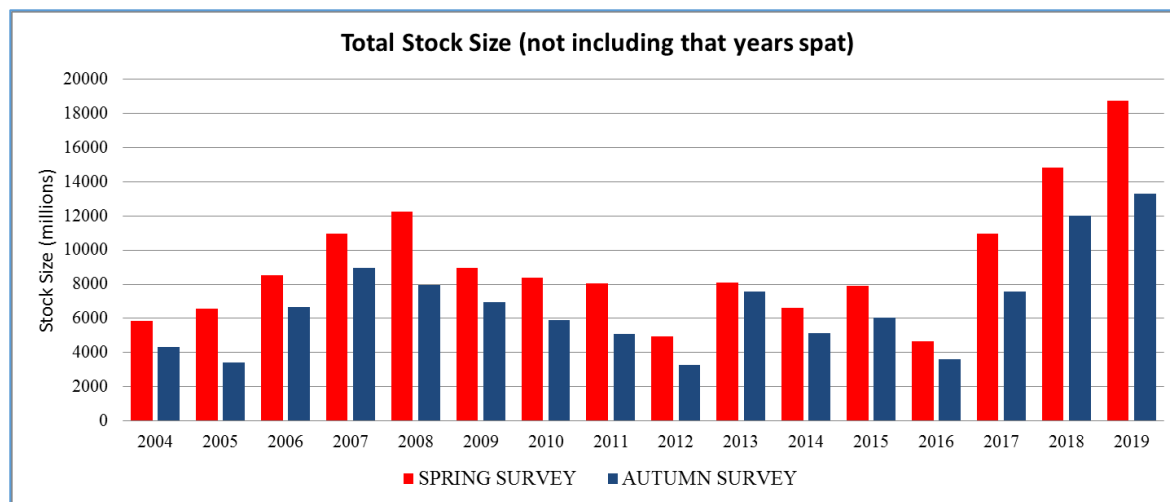
**Table 22: Stocks of all cockles (millions), excluding spat, in areas outside of those covered by the TECFO between 1997 & 2019**

YEAR	Area 7	Area 7	Area 7	Area 10	Area 14	TOTAL
	Dengie	Buxey	Ray			
1997	138	84				232
1998	926	232			10	1168
1999	2173	1130				3702
2000	1992	296				2288
2001	1220	486				1506
2002	1031	340				1371
2003	507	561	1193			2161
2004	245	405	272	69	9	1000
2005	1640	1418	540	3		3601
2006	891	445	1090		327	2753
2007	1120	2041	2430		100	5691
2008	1105	2211	2106		359	5781
2009	391	475	875	73	62	1876
2010	231	522	955	117	19	1844
2011	878	632	1330	63	33	2936
2012	319	299	1005	367	9	1999
2013	225	312	811	176	3	1527
2014	120	131	981	44	67	1343
2015	231	101	560	16	47	954
2016	429	655	1000	18	21	2123
2017	192	472	389	192	90	1335
2018	424	863	1978	86	129	3480
2019	263	839	1559	-	-	2661

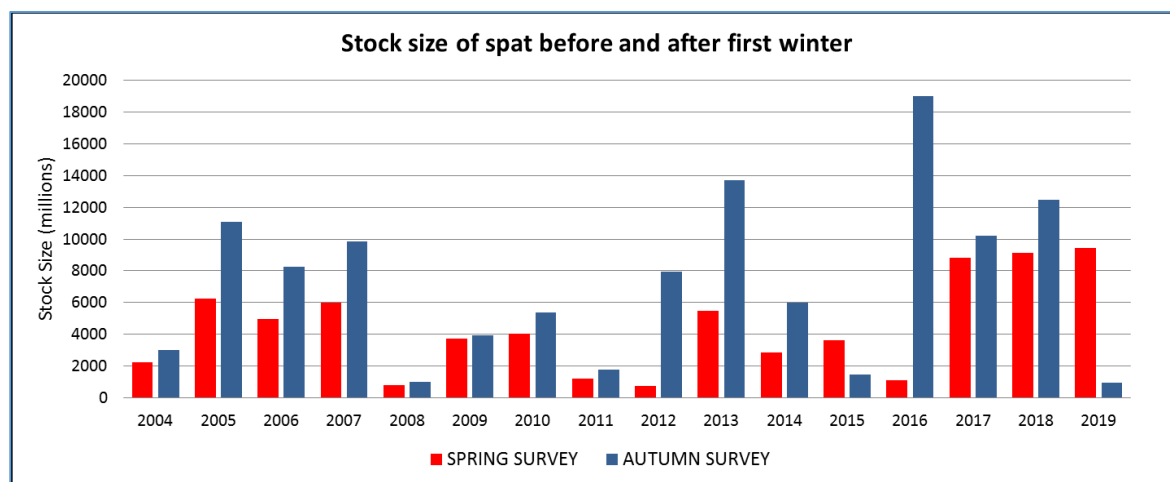
### 3.20 Comparison of long-term trends for areas 4, 5 & 6

Surveys of the Areas 4, 5 & 6 within the TECFO have now been carried out for almost two decades. All data refers to the standard survey area.

