Poole Harbour *Sabella pavonina* Verification Survey using Underwater Video Techniques 2015

Introduction

The aim of this project, in partnership with Natural England and Southern IFCA, was to assess and where possible quantify the presence/absence of the peacock worm *Sabella pavonina* in Poole Harbour through the use of underwater video. The data collected as part of the project will provide data to inform the proposed review and extension of the Poole Harbour SSSI and the future development of aquaculture under the Poole Harbour Fishery Order 2015.

Poole Harbour is designated as a Site of Special Scientific Interest (SSSI), recognised as a nationally important site for its extensive mudflats and marshes which together with the permanent channels support large populations of nationally and internationally significant populations of overwintering waders and wildfowl. The fringing habitats of heathland and grassland provide additional habitats of interest and the Harbour further supports several rare marine invertebrate species such as the sponge *Suberites massa* and the mollusc *Aeolidiella sanguinea*. The Harbour is also designated as a Special Protection Area (SPA) and Ramsar site, as the area supports internationally important populations of regularly occurring Annex 1 bird species, migratory species and waterfowl assemblages under the EU Birds Directive.

A number of marine invertebrates occur in the Harbour, most exhibiting a widespread distribution. Where invertebrate species occur in more sheltered areas they are often seen in high numbers. *Sabella pavonina* is a species of polychaete worm producing species-rich beds associated with the subtidal fine sands of the central Harbour. The species was identified under the Poole Harbour Site of Special Scientific Interest (SSSI) as a notable community due to the beds being better developed in Poole Harbour than is commonly seen elsewhere. The worms inhabit a protective mud-mucoid tube which is anchored in the substratum up to a depth of 60cm (Murray *et al.,* 2011) and feed via a protruding feathery crown of ciliated filaments (Wells, 1951). *S. pavonina* often prevail downstream of turbid water assemblages, they occur on channel flanks where tidal currents are relatively strong and on the centre of the channel bottom where currents are fairly modest (Dyrynda, 2005). Emergent parts of the worm's tubes are often colonised by red seaweeds, the sponge *Halichondra bowerbankii* or clusters of sea squirts. Seaweeds, invertebrates and fish are often typically associated with *Sabella* forests resulting in species-rich communities.

Poole Harbour is subject to a large degree of anthropogenic activity both from fishing and other activities such as maintenance dredging and recreational boating. Fishing

activity is managed by the Southern Inshore Fisheries and Conservation Authority (SIFCA) who seek to balance the sustainability of the fishing industry with the protection of the marine environment. In July 2015, new measures were introduced to manage shellfish within the Harbour. This included the Poole Harbour Dredge Permit Byelaw to regulate the wild fishery through the issue of a permit and The Poole Harbour Fishery Order 2015 which allows for the development of aquaculture activity through the leasing of ground. The Order replaced the previous Poole Fishery Order 1985, continuing the ability to support aquaculture activity which has been present in the Harbour since 1915. The Order and the associated lease of ground for specific activities is accompanied by a Habitats Regulations Assessment which considers whether the activity proposed will have an adverse effect on Poole Harbour as a designated SPA and Ramsar site with consideration also given to the features and communities identified under the SSSI such as *Sabella pavonina.* The data compiled through this project will help inform future assessments of proposed aquaculture activity within the Order.

During the 1980s a dive survey was conducted to assess and map the location and abundance of *S. pavonia* in Poole Harbour (Dyrynda, 2005). The survey found that *S. pavonina* formed dense forests within the channels of the Harbour particularly in the areas of South Deep and the Wych Channel, occurring on both the channel flanks where tidal currents were relatively strong and on the central channel bottom where currents were more modest (Dyrynda, 2005). The survey also highlighted that fine sediment can settle in between the tubes in dense aggregations resulting in mudbanks with a thickness of 0.5m or more. This dive survey formed the basis for the site locations of this survey with initial sites identified in areas where *S. pavonina* was recorded in 1984-1985; survey coverage was then expanded to also include further sites within the area of the Poole Harbour Fishery Order 2015. The aim of this survey was to record presence/absence of *S. pavonina*, where possible, make a quantification of percentage cover and identify associated habitat type and any commonly occurring species associated with the presence of *S. pavonina.*

Methodology

The survey was undertaken over a period of five days – the 25th February, the 4th March, 10th March, 11th March and 12th March 2015 during daylight hours using the Southern IFCA vessel FPV Tenacity.

