

STEMM-CCS Camera Survey Data using Gavia

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Contents

| | |
|-------------------------------------|----|
| Overview | 3 |
| Dive 1 – Deployment 9 | 5 |
| Camera Setup | 5 |
| Data | 5 |
| Image Analysis and Processing | 6 |
| Specimen Examples | 7 |
| Camera tests on deck (1) | 8 |
| Dive 2 – Deployment 17 | 11 |
| Camera Setup | 11 |
| Data | 11 |
| Image Analysis and Processing | 14 |
| Specimen Examples | 15 |
| Camera tests on deck (2) | 16 |
| Dive 3 – Deployment 35 | 19 |
| Camera Setup | 19 |
| Data | 19 |
| Dive 4 – Deployment 44 | 20 |
| Camera Setup | 20 |
| Data | 20 |
| Dive 5 – Deployment 52 | 24 |
| Camera Setup | 24 |
| Data | 24 |
| Image Analysis and Processing | 25 |
| Specimen Examples | 26 |
| Dive 6 – Deployment 60 | 27 |
| Camera Setup | 27 |
| Data | 27 |
| Image Analysis and Processing | 28 |
| Specimen Examples | 29 |
| Dive 7 – Deployment 63 | 30 |
| Camera Setup | 30 |

| | |
|-------------------------------------|----|
| Data | 30 |
| Image Analysis and Processing | 31 |
| Specimen Examples | 32 |
| Dive 8 – Deployment 67..... | 33 |
| Camera Setup..... | 33 |
| Data | 33 |
| Image Analysis and Processing | 34 |
| Specimen Examples | 35 |

Overview

As the Gavia camera had not had much usage prior to this cruise, other than for capturing monochrome jpeg imagery, there was some degree of experimentation and trial and error during the initial deployments to produce desirable image quality. This also meant that the amount of storage required for imagery prior to this cruise was relatively small and it wasn't until after the first Gavia dive (and during Dive2) that it was realised that the memory card within the camera only had a 16 GB capacity. Using the minimum temporal sampling frequency of 1.875 fps, the maximum spatial frequency of 1280x960 pixels, the 'RAW' setting, and including the camera system files, it is possible to capture roughly 32 minutes of continuous imagery. For this reason, from Dive3 onwards, camera surveys were programmed to be much shorter so not to waste time that could be used for collecting other forms of data using the Gavia at different altitudes.

The first dive produced images that were predominantly green, although it was initially unclear why this was the case. Tests performed on deck, with the same settings, produced a much more desirable colour balance. It was therefore expected that the colour temperature of the flash was the cause, as the images on deck were captured under natural light. The Gavia manual also states that the flash is designed to be used for monochrome images. Post processing produced better results but lack of information in the blue and red channels meant that it was hard to produce a realistic colour balance with sufficient detail. An error also caused the camera logs to be dated 14th June 2014. This error was calculated to be 153719717.155357794 seconds.

Different colour gain combinations were tested during the beginning of Dive2 and slight adjustments were made for the main camera survey in attempt to counteract the problem. The images captured for this dive were still predominantly green but the results gave us a better idea of what adjustments should be made for future dives. Due to difficulties during Dive3, no camera data were collected. Part of Dive4 was used to run a short camera survey (just off from the experimental site) to test more camera settings. From these we were able to learn a good combination of parameters that we intended to use for the remainder of the camera surveys. Dive5 produced images with a much more realistic colour balance. Dive6, however, produced images similar to Dive2 as parameters were input into the Gavia Control Centre software incorrectly. This was rectified before Dive7, which produce images similar in colour to those of Dive5. The final dive over the experimental site, Dive8, also produce images similar in colour to those of Dive5.

It is recommended that a greater capacity memory card is fitted to allow for longer camera surveys. However, it should be noted that the download time from the Gavia takes roughly 30 minutes with a 16 GB memory card and therefore longer download times should be expected with greater capacity memory cards. To reduce vignetting the Gavia could be flown at a lower altitude, however, this increases the risk of colliding into the seafloor.

The Gavia Control Centre (*master_build-213_2018-11-26_dbdcb34d-181126-1330*) was used for programming the Gavia missions. The Gavia camera logs were processed using a purpose-built Python package *Gavia* (github.com/brett-hosking/gavia [version 0.0.1]), which was developed onboard, see *examples* section on GitHub for usage examples. Image histograms were calculated using Python and image processing was applied using InfranView. All plots were generated using Python and Matplotlib. Examples of specimens were located manually using the processed imagery. The full version of the camera report can be found at github.com/brett-hosking/gavia/docs/reports/.

| Dive | Survey Images | Average Survey Altitude | Survey Duration | Test Images |
|------|---------------|-------------------------|-----------------|-------------|
| 1 | 3704 | 2.3531 | 37.57 | 0 |
| 2 | 3445 | 2.3652 | 34.51 | 255 |
| 3 | 0 | - | - | 0 |
| 4 | 0 | - | - | 593 |
| 5 | 1315 | 2.3427 | 14.7640 | 0 |
| 6 | 3495 | 2.3400 | 32.6926 | 0 |
| 7 | 3594 | 2.3646 | 33.7414 | 0 |
| 8 | 3671 | 2.3679 | 82.0243* | 0 |

*There was a break in the middle of the camera survey

Dive 1 – Deployment 9

Camera Setup

| | |
|--------------------------|------------------------------|
| Camera | GRAS-14S5M-C |
| Lens | Tamron TAM 23FM08-L |
| Sensor Size | 10.2mm x 8.3mm |
| Focal Length | 8mm |
| Resolution | 1280x960 (max) |
| Frame Rate | 1.875 fps (minimum) |
| Auto Whitebalance | Enabled |
| Blue Gain | 512 |
| Red Gain | 512 |
| Memory Card | 16 GB Compact Flash |
| Flash | 20x Lumiled (LXHL-PW03) LEDs |

Data

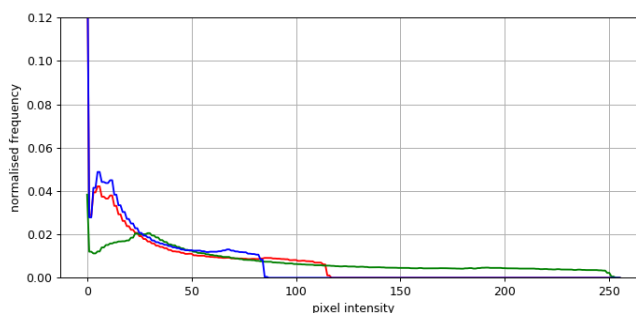
| | |
|--|------------------------|
| Deployment Time (GMT) | 28/05/2019 10:41 |
| Recovery Time (GMT) | 28/05/2019 14:51 |
| Start Position | 5759.8391N 00022.2045W |
| End Position | 5759.9116N 00022.1054W |
| Images Captured | 3704 |
| Average Camera Survey Altitude (m) | 2.3531 |
| Camera operation duration (minutes) | 37.57 |

Due to difficulties during launch an error incurred in the camera logs which caused the time stamps to be shifted back to June 14th 2014. An error (in seconds) was calculated as **153719717.155357794** and applied. As shown below, the camera samples align with the navigation data after applying this correction. While the Gavia is turning the camera stops sampling. Not including turns, the camera captured ~32 minutes worth of images at 1.875 fps before the memory cards capacity was reached.



Altitude of dive 1 and photo sampling - the memory card was too small to store all of the images captured during the camera survey (~2m altitude)

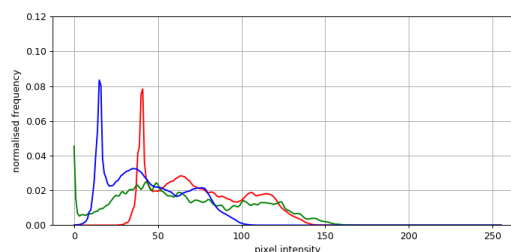
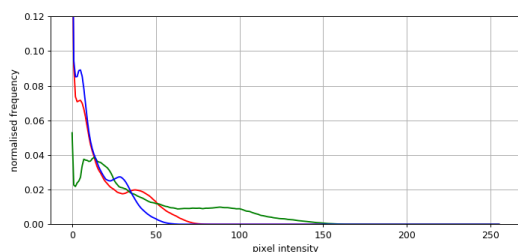
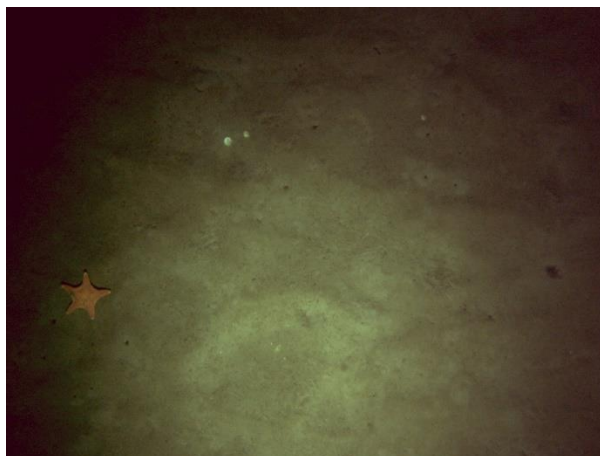
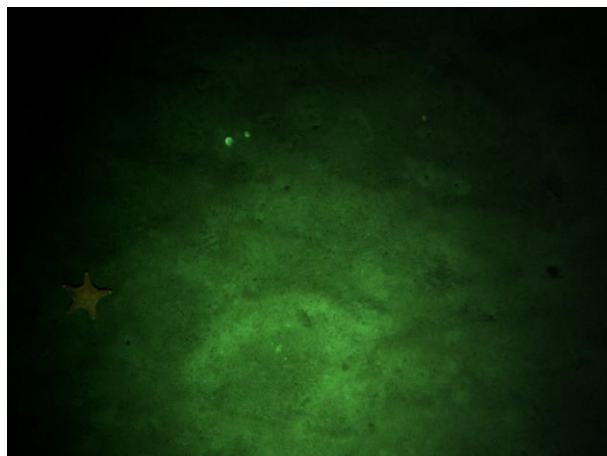
Each image produced was predominantly green. As the Auto Whitebalance option was enabled for this dive it was expected that the colour gains were automatically adjusted to significantly enhance the green gain.



Mean image for Dive 1 – With Auto WhiteBalance enabled the images contained a wide range of pixel intensities in the green channel but the range in the blue and red channels were much more limited

