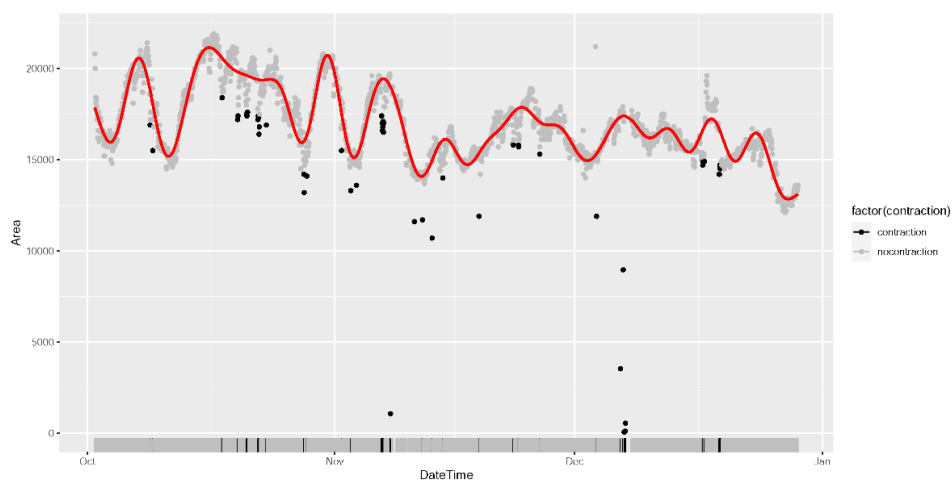


## Supplementary Figures

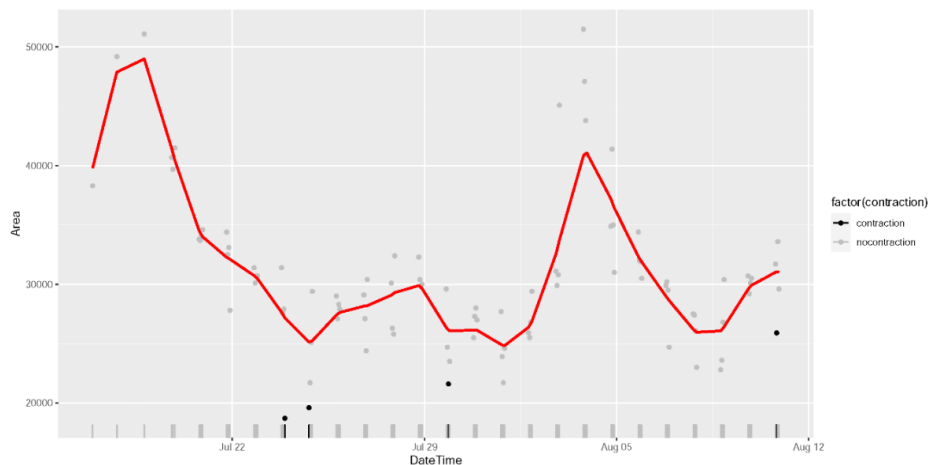
Long-term observations of a sponge *in situ* reveal a rich repertoire of contractile behaviors, including winter dormancy

**Fig. S1. Contraction detection for each time-lapse.** Generalized Additive Models were used to smooth long-term trends (red line – GAMs fitted line, grey dots, original data points). Contractions were detected by determining when the sponge area deviated by more than 90% from the fitted line (black dots and corresponding black bars on the x-axis), i.e., if the fitted line is at 100 and the actual area is at 10, that would constitute a time when the sponge is in a contracted state. This was done for each time-lapse series: A) TL1, B) TL2, C) TL3, D) TL4, E) TL5, and F) TL6.