**Figure 9: Adult cockle stocks (1 year +) on areas 4, 5 and 6 from 2002 to 2019**

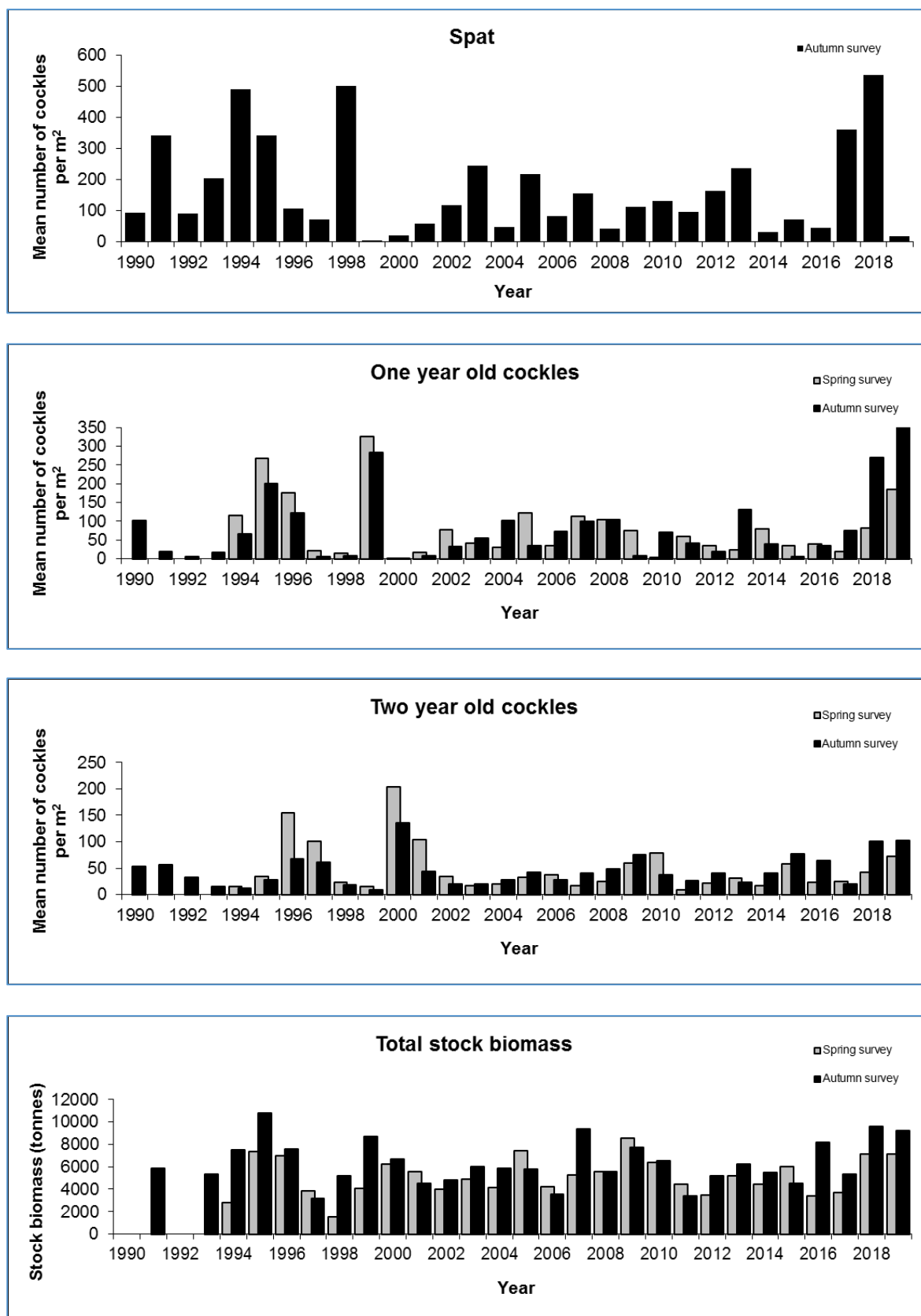


**Figure 10: Number of cockle spat before and after the first winter on areas 4, 5 and 6 from 2004-2019**



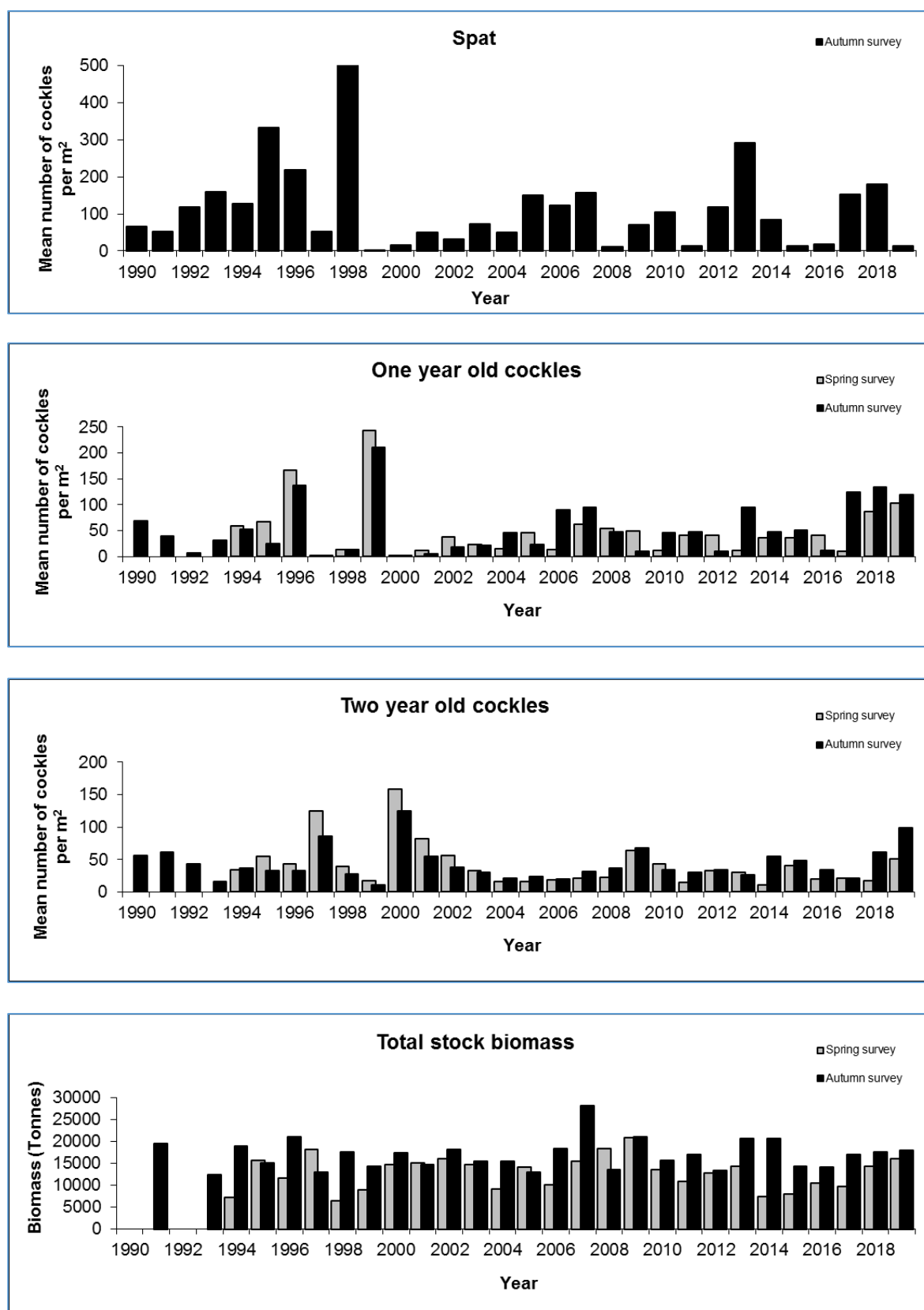