Survey Sites

Five survey sites were identified prior to surveying, which are split into three priority sites and two additional sites (Figure 1). The three priority sites cover locations where S*. pavonina* was previously recorded by the dive survey in 1984-1985[4]. Further areas were included which occur within the extent of the Poole Harbour Fishery Order 2015 and areas which could be suitable for aquaculture activity in the future. The two additional sites, which were surveyed after the priority sites, follow on from the Wych Channel. The inclusion of these areas widened the scope of the survey and allowed for full coverage of the main channel areas in the centre of the Harbour.

Initially, survey stations were positioned at 500m intervals along each of the sites with the aim to carry out a camera drop at the centre and either side of the channel for each station. In practice, on the first day of surveying, it was determined that in most places the width of the channel was not sufficient enough for three camera drops and the motion of the vessel with tide and wind made still drops difficult. The methodology was therefore modified so that, at each station, the camera would be deployed and the vessel allowed to drift from one side of the channel to the other. In practice this resulted in a number of video transects for each site recording both across the pre-determined stations and between stations. For some stations, the tide and wind action meant a direct drift across the channel was not possible so a drift between stations, incorporating as much of the channel as possible, was carried out.

The three priority survey sites were identified as:

- Site A – South Deep: 42 survey stations
    - Two additional fixed stations were added, number 7 to incorporate an additional area of leased ground outside the main channel and number 9 to cover both sides of the channel around an area of intertidal mud north of Goathorn point.
- Site B – Blood Alley: 27 survey stations
    - An additional fixed station was added, number 2 to allow for surveying across the wider area of the channel at this point.
- Site C – Wych Channel: 27 survey stations
    - There are a number of fixed moorings in the channel at this site – the exact positioning of the fixed stations and the ability to survey either side of the channel had to be flexible to accommodate the positioning of the mooring sites.

Additional Sites A and B were identified as:

- Additional Site A – Wych Channel: 12 survey stations
    - This site covers the area of Ramshorn Lake which is a narrow secondary channel. The ability to survey within this area and the number of stations across the width of the channel had the tendency to vary due to the tide, depth and weather conditions as well as instructions of the skipper.
- Additional Site B – Wych Channel: 9 survey stations.

For full station coordinates see Appendix 1.

Use of Underwater Towed Camera Array

Data was collected using the ROVTECH C-MOR Marine 12/7948 camera system deployed from the Southern IFCA vessel FPV Tenacity. The system records PAL Colour high resolution video from a camera contained in a stainless steel housing which is pressure tested to 100 m. The camera is supported by 2 24 v DC 50 W 'Mini Seabeam' LEDs which are manually controlled using the topside processor unit. Two laser-scaling devices are also fixed to the camera, calibrated to project onto the seabed at a set distance of 20cm.

The camera system was deployed as per the 'Standard operation procedures for camera work aboard FPV Tenacity' (Appendix 2). The camera provides a live feed to the vessel allowing the operator to monitor the tow and make adjustments to the height at which the array is towed depending on the nature of the seabed. This also gives the ability to see if the camera is not recording correctly or has become snagged or incorrectly orientated at which point adjustments can be made. Camera Tows for the survey lasted from around 8 – 50 minutes long. The GPS position of the boat is overlaid onto the video display which includes the time, date, latitude and longitude (WGS84) of the GPS at the surface. This data is combined with the cable outlay information to determine the offset and therefore true location of the camera sled. The overlay also shows vessel speed (knots) and gives a bearing. The GPS in operation on FPV Tenacity used for the overlay onto the video display is an NSS 12 SIMRAD system. The cable outlay is measured from the tow point on the starboard side of the vessel.

For each tow, data was recorded on a standard 'Southern IFCA video logsheet' (Appendix 3). The time and position at the start and finish of the tow is recorded along with the vessel speed (knots) and the length of cable outlay (m). For each tow