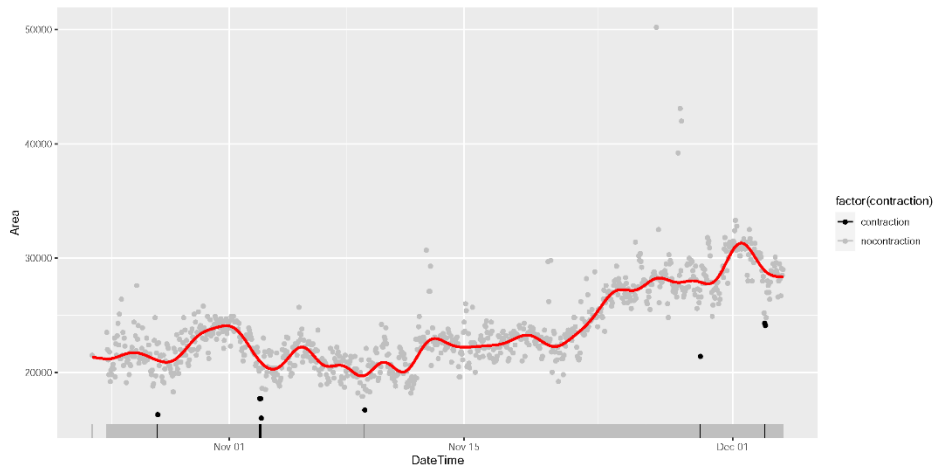
### A) TL1- contraction detection



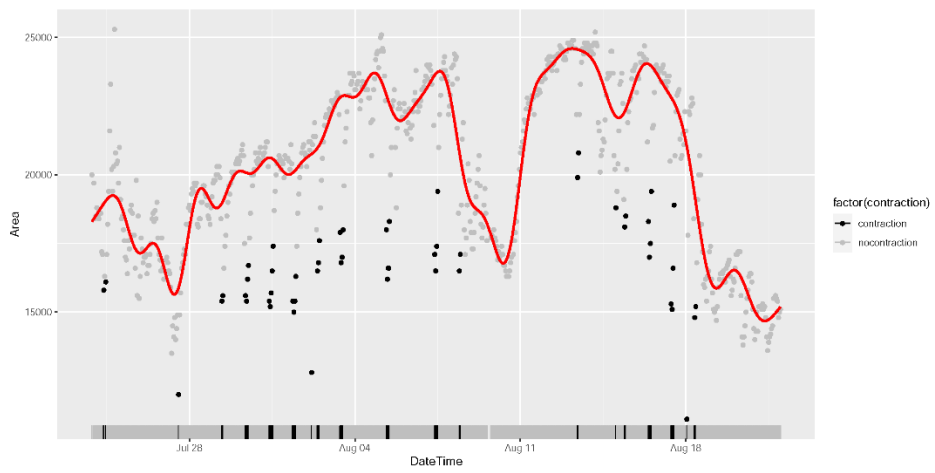
### B) TL2- contraction detection



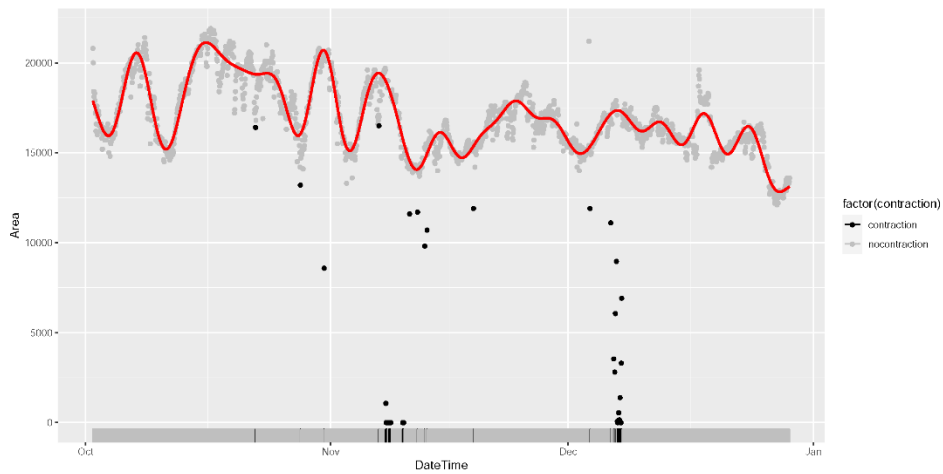