### 3.21 Comparison of long-term trends for area 4

**Figure 11: Mean cockle densities & total stock biomass in area 4, 1990-2019**



### 3.22 Comparison of long-term trends for area 5

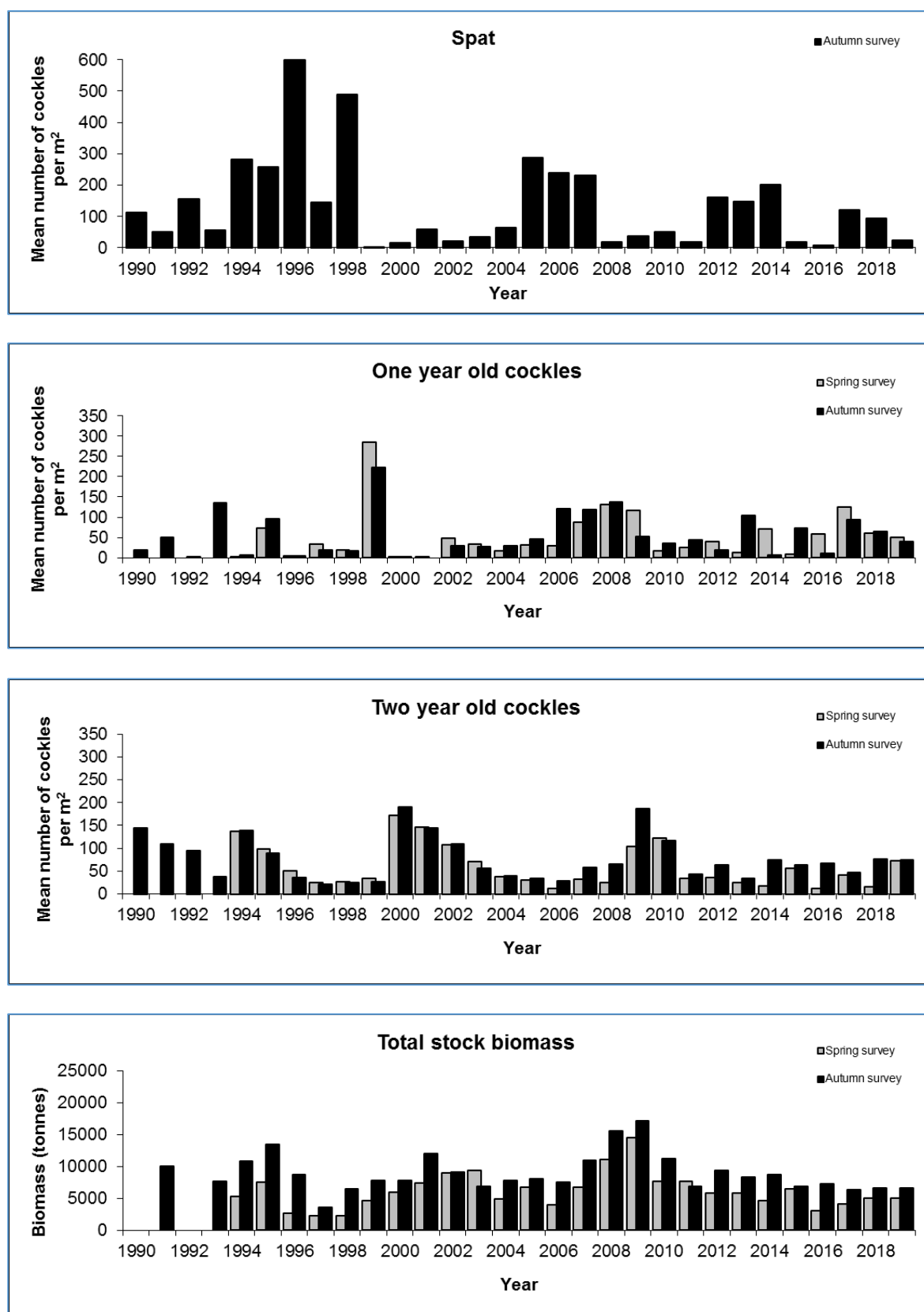
**Figure 12: Mean cockle densities & total stock biomass in area 5, 1990-2019**