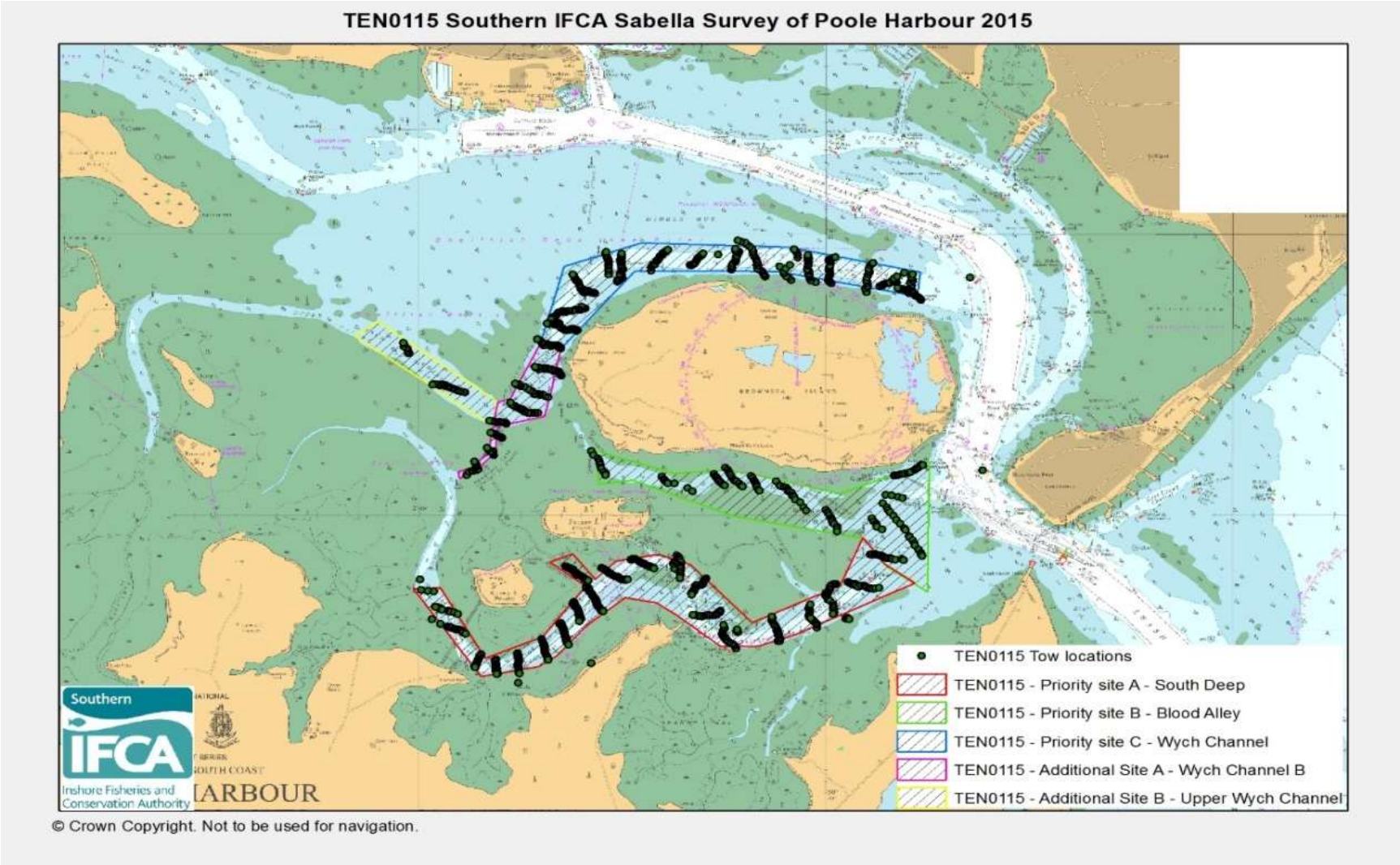

Figure 1: Chart showing the survey sites and tow locations for the survey, tows were made across the channel width at defined survey stations and between stations with additional tows along the channel between stations due to wind and tidal movements.

the video output was monitored and the time was recorded for any significant change in depth along with a record of the depth itself (m). Time and position were also recorded for any change in cable outlay along with the amount of cable let out or recalled. Further notes were made on anything seen from the video output including visibility, assessment of seabed and any notable features. There were occasions where the camera flipped over either on deployment or during the tow or where the equipment stopped recording, at this time, if the problem could not be resolved immediately, the position was recorded and the recording stopped. A new recording was then started from the same position. These video files were appropriately identified to indicate that they formed part of the same tow.

In addition a daily progress report was completed for each survey day making note of weather conditions, tows completed and any issues which arose. For the duration of the survey all personnel worked to the Risk Assessments for the use of FPV Tenacity for survey work, the use of the camera equipment and the use of the pot hauler for deployment and recovery. Only Southern IFCA members of staff who were trained in the use of the pot hauler were allowed to operate the equipment.

Analysis of Video Footage

Video footage was analysed and spreadsheet data was compiled making a note of the presence or absence of Sabella communities and the percentage cover.

