

The Effect of UVC Radiation on Tardigrades

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Tardigrade Species

Aquatic animals

Require film of
water around their
body

100-500
micrometers

Commonly found
on moss, freshwater,
and other damp
places

Variation in species
dependent on
environment

Terrestrial and Freshwater Species



Hypsibius exemplaris

- Freshwater tardigrade
- In most cases, species does not show strong evidence of high survivability in extreme conditions



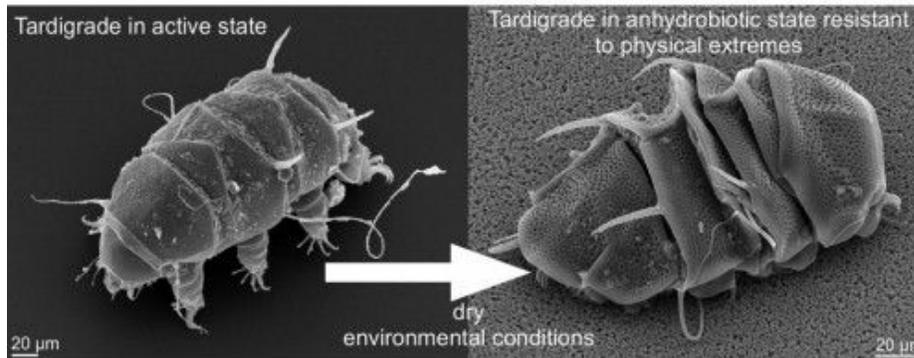
Ramazzottius varieornatus

- Terrestrial tardigrade
- Species exhibits extraordinary capacity to withstand extreme conditions such as ionizing radiation and UVC radiation

Mechanism of Resistance to Radiation

Hydrated State

- Special protein phrA suggested as mechanism for DNA repair in *R. varieornatus*
- *H. exemplaris* does not show evidence of phrA protein
- Mechanism of UVC and radiation resistance in *H. exemplaris* largely unknown

