

BIOASSAY DATA FOR MARINE POLLUTION USING SEA URCHIN EGGS, 1971

In 1971, nine experiments for biological assay were made using sea urchin eggs to measure marine pollution around the Seto Marine Biological Laboratory.

I. Winter season, February 25. Eggs of *Hemicentrotus pulcherrimus* (A. AGASSIZ) were used, see Table 1.

II. Spring season, March 26. Eggs of *Hemicentrotus pulcherrimus* were used, see Table 2.

III. Summer season, five experiments were made in June-early September, using *Anthocidaris crassispina* (A. AGASSIZ) eggs.

1. June 12, see Table 3.

2. July 10, see Table 4.

3. July 20, see Table 5.

4. August 18, see Table 6.

5. September 4, see Table 7.

IV. Autumn season, two experiments were made in November and early December, with eggs of *Pseudocentrotus depressus* (A. AGASSIZ).

1. November 4, see Table 8. 2. December 4, see Table 9. (Notes common to all tables: "Time of observation*" shows the time after insemination; No. 1 to No. 3 are batch numbers of eggs; the maturing states of gonads are given as nearly ripe + (+), ripe ++, nearly full ripe ++ (+), full ripe +++.)

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Table 1. Results of the Feb. 25 experiment with eggs of *Hemicentrotus pulcherrimus*. Wind: 0. Test water temperature: 17.5°C (warmed).

Indicatory states	Time of observation*	Running sea water of laboratory			Water from open sea side of Hatakejima			Water from land side of Hatakejima			Sea water from Tsunashirazu cove		
		No. 1 +++	No. 2 ++	No. 3 +(+)	No. 1	No. 2	No. 3	No. 1	No. 2	No. 3	No. 1	No. 2	No. 3
formation of fertilization membrane	hr. min. 0:03	% 99.9	% 98.2	% 99.8	% 99.8	% 98.1	% 99.8	% 99.8	% 97.9	% 99.6	% 99.7	% 97.2	% 99.6
one cell	1:30	0.2	4.2	0.9	0.3	3.5	2.7	0.7	4.7	3.1	1.0	9.8	5.4
two cells		99.8	93.7	98.8	99.7	94.7	96.2	99.1	92.9	95.7	98.5	85.0	92.4
multi-cells (polyspermy)		0.0	2.1	0.3	0.0	1.8	1.1	0.2	2.4	1.2	0.5	5.2	2.2
permanent blastula	24:00	0.2	0.2	0.1	0.1	0.2	0.2	0.3	0.4	0.4	0.4	0.5	0.8
gastrula		99.8	99.8	99.7	99.8	99.8	99.7	99.6	99.4	99.3	99.4	99.1	99.0
exogastrula		0.0	0.0	0.2	0.1	0.0	0.1	0.1	0.2	0.3	0.2	0.4	0.2

Table 2. Results of the Mar. 26 experiment with eggs of *Hemicentrotus pulcherrimus*. Wind: NW 1. Test water temperature: 16°C.

Indicatory states	Time of observation*	Running sea water of laboratory			Water from open sea side of Hatakejima			Water from land side of Hatakejima			Sea water from Tsunashirazu cove		
		No. 1 ++	No. 2 ++(+)	No. 3 ++(+)	No. 1	No. 2	No. 3	No. 1	No. 2	No. 3	No. 1	No. 2	No. 3
formation of fertilization membrane	hr. min. 0:03	% 98.3	% 99.4	% 92.8	% 98.1	% 98.1	% 91.0	% 98.3	% 97.3	% 90.7	% 97.7	% 96.8	% 90.5
one cell	2:00	2.1	0.7	8.4	2.9	2.6	9.1	3.0	3.1	14.6	3.5	4.5	15.2
two cells		97.8	99.2	91.4	97.1	97.3	90.8	97.0	96.7	85.3	96.3	95.1	84.5
multi-cells (polyspermy)		0.1	0.1	0.2	0.0	0.1	0.1	0.0	0.2	0.1	0.2	0.4	0.3
permanent blastula	36:00	0.1	0.2	0.1	0.1	0.1	0.2	0.1	0.3	0.2	0.2	0.2	0.3
gastrula		99.9	99.8	99.8	99.9	99.7	99.8	99.8	99.6	99.6	99.6	99.8	99.5
exogastrula		0.0	0.0	0.1	0.0	0.2	0.0	0.1	0.1	0.2	0.2	0.0	0.2

Table 3. Results of the June 12 experiment with eggs of *Anthocidaris crassispina*. Wind: NS 1. Test water temperature: 25°C.

Indicatory states	Time of observation*	Running sea water of laboratory			Water from open sea side of Hatakejima			Water from land side of Hatakejima			Sea water from Tsunashirazu cove		
		No. 1 ++	No. 2 ++	No. 3 ++	No. 1	No. 2	No. 3	No. 1	No. 2	No. 3	No. 1	No. 2	No. 3
formation of fertilization membrane	hr. min. 0:03	% 99.1	% 99.5	% 99.8	% 97.8	% 99.4	% 99.8	% 98.2	% 99.0	% 99.4	% 98.1	% 98.7	% 99.0
one cell	1:00	4.0	3.4	2.6	4.8	3.9	3.2	6.2	5.3	3.7	6.5	8.4	8.0
two cells		96.0	96.6	97.1	95.1	96.1	96.6	93.5	94.5	96.1	93.1	91.4	91.8
multi-cells (polyspermy)		0.0	0.0	0.3	0.1	0.0	0.2	0.3	0.2	0.2	0.4	0.2	0.2
permanent blastula	17:00	0.8	0.7	0.3	0.6	0.7	0.5	0.9	0.8	0.7	1.2	0.9	0.9
gastrula		99.2	99.2	99.7	99.4	99.3	99.4	98.9	99.1	99.2	98.5	98.9	98.9
exogastrula		0.0	0.1	0.0	0.0	0.0	0.1	0.2	0.1	0.1	0.3	0.2	0.2

Table 4. Results of the July 10 experiment with eggs of *Anthocidaris crassispina*. Wind: 0. Test water temperature: 27°C.

