

**BIOASSAY DATA FOR MARINE POLLUTION USING SEA
URCHIN EGGS, 1970**

In 1970, 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 21–22. Eggs of *Hemicentrotus pulcherrimus* (A. AGASSIZ) were used (see Publ. Seto Mar. Biol. Lab., vol. 18, no. 6, p. 385, Table 1).

II. Spring season, May 21–22. Eggs of *Anthocardis crassispina* (A. AGASSIZ) were used (see Publ. Seto Mar. Biol. Lab., vol. 18, no. 6, p. 386, Table 2).

III. Summer season, five experiments were made in June–August, using *Anthocardis crassispina* eggs.

1. June 6–7, see Table 1.

2. July 17, see Table 2.

3. July 21 (see Publ. Seto Mar. Biol. Lab., vol. 18, no. 6, p. 387, Table 3).

4. August 4, see Table 3.

5. August 18–19, six batches of eggs were experimented with. Results obtained from batches nos. 1–3 are given in Publ. Seto Mar. Biol. Lab., vol. 18, no. 6, p. 389, Table 4; as to the results gained from batches nos. 4–6, see Table 4.

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

1. October 20–21, in the very early time of the spawning season, see Table 5.

2. November 28–29, see Table 6.

(Notes common to all tables: "Time of observation*" shows the time after insemination; No. 1 to No. 6 are batch numbers of eggs; the maturing states of gonads are given as nearly ripe ++(+), ripe ++, nearly full ripe ++(+), full ripe +++.)

NAOMASA KOBAYASHI

Table 1. Results of the June 6 and 7 experiment with eggs of *Anthocardis crassispina*. Wind: S 1.
Test water temperature: 22°C

Indicatory states	Time of observation*	Running sea water of laboratory		Water from open sea side of Hatakejima		Water from land side of Hatakejima	
		No. 1 +++	No. 2 +++	No. 1	No. 2	No. 1	No. 2
formation of fertilization membrane	0:03	99.4	99.2	87.8	98.0	71.6	92.2
one cell	1:15	2.1	0.8	15.1	2.4	30.2	7.7
two cells		97.8	99.1	84.3	97.2	69.0	90.1
multi-cells (polyspermy)		0.1	0.1	0.6	0.4	0.8	2.2
permanent blastula	24:00	4.6	1.2	5.4	1.4	10.4	2.3
gastrula		95.2	98.8	94.4	98.6	89.1	97.6
exogastrula		0.2	0.0	0.2	0.0	0.5	0.1

Table 2. Results of the July 17 experiment with eggs of *Anthocidaris crassispina*. Wind: S 1. Test water temperature: 28°C.

Indicatory states	Time of observation*	Running sea water of laboratory			Water from open sea side of Hatakejima			Water from land side of Hatakejima		
		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	% 98.8	% 99.4	% 99.3	% 98.6	% 99.4	% 99.1	% 97.8	% 99.6	% 99.2
one cell	0:45	2.1	1.1	1.2	3.4	2.1	1.6	5.4	3.4	1.4
two cells		96.4	98.7	98.5	95.2	96.8	97.3	92.4	95.4	97.6
multi-cells (polyspermy)		1.5	0.2	0.3	1.4	1.1	1.1	2.2	1.2	1.0
permanent blastula	12:00	0.7	0.5	0.7	0.8	0.7	0.5	0.8	0.5	0.7
gastrula		99.3	99.4	99.0	99.2	99.3	99.4	99.2	99.1	99.1
exogastrula		0.0	0.1	0.3	0.0	0.0	0.1	0.0	0.4	0.2