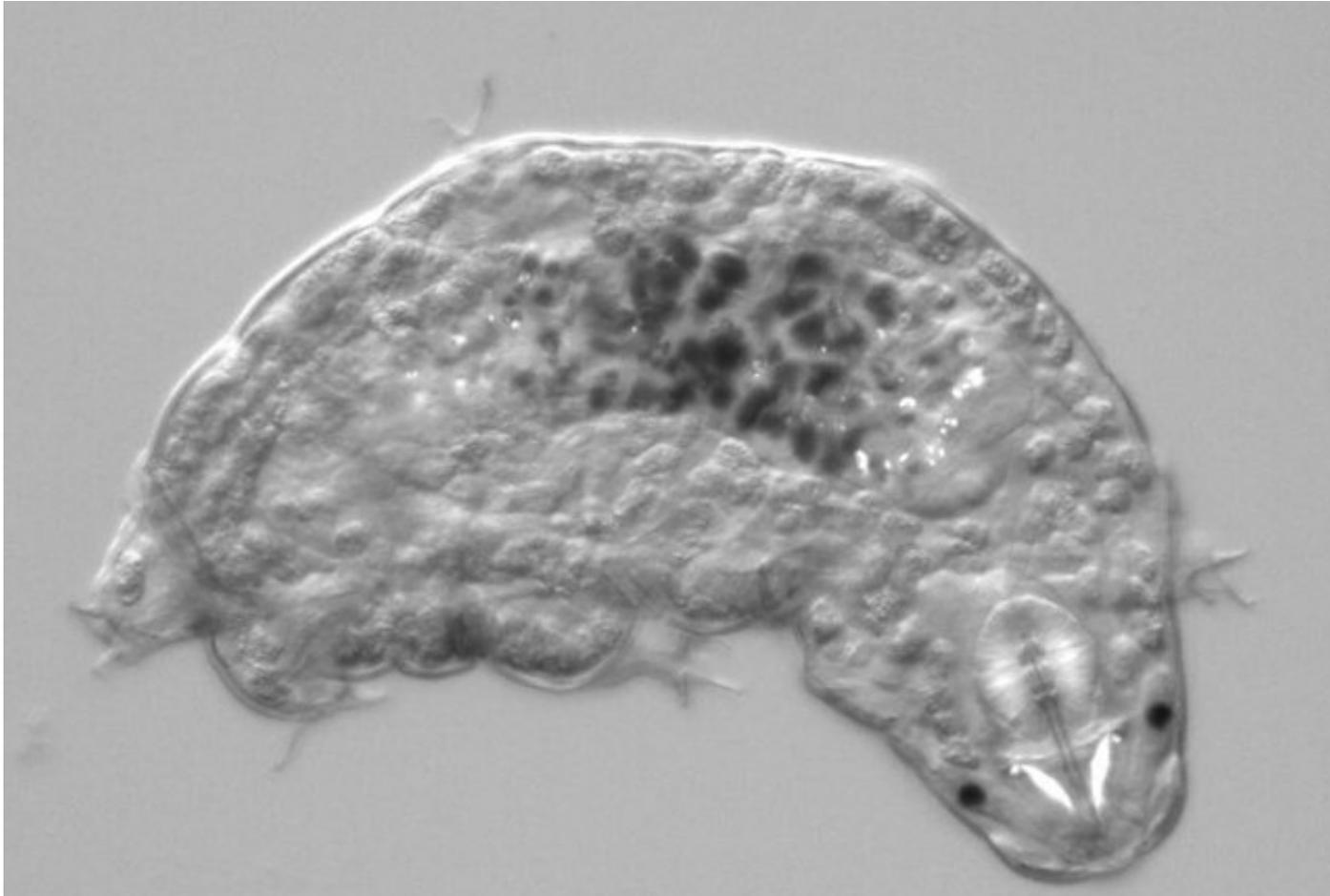


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Dehydrated State

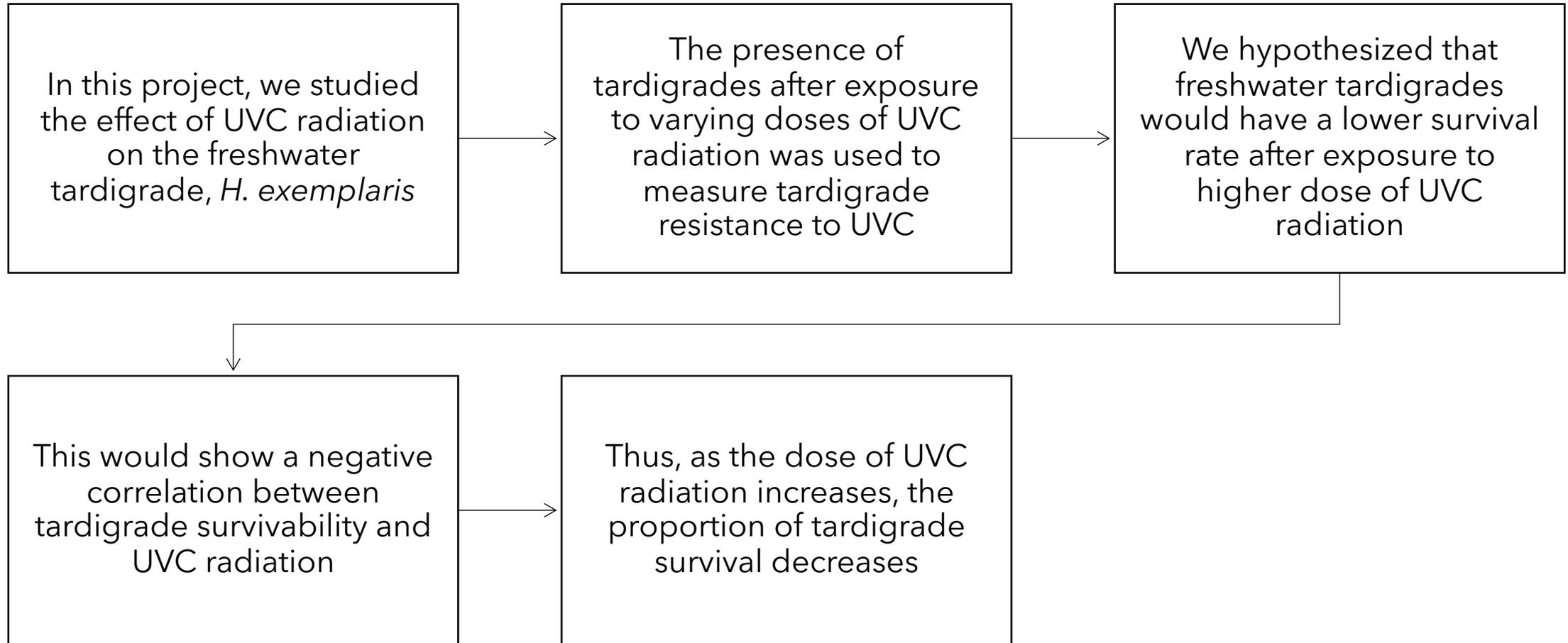
- Metabolism halted, water content decreased, and cellular content is encased in special protein
- State referred to as tun state
- Tolerance of UVC radiation in terrestrial tardigrades is higher in a desiccated state
- Both *R. varieornatus* and *H. exemplaris* can enter into a dehydrated state