### C) TL3- contraction detection



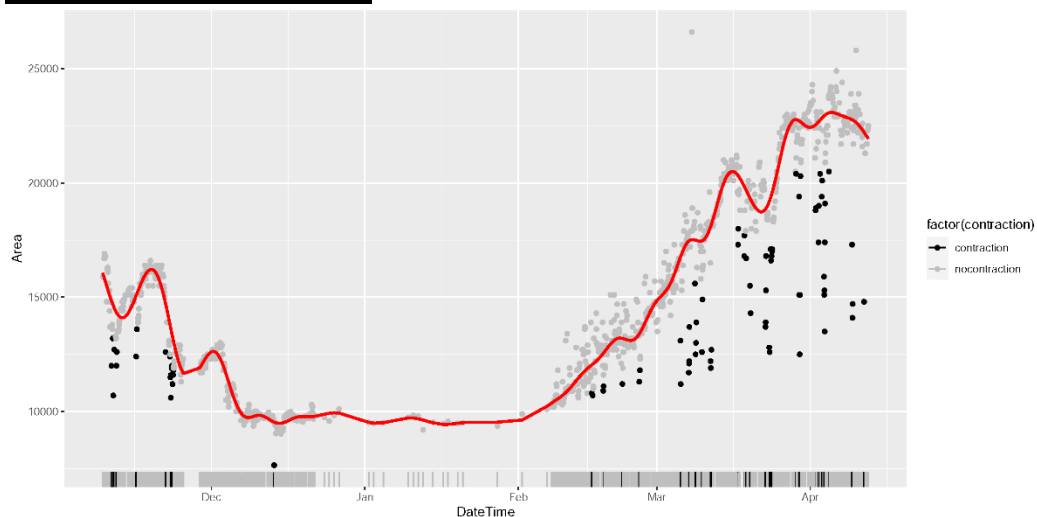
### D) TL4- contraction detection



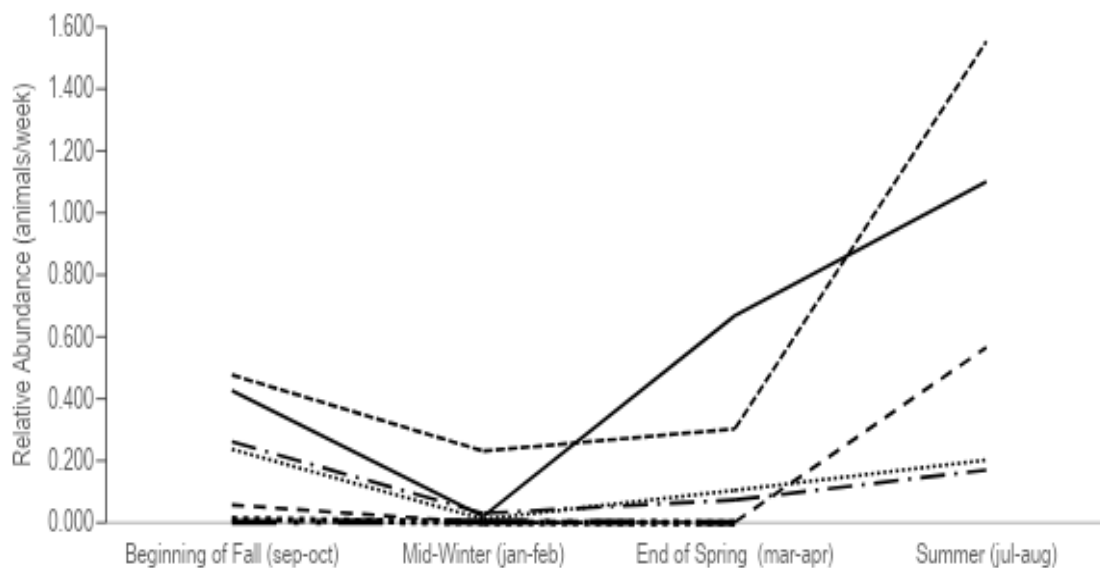
### E) TL5- contraction detection



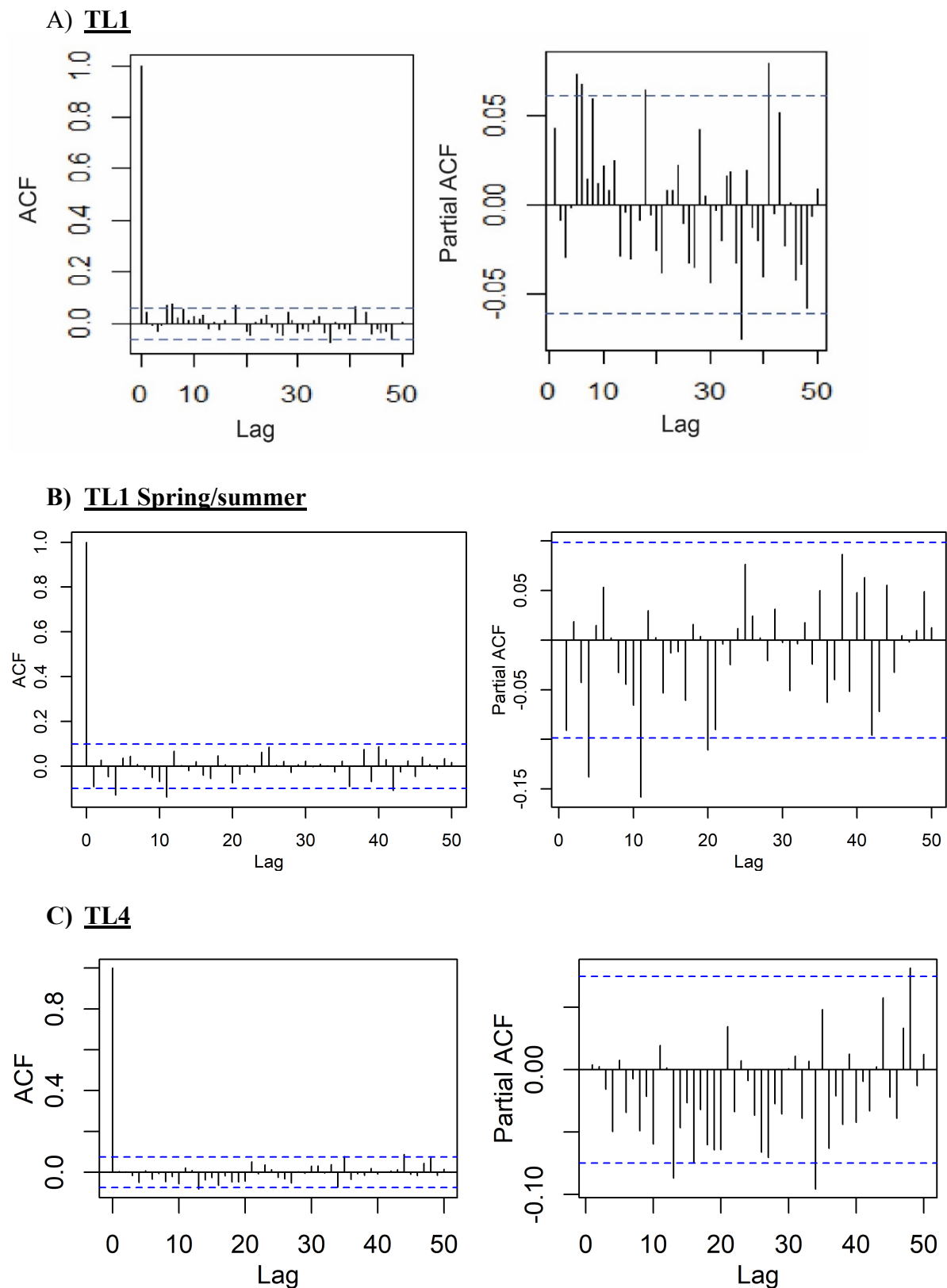