The footage for each site was assessed per individual tow. Initially, each video file was viewed at twice speed and noting when there was a consistent change in habitat type lasting more than 30 seconds. Each video file was then divided up into sections based on the changes in habitat type which was defined to EUNIS code level 3. Each video section was then viewed at normal speed with screenshots taken every 30 seconds to 1 minute depending on the rate at which there were notable changes to the field of view.

For each screenshot, the position was recorded along with the time and vessel speed. *Sabella pavonina* presence or absence was noted and an assessment made of the percentage cover, in addition any other notable species occurring consistently with the presence of *S. pavonina* were also noted.

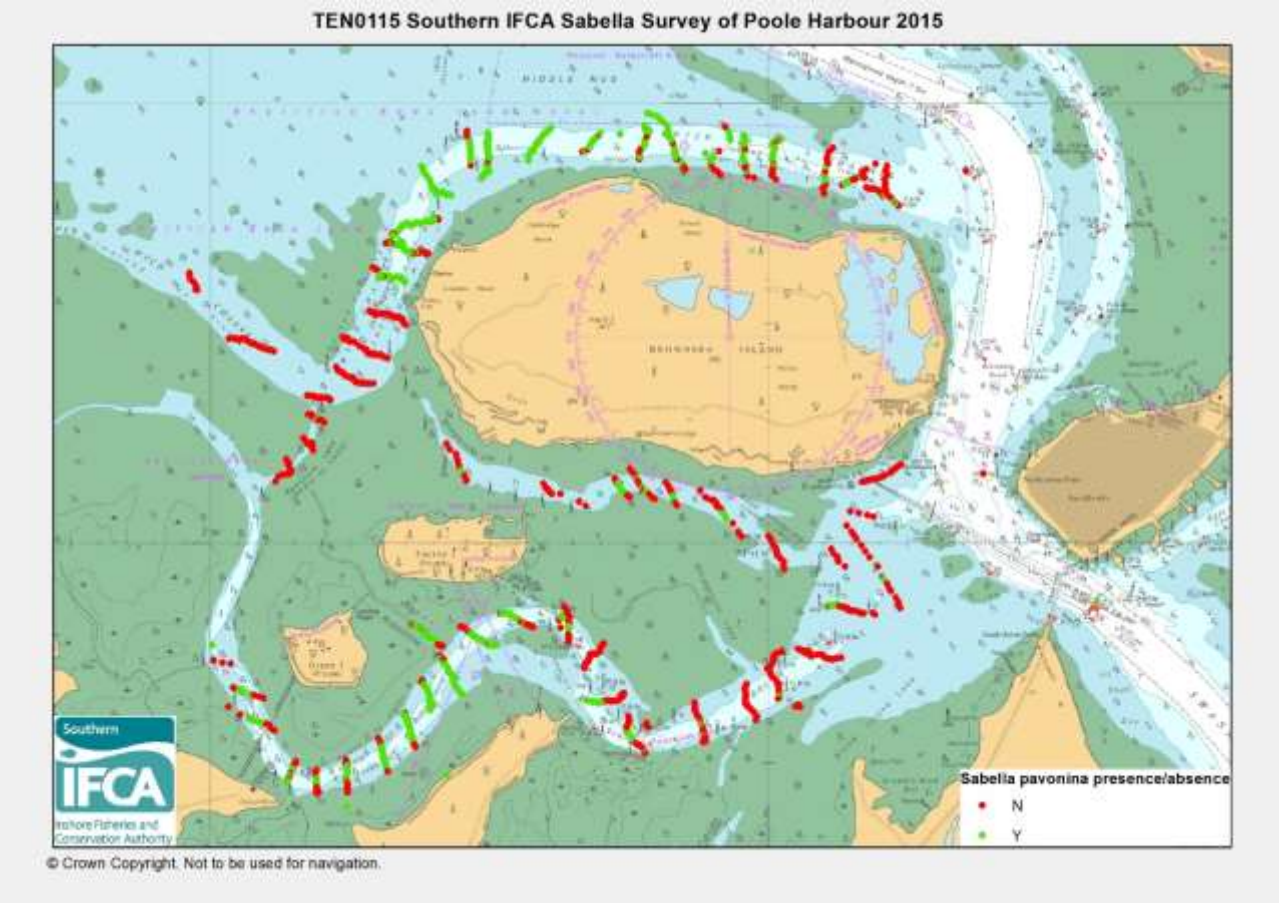

Figure 2: chart showing the presence or absence of *Sabella pavonina* recorded from screenshots taken from the video footage of each tow.