Hypsibius exemplaris freshwater tardigrade used in project



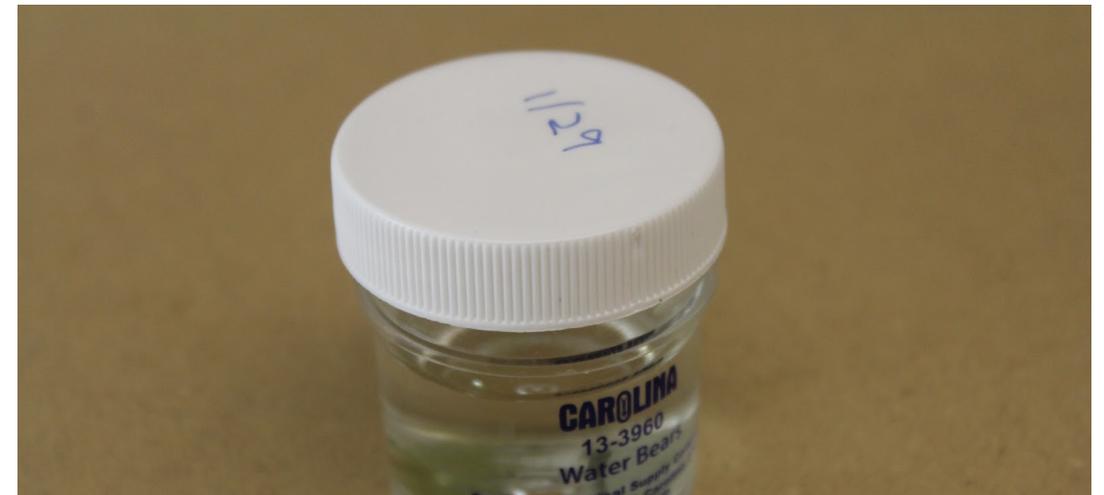
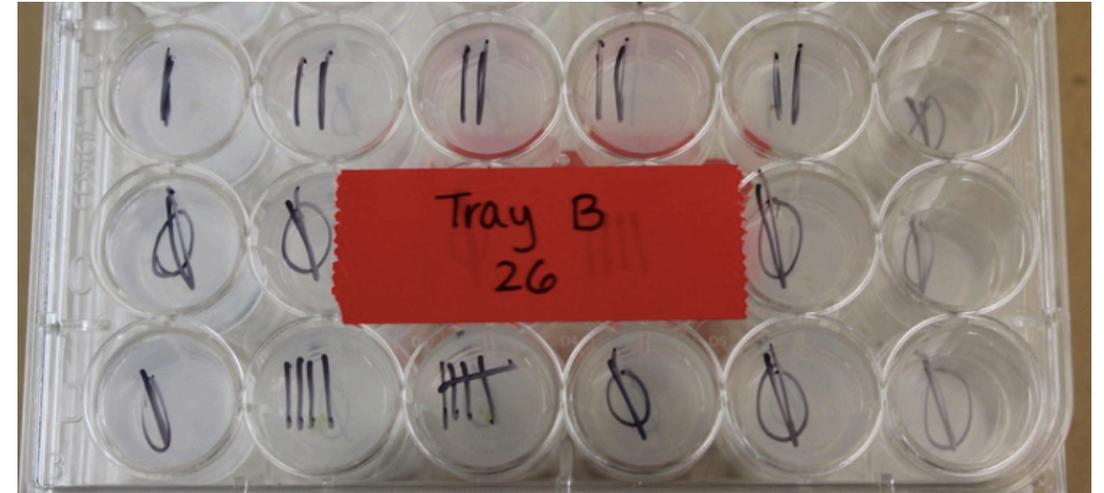
- ❑ Does not show such evidence of high survivability in most extreme conditions, such as high doses of UVC radiation.
- ❑ Exhibit high tolerance to gamma radiation
- ❑ Capacity to withstand high doses of gamma radiation in a hydrated state suggests mechanisms of tolerance besides desiccation.
- ❑ Variation in the resistance to UVC and gamma radiation suggest differenced in genetic makeup of freshwater and terrestrial tardigrades

