

## Supplementary Material

**Supplementary Table S1.** Chemical analyses of Total PAHs and Total PCBs on sediment collected at time zero (t0, corresponding at the beginning of the experiments, before adding compounds), time one (t1, corresponding at just after adding compounds) and at the end of experiments (tf). Data are expressed as µg/L. W+SED = Water+ sediment; W+SED+PAHs = Water + sediment + PAHs; W+SED+PCBs = Water + sediment + PCBs.

|                   | t0              |                 | t1              |                 | tf              |                 |
|-------------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
|                   | ΣPAHs<br>(µg/L) | ΣPCBs<br>(µg/L) | ΣPAHs<br>(µg/L) | ΣPCBs<br>(µg/L) | ΣPAHs<br>(µg/L) | ΣPCBs<br>(µg/L) |
| <b>W+SED</b>      | < 0.005         | < 0.005         | < 0.005         | < 0.005         | < 0.005         | < 0.005         |
| <b>W+SED+PAHs</b> | < 0.005         | < 0.005         | < 0.005         | < 0.005         | < 0.005         | < 0.005         |
| <b>W+SED+PCBs</b> | < 0.005         | < 0.005         | < 0.005         | < 0.005         | < 0.005         | < 0.005         |

**Supplementary Table S2.** Chemical analyses of Total PAHs and Total PCBs on seawater collected at time zero (t0, corresponding at the beginning of the experiments, before adding compounds), time one (t1, corresponding at just after adding compounds) and at the end of experiments (tf). Data are expressed as µg/L. W = water; W+SED = Water+ sediment; W+SED+PAHs = Water + sediment + PAHs; W+SED+PCBs = Water + sediment + PCBs.

|                   | t0              |                 | t1              |                 | tf              |                 |
|-------------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
|                   | ΣPAHs<br>(µg/L) | ΣPCBs<br>(µg/L) | ΣPAHs<br>(µg/L) | ΣPCBs<br>(µg/L) | ΣPAHs<br>(µg/L) | ΣPCBs<br>(µg/L) |
| <b>W</b>          | < 0.005         | < 0.005         | < 0.005         | < 0.005         | < 0.005         | < 0.005         |
| <b>W+SED</b>      | < 0.005         | < 0.005         | < 0.005         | < 0.005         | < 0.005         | < 0.005         |
| <b>W+SED+PAHs</b> | < 0.005         | < 0.005         | < 0.005         | < 0.005         | < 0.005         | < 0.005         |
| <b>W+SED+PCBs</b> | < 0.005         | < 0.005         | < 0.005         | < 0.005         | < 0.005         | < 0.005         |

**Supplementary Table S3.** Chemical analyses of Total PAHs, Total PCBs and Zn on sediment collected at time zero (t0), corresponding at the beginning of the experiments, before adding compounds. The samples are numbered as 1-2-3=W+SED+PAHs, 4-5-6=W+SED+PCBs, 7-8=W+SED.

| (µg/L)                 | t0      |         |         |         |         |         |         |         |
|------------------------|---------|---------|---------|---------|---------|---------|---------|---------|
|                        | 1       | 2       | 3       | 4       | 5       | 6       | 7       | 8       |
| Naphthalene            | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 |
| Acenaphthylene         | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 |
| Acenaphthene           | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 |
| Fluorene               | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 |
| Anthracene             | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 |
| Phenanthrene           | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 |
| Fluoranthene           | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 |
| Pyrene                 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 |
| Benz[a]anthracene      | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 |
| Chrysene               | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 |
| Benzo(b)Fluorantene    | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 |
| Benzo[k]fluoranthene   | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 |
| Benzo[a]pyrene         | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 |
| Indeno[1,2,3-cd]pyrene | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 |
| Dibenz[a,h]anthracene  | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 |
| Benzo[ghi]perylene     | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 |
| PCB1                   | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 |
| PCB5                   | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 |
| PCB18                  | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 |
| PCB31                  | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 |
| PCB44                  | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 |
| PCB52                  | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 |
| PCB66                  | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 |
| PCB87                  | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 |
| PCB101                 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 |
| PCB110                 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 |
| PCB138                 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 |
| PCB141                 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 |
| PCB151                 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 |
| PCB153                 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 |
| PCB170                 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 |
| PCB180                 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 |
| PCB183                 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 |
| PCB187                 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 |
| PCB206                 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 |

**Supplementary Table S4.** Chemical analyses of Total PAHs, Total PCBs and Zn on seawater collected at time zero (t0), corresponding at the beginning of the experiments, before adding compounds. The samples are numbered as 1-2-3=W+SED+PAHs, 4-5-6=W+SED+PCBs, 7-8=W+SED, 9-10=W.