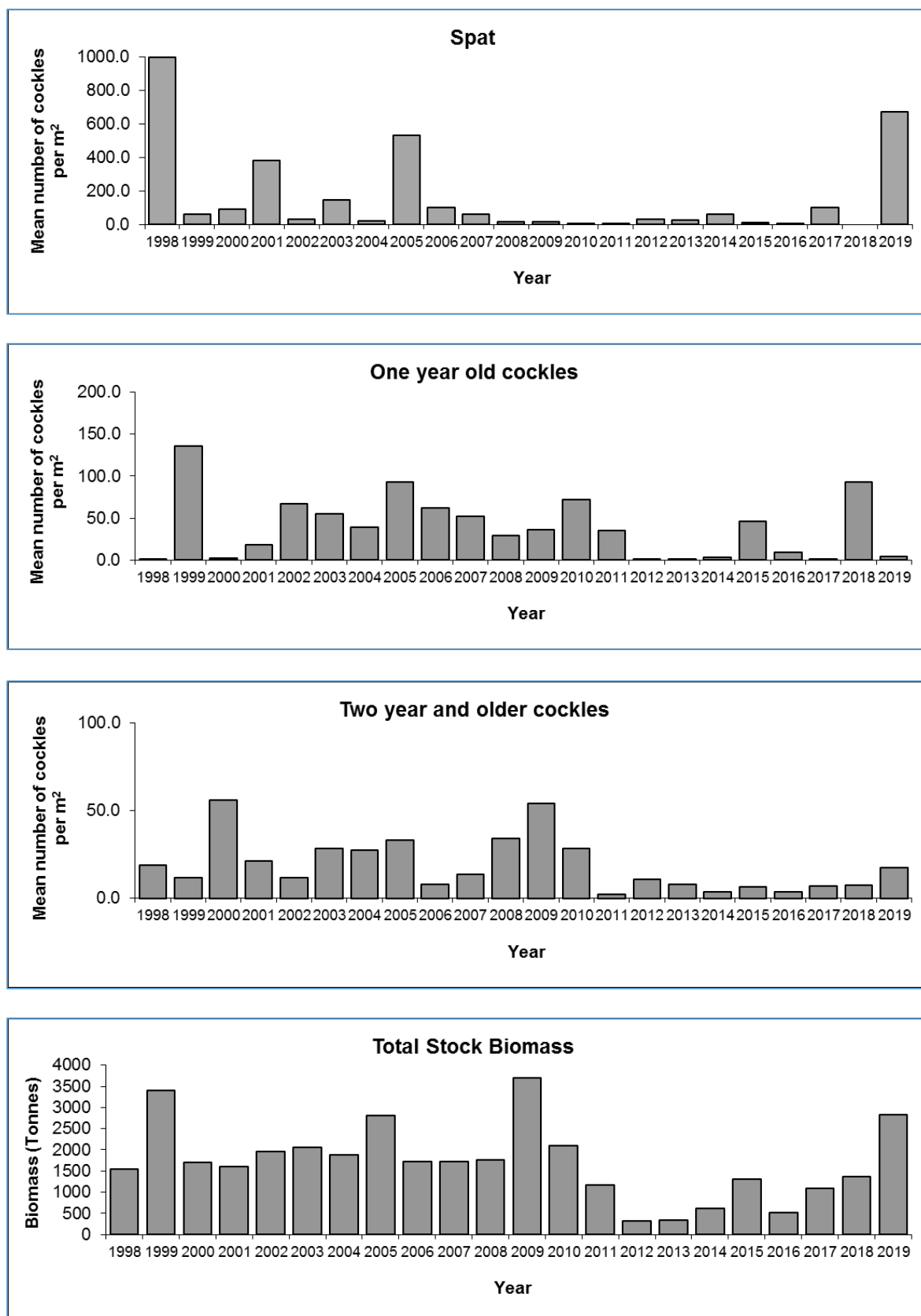
### 3.2.3 Comparison of long-term trends for area 6