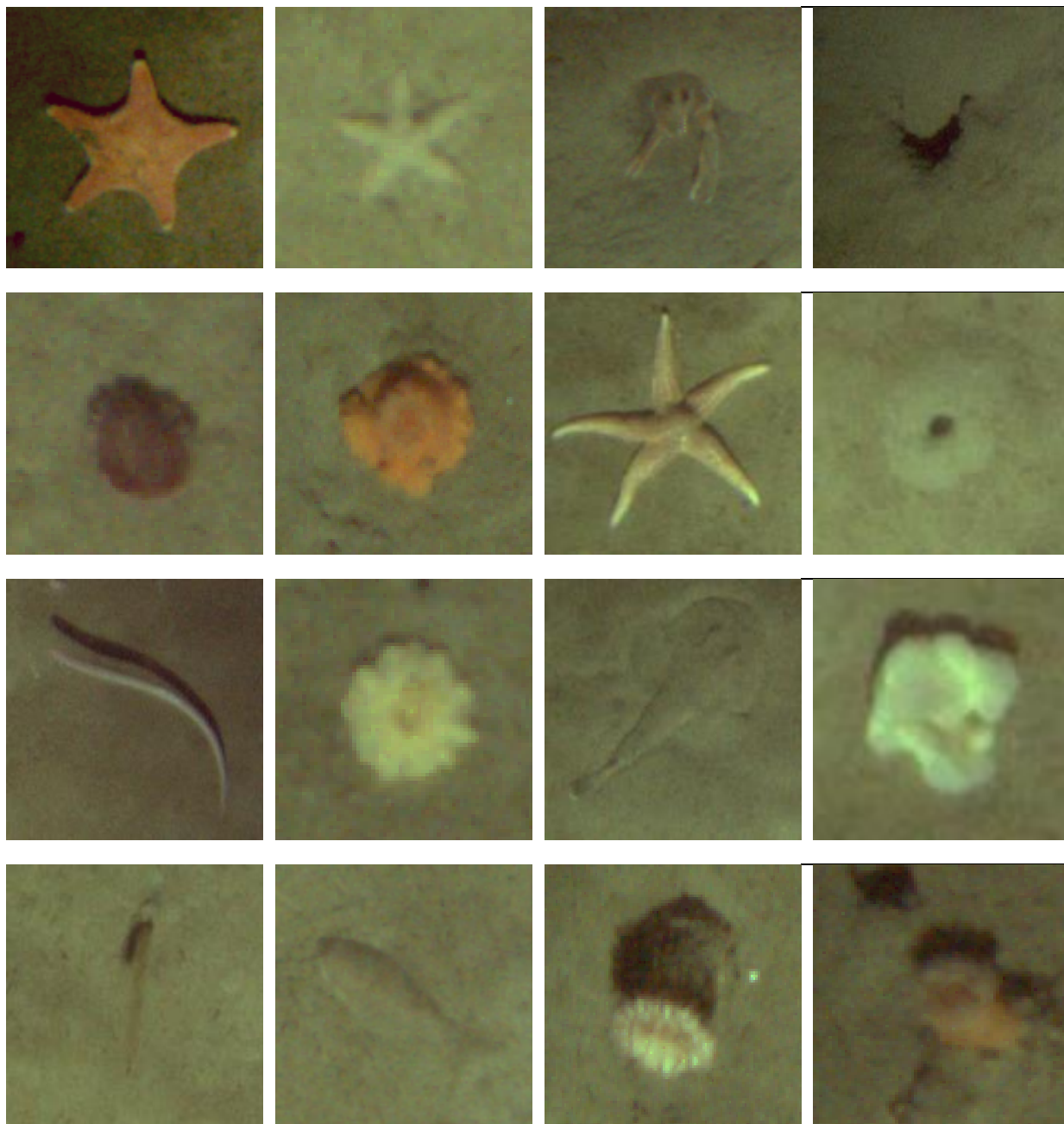
Image Analysis and Processing

Onboard, the images were processed in attempt to produce a more realistic colour balance, as shown below. These processed images were then used for manually detecting specimen and feature examples shown in the next section.



Example from the first Gavia Dive – Original (Top Left) and Processed (Top Right) image. Minor post processing was applied to produce a better colour balance and reduce contrast (Red+30, Green-10, Blue+5, contrast-40). Original image histogram (Bottom Left), Processed image histogram (Bottom Right)

Specimen Examples



Examples of specimens and features found during Dive 1 -

Camera tests on deck (1)

After Dive 1, camera tests were performed onboard to observe how the colour gain parameters affect the colour balance without Auto WhiteBalance enabled. Gains are input within the range [0,1024], suggesting 10 bits per pixel (BBP), however the size of the images in memory is 11.7 MB, indicating 24 BBP (given 8 bits in a byte). This can be confirmed using the relationship:

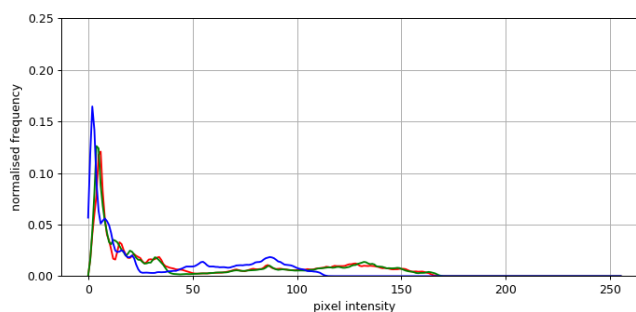
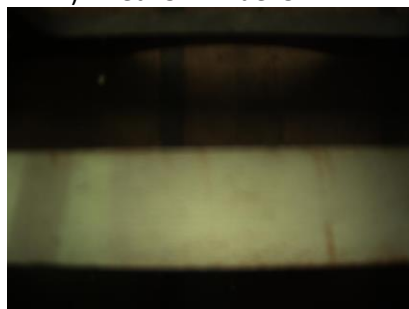
$$M = W \times H \times C \times BPP,$$

where M is the number of bits in memory, W is the width in pixels, H is the height in pixels, and C is the number of channels ($C=3$ for RGB).

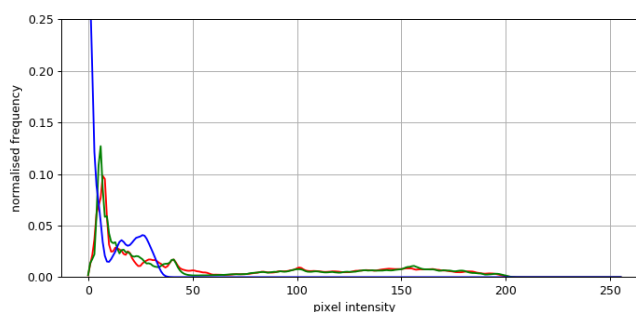
Pixel intensities therefore range between [0, 16777215] ($2^{24} - 1 = 16777215$). It is also worth noting that there is a 11.7:3.603 compression ratio (30.79%) as each image is 3.603 MB on disk.

Below are images captured on deck with natural light (the flash fired but was mostly covered up) with the corresponding Red and Blue gains input into the Gavia Control Center software. Colour histograms were produced using 256 pixel intensity bins, and are also given below.

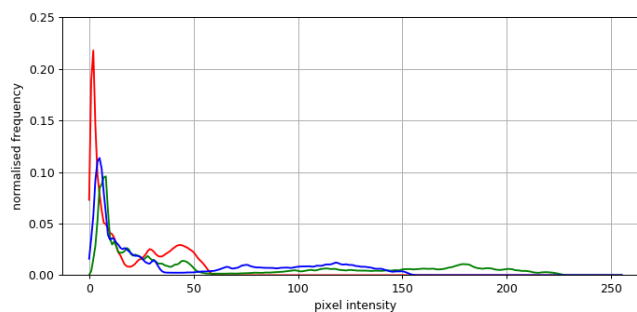
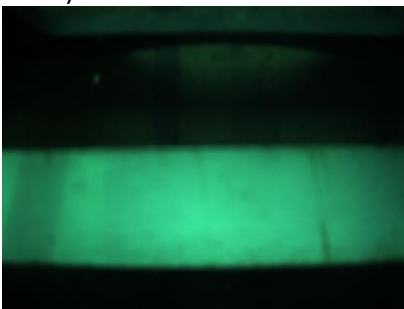
1) Red: 512 Blue: 512



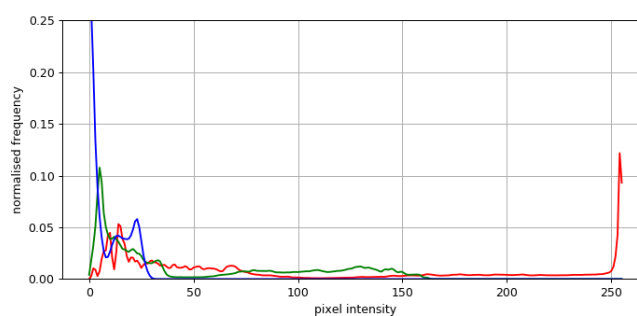
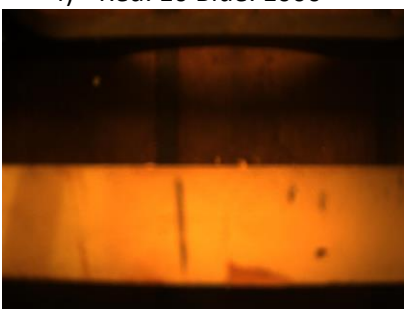
2) Red: 10 Blue: 512



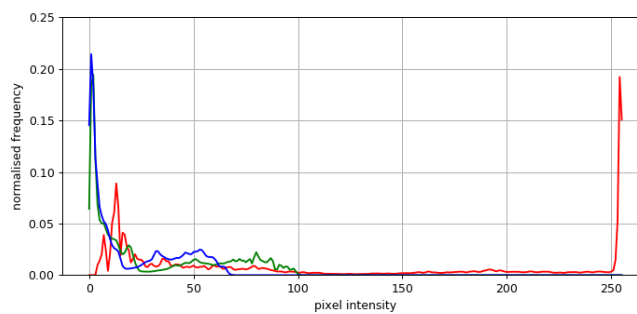
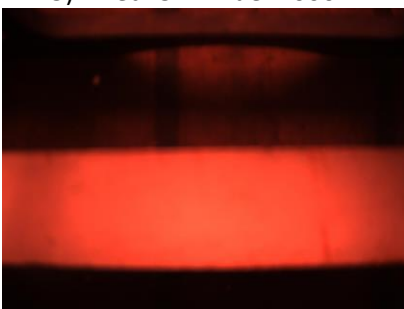
3) Red: 512 Blue: 10



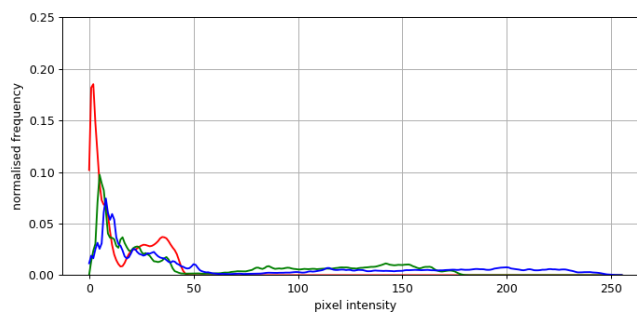
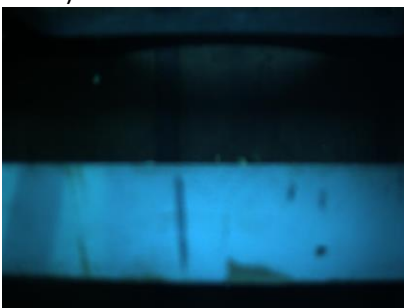
4) Red: 10 Blue: 1000



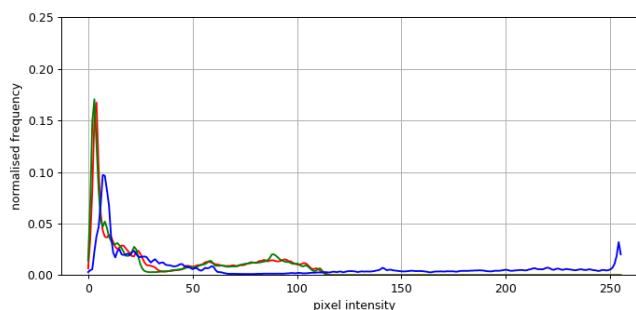
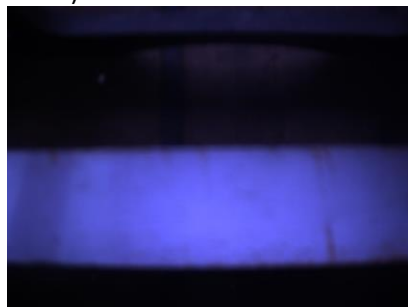
5) Red: 512 Blue: 1000



6) Red: 1000 Blue: 10



7) Red: 1000 Blue: 512



It is not entirely clear how the blue and red gain parameters in the Gavia Control Center software relate to actual colour gains for each RGB channel. As no green gain parameter is provided it is assumed that the green gain is calculated from the other two, i.e the sum of all three is a constant value. It also appears that the blue and red gain parameters are reversed; increasing the blue gain increases the red and increasing the red gain increases the blue. However, this is not always immediately obvious as reducing either gain will also increase the green.

From image 1 (Red: 512 Blue: 512) to image 2 (Red: 10 Blue: 512), the red gain is reduced by 502 points while the blue gain is maintained at 512 points. However, from the histogram it can be seen that the red and green channels still contain a wide range of pixel intensity values while the intensities in the blue channel are far less varied and constrained closer to zero. From the image itself it can also be seen that there is more red than blue, again suggesting that the parameters in the Gavia Control Center are reversed.