| (µg/L)                 | t0     |        |        |        |        |        |        |        |        |        |
|------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
|                        | 1      | 2      | 3      | 4      | 5      | 6      | 7      | 8      | 9      | 10     |
| Naphthalene            | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| Acenaphthylene         | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| Acenaphthene           | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| Fluorene               | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| Anthracene             | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| Phenanthrene           | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| Fluoranthene           | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| Pyrene                 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| Benz[a]anthracene      | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| Chrysene               | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| Benzo(b)Fluoranthene   | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| Benzo[k]fluoranthene   | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| Benzo[a]pyrene         | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| Indeno[1,2,3-cd]pyrene | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| Dibenz[a,h]anthracene  | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| Benzo[ghi]perylene     | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| PCB1                   | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| PCB5                   | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| PCB18                  | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| PCB31                  | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| PCB44                  | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| PCB52                  | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| PCB66                  | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| PCB87                  | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| PCB101                 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| PCB110                 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| PCB138                 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| PCB141                 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| PCB151                 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| PCB153                 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| PCB170                 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| PCB180                 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| PCB183                 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| PCB187                 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| PCB206                 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |

**Supplementary Table S5.** Chemical analyses of Total PAHs, Total PCBs and Zn on sediment collected at time one (t1), corresponding just after adding compounds. The samples are numbered as 1-2-3=W+SED+PAHs, 4-5-6=W+SED+PCBs, 7-8=W+SED.

| (µg/L)                 | t1      |         |         |         |         |         |         |         |
|------------------------|---------|---------|---------|---------|---------|---------|---------|---------|
|                        | 1       | 2       | 3       | 4       | 5       | 6       | 7       | 8       |
| Naphthalene            | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 |
| Acenaphthylene         | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 |
| Acenaphthene           | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 |
| Fluorene               | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 |
| Anthracene             | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 |
| Phenanthrene           | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 |
| Fluoranthene           | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 |
| Pyrene                 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 |
| Benz[a]anthracene      | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 |
| Chrysene               | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 |
| Benzo(b)Fluorantene    | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 |
| Benzo[k]fluoranthene   | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 |
| Benzo[a]pyrene         | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 |
| Indeno[1,2,3-cd]pyrene | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 |
| Dibenz[a,h]anthracene  | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 |
| Benzo[ghi]perylene     | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 |
| PCB1                   | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 |
| PCB5                   | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 |
| PCB18                  | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 |
| PCB31                  | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 |
| PCB44                  | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 |
| PCB52                  | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 |
| PCB66                  | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 |
| PCB87                  | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 |
| PCB101                 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 |
| PCB110                 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 |
| PCB138                 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 |
| PCB141                 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 |
| PCB151                 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 |
| PCB153                 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 |
| PCB170                 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 |
| PCB180                 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 |
| PCB183                 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 |
| PCB187                 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 |
| PCB206                 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 |

**Supplementary Table S6.** Chemical analyses of Total PAHs, Total PCBs and Zn on seawater collected at time zero (t1), corresponding just after adding compounds. The samples are numbered as 1-2-3=W+SED+PAHs, 4-5-6=W+SED+PCBs, 7-8=W+SED, 9-10=W.

| (μg/L)                        | t1     |        |        |        |        |        |        |        |        |        |
|-------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
|                               | 1      | 2      | 3      | 4      | 5      | 6      | 7      | 8      | 9      | 10     |
| <b>Naphthalene</b>            | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| <b>Acenaphthylene</b>         | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| <b>Acenaphthene</b>           | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| <b>Fluorene</b>               | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| <b>Anthracene</b>             | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| <b>Phenanthrene</b>           | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| <b>Fluoranthene</b>           | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| <b>Pyrene</b>                 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| <b>Benz[a]anthracene</b>      | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| <b>Chrysene</b>               | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| <b>Benzo(b)Fluorantene</b>    | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| <b>Benzo[k]fluoranthene</b>   | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| <b>Benzo[a]pyrene</b>         | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| <b>Indeno[1,2,3-cd]pyrene</b> | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| <b>Dibenz[a,h]anthracene</b>  | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| <b>Benzo[ghi]perylene</b>     | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| <b>PCB1</b>                   | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| <b>PCB5</b>                   | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| <b>PCB18</b>                  | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |

[illegible]

**Supplementary Table S7.** Chemical analyses of Total PAHs, Total PCBs and Zn on sediment collected at tf, corresponding at the end of the experiments. The samples are numbered as 1-2-3=W+SED+PAHs, 4-5-6=W+SED+PCBs, 7-8=W+SED.