**F) TL6- contraction detection**

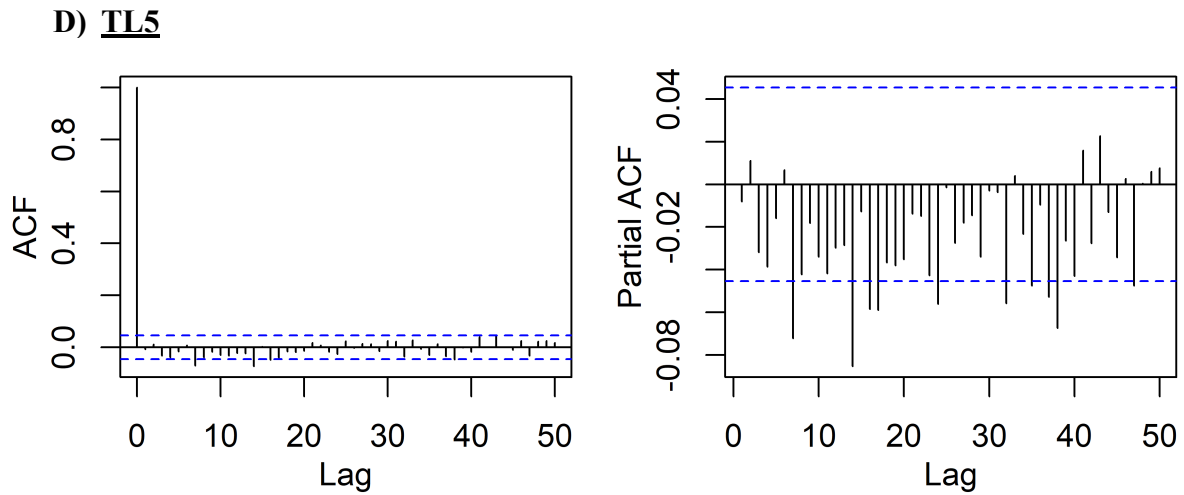


**Fig. S2. Relative animal abundance of the seven types of animal annotated for each season.** Mean (number of animals recorded in contact with the sponge /week) across all seasons; animals are represented by the different lines: Hermit crabs, solid; Snails, dash; Shrimp, long dash; Crabs, dotted; Nudibranchs, dash-dot.