**Figure 13: Mean cockle densities & total stock biomass in area 6, 1990-2019**



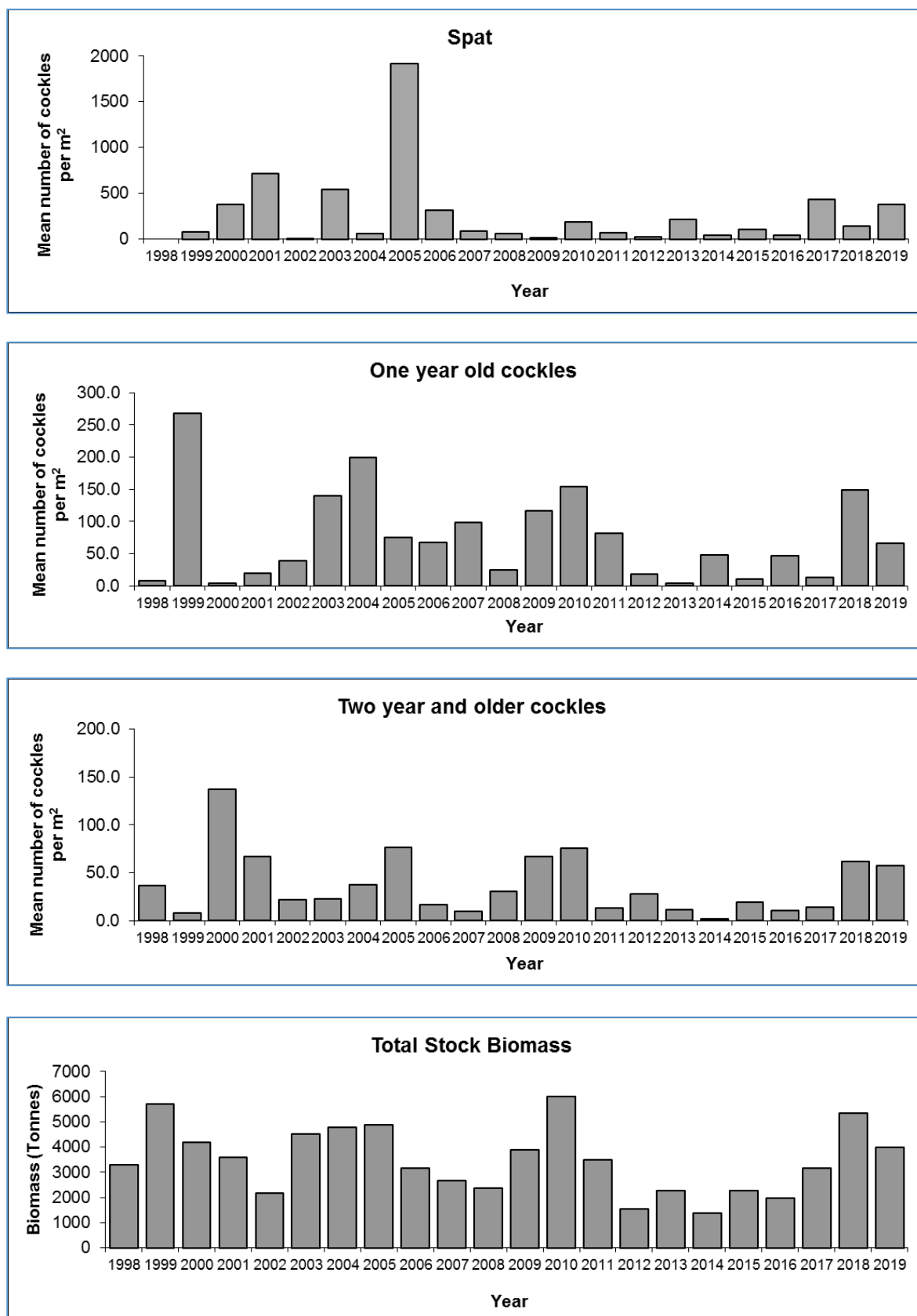
### 3.24 Comparison of long-term trends for area 2