Results and Discussion

The presence/absence data as recorded from the screenshots of each tow was mapped using ArcGIS software (Figure 2). *S. pavonina* is notably present within Poole Harbour as was recorded within all three of the priority sites; South Deep, Blood Alley and the Wych Channel. There was no *S. pavonina* recorded in either of the additional sites covering the upper Wych Channel.

Across the sites were *S. pavonina* was present, the Wych Channel (Priority Site C) showed the highest presence from the area of Pottery Pier on the western side of Brownsea Island through to the eastern end of the island prior to joining the main channel. A notable presence was also seen in South Deep (Priority Site A) at the western end of the site, the presence of *S. pavonina* was seen to be reduced beyond the eastern end of Furzey Island. For a number of tows at both sites and additionally in Blood Alley (Priority Site B), the presence of *S. pavonina* was increased in the centre of the channel with densities decreasing either side. This was also noted during the real-time viewing of the footage as it was being recorded during the survey.

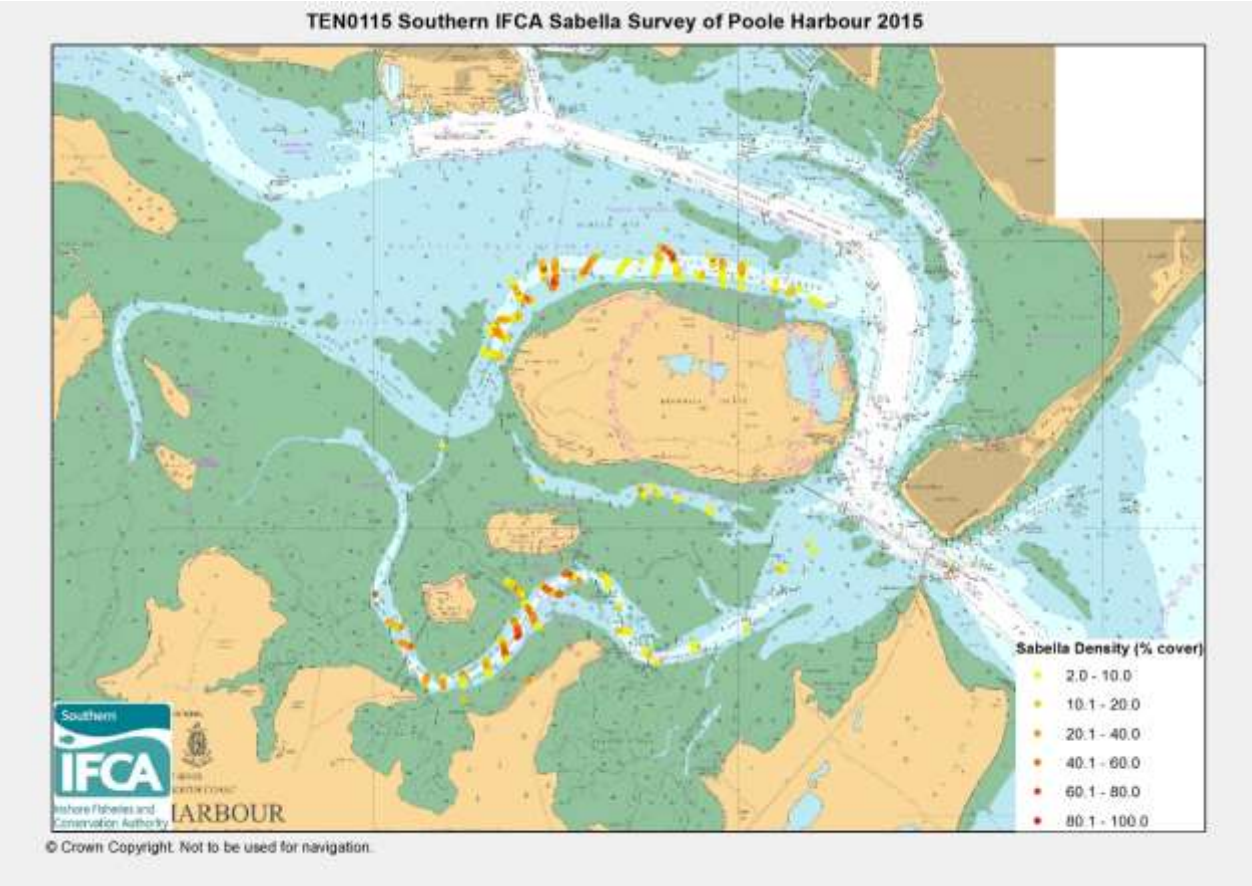

Figure 3: chart showing the density of *Sabella pavonina* as percentage cover based on an assessment of screenshots taken from the video footage of each tow.