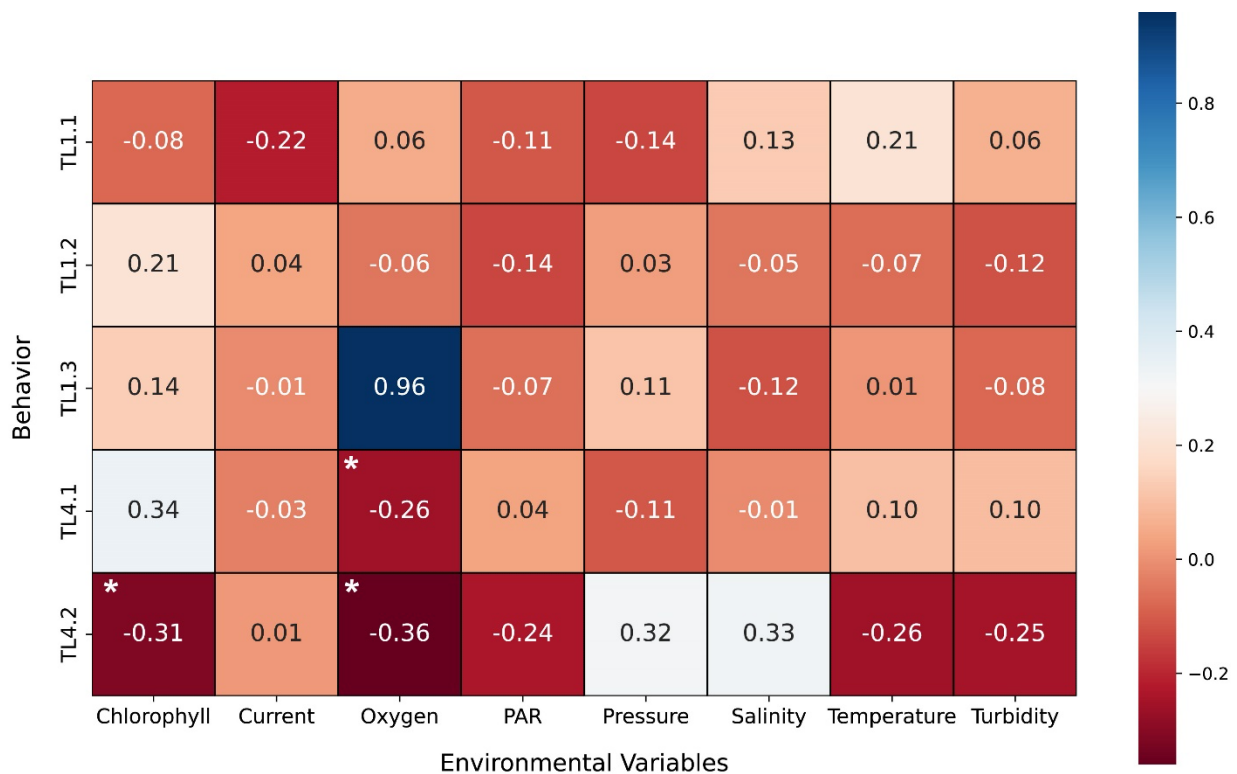


**Fig. S3. Autocorrelation function plot (ACF) and Partial ACF of the GAMM model residuals** for A) TL1 with an AR3 correlation structure; B) TL1-Winter with an AR3 correlation structure; C) TL1-Spring with an AR1 correlation structure; D) TL4 with an AR2 correlation structure; E) TL5 with an AR1 correlation structure. Blue dashed horizontal lines indicate significant threshold levels.