**Figure 14: Mean cockle densities & total stock biomass in area 2, 1998-2019**



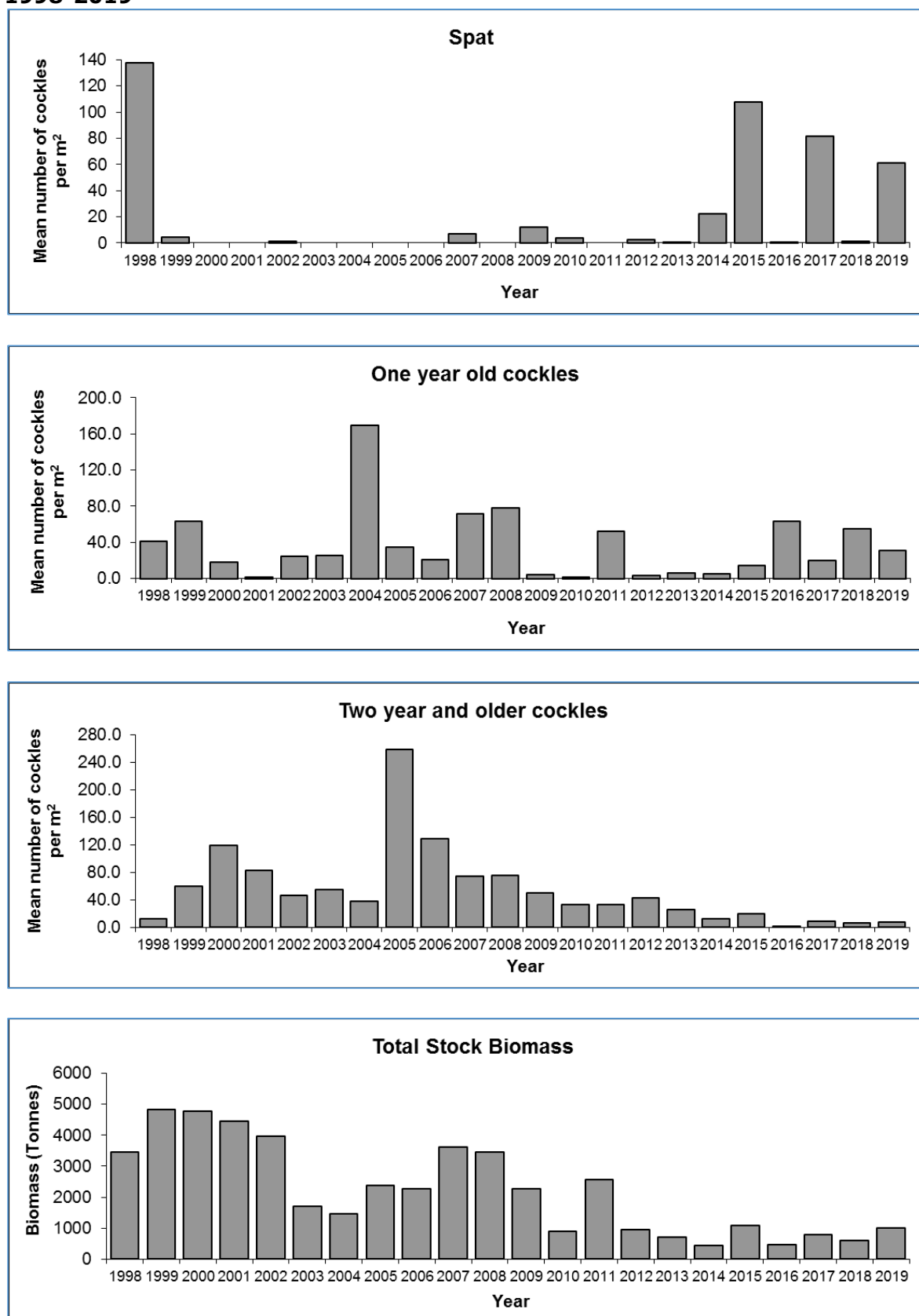
### 3.25 Comparison of long-term trends for area 3