Image 4 (Red: 10 Blue: 1000) to image 5 (Red: 512 Blue: 1000) changes from a predominantly orange colour to a predominantly red colour. This would suggest that the parameters in the Gavia Control Center are actually correct, however, from the histograms it can be seen that there is little change in the red channel while the range of values in the blue channel increases slightly and the range of values in the green channel decreases.

Dive 2 – Deployment 17

Camera Setup

| | |
|--------------------------|------------------------------|
| Camera | GRAS-14S5M-C |
| Lens | Tamron TAM 23FM08-L |
| Sensor Size | 10.2mm x 8.3mm |
| Focal Length | 8mm |
| Resolution | 1280x960 (max) |
| Frame Rate | 1.875 fps (minimum) |
| Auto Whitebalance | Disabled |
| Blue Gain | 527 |
| Red Gain | 497 |
| Memory Card | 16 GB Compact Flash |
| Flash | 20x Lumiled (LXHL-PW03) LEDs |

Data

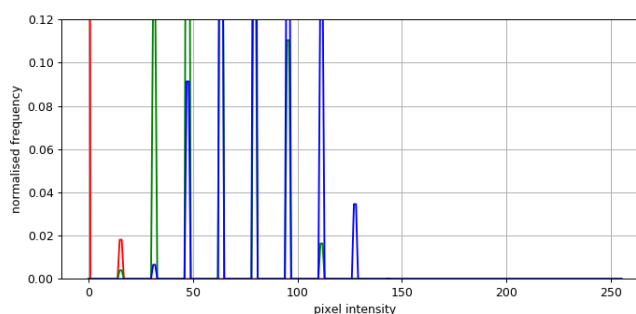
| | |
|--|------------------------|
| Deployment Time (GMT) | 01/05/2019 11:14 |
| Recovery Time (GMT) | 01/05/2019 17:32 |
| Start Position | 5802.0330N 00018.5394W |
| End Position | 5802.0892N 00018.6005W |
| Images Captured (main survey) | 3445 |
| Average Camera Survey Altitude (m) | 2.3652 |
| Camera operation duration (minutes) | 34.51 |

This dive was split into two camera surveys; a quick camera survey was run at the start of the dive to test different colour gains for the blue and red channels, and then the main survey was run with a fixed set of gain parameters (Red: 497, Blue: 527), assuming that the red and blue gains are actually mislabeled for each other.

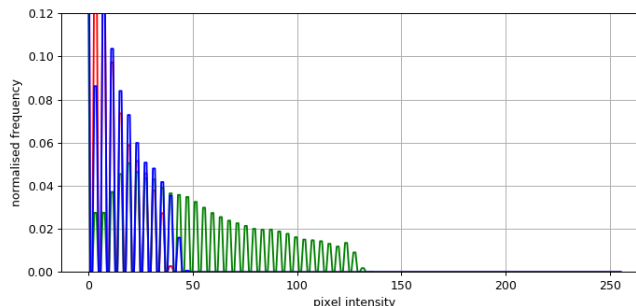
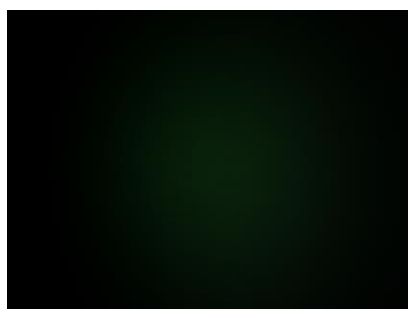


Dive 2 altitude and photo sampling – camera tests were performed at the beginning of the dive before starting the acoustic surveys. The main camera survey started at 15:19:47

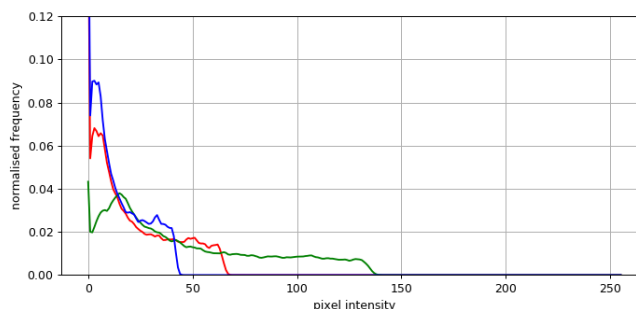
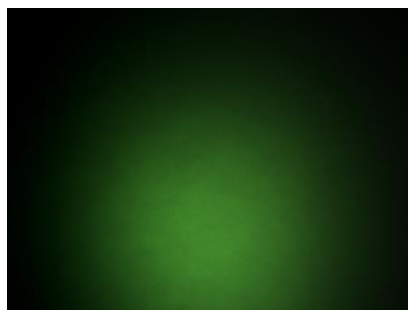
With Auto WhiteBalance disabled, and with only minor adjustments to the colour gain parameters, it was expected that the images would appear mostly blue due to the variation in wavelength attenuation underwater. However, as seen below, the images still contain much more energy in the green channel compared to the red and blue channels. This is possibly due to the colour temperature of the flash, which, as stated in the manual, is actually designed for black and white imagery. Below are the mean images from each camera test (~30 images in each test), using different colour gains. For the main survey the red gain was set to 497 and the blue gain was set to 527. As we believe these parameters are actually reversed in the software, the blue gain is actually set to 497 and the red gain is actually set to 527.



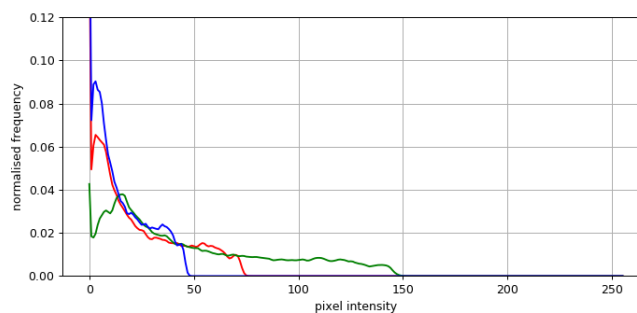
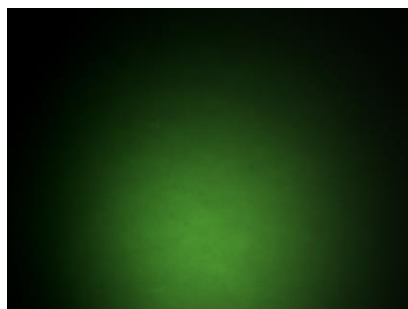
Mean image from Camera Test 1 - Red: 497 Blue: 537. Due to the high altitude when the camera began sampling, there was insufficient lighting.



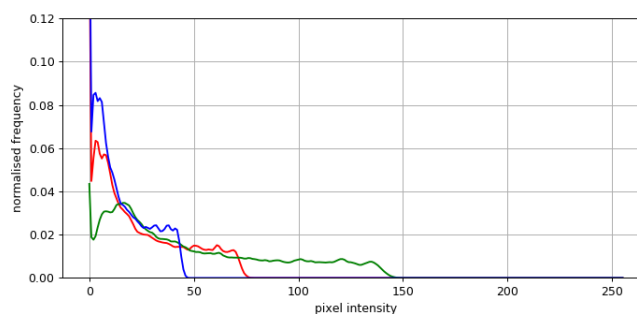
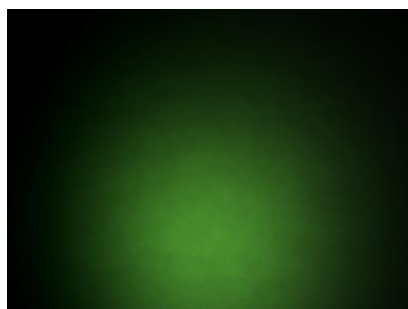
Mean image from Camera Test 2 - Red: 487 Blue: 537. The AUV was still descending during this test and therefore the altitude was still too high.



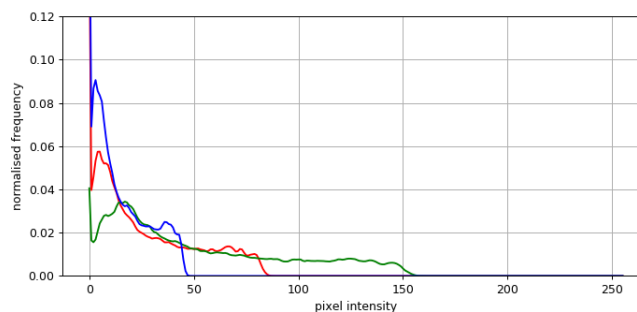
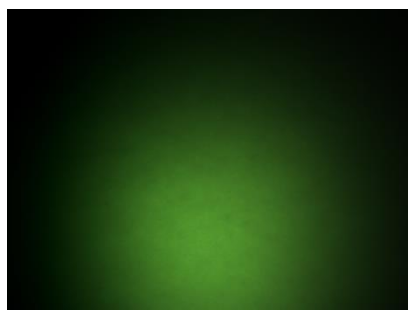
Mean image from Camera Test 3 - Red: 477 Blue: 537



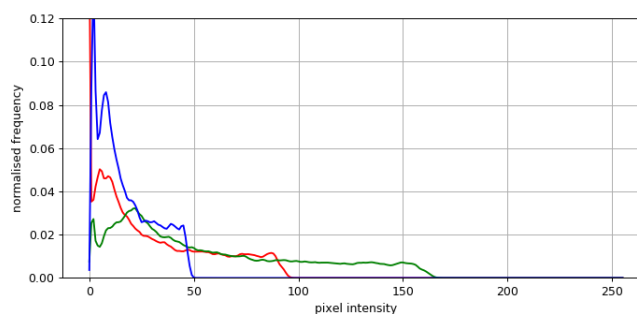
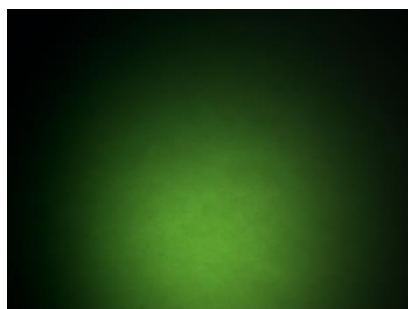
Mean image from Camera Test 4 - Red: 477 Blue: 547



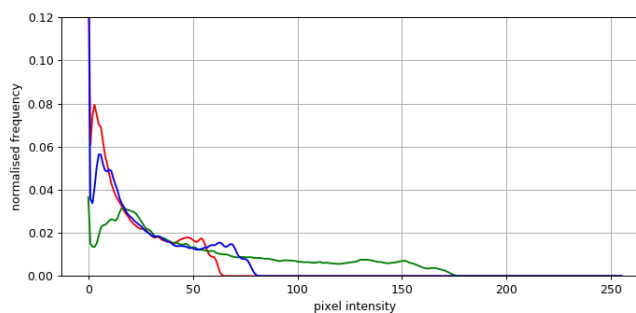
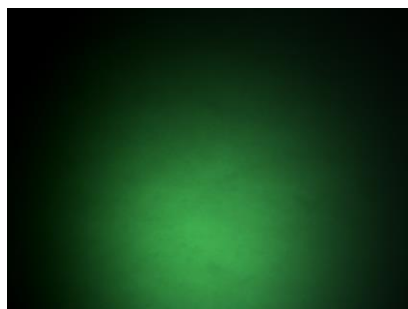
Mean image from Camera Test 5 - Red: 477 Blue: 557



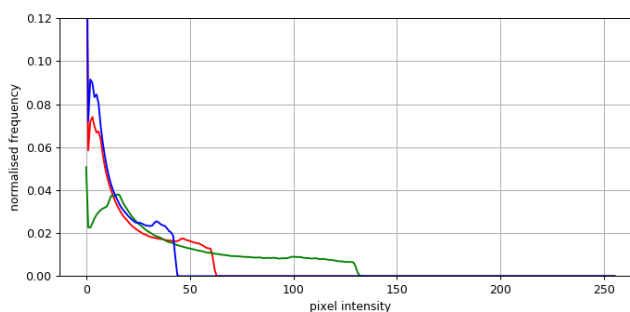
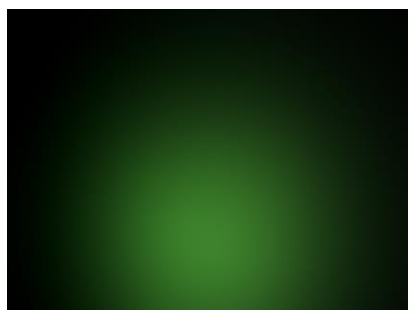
Mean image from Camera Test 6 - Red: 457 Blue: 577