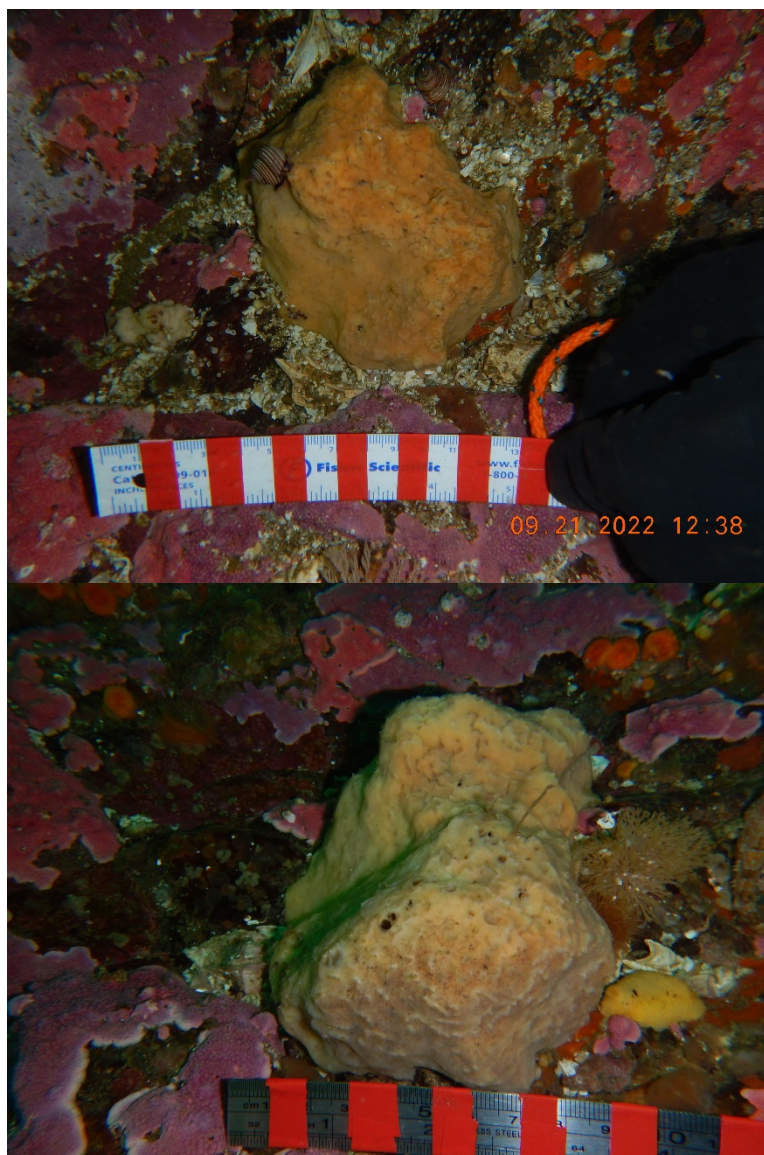




**Fig. S4. Kendall’s Tau correlation analyses of short-term behaviors.** Three behaviors in TL1 (TL1.1, 1.2, and 1.3), and two short-term behaviors in TL4 (TL4.1 and 4.2) were analysed. Significant correlations are indicated with a white star with the adjusted p-value (all adjusted p-values < 0.001) and include TL4.1 and TL4.2 with oxygen as well as TL4.2 with chlorophyll. All other relationships had no significant correlation. The numbers represent the correlation coefficient values, and the colors red and blue indicate the strength of the coefficients.



**Fig. S5.** Images of ‘Belinda’, *Suberites concinnus*, captured during maintenance of the Folger Pinnacle platform on September 21, 2022 (upper photo), and April 24, 2023 (lower photo). The sponge is contracted in both images because of disturbance by divers, but in both images, it has the same texture and color as it had when the cameras were installed in 2012. In the upper photo a snail (*Caliostoma ligatum*) is on the left of the sponge grazing the surface. In the lower photo, a yellow nudibranch (possibly *Peltodoris nobilis*) is just to the right of the sponge. Scale: red bands on the ruler indicate 1cm.



## Supplementary videos

**Video series S1.** Available on the University of Alberta Education and Research Archive: <https://doi.org/10.7939/r3-z7nh-6193>

Videos of each of the time lapse series TL1 to TL6. One frame each hour.

Description:

**Video TL1:** Time Lapse series 1 (TL1) comprising 1071 images captured hourly and covering the period from November 9, 2012 to April 12, 2013. In November the sponge is a typical size with open oscula (excurrent holes) along a ridge on its upper surface. The open oscula indicate that the sponge is filtering. During the next month the sponge gradually contracts until at approximately 55 minutes into the video (early December) it is relatively still and no oscula are visible. It remains contracted until, approximately 1hr 20min into the video (early February), it begins to expand again. Over the next three months the sponge expands further and as it does so, it begins a series of contractions in mid-March (starting at approximately 2hr 20min into the video) until it is fully expanded at the end of the video in mid-April.

**Video TL2:** Time Lapse series 2 (TL2) comprising 95 images captured hourly and covering the period from July 16, 2013 to August 10, 2013. This shorter sequence is very dynamic with a lot of activity by the sponge and by a multitude of invertebrates that visit it. The sponge is fully expanded, and carries out massive contractions, each of which takes approximately 11 hours, during which the oscula close and open again as the sponge expands.