| (µg/L)                 | tf      |         |         |         |         |         |         |         |
|------------------------|---------|---------|---------|---------|---------|---------|---------|---------|
|                        | 1       | 2       | 3       | 4       | 5       | 6       | 7       | 8       |
| Naphthalene            | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 |
| Acenaphthylene         | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 |
| Acenaphthene           | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 |
| Fluorene               | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 |
| Anthracene             | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 |
| Phenanthrene           | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 |
| Fluoranthene           | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 |
| Pyrene                 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 |
| Benz[a]anthracene      | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 |
| Chrysene               | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 |
| Benzo(b)fluorantene    | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 |
| Benzo[k]fluoranthene   | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 |
| Benzo[a]pyrene         | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 |
| Indeno[1,2,3-cd]pyrene | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 |
| Dibenz[a,h]anthracene  | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 |
| Benzo[ghi]perylene     | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 |
| PCB1                   | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 |
| PCB5                   | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 |
| PCB18                  | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 |
| PCB31                  | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 |
| PCB44                  | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 |
| PCB52                  | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 |
| PCB66                  | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 |
| PCB87                  | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 |
| PCB101                 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 |
| PCB110                 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 |
| PCB138                 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 |
| PCB141                 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 |
| PCB151                 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 |
| PCB153                 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 |
| PCB170                 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 |
| PCB180                 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 |
| PCB183                 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 |
| PCB187                 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 |
| PCB206                 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 |





**Supplementary Table S8.** Chemical analyses of Total PAHs, Total PCBs and Zn on seawater collected at time zero (t<sup>0</sup>), corresponding at the end of the experiments. The samples are numbered as 1-2-3=W+SED+PAHs, 4-5-6=W+SED+PCBs, 7-8=W+SED, 9-10=W.

| (μg/L)                     | tf     |        |        |        |        |        |        |        |        |        |
|----------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
|                            | 1      | 2      | 3      | 4      | 5      | 6      | 7      | 8      | 9      | 10     |
| Naphthalene                | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| Acenaphthylene             | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| Acenaphthene               | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| Fluorene                   | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| Anthracene                 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| Phenanthrene               | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| Fluoranthene               | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| Pyrene                     | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| Benz[a]anthracene          | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| Chrysene                   | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| Benzo(b)Fluorant<br>ene    | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| Benzo[k]fluoranth<br>ene   | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| Benzo[a]pyrene             | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| Indeno[1,2,3-<br>cd]pyrene | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| Dibenz[a,h]anthra<br>cene  | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| Benzo[ghi]peryle<br>ne     | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| PCB1                       | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| PCB5                       | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| PCB18                      | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| PCB31                      | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| PCB44                      | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| PCB52                      | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| PCB66                      | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| PCB87                      | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| PCB101                     | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| PCB110                     | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| PCB138                     | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| PCB141                     | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| PCB151                     | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| PCB153                     | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| PCB170                     | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| PCB180                     | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| PCB183                     | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| PCB187                     | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| PCB206                     | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |

**Supplementary Table S9.** Adult sizes (in millimetres) and gonadal index ( $GI \pm SD$ ,  $n = 5/\text{group}$ ) of adults of sea urchin *P. lividus* collected in the field at the beginning ( $t_0$ ) and after two months in the three experimental conditions: W, W+SED, W+SED+PAHs and W+SED+PCBs ( $p$  value  $> 0.05$ ). W = water; W+SED = Water+ sediment; W+SED+PAHs = Water + sediment + PAHs; W+SED+PCBs = Water + sediment + PCBs.

|                           | W               | W+SED           | W+SED+ PAHs     | W+SED+PCBs       |
|---------------------------|-----------------|-----------------|-----------------|------------------|
| <b><u>Adult size,</u></b> | $50.5 \pm 4.36$ |                 |                 |                  |
| <b><math>t_0</math></b>   | $44.5 \pm 1.1$  | $51.9 \pm 5.6$  | $58.8 \pm 5.3$  | $56.6 \pm 3.7$   |
| <b>2 months</b>           | $37.2 \pm 9.6$  | $52.2 \pm 5.1$  | $57.6 \pm 5.9$  | $56.1 \pm 3.9$   |
| <b><u>GI</u></b>          |                 |                 |                 |                  |
| <b><math>t_0</math></b>   | $3.68 \pm 0.01$ |                 |                 |                  |
| <b>2 months</b>           | $0.88 \pm 0.01$ | $3.78 \pm 0.02$ | $2.32 \pm 0.02$ | $2.22 \pm 0.004$ |



**Supplementary Table S10.** Quantity ( $\mu\text{g/Kg}$ ) PCBs detected in theca including spines, gonads and gut from adult sea urchin *P. lividus* in two experimental conditions after two months: W/W+SED, W+SED+PCBs.