Mean image from Camera Test 7 - Red: 427 Blue: 607



Mean image from Camera Test 8 - Red: 607 Blue: 427

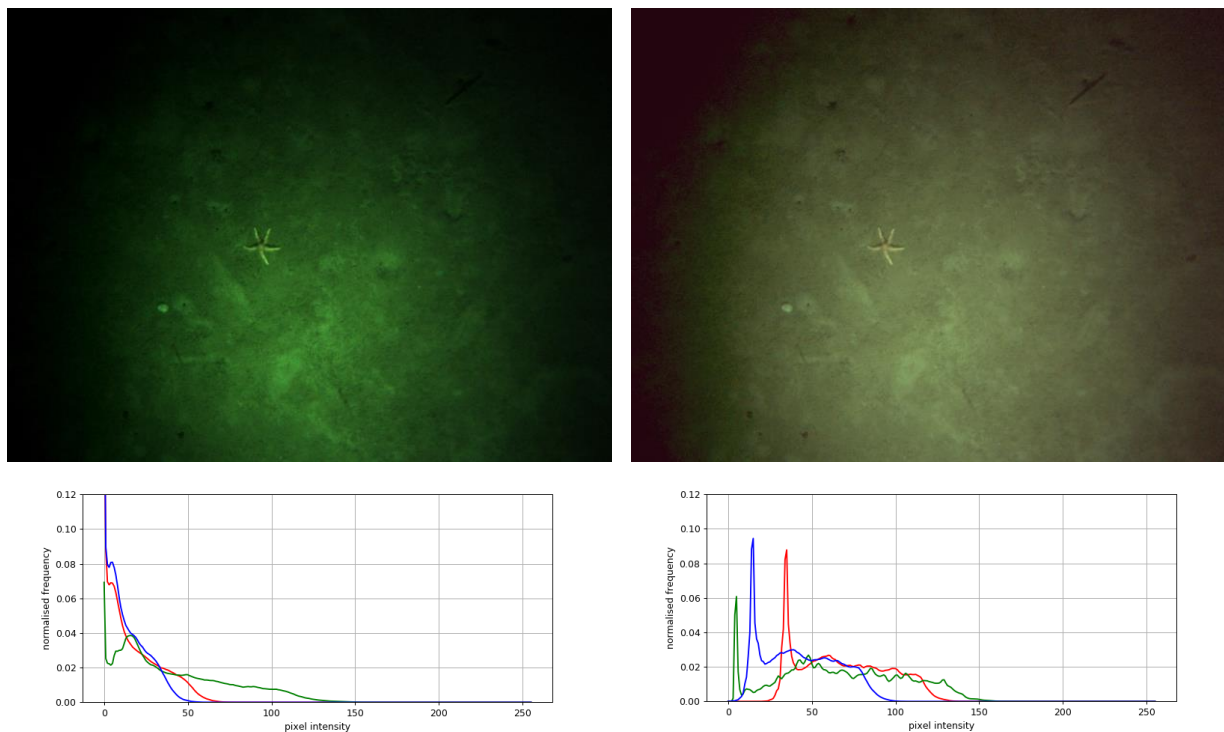


Mean image for main survey of Dive 2 – Without Auto WhiteBalance enabled and the colour gains set to Red: 527 and Blue: 497 the images

From these tests it's clear that, to reduce the green energy in the images, both the red and blue gains need to be increased above 512, while still keeping the red gain (blue gain in the software) higher to account for the greater attenuation at varying wavelengths.

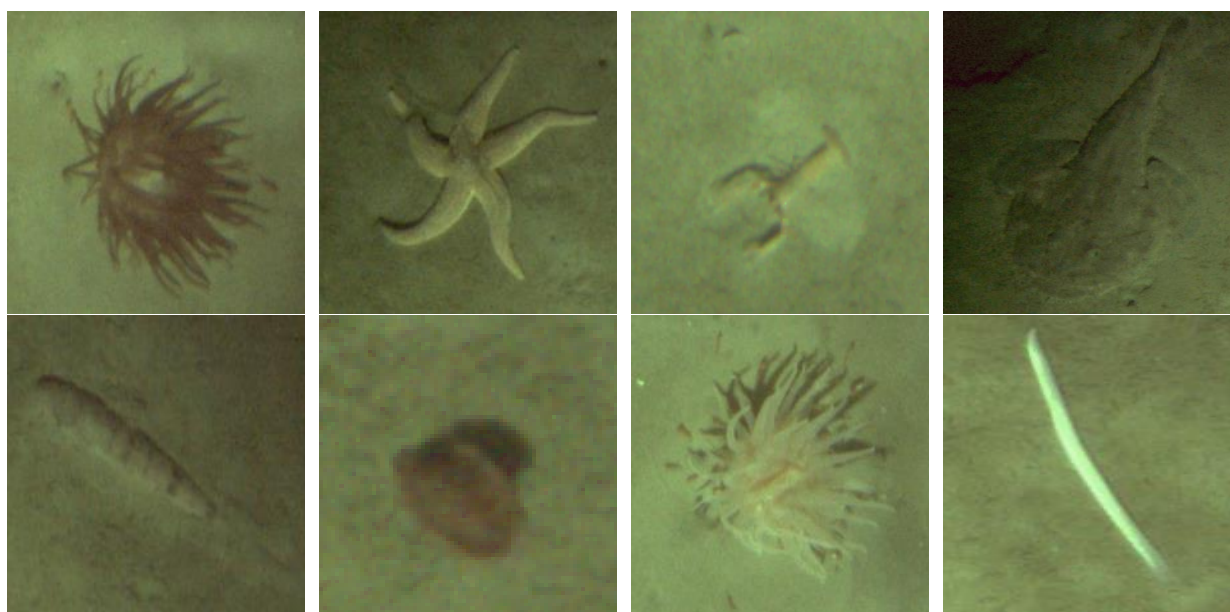
Image Analysis and Processing

As before, for the data collected from dive 1, the images were processed in attempt to produce a more realistic colour balance, as shown below. These processed images were then used for manually detecting specimen and feature examples shown in the next section.



Example from the second Gavia Dive – Original (Top Left) and Processed (Top Right) image. Minor post processing was applied to produce a better colour balance and reduce contrast (Red+25, Green-5, Blue+5, contrast-40). Original image histogram (Bottom Left), Processed image histogram (Bottom Right)

Specimen Examples

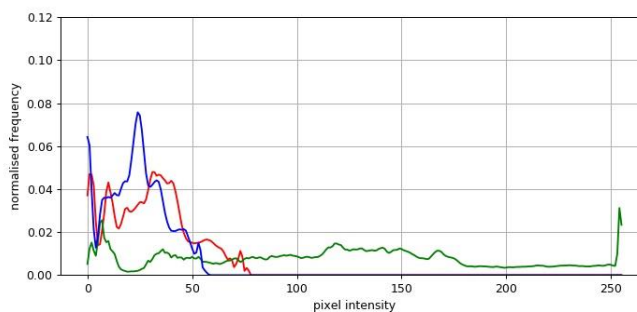
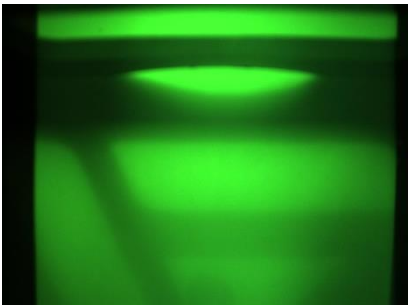


Examples of specimens found during Dive 2 -

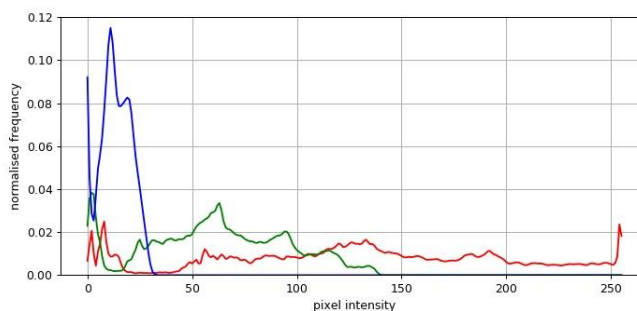
Camera tests on deck (2)

Further tests were carried out on deck with different combinations of red and blue colour gains for the Gavia camera to better understand how the gain parameters should be adjusted in the Gavia Control Centre software.

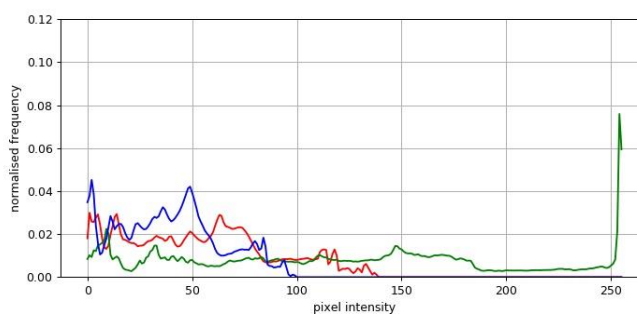
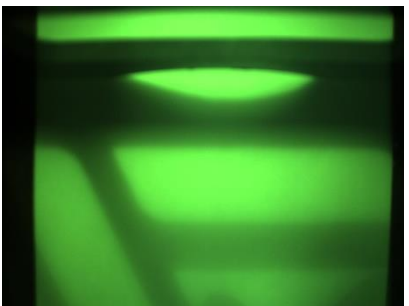
Red: 10 Blue: 10



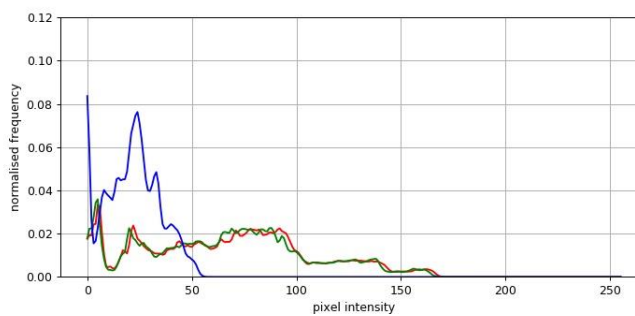
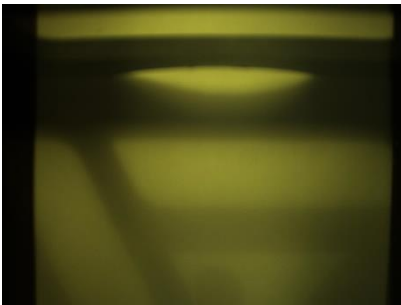
Red: 10 Blue: 1000



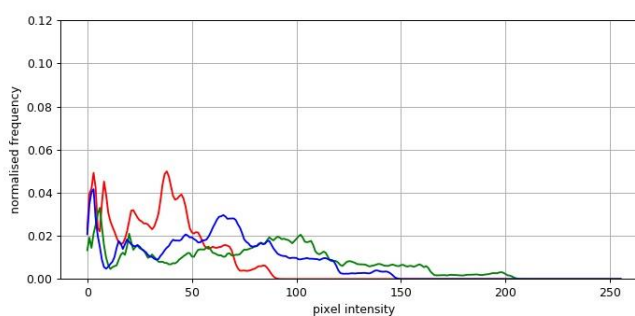
Red: 200 Blue: 200



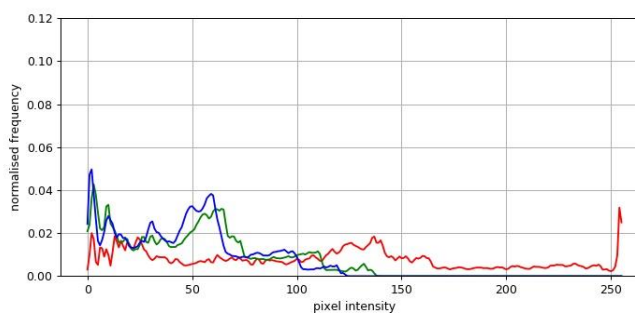
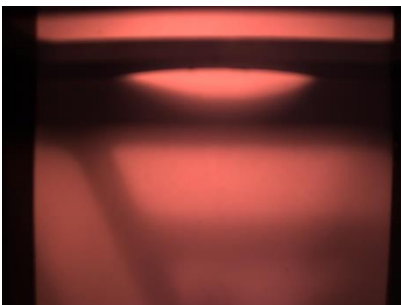
Red: 200 Blue: 512