**Video TL3:** Time Lapse series 3 (TL3) comprising 968 images captured hourly and covering the period from October 23, 2013 to December 3, 2013. This is a wonderful series showing the sponge largely dormant in winter. In this video Belinda is already quite contracted at the end of October, and is quite still in comparison to the summer behaviour seen in Video S2. No oscula are evident through the whole video. A myriad of invertebrates visit the sponge, sitting on the sponge, feeding on surface material. There are large beautiful sea stars (some orange/red, *Mediaster* sp., others brown with soft raised dermal papillae, *Stylasterias forreri*), colourful small nudibranchs, a range of snails, and lots of small crabs, one in particular that lives right under the middle part of the sponge. The sponge remains contracted through this image series.

**Video TL4:** Time Lapse series 4 (TL4) comprising 696 images captured hourly and covering the period from July 23, 2014 to August 21, 2014. This sequence takes place in mid-summer with the sponge looking quite different from the previous sequence (video S3). It is a slightly different shape, with the ridge now bent over the side that faces the camera. The colour has changed from a vibrant orange to a darker hue with parts of the surface almost brown. Despite it being summer, the sponge's movement is generally slower, and there are no obvious whole body contractions. A large sea star approaches and touches it early on in the video (at 8 minutes), and almost immediately afterwards (at 16 minutes) a dusting of shelly debris lands on the sponge, and is cleared off in about 4 hours (at 20 minutes).

**Video TL5:** Time Lapse series 5 (TL5) comprising 1932 images captured hourly and covering the period from October 1, 2014 to December 12, 2014. This is the third winter, and as with the previous winters, the sponge moves less, but as in the previous series (video S4) its colour is dark orange, almost brown, and the texture appears bumpy, with large lobes that



were not present in 2012. Sea stars, nudibranchs and crabs crawl over its surface. Of particular interest is the little crab with its cover of hydroids that lives under the lower edge of the sponge, foraging at the base at the front of the sponge.

**Video TL6:** Time Lapse series 6 (TL5) comprising 316 images captured hourly and covering the period July 21, 2015 to August 4, 2015. This is the summer of 2015 and the sponge has a very pale colour. It appears squat in contrast to the upright aspect it had in 2012. It is not nearly as active as it was the previous two summers. A large dorid nudibranch (sea slug, *Peltotoris nobilis*) grazes the sponge's surface, visibly removing the outer layer of tissue and exposing oscula (excurrent holes). At the very end of the sequence (approximately 58 minutes into the video) a very active anemone (*Epiactus prolifera*) wanders over and, in less than 3 minutes, climbs up onto the sponge.

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**Video series S2.** A series of 8 videos that are extracts from the Videos TL1-TL6 above. These extracts illustrate Type 1, 2 and 3 contractions, twitches and ripples, and are available at <https://www.youtube.com/playlist?list=PLIDwRK0-Sr9zBRNpNLR55eWolys-IP5OA>

Description:

Video #1 illustrates a Type 2 contraction

Video #2 illustrates a partial contraction, here called a 'twitch'

Video #3 shows a period when the sponge has no contractions during the winter

Videos #4, 6, and 7 illustrate Type 1 contractions, roughly 11 hour-long reductions of the whole body size

Video #5 illustrates a Type 3 contraction

Video #8 illustrates a series of partial contractions, here called a 'ripple' that runs across the body of the sponge.

Annotations on the videos are as follows:

Video 1- TL4 Type 2 w 10cm scale, 1 frame per second (fps)

Video 2- TL2 Twitch w 10cm scale, 1fps

Video 3- TL3 no contractions w 10cm scale, 1fps

Video 4- TL4 Type 1 w 10cm scale, 1fps

Video 5- TL5 Type 3 w 10cm scale, 2fps

Video 6- TL2 Type 1 w 10cm scale, 1 fps

Video 7- TL1 Type 1 w 10cm scale, 1fps

Video 8- TL6 Ripples w 10cm scale, 1fps.