Can *H. exemplaris* withstand low doses of UVC radiation?



Materials and Methods

- Three jars of *H. exemplaris* and one jar *Chlorococcum* sp. obtained from Carolina Biological Supply Company
- Tardigrades were transferred to 24 well- cell culture plates with a culture area of 2 sq. cm a well volume of 3.5 mL
- 18 cell plates were used to transfer tardigrades.
- Dose groups were created by grouping plates, which together summed roughly 50-60 tardigrades
- Each well contained 2 mL of a 1.5% bacto-agar gel
- Tardigrades were kept hydrated with spring water via pipette
- Culture plates were maintained in room temperature conditions with constant light exposure



Materials and Methods

- Exposed to UVC radiation via G15T8 Base Germicidal UV Light Bulb
- Each dose group was placed in the enclosure with the light off
- The light was switched on and remained on for the calculated time depending on the dose group.
- After the allotted time passed, light was turned off and each dose group remained in the enclosure for two minutes

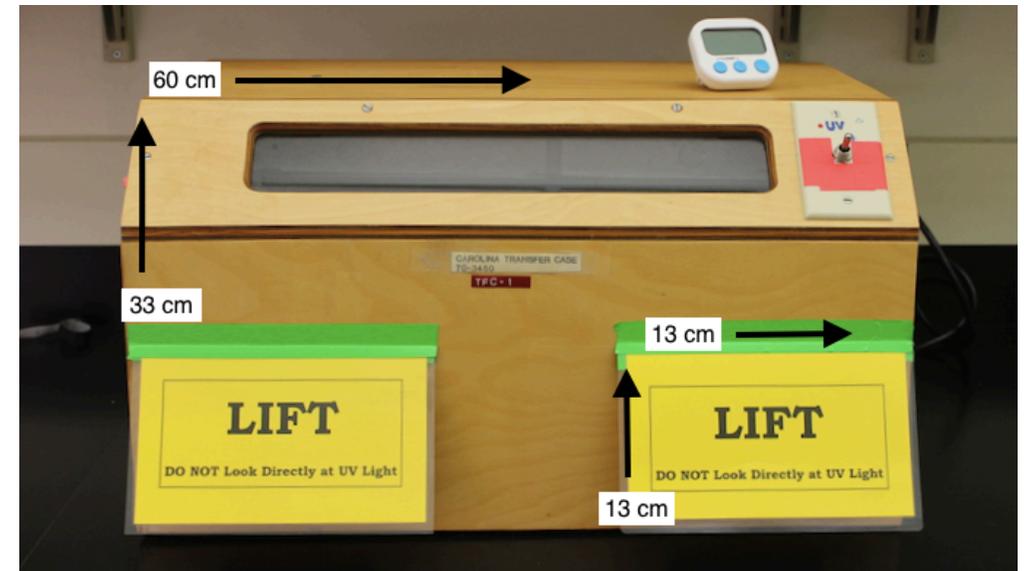
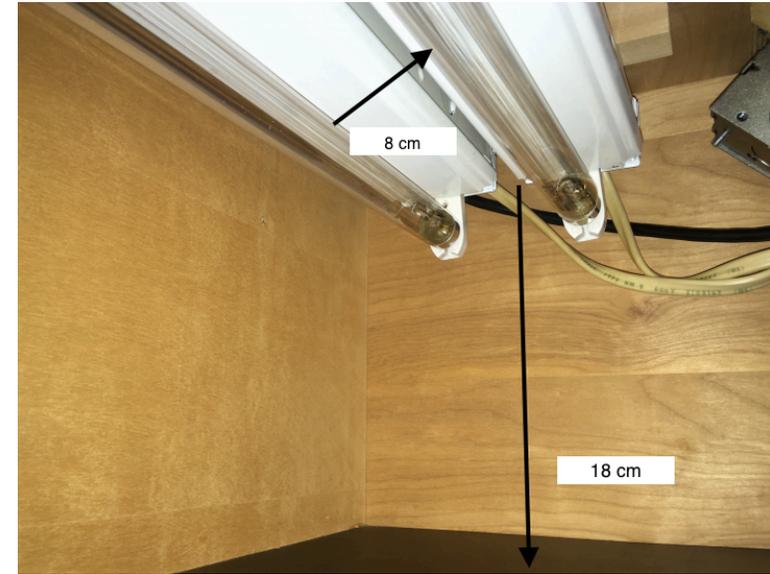