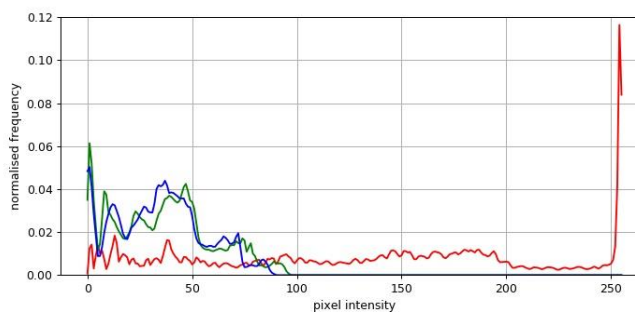
Red: 512 Blue: 200



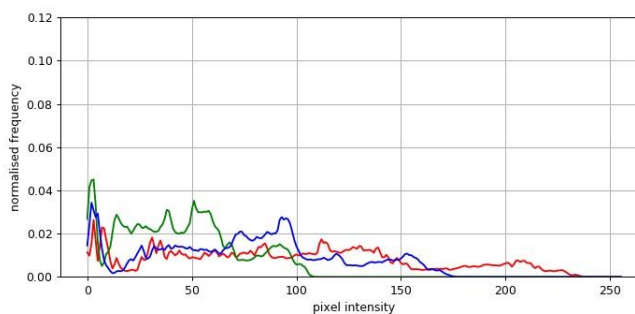
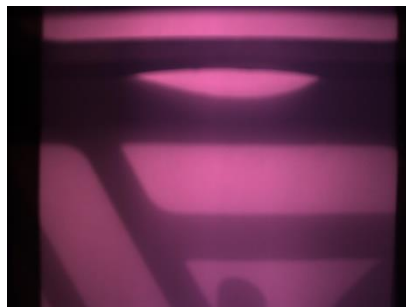
Red: 600 Blue: 800



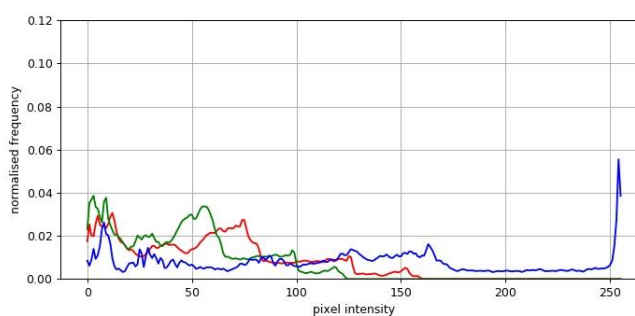
Red: 600 Blue: 1000



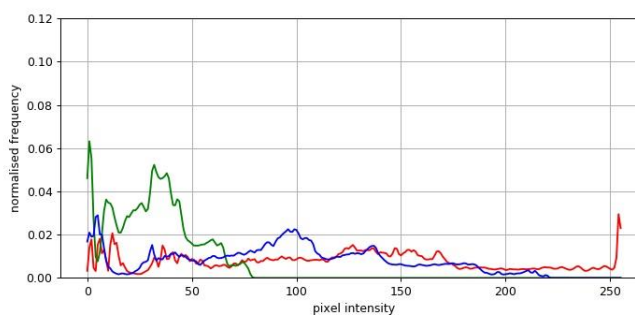
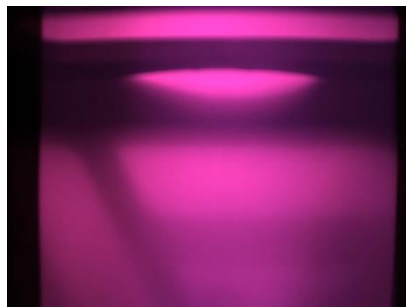
Red: 800 Blue: 800



Red: 1000 Blue: 600



Red: 1000 Blue:1000



From the test images it can again be seen that the red and blue gains appear to be reversed in the software but also we need to increase both the red and blue gain to decrease the green gain. This follows the theory that the sum of all three gains is a constant value.

Dive 3 – Deployment 35

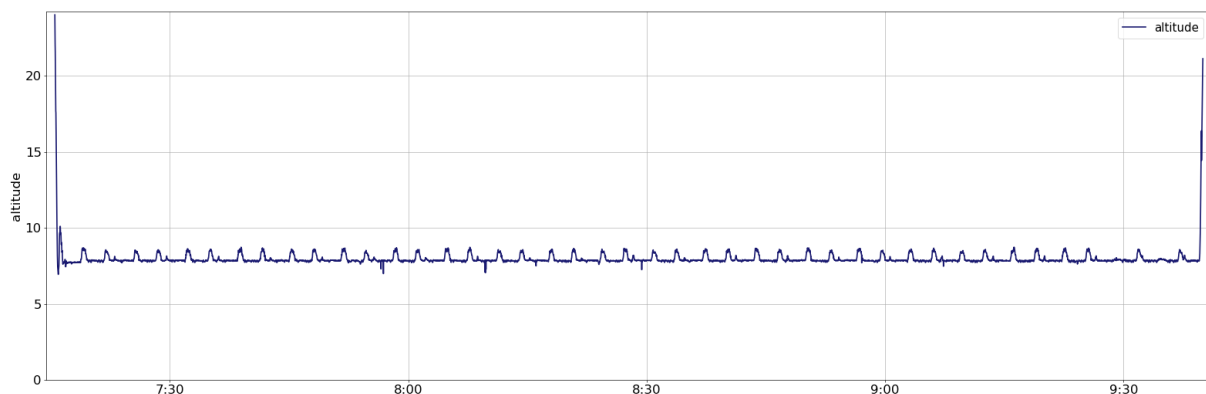
Camera Setup

| | |
|--------------------------|------------------------------|
| Camera | GRAS-14S5M-C |
| Lens | Tamron TAM 23FM08-L |
| Sensor Size | 10.2mm x 8.3mm |
| Focal Length | 8mm |
| Resolution | 1280x960 (max) |
| Frame Rate | 1.875 fps (minimum) |
| Auto Whitebalance | Disabled |
| Blue Gain | - |
| Red Gain | - |
| Memory Card | 16 GB Compact Flash |
| Flash | 20x Lumiled (LXHL-PW03) LEDs |

Data

| | |
|--|------------------------|
| Deployment Time (GMT) | 14/05/2019 06:59 |
| Recovery Time (GMT) | 14/05/2019 12:34 |
| Start Position | 5759.6611N 00022.4261W |
| End Position | 5759.6825N 00022.3648W |
| Images Captured | 0 |
| Average Camera Survey Altitude (m) | - |
| Camera operation duration (minutes) | 0 |

This dive was primarily for acoustics over the experiment site but a small camera survey was programmed slightly off-site to perform more tests. Unfortunately the Gavia failed to complete the whole mission and therefore no image data were collected.



Dive 3 altitude - After resurfacing Gavia failed to dive again and continue with the next dive plan.

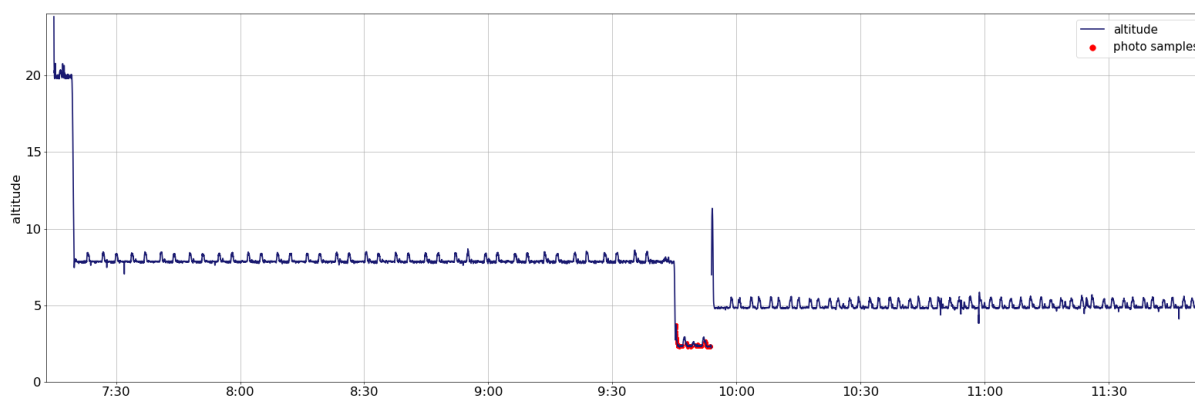
Dive 4 – Deployment 44

Camera Setup

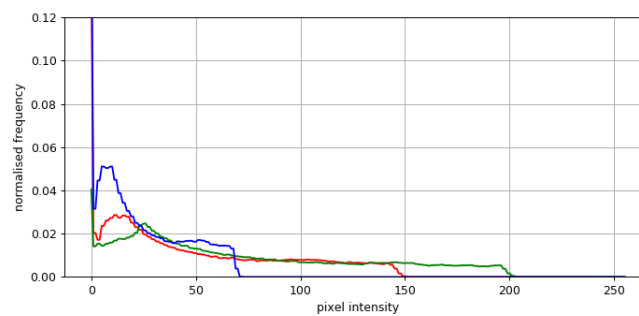
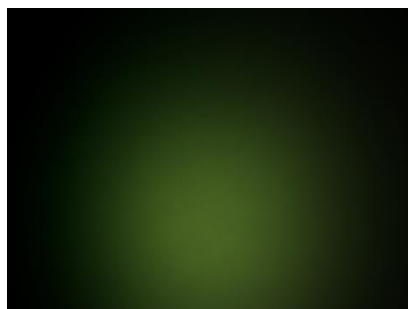
| | |
|--------------------------|------------------------------|
| Camera | GRAS-14S5M-C |
| Lens | Tamron TAM 23FM08-L |
| Sensor Size | 10.2mm x 8.3mm |
| Focal Length | 8mm |
| Resolution | 1280x960 (max) |
| Frame Rate | 1.875 fps (minimum) |
| Auto Whitebalance | Disabled |
| Blue Gain | - |
| Red Gain | - |
| Memory Card | 16 GB Compact Flash |
| Flash | 20x Lumiled (LXHL-PW03) LEDs |

Data

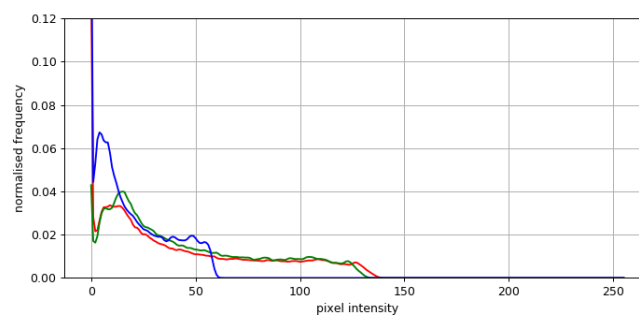
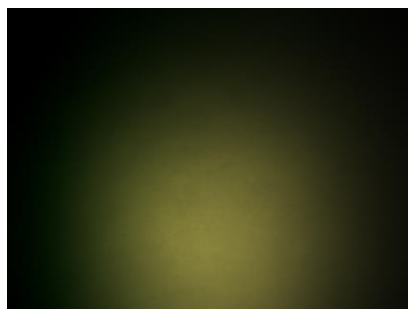
| | |
|--|------------------------|
| Deployment Time (GMT) | 17/05/2019 07:01 |
| Recovery Time (GMT) | 17/05/2019 12:03 |
| Start Position | 5759.7365N 00022.2527W |
| End Position | 5759.6322N 00022.4057W |
| Images Captured (test images) | 593 |
| Average Camera Survey Altitude (m) | 2.42627 |
| Camera operation duration (minutes) | 8.44 |