**Figure 15: Mean cockle densities & total stock biomass in area 3, 1998-2019**



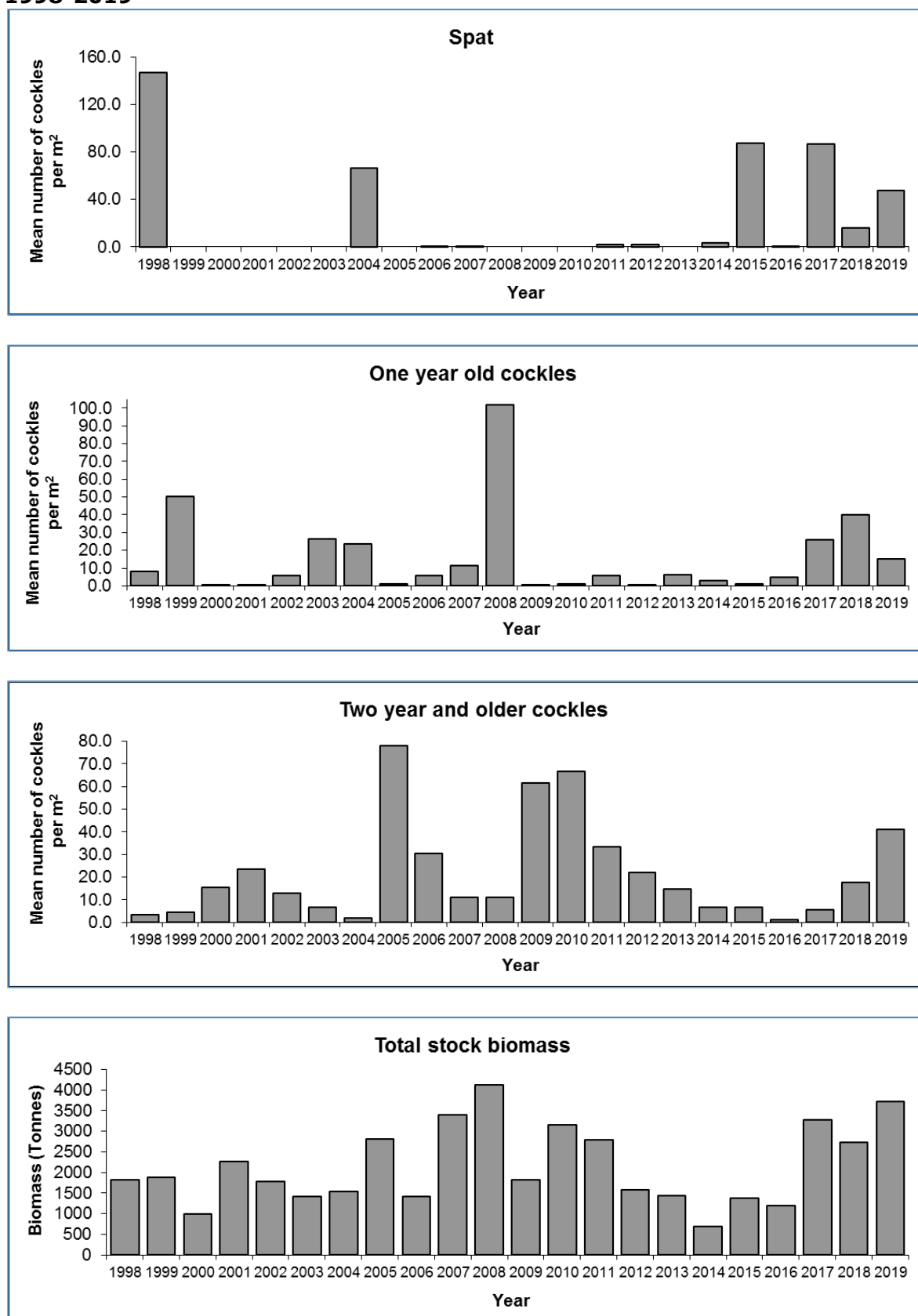
### 3.26 Comparison of long-term trends for area 7 – Dengie Flats

**Figure 16: Mean cockle densities & total stock biomass in area 7 - Dengie Flats, 1998-2019**



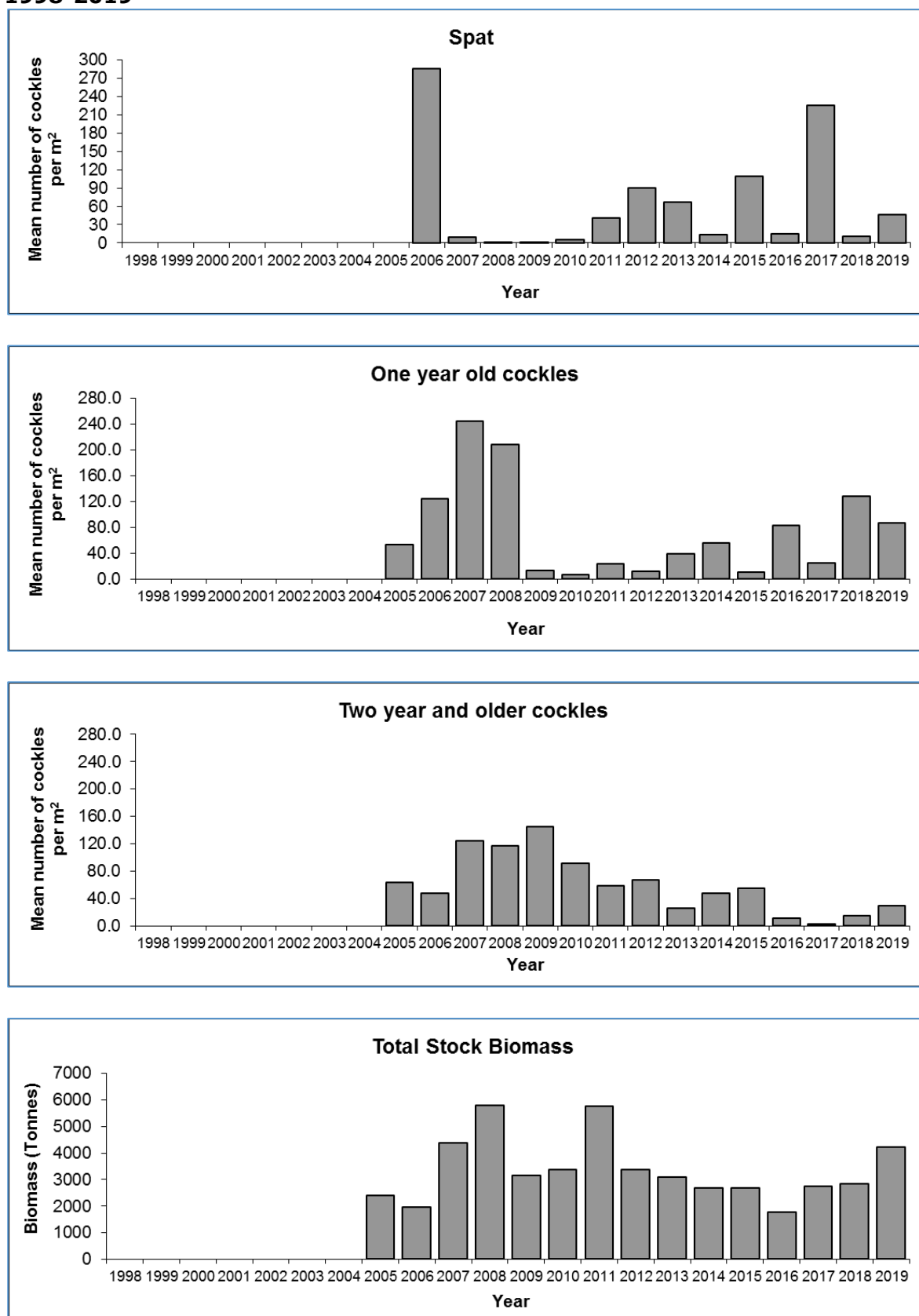
### 3.27 Comparison of long-term trends for area 7 – Buxey Sands