Table 1

A summary of the pretreatment setup

Dose	Number of Wells	Average Tardigrades Per Well	Standard Deviation	Time spent in UVC enclosure with light on	Total time in UVC Enclosure
0.0 kJ/m ²	6	9.67	12.32	0s	120s
0.5 kJ/m ²	24	2.62	2.69	23s	120s
1.0 kJ/m ²	27	2.33	1.75	42s	120s
1.5 kJ/m ²	12	5.75	5.83	63s	120s
2.0 kJ/m ²	24	2.46	2.43	84s	120s
2.5 kJ/m ²	26	2.31	2.12	105s	120s

Results

Figure 1

Day 3 Tardigrade Proportion Survival

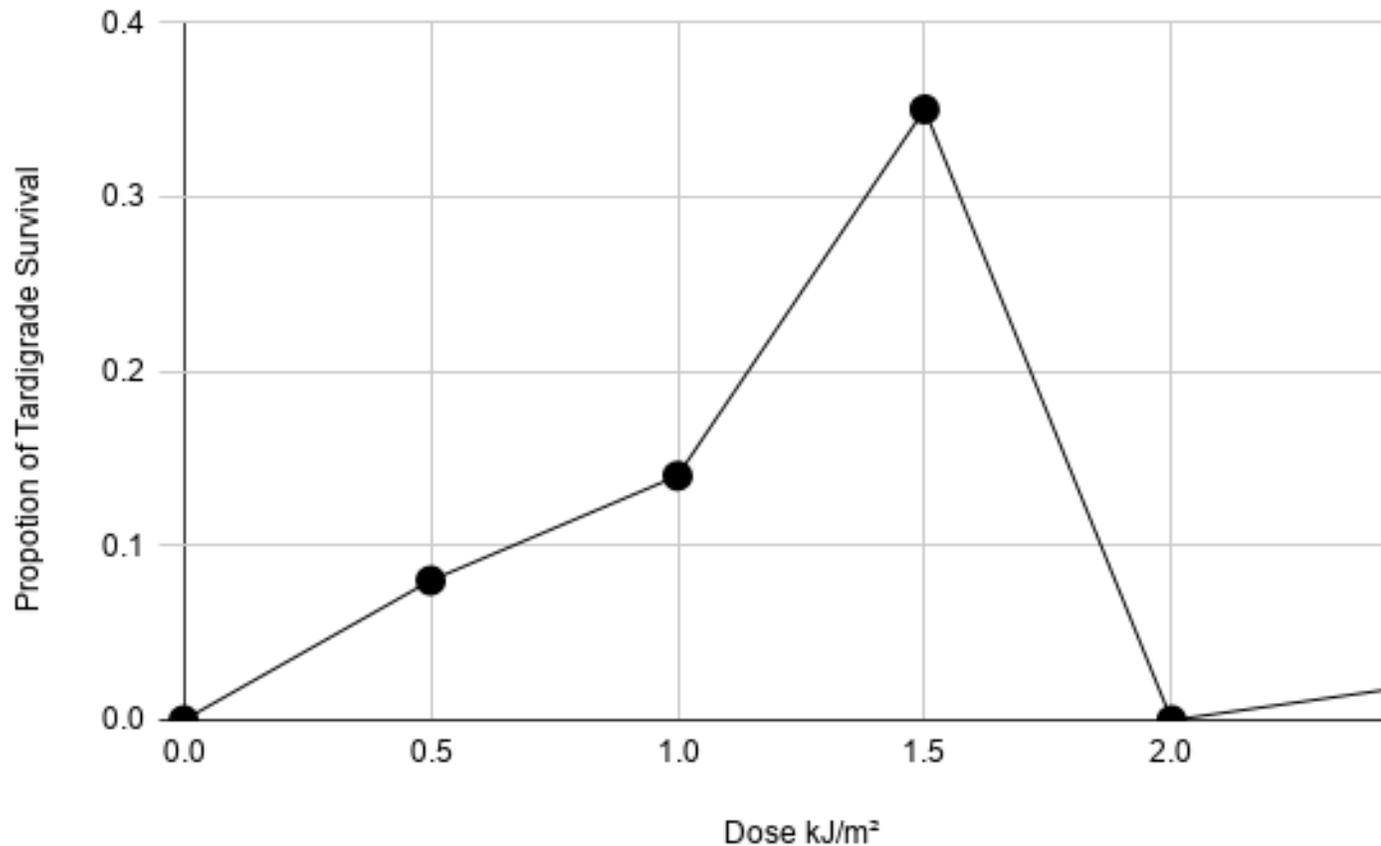


Figure 1 shows the proportion of tardigrade survival on Day 3 post UVC exposure. The average tardigrade per well was used to calculate this proportion.

Results

Figure 2

Tardigrade Survival

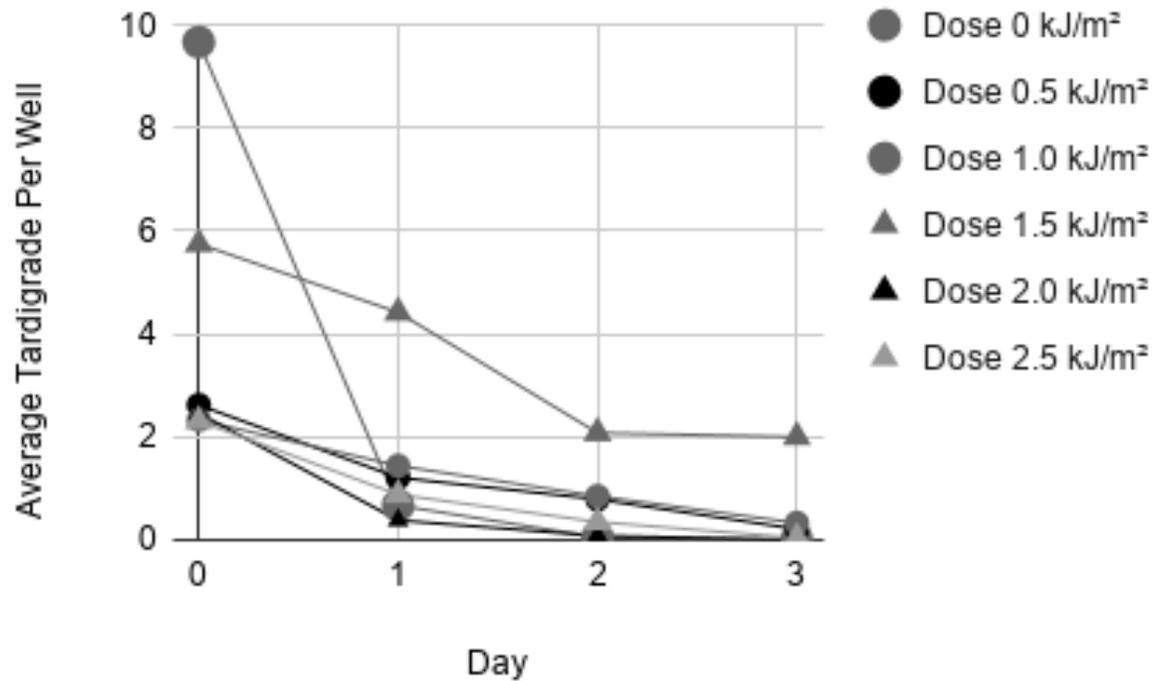


Figure 2 follows the tardigrade survival post UVC exposure. Each data point is the average number of tardigrades per well.