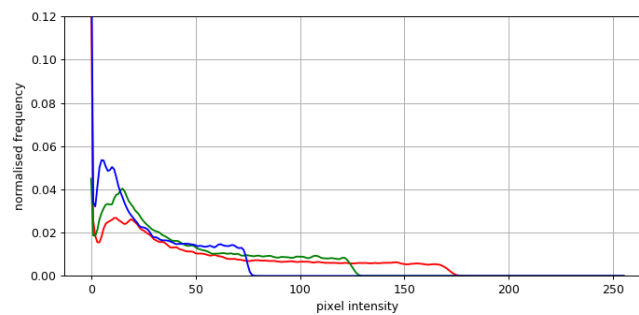
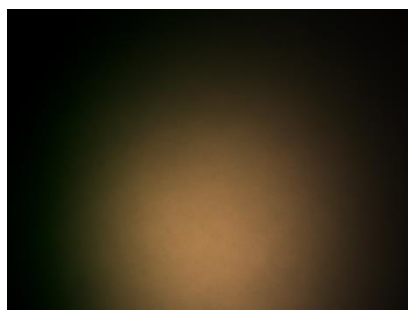
Dive 4 altitude and camera samples



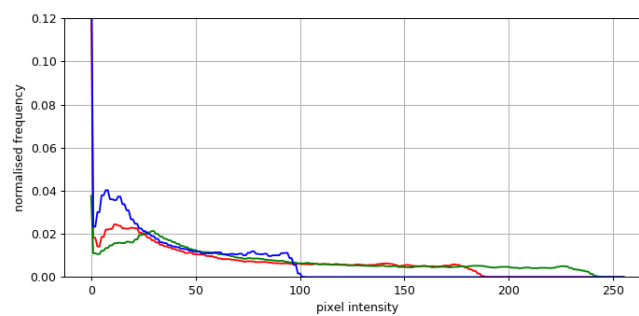
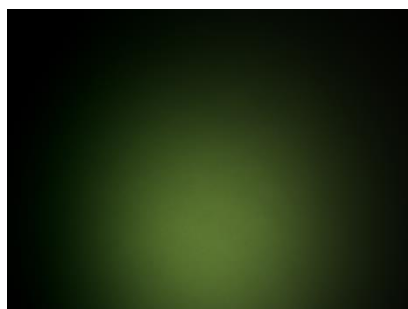
Mean image from Camera Test 1 - Red: 512 Blue: 712.



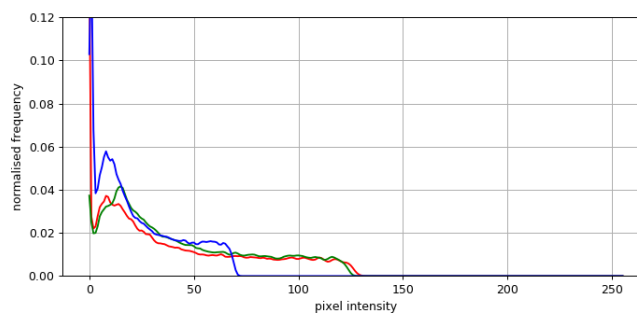
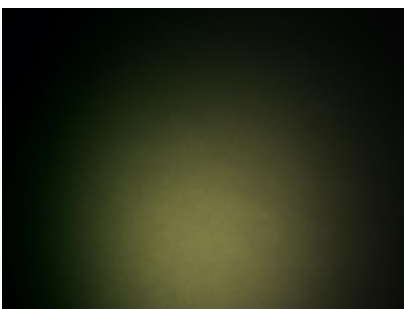
Mean image from Camera Test 2 - Red: 612 Blue: 812:.



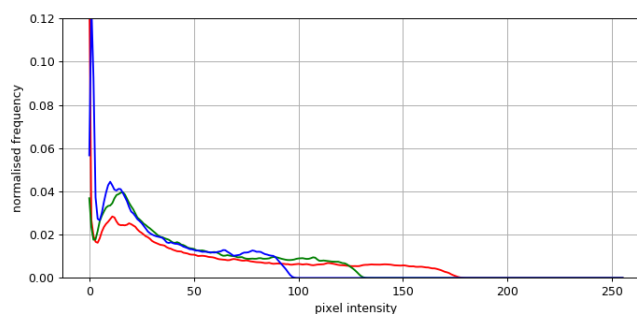
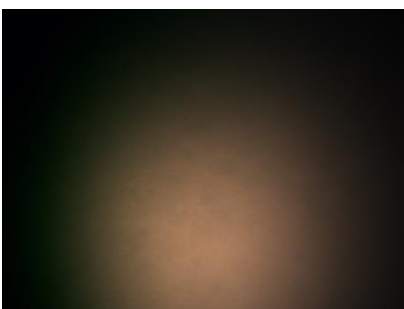
Mean image from Camera Test 3 - Red:712 Blue:912.



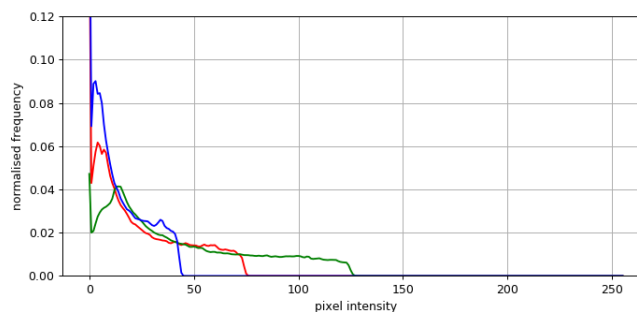
Mean image from Camera Test 4 - Red: 571 Blue:712.



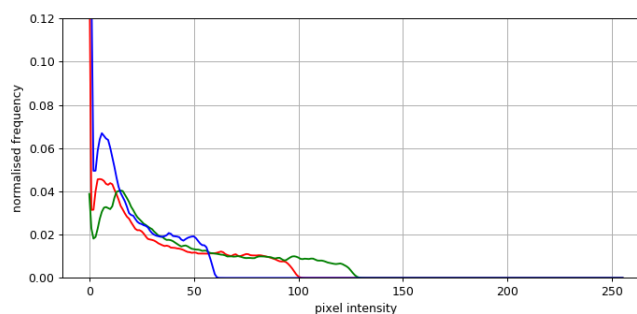
Mean image from Camera Test 5 - Red:675 Blue:812.



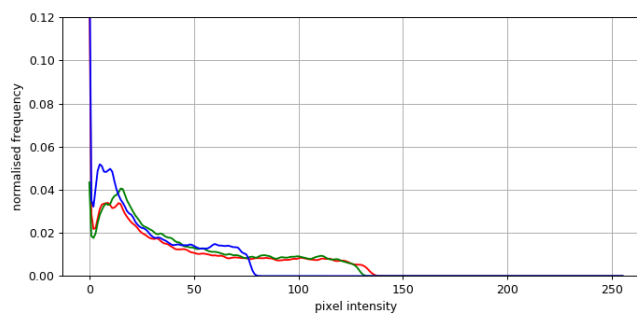
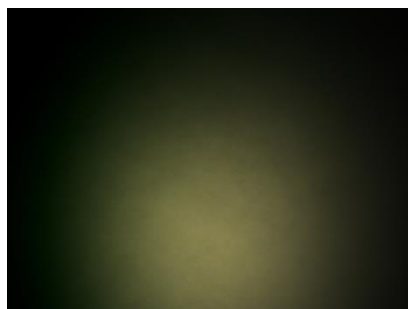
Mean image from Camera Test 6 - Red:775 Blue:912.



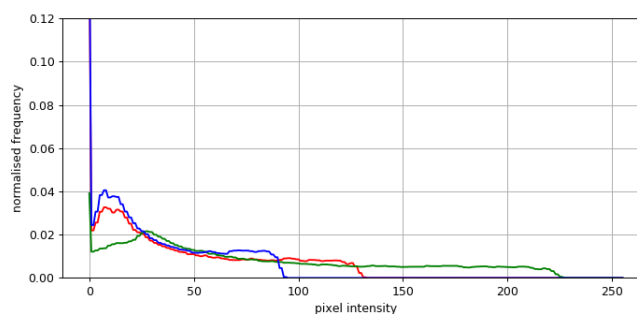
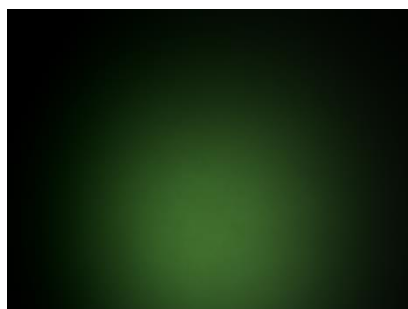
Mean image from Camera Test 7 - Red:512 Blue:612.



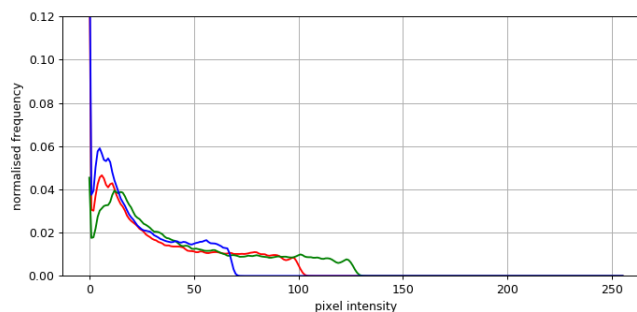
Mean image from Camera Test 8 - Red:612 Blue:712.



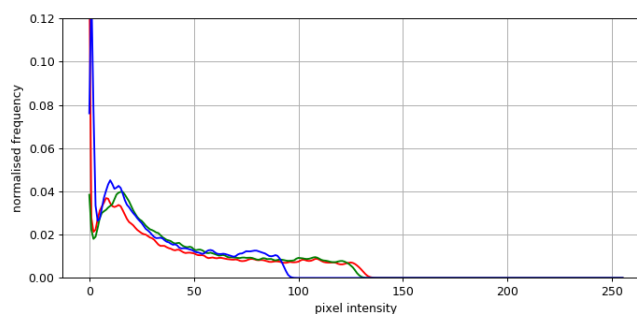
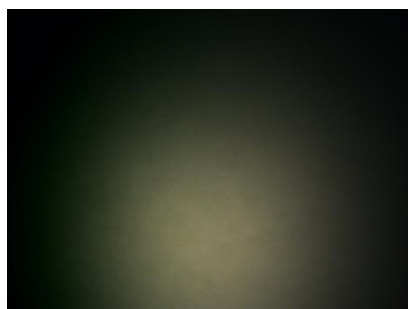
Mean image from Camera Test 9 - Red:712 Blue:812.



Mean image from Camera Test 10 - Red:575 Blue:612.



Mean image from Camera Test 11 - Red:675 Blue:712.



Mean image from Camera Test 12 - Red:775 Blue:812.