**Figure 17: Mean cockle densities & total stock biomass in area 7 - Buxey Sand, 1998-2019**



### 3.28 Comparison of long-term trends for area 7 – Ray Sands

**Figure 18: Mean cockle densities & total stock biomass in area 7 - Ray Sand, 1998-2019**



## **4 CONCLUSION**

### **4.1 Summary of results**

A total area of 181.6 km<sup>2</sup> was surveyed (including areas that were surveyed twice) during 2019, with a total of 1158 samples taken. On the Maplin and Foulness Sands (Areas 4, 5 & 6), which constitute the main commercial harvesting areas, a total of 619 samples were taken, with 418 taken during the spring survey and 201 during the autumn survey.

Calculations for 2019 based on cockle density data collected during these surveys estimated that the total number of adult cockles (excluding any spat) on the Maplin and Foulness Sands was 9269 million in the spring and 13318 million in the autumn. The corresponding surveys carried out in 2018 indicated that there were 12029 million cockles in the spring, and 12030 million in the autumn. This shows that while stock numbers were higher going into the 2018 season, the stock during the 2019 autumn survey exceeded the corresponding figure during 2018. The total biomass of cockles above 16 mm in the main harvesting areas was 8416 tonnes during the spring and 8641 tonnes in the autumn.

The estimated number of cockle spat (cockles of the 2019 year class) on the Maplin and Foulness Sands, calculated from the results of the surveys carried out in the autumn of 2019 was 957 million. This is a 13 fold decrease compared with the spat level from 2018 (12455 million) and represents the first poor spatfall year following the three consecutive years of excellent spatfall in 2016, 2017 and 2018.

Survival of spat over the winter of 2018/2019 was, once again, above the historical average. High spat numbers and high survival led to a record high number of spat in the spring survey of 9462 million. This was an increase on the previous high from 2018 of 9137 million.

### **4.2 Implications for future management of the fishery**

Data from the 2019 cockle survey contributes to a long term data set of cockle stocks collected by KEIFCA in the Thames estuary. Cockle spat fall was very high in 2016 on the main cockle harvesting areas of the Maplin and Foulness sands and this has been followed by strong spatfalls in both 2017 and 2018. Stock numbers on the sands remain high, although this is tempered by the low spatfall observed during the autumn 2019 survey.

Analysis of the cockle population since surveys commenced in 1998 indicate periodic fluctuations, with typical peaks and troughs, and that the observations made during the 2019 survey fall towards the bottom end of these observed ranges. The observed spatfall in 2019 was below the level of the poor spatfall in 2015. This lack of spat on the sands may allow the 3 strong year classes from 2016-2018 to grow on more than has been observed in previous years. There remains a sizeable adult stock on the sands, which has displayed poor growth in recent years. Close scrutiny of growth rates during 2020 will indicate whether this trend can be reversed with less crowded stocks in 2020. The results would suggest that the cockle management plan currently implemented by KEIFCA is resulting in a sustainable commercially viable cockle stock. Stocks should continue to be carefully monitored however, as spat fall and winter survivability can, and will, play a role in stock size over the coming years. Reacting to annual changes in stock is an essential tool in the sustainable exploitation of the fishery.

The sustainable management of the cockle stocks also provides continued adequate food for wading birds and marine species. In addition, this management controls the exploitation of



the population to ensure that there is not any significant adverse impact upon the features of the Essex Estuaries SAC along with the Mid Essex Coast and Outer Thames Estuary SPA sites.

The results from the autumn survey, together with the results from the future spring survey in 2020 will be used to regulate the total allowable catch (TAC) for the commercial fishing sector in 2020. The TAC for 2020 will potentially be towards the upper half of the historical range as the significant year classes from the previous 3 years provide a significant stock at a viable size for commercial harvesting. This will be dependent on winter mortality of the adult cockles over the 2019/2020 winter and how this affects the cockle stocks for spring 2020.