|                   | Theca + spines |         | Gonads     |         | Gut        |         |
|-------------------|----------------|---------|------------|---------|------------|---------|
| PCBs              | W+SED+PCBs     | W+SED/W | W+SED+PCBs | W+SED/W | W+SED+PCBs | W+SED/W |
|                   |                |         |            |         |            |         |
| PCB1              | < 0.5          | < 0.5   | < 2        | < 2     | < 2        | < 2     |
| PCB5              | < 0.5          | < 0.5   | < 2        | < 2     | < 2        | < 2     |
| PCB18             | < 0.5          | < 0.5   | < 2        | < 2     | < 2        | < 2     |
| PCB31             | < 0.5          | < 0.5   | < 2        | < 2     | < 2        | < 2     |
| PCB44             | < 0.5          | < 0.5   | < 2        | < 2     | < 2        | < 2     |
| PCB52             | < 0.5          | < 0.5   | < 2        | < 2     | < 2        | < 2     |
| PCB66             | < 0.5          | < 0.5   | < 2        | < 2     | < 2        | < 2     |
| PCB87             | < 0.5          | < 0.5   | < 2        | < 2     | < 2        | < 2     |
| PCB101            | < 0.5          | < 0.5   | < 2        | < 2     | < 2        | < 2     |
| PCB110            | < 0.5          | < 0.5   | < 2        | < 2     | < 2        | < 2     |
| PCB138            | < 0.5          | < 0.5   | < 2        | < 2     | < 2        | < 2     |
| PCB141            | < 0.5          | < 0.5   | < 2        | < 2     | < 2        | < 2     |
| PCB151            | < 0.5          | < 0.5   | < 2        | < 2     | < 2        | < 2     |
| PCB153            | < 0.5          | < 0.5   | < 2        | < 2     | < 2        | < 2     |
| PCB170            | < 0.5          | < 0.5   | < 2        | < 2     | < 2        | < 2     |
| PCB180            | < 0.5          | < 0.5   | < 2        | < 2     | < 2        | < 2     |
| PCB183            | < 0.5          | < 0.5   | < 2        | < 2     | < 2        | < 2     |
| PCB187            | < 0.5          | < 0.5   | < 2        | < 2     | < 2        | < 2     |
| PCB206            | < 0.5          | < 0.5   | < 2        | < 2     | < 2        | < 2     |
|                   |                |         |            |         |            |         |
| <b>Total PCBs</b> | < 0.5          | < 0.5   | < 2        | < 2     | < 2        | < 2     |

**Supplementary Table S11.** Number of differentially expressed (DE) genes and isoforms, identified with a False Discovery Rate (FDR)  $\leq 0.05$ , and with a Fold Change (FC)  $\geq 1.5$  (upregulated genes/isoforms) and  $\leq -1.5$  (down-regulated genes/isoforms). Control: plutei from adults sea urchin *P. lividus* reared for two months in tanks with sediment without contaminants; Treated1: plutei deriving from adults exposed for two months to sediment contaminated with PAHs; Treated2: plutei deriving from adults exposed for two months to sediment contaminated with PCBs.

|                      | FDR $\leq 0.05$ | FC $\geq 1.5$<br>FDR $\leq 0.05$ | FC $\leq -1.5$<br>FDR $\leq 0.05$ |
|----------------------|-----------------|----------------------------------|-----------------------------------|
| <b>Genes</b>         |                 |                                  |                                   |
| Treated1 vs Control  | 1898            | 933                              | 965                               |
| Treated2_ vs Control | 2396            | 1079                             | 1317                              |
| Treated2 vs Treated1 | 1356            | 755                              | 601                               |
| <b>Isoforms</b>      |                 |                                  |                                   |
| Treated1 vs Control  | 5591            | 2200                             | 3388                              |
| Treated2_ vs Control | 7703            | 3715                             | 3985                              |
| Treated2 vs Treated1 | 4762            | 2911                             | 1850                              |

**Supplementary Table S12.** Common up-regulated genes in the Venn diagrams (for more details see also **Figure 4** and legend to this figure) among the three experimental groups: “Treated\_1 (plutei deriving from adults exposed for two months to sediment contaminated with PAHs) versus Control” (plutei from adults sea urchin *P. lividus* reared for two months in tanks with sediment without contaminants, “Treated\_2 (plutei deriving from adults exposed for two months to sediment contaminated with PCBs) versus Control” and “Treated\_1 versus Treated\_2”.

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**Up-regulated genes**

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**"Treated\_1 vs Control" and "Treated\_2 vs Control"**