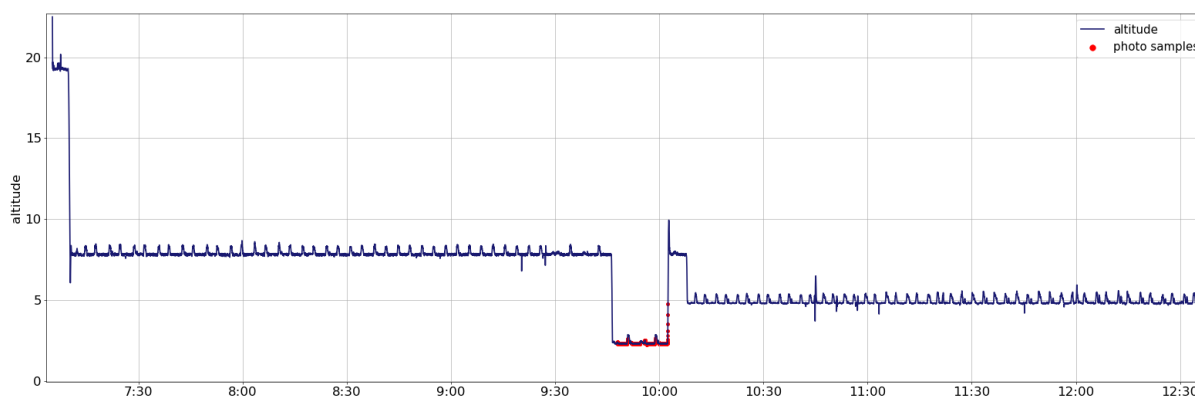
Dive 5 – Deployment 52

Camera Setup

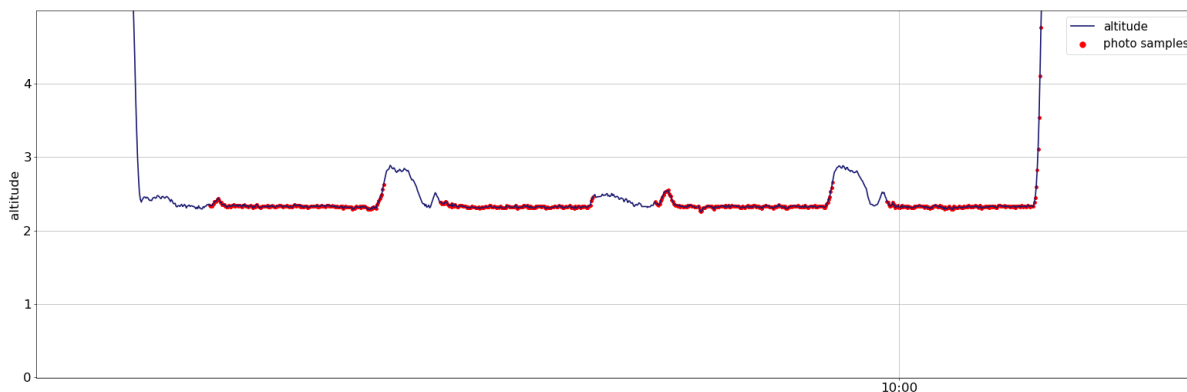
| | |
|--------------------------|------------------------------|
| Camera | GRAS-14S5M-C |
| Lens | Tamron TAM 23FM08-L |
| Sensor Size | 10.2mm x 8.3mm |
| Focal Length | 8mm |
| Resolution | 1280x960 (max) |
| Frame Rate | 1.875 fps (minimum) |
| Auto Whitebalance | Disabled |
| Blue Gain | 820 |
| Red Gain | 760 |
| Memory Card | 16 GB Compact Flash |
| Flash | 20x Lumiled (LXHL-PW03) LEDs |

Data

| | |
|--|------------------------|
| Deployment Time (GMT) | 20/05/2019 07:01 |
| Recovery Time (GMT) | 20/05/2019 12:03 |
| Start Position | 5759.6910N 00022.2534W |
| End Position | 5759.6061N 00022.4420W |
| Images Captured | 1315 |
| Average Camera Survey Altitude (m) | 2.3427 |
| Camera operation duration (minutes) | 14.7640 |

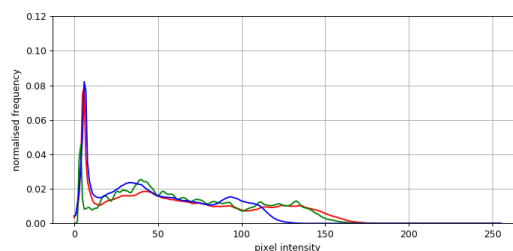
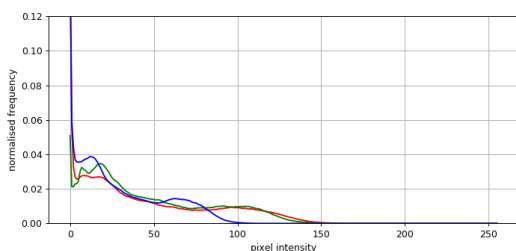
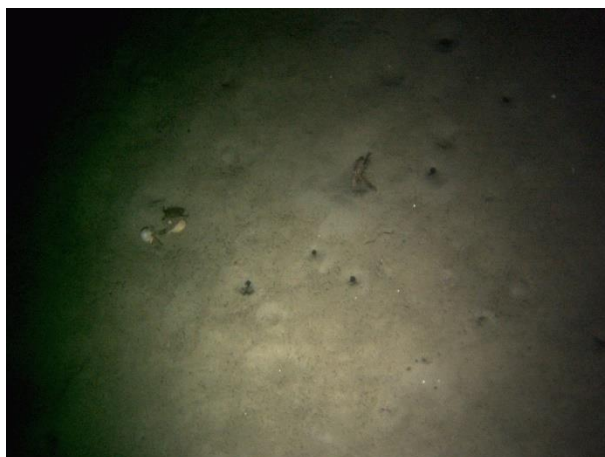
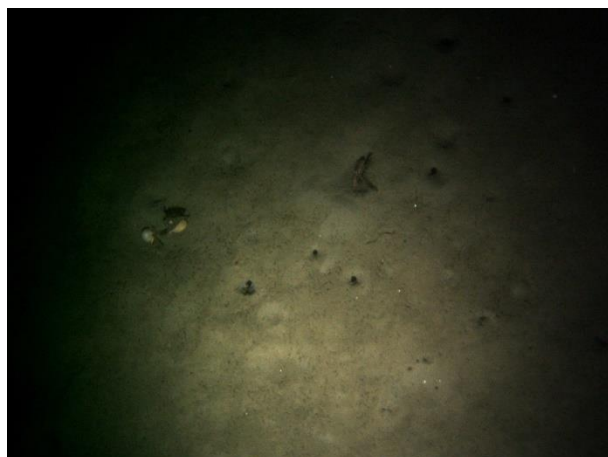


Dive 5 altitude and camera samples



Dive 5 altitude and camera samples (zoom) – There appears to be a delay in the camera logs; all images actually appear to be taken at an altitude less than 3meters and although images are not actually captured during turns, here images are shown to be captured during turns. Based on this, the camera timestamps appear to have a positive shift relative to the navigation logs.

Image Analysis and Processing



Example from the fifth Gavia Dive – Original (Top Left) and Processed (Top Right) image. Minor post processing was applied to produce a better colour balance and reduce contrast (Red+2, Green+0, Blue+2, contrast-14). Original image histogram (Bottom Left), Processed image histogram (Bottom Right)

Specimen Examples



Examples of specimens found during Dive 5 -

Dive 6 – Deployment 60

Camera Setup

| | |
|--------------------------|------------------------------|
| Camera | GRAS-14S5M-C |
| Lens | Tamron TAM 23FM08-L |
| Sensor Size | 10.2mm x 8.3mm |
| Focal Length | 8mm |
| Resolution | 1280x960 (max) |
| Frame Rate | 1.875 fps (minimum) |
| Auto Whitebalance | Disabled |
| Blue Gain | 496* |
| Red Gain | 527* |
| Memory Card | 16 GB Compact Flash |
| Flash | 20x Lumiled (LXHL-PW03) LEDs |

*Gain parameters were entered in error

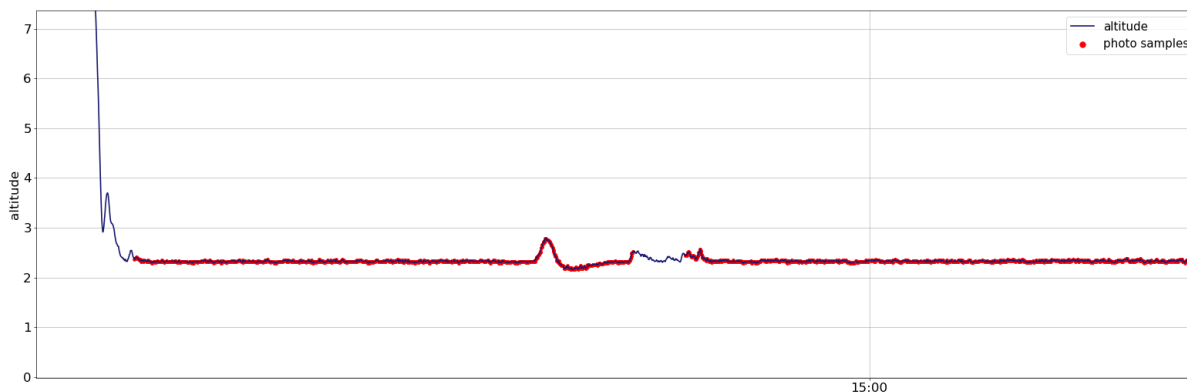
Data

| | |
|--|------------------------|
| Deployment Time (GMT) | 25/05/2019 09:23 |
| Recovery Time (GMT) | 25/05/2019 15:15 |
| Start Position | 5802.0150N 00021.5983W |
| End Position | 5802.0704N 00021.9189W |
| Images Captured | 3495 |
| Average Camera Survey Altitude (m) | 2.3400 |
| Camera operation duration (minutes) | 32.6926 |

Camera gain parameters were input incorrectly, using the same settings as dive 2 instead of dive 5, the result is a set of overly green images similar to those captured during the early dives.

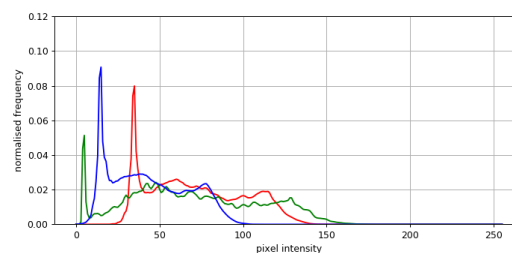
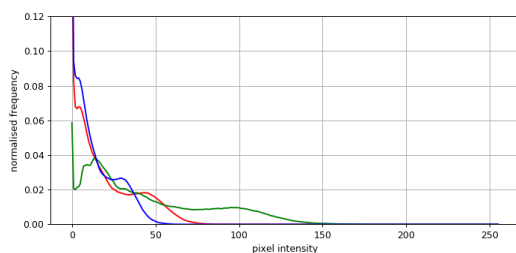


Dive 6 altitude and camera samples



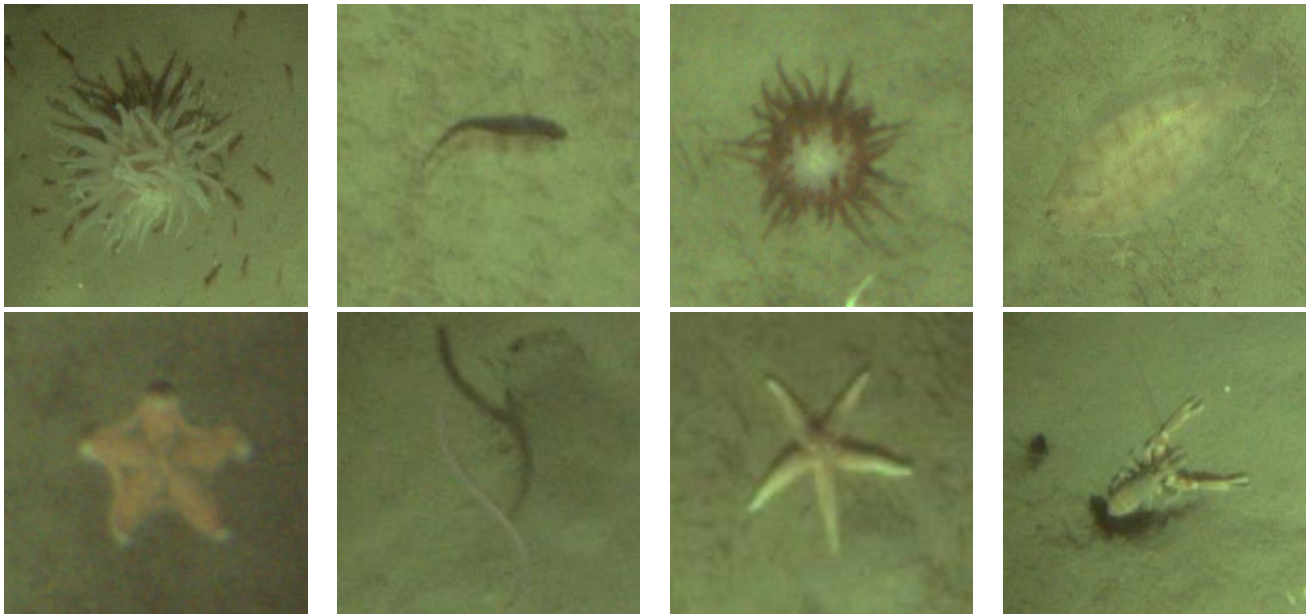
Dive 6 altitude and camera samples (zoom) – Similar to dive5, there appears to be a delay in the camera logs; all images actually appear to be taken at an altitude less than 3meters but the camera timestamps indicate some samples were taken during the Gavia's ascent, above 3meters.