Table 3. Results of the August 4 experiment with eggs of *Anthocidaris crassispina*. Wind: SW 1. Test water temperature: 28.5°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	% 99.8	% 98.2	% 98.6	% 99.7	% 98.5	% 98.3	% 99.6	% 98.0	% 95.1	% 98.8	% 98.2	% 95.0
one cell	0:45	9.4	32.4	12.4	7.6	32.6	13.5	12.3	40.2	20.8	15.3	41.0	20.9
two cells		90.0	67.2	87.1	91.9	66.7	85.9	87.2	58.5	77.6	83.8	57.8	75.3
multi-cells (polyspermy)		0.6	0.4	0.5	0.5	0.7	0.6	0.5	1.3	1.6	0.9	1.2	3.8
permanent blastula	10:00	1.8	1.8	1.7	1.5	1.6	1.4	2.3	3.6	2.2	2.2	2.1	3.3
gastrula		98.2	98.1	98.3	98.5	98.3	98.5	97.6	96.1	97.3	97.4	97.3	96.3
exogastrula		0.0	0.1	0.0	0.0	0.1	0.1	0.1	0.3	0.5	0.4	0.6	0.4

Table 4. Results of the Aug. 18 and 19 experiment with eggs of *Anthocardis crassispina*. Wind: 0. Test water temperature: 28°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. 4 +(+)	No. 5 ++	No. 6 ++(+)	No. 4	No. 5	No. 6	No. 4	No. 5	No. 6	No. 4	No. 5	No. 6
formation of fertilization membrane	hr. min. 0:03	% 85.7	% 89.8	% 85.3	% 80.3	% 87.9	% 78.9	% 73.5	% 85.2	% 61.2	% 68.2	% 82.3	% 62.3
one cell	0:45	19.7	13.2	21.5	26.6	14.2	27.5	36.2	19.6	41.2	45.6	22.4	38.2
two cells		80.2	86.6	78.4	73.2	85.5	72.3	63.4	80.0	58.1	53.6	76.9	61.0
multi-cells (polyspermy)		0.1	0.2	0.1	0.2	0.3	0.2	0.4	0.4	0.7	0.8	0.7	0.8
permanent blastula	12:00	0.7	0.6	0.9	0.8	0.6	0.7	0.9	0.9	1.2	0.9	1.3	1.4
gastrula		99.3	99.3	99.0	99.2	99.3	99.3	99.0	99.0	98.6	98.9	98.5	98.3
exogastrula		0.0	0.1	0.1	0.0	0.1	0.0	0.1	0.1	0.2	0.2	0.2	0.3

Table 5. Results of the Oct. 20 and 21 experiment with eggs of *Pseudocentrotus depressus*. Wind: 0. Test water temperature: 21°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	% 93.2	% 82.1	% 93.4	% 83.0	% 92.8	% 80.8	% 90.2	% 80.1
one cell	1:30	7.5	20.1	7.1	20.3	8.6	21.3	10.4	22.6
two cells		92.4	79.6	92.7	79.5	91.2	78.5	86.1	77.1
multi-cells (polyspermy)		0.1	0.3	0.2	0.2	0.2	0.2	3.5	0.3
permanent blastula	19:00	0.3	0.2	0.2	0.3	0.4	0.3	0.7	0.4
gastrula		99.7	99.8	99.8	99.7	99.5	99.7	99.0	99.5
exogastrula		0.0	0.0	0.0	0.0	0.1	0.0	0.3	0.1

Table 6. Results of the Nov. 28 and 29 experiment with eggs of *Pseudocentrotus depressus*. Wind: N1. Test water temperature: 16.5°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	% 98.9	% 84.7	% 85.7	% 98.7	% 84.5	% 86.1	% 96.7	% 83.1	% 85.1	% 92.2	% 82.3	% 82.6
one cell	2:00	3.1	17.6	16.4	3.2	18.1	15.3	5.4	19.2	17.3	6.8	22.1	19.4
two cells		96.9	82.4	83.5	96.7	81.9	84.5	94.4	79.5	82.2	91.4	76.0	79.3
multi-cells (polyspermy)		0.0	0.0	0.1	0.1	0.0	0.2	0.2	1.3	0.5	1.8	1.9	1.3
permanent blastula	32:00	4.3	4.5	4.7	4.1	4.3	4.9	5.2	5.8	5.9	5.9	7.9	8.1
gastrula		95.7	95.4	95.3	95.8	95.7	94.9	94.6	94.1	93.7	93.8	91.7	91.7
exogastrula		0.0	0.1	0.0	0.1	0.0	0.2	0.2	0.1	0.4	0.3	0.4	0.2