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DNA replication licensing factor mcm7-A isoform X1  
unnamed protein product  
diamine acetyltransferase 2  
arylsulfatase  
PREDICTED: uncharacterized protein LOC578221  
high-affinity choline transporter 1  
PREDICTED: uncharacterized protein LOC100889675  
PREDICTED: fibropellin-3  
PREDICTED: uncharacterized protein LOC100891625  
nucleolin isoform X3  
PREDICTED: titin  
spectrin alpha chain, non-erythrocytic 1 isoform X6  
185/333  
tethering factor for nuclear proteasome STS1 isoform X2  
tryptophan 5-hydroxylase 1 isoform X1  
high-affinity choline transporter 1-like  
DYI2\_HELCRRName: Full=Dynein intermediate chain 2, ciliary  
hypothetical protein B7P43\_G03953  
putative nuclease HARB1  
dolichyl-diphosphooligosaccharide--protein glycosyltransferase subunit 1  
nodal  
putative TBC1 domain family member 2A  
PREDICTED: uncharacterized protein LOC105436430  
threonine synthase-like 1  
E3 ubiquitin-protein ligase RNF8 isoform X1  
PREDICTED: trypsin-1-like  
uncharacterized protein LOC111859709  
PREDICTED: uncharacterized protein LOC575796  
MFS-type transporter SLC18B1  
antivin/lefty  
deleted in malignant brain tumors 1 protein  
PREDICTED: uncharacterized protein LOC105441695  
PREDICTED: uncharacterized protein LOC100888967  
hypothetical protein pdam\_00008083  
cell wall-associated hydrolase

alpha-5 collagen  
 retinol dehydrogenase 8  
 MYCBP-associated protein isoform X4  
 heparan sulfate 2-O-sulfotransferase 1  
 PREDICTED: uncharacterized protein LOC100889612  
 PREDICTED: uncharacterized protein LOC754545  
 PREDICTED: uncharacterized protein LOC756027  
 uncharacterized protein LOC113054557  
 condensin complex subunit 3 isoform X1  
 PREDICTED: uncharacterized protein LOC105444166  
 transmembrane 9 superfamily member 4  
 PREDICTED: uncharacterized protein LOC105439689  
 PREDICTED: uncharacterized protein LOC764367  
 DNMT1\_PARLIRecName: (cytosine-5)-methyltransferase PliMCI  
 NFU1 iron-sulfur cluster scaffold homolog, mitochondrial  
 hypothetical protein BSL78\_07137, partial  
 PREDICTED: uncharacterized protein LOC108671849  
 forkhead transcription factor Q2  
 ubiquitin carboxyl-terminal hydrolase CYLD  
 uncharacterized protein K02A2.6-like  
 hypothetical protein X975\_19031, partial  
 PREDICTED: uncharacterized protein LOC105447528  
 putative RNA-directed DNA polymerase from transposon BS  
 PREDICTED: uncharacterized protein LOC105439906  
 PREDICTED: uncharacterized protein LOC105442605  
 PREDICTED: uncharacterized protein LOC100890383  
 reverse transcriptase family protein  
 dnaJ homolog subfamily B member 13  
 laminin subunit alpha  
 meiosis-specific protein MEI4-like  
 uncharacterized protein LOC114575677  
 PREDICTED: uncharacterized protein LOC100892571  
 hypothetical protein BBROOKSOX\_704  
 PREDICTED: uncharacterized protein LOC105444429  
 PREDICTED: uncharacterized protein LOC105326080  
 long-chain-fatty-acid--CoA ligase 4  
 coiled-coil domain-containing protein 40  
 PREDICTED: uncharacterized protein LOC590579  
 PREDICTED: uncharacterized protein LOC105335220

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**"Treated\_1 vs Control", "Treated\_2 vs Control" and "Treated\_1 vs Treated\_2"**

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putative RNA-directed DNA polymerase from transposon X-element  
 PREDICTED: uncharacterized protein LOC100890353



hypothetical protein  
 PREDICTED: uncharacterized protein LOC105439418  
 RNA-directed DNA polymerase from mobile element jockey-like  
 PREDICTED: uncharacterized protein LOC105444767  
 protein FAM166B  
 uncharacterized protein LOC110990766  
 PREDICTED: uncharacterized protein K02A2.6-like  
 PREDICTED: uncharacterized protein LOC105440140  
 PREDICTED: uncharacterized protein LOC587493  
 PREDICTED: uncharacterized protein LOC577099  
 uncharacterized protein LOC110984997 isoform X1  
 endonuclease-reverse transcriptase  
 craniofacial development protein 2-like  
 RNA-directed DNA polymerase from mobile element jockey  
 hypothetical protein DSY43\_04445  
 PREDICTED: uncharacterized protein LOC589347

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**"Treated\_1 vs Control" and "Treated\_1 vs Treated\_2"**

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annexin A4  
 heme-binding protein 2  
 proteasome subunit beta type-1-B  
 PREDICTED: uncharacterized protein LOC105444208

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**"Treated\_2 vs Control" and "Treated\_1 vs Treated\_2"**

---

PREDICTED: uncharacterized protein LOC105443609  
 uncharacterized protein LOC110987973  
 haloacid dehalogenase-like hydrolase domain-containing protein 2  
 uncharacterized protein LOC111085826  
 biogenesis of lysosome-related organelles complex 1 subunit 1  
 PREDICTED: uncharacterized protein LOC105441676  
 PREDICTED: mucin-4  
 PREDICTED: uncharacterized protein LOC105437795  
 PREDICTED: uncharacterized protein LOC105912973  
 PREDICTED: uncharacterized protein LOC105447150  
 PREDICTED: uncharacterized protein LOC105441670  
 protein KRI1 homolog  
 homeobox protein cut-like 1 isoform X1  
 low-density lipoprotein receptor-related protein 1B isoform X1  
 uncharacterized protein LOC110984676 isoform X7  
 PREDICTED: uncharacterized protein LOC107350581  
 putative DNA transposase THAP9-like  
 PREDICTED: uncharacterized protein LOC105437731  
 PREDICTED: uncharacterized protein LOC754161