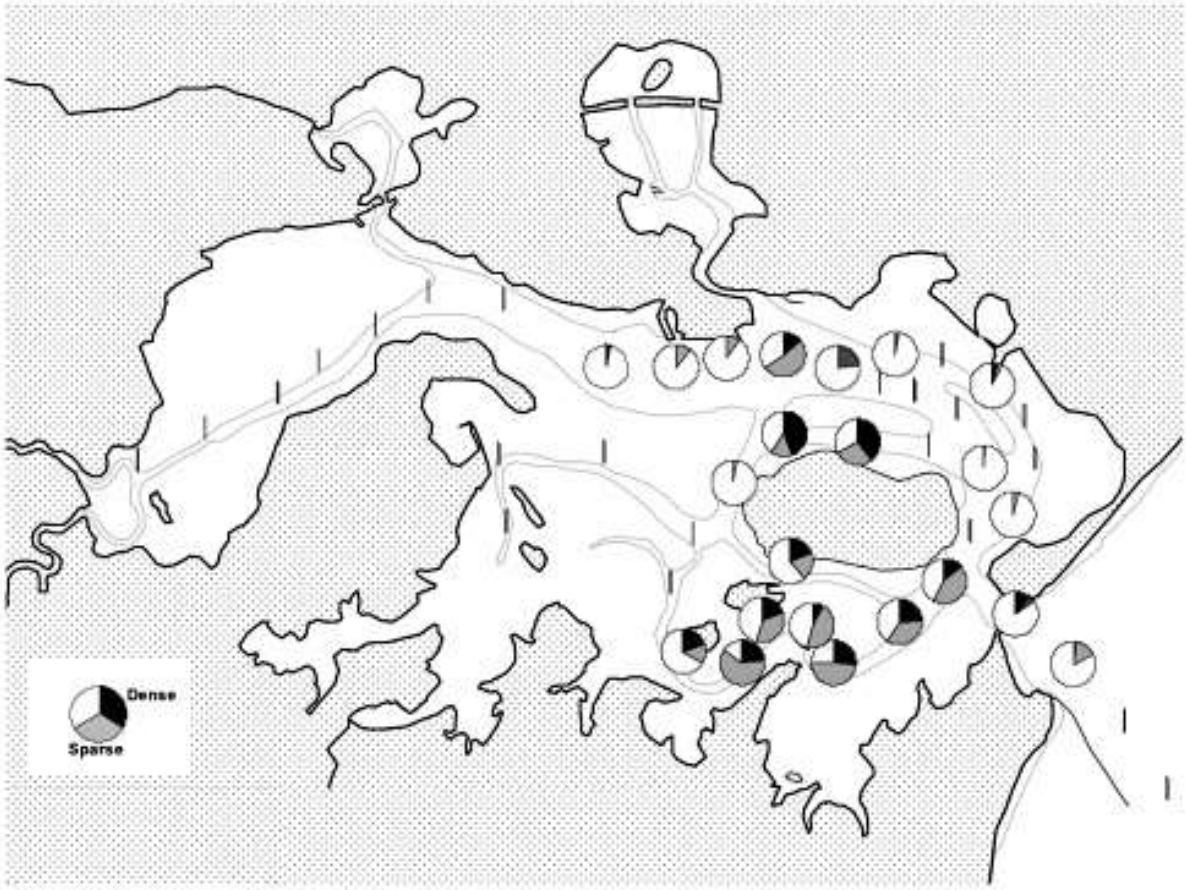

Figure 4: Map showing distribution and density of *Sabella pavonina* in 1984-1985 as recorded by Dyrynda[4] using dive surveyed transects.

The areas where presence of *S. pavonina* was greater corresponds with the percentage cover data (Figure 3), which shows the highest densities within the Wych Channel and South Deep. Percentage cover in these areas ranged from 2-90% with the higher densities corresponding to the centre of the channel with density decreasing on either side.