Image Analysis and Processing



Example from the sixth Gavia Dive – Original (Top Left) and Processed (Top Right) image. Post processing was applied in the same manner as for dive2 to produce a better colour balance and reduce contrast (Red+25, Green-5, Blue+5, contrast-40). Original image histogram (Bottom Left), Processed image histogram (Bottom Right)

Specimen Examples



Examples of specimens found during Dive 6 -

Dive 7 – Deployment 63

Camera Setup

| | |
|--------------------------|------------------------------|
| Camera | GRAS-14S5M-C |
| Lens | Tamron TAM 23FM08-L |
| Sensor Size | 10.2mm x 8.3mm |
| Focal Length | 8mm |
| Resolution | 1280x960 (max) |
| Frame Rate | 1.875 fps (minimum) |
| Auto Whitebalance | Disabled |
| Blue Gain | 820 |
| Red Gain | 760 |
| Memory Card | 16 GB Compact Flash |
| Flash | 20x Lumiled (LXHL-PW03) LEDs |

Data

| | |
|--|------------------------|
| Deployment Time (GMT) | 26/05/2019 09:08 |
| Recovery Time (GMT) | 26/05/2019 15:15 |
| Start Position | 5758.4528N 00021.9809W |
| End Position | 5758.4708N 00022.2704W |
| Images Captured | 3594 |
| Average Camera Survey Altitude (m) | 2.3646 |
| Camera operation duration (minutes) | 33.7414 |

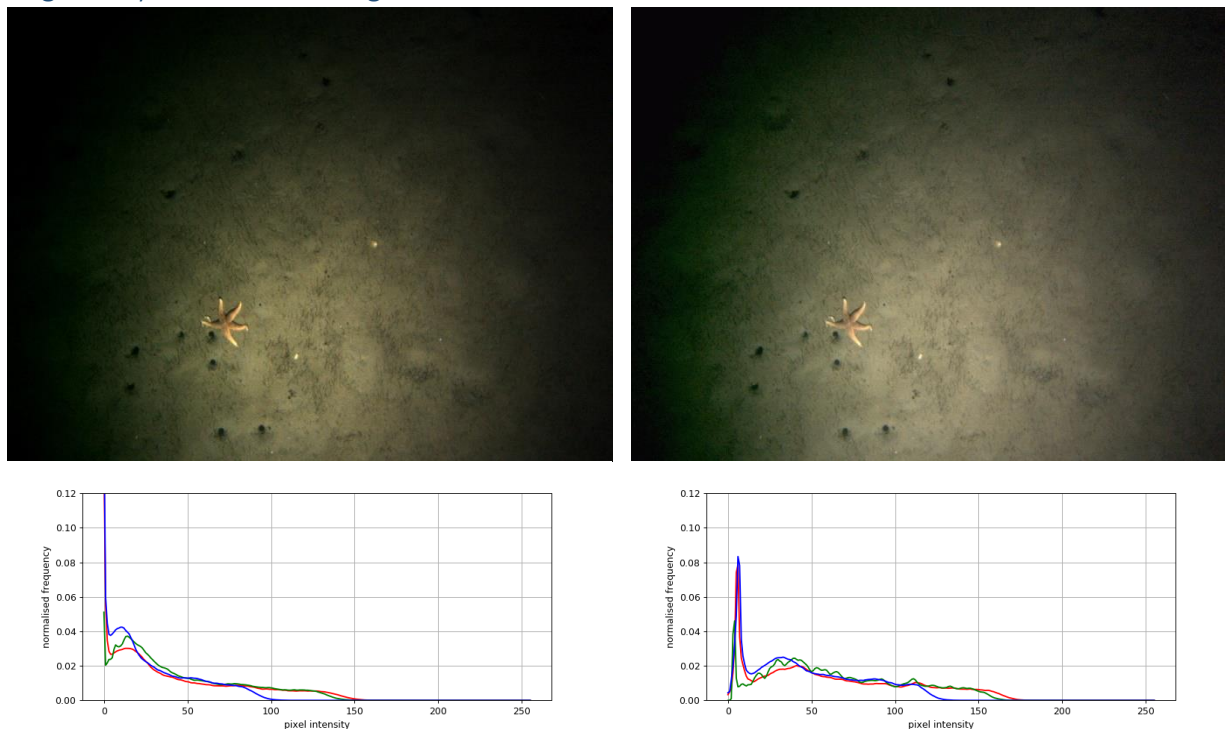


Dive 7 altitude and camera samples



Dive 7 altitude and camera samples (zoom) – Similar to dive5, there appears to be a delay in the camera logs; all images actually appear to be taken at an altitude less than 3meters but the camera timestamps indicate some samples were taken during the Gavia's ascent, above 3meters.

Image Analysis and Processing



Example from the seventh Gavia Dive (Lat: Lon: Alt:) – Original (Top Left) and Processed (Top Right) image. Minor post processing was applied to produce a better colour balance and reduce contrast (Red+2, Green+0, Blue+2, contrast-14). Original image histogram (Bottom Left), Processed image histogram (Bottom Right)

Specimen Examples



Examples of specimens and features found during Dive 7 -

Dive 8 – Deployment 67

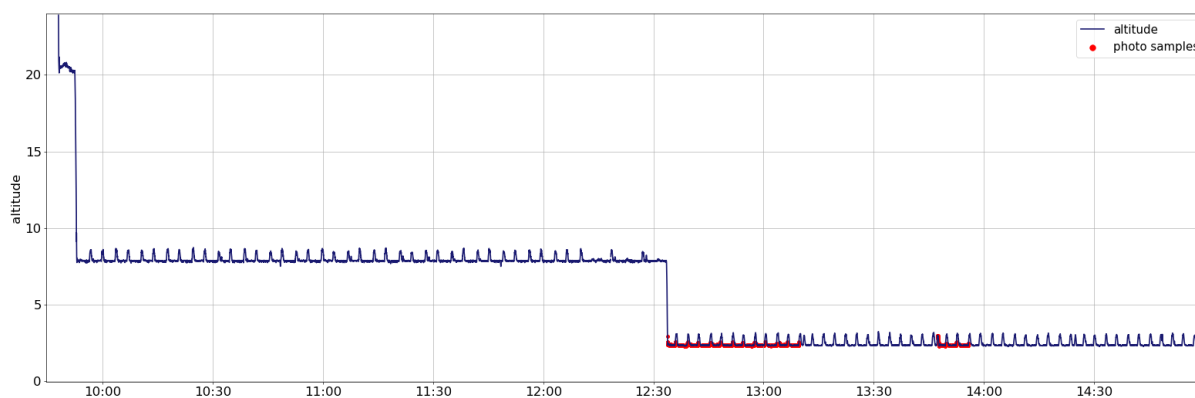
Camera Setup

| | |
|--------------------------|------------------------------|
| Camera | GRAS-14S5M-C |
| Lens | Tamron TAM 23FM08-L |
| Sensor Size | 10.2mm x 8.3mm |
| Focal Length | 8mm |
| Resolution | 1280x960 (max) |
| Frame Rate | 1.875 fps (minimum) |
| Auto Whitebalance | Disabled |
| Blue Gain | 820 |
| Red Gain | 760 |
| Memory Card | 16 GB Compact Flash |
| Flash | 20x Lumiled (LXHL-PW03) LEDs |

Data

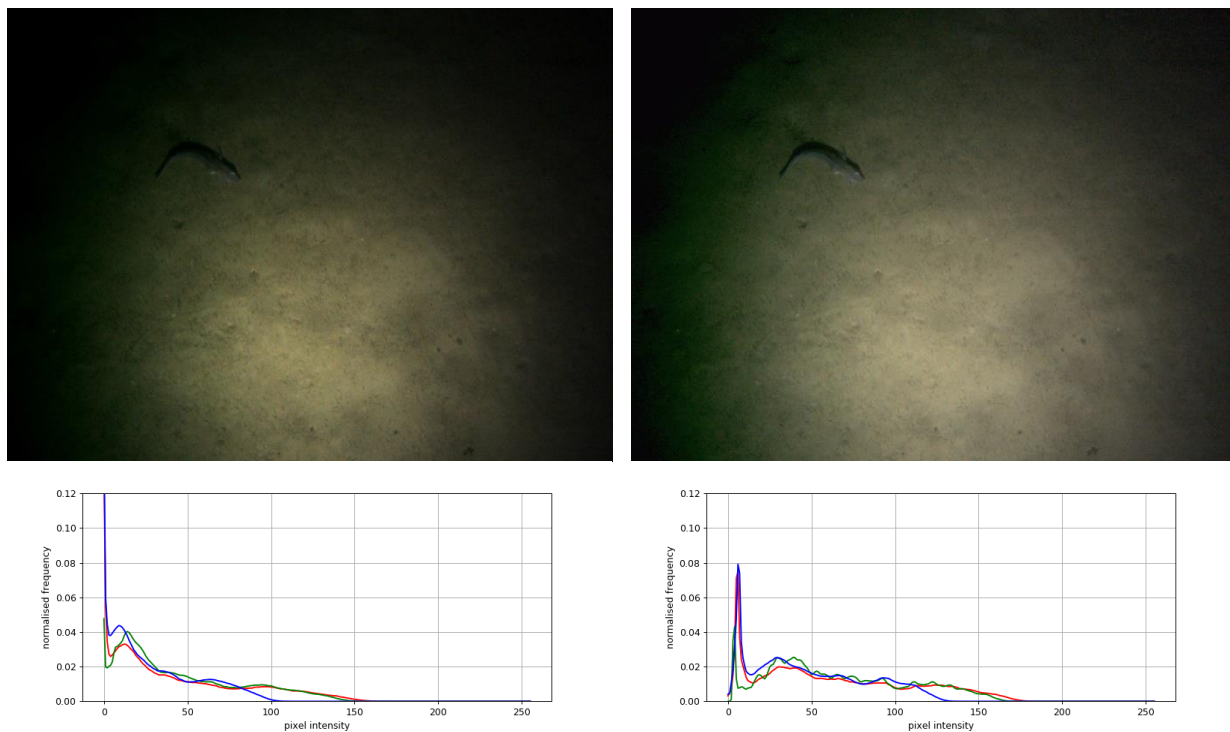
| | |
|--|------------------------|
| Deployment Time (GMT) | 27/05/2019 09:08 |
| Recovery Time (GMT) | 27/05/2019 15:15 |
| Start Position | 5759.7979N 00022.2767W |
| End Position | 5759.7750N 00022.3708W |
| Images Captured | 3671 |
| Average Camera Survey Altitude (m) | 2.3679 |
| Camera operation duration (minutes) | 82.0243* |

*There was a break in the middle of the camera survey



Dive 8 altitude and camera samples

Image Analysis and Processing



Example from the eighth Gavia Dive – Original (Top Left) and Processed (Top Right) image. Minor post processing was applied to produce a better colour balance and reduce contrast (Red+2, Green+0, Blue+2, contrast-14). Original image histogram (Bottom Left), Processed image histogram (Bottom Right)

Specimen Examples



Examples of specimens found during Dive 8