PREDICTED: uncharacterized protein LOC578465  
 PREDICTED: LOW QUALITY PROTEIN: uncharacterized protein LOC107348641  
 toll-like receptor 3  
 uncharacterized protein LOC110975147 isoform X1  
 hypothetical protein AC249\_AIPGENE18192  
 hypothetical protein CIL05\_21475  
 PREDICTED: uncharacterized protein LOC100890507  
 PREDICTED: uncharacterized protein LOC107334619  
 long-chain-fatty-acid--CoA ligase 5-like  
 PREDICTED: uncharacterized protein LOC100893480 isoform X5  
 hypothetical protein AWC38\_SpisGene22463  
 PREDICTED: sialin  
 PREDICTED: plexin-B3-like  
 hypothetical protein BSL78\_27382  
 PREDICTED: uncharacterized protein LOC105440726  
 PREDICTED: uncharacterized protein LOC105437364  
 PREDICTED: uncharacterized protein LOC105442164, partial  
 uncharacterized protein LOC110234800  
 pre-rRNA-processing protein TSR1 homolog  
 PREDICTED: uncharacterized protein LOC105444020  
 sodium/myo-inositol cotransporter 2 isoform X1  
 PREDICTED: mucin-22-like  
 deleted in malignant brain tumors 1 protein-like  
 cystine/glutamate transporter  
 V(D)J recombination-activating protein 1-like isoform X2  
 zinc-carboxypeptidase, putative  
 PREDICTED: uncharacterized protein LOC100890950  
 PREDICTED: uncharacterized protein LOC108087055  
 PREDICTED: latrophilin-1  
 PREDICTED: uncharacterized protein LOC105442991  
 recombination activating protein 2-like  
 PREDICTED: uncharacterized protein LOC105445996  
 PREDICTED: uncharacterized protein LOC105440296  
 sucrase-isomaltase, intestinal  
 PREDICTED: uncharacterized protein LOC105447620, partial  
 PREDICTED: uncharacterized protein LOC105445209  
 hypothetical protein BSL78\_14139  
 hypothetical protein BSL78\_24528, partial  
 PREDICTED: uncharacterized protein LOC105443558  
 uncharacterized protein LOC115369174  
 hyphally regulated cell wall protein 3  
 PREDICTED: uncharacterized protein LOC100893587  
 uncharacterized protein LOC110464703

**Supplementary Table S13.** Common down-regulated genes in the Venn diagrams (for more details see also **Fig. 5** and legend to this figure) among the three experimental groups: “Treated\_1 (plutei deriving from adults exposed for two months to sediment contaminated with PAHs) versus Control” (plutei from adults sea urchin *P. lividus* reared for two months in tanks with sediment without contaminants, “Treated\_2 (plutei deriving from adults exposed for two months to sediment contaminated with PCBs) versus Control” and “Treated\_1 versus Treated\_2”.

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**Down-regulated genes**

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**"Treated\_1 vs Control" and "Treated\_2 vs Control"**

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PREDICTED: uncharacterized protein LOC105440703 isoform X1  
E3 ubiquitin-protein ligase TRIM33-like  
cGMP-dependent protein kinase 1 isoform X5  
PREDICTED: uncharacterized protein LOC105441665  
zinc finger protein 862-like  
galactosylceramide sulfotransferase-like  
UDP-glucuronosyltransferase 2B33-like  
PREDICTED: uncharacterized protein LOC105444646  
PREDICTED: uncharacterized protein LOC105444794  
methylmalonyl-CoA epimerase, mitochondrial  
neurogenic locus notch homolog protein 1  
zinc finger and SCAN domain-containing protein 29-like  
PREDICTED: uncharacterized protein LOC100888828  
solute carrier family 28 member 3 isoform X1  
uncharacterized protein LOC110061264  
PREDICTED: uncharacterized protein LOC109618538  
hypothetical protein CRYPA\_1785  
PREDICTED: uncharacterized protein LOC764539  
uncharacterized protein LOC113684170, partial  
EGF, latrophilin and seven transmembrane domain-containing protein 1-like  
AAEL014742-PA, partial  
serine/arginine-rich SC35-like splicing factor SCL33  
PREDICTED: uncharacterized protein LOC100893955  
fibrillin-1-like  
structural maintenance of chromosomes protein 1A isoform X2  
uncharacterized protein LOC11113885  
gastrula zinc finger protein XICGF8.2DB-like  
PREDICTED: uncharacterized protein LOC105447180  
PREDICTED: uncharacterized protein LOC105444769  
uncharacterized protein LOC111321513  
equilibrative nucleoside transporter 1-like  
isocitrate dehydrogenase [NADP] cytoplasmic isoform X2  
cilia- and flagella-associated protein 221  
putative nuclease HARB1  
hypothetical protein AC249\_AIPGENE2135