Indicatory states	Time of observation*	Running sea water of laboratory			Water from open sea side of Hatakejima			Water from land side of Hatakejima			Sea water from Tsunashirazu cove		
		No. 1 ++	No. 2 ++	No. 3 ++	No. 1	No. 2	No. 3	No. 1	No. 2	No. 3	No. 1	No. 2	No. 3
formation of fertilization membrane	hr. min. 0:03	% 98.1	% 97.2	% 98.9	% 98.4	% 97.5	% 98.2	% 96.9	% 96.2	% 97.1	% 95.1	% 94.3	% 96.7
one cell	1:00	6.2	7.5	2.1	6.4	8.1	3.1	9.2	9.4	8.7	9.5	11.2	10.2
two cells		93.7	92.5	97.9	93.6	91.8	96.9	90.7	90.4	90.4	89.8	87.5	88.6
multi-cells (polyspermy)		0.1	0.0	0.0	0.0	0.1	0.0	0.1	0.2	0.9	0.7	1.3	1.2
permanent blastula	12:00	1.7	1.8	1.5	1.5	1.7	1.3	1.8	1.9	1.9	2.1	2.3	2.2
gastrula		98.2	98.2	98.5	98.5	98.2	98.7	98.0	97.9	98.0	97.7	97.4	97.6
exogastrula		0.1	0.0	0.0	0.0	0.1	0.0	0.2	0.2	0.1	0.2	0.3	0.2

Table 7. Results of the Sept. 4 experiment with eggs of *Anthocardis crassispina*. Wind: 0. Test water temperature: 25°C.

Indicatory states	Time of observation*	Running sea water of laboratory		Water from open sea side of Hatakejima		Water from land side of Hatakejima		Sea water from Tsunashirazu cove	
		No. 1 ++	No. 2 ++	No. 1	No. 2	No. 1	No. 2	No. 1	No. 2
formation of fertilization membrane	hr. min. 0:03	% 99.3	% 97.3	% 99.4	% 97.1	% 95.4	% 95.2	% 94.1	% 94.3
one cell	1.00	1.3	3.2	2.1	3.5	5.7	6.6	6.5	7.9
two cells		98.7	96.8	97.9	96.5	94.2	93.2	93.3	91.9
multi-cells (polyspermy)		0.0	0.0	0.0	0.0	0.1	0.2	0.2	0.2
permanent blastula	15.00	0.5	1.6	0.7	1.7	1.0	2.5	1.3	2.8
gastrula		99.5	98.3	99.3	98.3	98.9	97.3	98.5	97.1
exogastrula		0.0	0.1	0.0	0.0	0.1	0.2	0.2	0.1

Table 8. Results of the Nov. 4 experiment with eggs of *Hemicentrotus depressus*. Wind: 0. Test water temperature: 20°C.

Indicatory states	Time of observation*	Running sea water of laboratory			Water from open sea side of Hatakejima			Water from land side of Hatakejima			Sea water from Tsunashirazu cove		
		No. 1 ++	No. 2 +++	No. 3 +++	No. 1	No. 2	No. 3	No. 1	No. 2	No. 3	No. 1	No. 2	No. 3
formation of fertilization membrane	hr. min. 0:03	% 86.5	% 93.2	% 90.3	% 91.0	% 94.0	% 91.5	% 85.1	% 92.7	% 90.1	% 83.2	% 91.3	% 90.2
one cell	1:20	14.0	6.9	10.3	11.6	6.4	9.5	15.1	8.5	10.5	16.2	9.0	11.0
two cells		85.2	92.9	89.5	87.9	93.5	90.3	84.3	91.3	89.2	82.9	90.6	88.7
multi-cells (polyspermy)		0.8	0.2	0.2	0.5	0.1	0.2	0.6	0.2	0.3	0.9	0.4	0.3
permanent blastula	20:00	0.8	0.2	0.6	0.6	0.2	0.5	0.7	0.7	0.7	1.0	0.7	1.0
gastrula		99.2	99.8	99.3	99.4	99.8	99.5	99.2	99.3	99.1	98.8	99.2	98.7
exogastrula		0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.2	0.2	0.1	0.3

Table 9. Results of the Dec. 4 experiment with eggs of *Hemicentrotus depressus*. Wind: 0. Test water temperature: 18°C.

Indicatory states	Time of observation*	Running sea water of laboratory		Water from open sea side of Hatakejima		Water from land side of Hatakejima		Sea water from Tsunashirazu cove	
		No. 1 ++	No. 2 ++	No. 1	No. 2	No. 1	No. 2	No. 1	No. 2
formation of fertilization membrane	hr. min. 0:03	% 87.2	% 89.3	% 87.4	% 89.5	% 87.1	% 88.3	% 87.0	% 87.4
one cell	1:30	13.0	10.8	12.8	10.6	13.0	12.6	13.1	12.8
two cells		86.9	89.1	87.1	89.4	87.0	87.3	86.7	87.1
multi-cells (polyspermy)		0.1	0.1	0.1	0.0	0.0	0.1	0.2	0.1
permanent blastula	22:00	0.1	0.2	0.1	0.1	0.1	0.2	0.2	0.3
gastrula		99.9	99.8	99.9	99.9	99.9	99.8	99.7	99.7
exogastrula		0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0