Results

Figure 3

Proportion of Tardigrade Survival by Individual Well

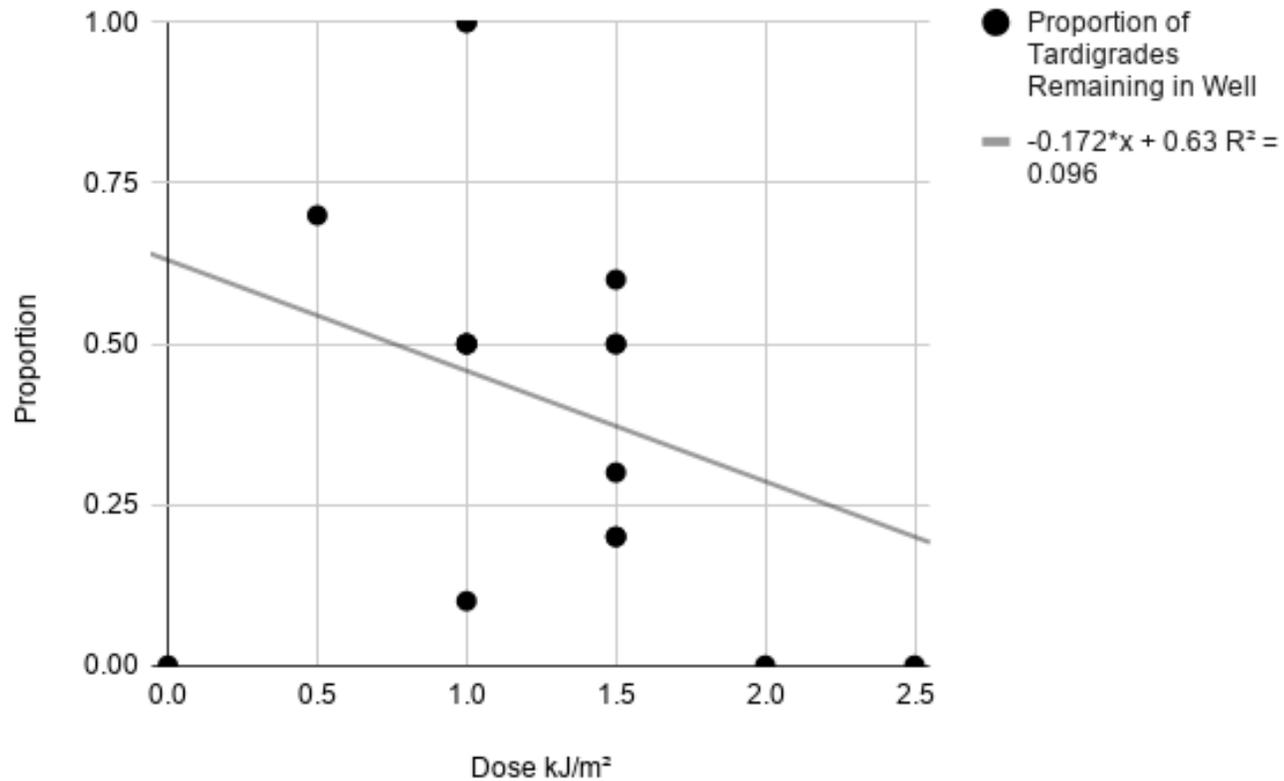


Figure 3 summarizes survivability on Day 3 Post UVC Exposure.

Table 2

Tardigrade Survival on Day 3 Post UVC Exposure

Dose kJ/m²	Population Remaining
0	0.0%
0.5	8.0%
1	14.2%
1.5	34.8%
2	0.0%
2.5	1.7%



Results

Tardigrade survival and dose found to be weakly correlated, $r(3) = .34$, $p = .032$.

Survivability of tardigrades exposed to the highest dose of UVC radiation at 2.5 kJ/m^2 was 1.7%.

Analysis

- Control group of 0.0 kJ/m² showed a 0% survival rate
- Possible indication of unknown factors contributing to the tardigrade's low survival rate
- Variation in survival among dose groups suggests results may be inconclusive

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