uncharacterized protein LOC110245901  
 beta-1,3-galactosyltransferase 1-like  
 zinc transporter 2  
 uncharacterized protein LOC110441045  
 cystine/glutamate transporter  
 uncharacterized protein LOC110977661  
 PREDICTED: uncharacterized protein LOC107343991  
 PREDICTED: uncharacterized protein LOC105446914  
 unnamed protein product  
 hypothetical protein, partial  
 uncharacterized protein LOC115366985, partial  
 protein NYNRIN-like  
 PREDICTED: uncharacterized protein LOC100893140  
 uncharacterized protein LOC110239146  
 PREDICTED: uncharacterized protein LOC105444695  
 PREDICTED: uncharacterized protein LOC581299 isoform X10  
 LINE-1 retrotransposable element ORF2 protein  
 PREDICTED: uncharacterized protein LOC589347  
 uncharacterized protein LOC110062710, partial  
 sushi domain-containing protein 2-like  
 GRIP and coiled-coil domain-containing protein 2-like  
 beta-1,4-galactosyltransferase 6-like  
 PREDICTED: uncharacterized protein LOC105441043  
 RNA-binding protein 34  
 kremen protein 2  
 PREDICTED: uncharacterized protein LOC580499  
 PREDICTED: uncharacterized protein LOC105440451, partial  
 uncharacterized protein LOC114531265  
 beta-1,4-galactosyltransferase 6  
 PREDICTED: uncharacterized protein LOC100888223  
 DNA (cytosine-5)-methyltransferase 3A  
 hypothetical protein BSL78\_13033  
 PREDICTED: uncharacterized protein LOC105438475  
 hypothetical protein DSY43\_04445  
 PREDICTED: uncharacterized protein LOC105437955  
 PREDICTED: uncharacterized protein LOC105439418  
 heparan sulfate glucosamine 3-O-sulfotransferase 1-like  
 DENN domain-containing protein 4C  
 Exodeoxyribonuclease III  
 PREDICTED: uncharacterized protein LOC105440670  
 PREDICTED: uncharacterized protein LOC588798, partial  
 PREDICTED: uncharacterized protein LOC105443839  
 PREDICTED: chondroadherin-like

PREDICTED: uncharacterized protein LOC100890838  
 centrosome-associated protein CEP250 isoform X4  
 uncharacterized protein LOC115383145  
 PREDICTED: uncharacterized protein LOC105444738  
 tripartite motif-containing protein 5-like  
 rho-related BTB domain-containing protein 1  
 prostatic spermine-binding protein-like  
 probable thiopurine S-methyltransferase  
 PREDICTED: uncharacterized protein LOC105439906  
 hypothetical protein LOTGIDRAFT\_145246, partial  
 acid ceramidase  
 hypothetical protein DJ031\_00320, partial  
 lysine-specific demethylase 8  
 Transposon TX1 uncharacterized 149 kDa protein  
 hydroxyacid oxidase 1  
 uncharacterized protein LOC114967315  
 deleted in malignant brain tumors 1 protein  
 hypothetical protein KP79\_PYT01408  
 zinc transporter ZIP10  
 piggyBac transposable element-derived protein 4-like  
 PREDICTED: uncharacterized protein LOC105339229  
 phospholipase B1, membrane-associated  
 4-hydroxyphenylpyruvate dioxygenase-like protein  
 PREDICTED: uncharacterized protein LOC100368444  
 transient receptor potential cation channel subfamily A member 1 homolog  
 PREDICTED: uncharacterized protein LOC764243 isoform X1

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**"Treated\_1 vs Control", "Treated\_2 vs Control" and "Treated\_1 vs Treated\_2"**

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RNA-directed DNA polymerase from mobile element jockey-like  
 putative RNA-directed DNA polymerase from transposon BS  
 reverse transcriptase family protein  
 hypothetical protein  
 uncharacterized protein LOC110990766  
 putative RNA-directed DNA polymerase from transposon X-element  
 PREDICTED: uncharacterized protein LOC100888345  
 polyprotein  
 RNA-directed DNA polymerase from mobile element jockey  
 P2X purinoceptor 7-like  
 hypothetical protein DSY43\_00385  
 uncharacterized protein LOC110975082

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**"Treated\_1 vs Control" and "Treated\_1 vs Treated\_2"**

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MAM and LDL-receptor class A domain-containing protein 1