In comparison to the dive survey undertaken by Dyrynda in 1984-1985[4] (Figure 4), the areas of highest density in the Wych Channel and South Deep found in the 2015 survey correspond to areas where Dyrydna noted denser populations of *S. pavnonina*. Although difficult to determine exact numbers it does appear that the South Deep Sabella forests have developed into denser areas of forest since the 1980s, emphasised through assemblages of almost 80% in the 2015 survey. The occurrence of *S. pavonina* in the 1980s survey, as noted by Dyrynda[4], also correspond with the 2015 survey, where they are present on channel flanks where tidal currents are relatively strong as well as on the central channel bottom where currents are more modest. Comparing the overall distribution pattern from both surveys, *S. pavonina* appears to have maintained a relatively similar population density and position within the channels of the Harbour. The dive survey data did indicate higher densities toward the entrance of the Harbour where South Deep joins the main channel, which was not seen in this survey however the general pattern of distribution corresponds well between both surveys.

Although some of the video footage was affected by visibility due to turbid conditions created by weather and tidal currents, the majority of the footage obtained presented a clear view of the seabed and enabled the presence and density of *S. pavonina* to be mapped within the main channels of Poole Harbour. The towed camera method used to obtain the data allowed for *S. pavonina* to be mapped across the width of the channel, further supporting the findings by Dyrynda[4] that higher densities are found in the centre of the channel and on the channel flanks where tidal currents are modest to strong.

References

Dyrynda, P. 2005. 'Sub-tidal Ecology of Poole Harbour – An Overview', *In:* Humphreys, J. and May, V. (eds.), *Proceedings in Marine Science 7: The Ecology of Poole Harbour,* Elsevier, Amsterdam, pp. 1-8

Murray, J.M., Watson, G.J., Giangrande, A., Bentley, M.G. and Farrell, P. 2001. 'Reproductive biology and population ecology of the marine fan worm *Sabella pavonina* (Savigny) (Polychaeta: Sabellidae)', *Invertebrate Reproduction & Development*, **55**, no. 3, pp. 183-196

Wells, G.P. 1951. 'On the behaviour of Sabella', *Proceedings of the Royal Society of London Series B Biological Sciences,* **138**, no. 891, pp. 278-299

Appendix 1

Table 1: Coordinates for central channel fixed stations points for each sampling site.

Priority Site A – South Deep				
Station Number	Latitude_D	Latitude_DM	Longitude_D	Longitude_DM
1	50	40.737	-1	59.956
2	50	40.59	-1	59.82
3	50	40.455	-1	59.664
4	50	40.508	-1	59.413
5	50	40.629	-1	59.221
6	50	40.768	-1	59.067
7	50	40.802	-1	59.255
8	50	40.836	-1	58.83
9	50	40.716	-1	58.809
10	50	40.617	-1	58.579
11	50	40.556	-1	58.347
12	50	40.623	-1	58.108
13	50	40.719	-1	57.884
14	50	40.82	-1	57.703

Priority Site B – Blood Alley				
Station Number	Latitude_D	Latitude_DM	Longitude_D	Longitude_DM
1	50	40.891	-1	57.5
2	50	41.079	-1	57.495
3	50	41.003	-1	57.729
4	50	40.985	-1	57.999
5	50	41.088	-1	58.205
6	50	41.132	-1	58.461
7	50	41.102	-1	58.724
8	50	41.154	-1	59.01
9	50	41.209	-1	59.126

Priority Site C – Wych Channel				
Station Number	Latitude_D	Latitude_DM	Longitude_D	Longitude_DM
1	50	41.815	-1	57.541
2	50	41.848	-1	57.809
3	50	41.902	-1	58.077
4	50	41.913	-1	58.352
5	50	41.893	-1	58.591
6	50	41.923	-1	58.86
7	50	41.875	-1	59.13
8	50	41.739	-1	59.298
9	50	41.596	-1	59.347

Additional Site A – Wych Channel B				
Station Number	Latitude_D	Latitude_DM	Longitude_D	Longitude_DM
1	50	41.433	-1	59.424
2	50	41.368	-1	59.619
3	50	41.219	-1	59.65
4	50	41.14	-1	59.806

Additional Site B – Upper Wych Channel				
Station Number	Latitude_D	Latitude_DM	Longitude_D	Longitude_DM
1	50	41.474	-1	59.873
2	50	41.577	-2	0.087
3	50	41.661	-2	0.255

Appendix 2

Standard Operating Procedures for camera work on board FPV Tenacity

Initial setup:

- Connect lights and camera power cables to the umbilical.
    - Ensure the connection is well sealed.
- Start up the external generator and connect the mains to 4 pin connector to the generator using the convertor.
- Switch on the system power for topside processor unit and switch on laptop.
- Turn on lights to check they are working, but switch off immediately after to avoid overheating the LED's.
- Check the monitor shows the camera picture.
- On the laptop open the Arc soft showbiz icon.
    - Select the capture tab
    - Set where the video is set to save to
        - Ensure there is sufficient space on the hard drive.
    - Press the red button to test record. Press again to stop.
- Plug the GPS RS232 receiver into the GPS plug.
    - Check the video feed to be sure the video is overlaid with GPS and time data.
    - Check the GPS is updating its position.
- Check the angle of the camera is as required
- Check both lasers are working and mounted correctly
- Mount the go-pro to the sled.
    - Ensure the go-pro is mounted securely
    - Ensure the waterproof casing is sealed.
    - Ensure the go-pro has enough battery for the tow.
    - Ensure the go-pro has enough space on the SD card for the tow.
- Ensure a board labelled with necessary information is prepared:
    - Survey Name
    - Date
    - Start time
    - Station/Tow number
- Ensure the tow rope is appropriately labelled with the depths.
    - Every 2 or 5 metres is typical
- Prepare appropriate log sheets are prepared detailing:
    - Cruise ID
    - Survey name
    - Time
    - Date
    - Station/Line number
    - Equipment used
    - Data collected
    - Cable layback
    - Location
    - File names

Deployment:

- The vessel does not tow under power, but typically drifts with the current.
    - Ensure that whilst setting up the vessel is slowly floating towards the start of the tow.
    - Leave plenty of time, the camera can't be on station until the camera reaches the seabed.
- Start recording on the main camera
- Turn on the gopro (if necessary synchronise with the main camera recording)
- Turn on the lasers
- Check the screen to ensure video is being recorded, the overlay is present and the GPS is updating itself.
- Film the board ensuring it is visible on both cameras.
- Ensuring the camera is still tied off on the tow point deploy over side of the vessel with no more than a metres slack.
- Attach to the pot hauler and slowly lower to seabed ensuring someone is watching the camera and that they can communicate to the pot hauler operator when the sled reaches the seabed.
- Remove line from hauler and attach to tow point.
- Turn on the lights and adjust to a suitable setting.
- On the log sheet, make a note of:
    - The time the seabed is reached
    - Location
    - Depth
    - Weather conditions

Data capture:

- Having logged noted in the logsheet details upon reaching the seabed, make note of conditions at set time e.g. every two minutes:
    - Time
    - Depth
    - Rough assessment of seabed
- Further additions can be made to the log to note:
    - Technical problems
    - Features of note
    - Significant changes in habitat
    - Significant changes in depth
    - Changes to cable layback
- Any additions to the log need time of assessment.
- Whilst collecting data the aim is to move SOG at roughly 0.5kn and not greater than 1.
- Whilst collecting one person should be watching the footage, one keeping watch and one available to man the hauler if necessary.
- If available, one person can use a second laptop with a GPS attachment to view the location in comparison to existing habitat maps.

End of Video Capture:

- At the end of the line take note of the position, depth and time.
    - Bear in mind the camera is being towed, and although the vessel may have reached the end of the survey, the camera may not have.
- Turn off the camera lights.
- Stop the recording of the main video
- Use the pot hauler to retrieve the camera, coil the umbilical as it comes in to avoid issues for the next station.
- Bring the camera inboard
- Stop the go-pro and check that a file has been recorded.
- Turn off the lasers.
- Check all connections, laser mountings and angle of cameras to ensure that nothing has changed during the tow.

End of survey:

- Back up all data onto an external hard drive.
- Take log sheets off the vessel, scan and back up at the earliest opportunity.

Appendix 3

Template video logsheet for recording data for each tow

Southern IFCA Video Logsheet

Cruise code:_____ Location:_____ Project Name _____

Station/Tow No.:_____Date:_____Video File Name:_____

Approx. Vessel Speed:_____ Primary Camera system:_____

Secondary:_____Stills collected? Y/N Still details:_____

Cable out:_____ GPS used:_____Laser Scale Calibration:_____

Tow Details:

	Time	**Latitude (°N)**	**Longitude (°W)**	**Depth (m)**	**Vessel Speed (knots)**
SOL					
EOL					

Time (hh:mm)	Depth (m)	Time (hh:mm)	Depth (m)	Time (hh:mm)	Depth (m)	Time (hh:mm)	Depth (m)

Cable adjustments (time and new outlay):
Visual/Video Notes (e.g. heading, visibility, assessment of seabed, notable features):

Completed by:_____Checked by:_____