PREDICTED: uncharacterized protein LOC105446188  
uncharacterized protein LOC106176709  
PREDICTED: uncharacterized protein K02A2.6-like

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**"Treated\_2 vs Control" and "Treated\_1 vs Treated\_2"**

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putative IQ motif and ankyrin repeat domain-containing protein  
PREDICTED: uncharacterized protein LOC584294  
PREDICTED: uncharacterized protein LOC105441319  
PREDICTED: uncharacterized protein LOC100893260  
Extracellular matrix protein 3  
PREDICTED: uncharacterized protein LOC105439932 isoform X1  
PREDICTED: hyalin  
transposase  
carboxypeptidase B  
serine/threonine-protein phosphatase 6 regulatory ankyrin repeat subunit B-like  
GD13022  
proteasome subunit beta type-7  
PREDICTED: uncharacterized protein LOC590790, partial  
transient receptor potential cation channel subfamily A member 1  
uncharacterized protein K02A2.6-like  
PREDICTED: uncharacterized protein LOC105442928  
Retrovirus-related Pol polyprotein from transposon 412  
PREDICTED: uncharacterized protein LOC105446133  
PREDICTED: uncharacterized protein LOC105437502  
mitochondrial 10-formyltetrahydrofolate dehydrogenase isoform X1  
PREDICTED: uncharacterized protein LOC106522096  
DNA topoisomerase 2-alpha-like  
PREDICTED: uncharacterized protein LOC105437506  
PREDICTED: uncharacterized protein F54H12.2-like  
kinesin-like protein KIF20A  
Elongator complex protein 3  
carbonyl reductase [NADPH] 1  
PREDICTED: uncharacterized protein LOC105437736  
non-specific lipid-transfer protein  
sulfotransferase 1C2A  
low-density lipoprotein receptor-related protein 12-like  
histone chaperone ASF1A  
hypothetical protein BSL78\_19340  
sushi, von Willebrand factor type A, EGF and pentraxin domain-containing protein 1  
retinol dehydrogenase 8  
uncharacterized protein LOC114544649  
PREDICTED: uncharacterized protein LOC100891882  
uncharacterized protein LOC113008516

PREDICTED: uncharacterized protein LOC100892824  
poly(U)-specific endoribonuclease isoform X2  
aldehyde dehydrogenase, mitochondrial  
PREDICTED: uncharacterized protein LOC100888657 isoform X1  
hyaluronidase-1 isoform X2  
PREDICTED: uncharacterized protein LOC100890018 isoform X5  
gamma-butyrobetaine dioxygenase  
microsomal glutathione S-transferase 1  
PREDICTED: alpha-amylase  
KLF2/4  
PREDICTED: uncharacterized protein LOC764164, partial  
uncharacterized protein LOC110989726  
protein dispatched homolog 1  
PREDICTED: uncharacterized protein LOC756169

**Supplementary Table S14.** Data of expression levels in embryos at the pluteus stage, deriving from sea urchins exposed to PAHs and PCBs, were reported as a fold difference (in red up-expressed genes; in light blue down-expressed genes) from control (represented by embryos deriving from adults of sea urchins reared in tanks with sediment without contaminants) at 48 hpf. Fold differences greater than  $\pm 1.5$  were considered significant. The genes were classified according the four functional classes (stress, development/differentiation, skeletogenesis detoxification, reported in the Supplementary Figure S5).

|                                    |                    | PAHs | PCBs |
|------------------------------------|--------------------|------|------|
| <b>Stress</b>                      | <i>ARF1</i>        | -2.1 | -0.5 |
|                                    | <i>caspase 3/7</i> | -1.6 | 0.7  |
|                                    | <i>CASP8</i>       | 5.0  | 5.6  |
|                                    | <i>cytb</i>        | 4.2  | 5.8  |
|                                    | <i>ERCC3</i>       | 1.8  | 0.2  |
|                                    | <i>GRHPR</i>       | 1.2  | 0.8  |
|                                    | <i>GS</i>          | 1.0  | 5.6  |
|                                    | <i>HIF1A</i>       | -0.2 | 3.4  |
|                                    | <i>hsp56</i>       | 0.6  | 6.0  |
|                                    | <i>hsp60</i>       | 0.4  | -0.1 |
|                                    | <i>hsp70</i>       | 0.1  | -0.7 |
|                                    | <i>MTase</i>       | 3.6  | 6.9  |
|                                    | <i>NF-kB</i>       | 0.1  | 0.1  |
|                                    | <i>PARP</i>        | 4.6  | 5.7  |
|                                    | <i>p38 MAPK</i>    | 0.7  | -0.1 |
|                                    | <i>p53</i>         | -5.7 | -3.8 |
|                                    | <i>SDH</i>         | 5.7  | 7.0  |
|                                    | <i>14-3-3 ε</i>    | 0.3  | 8.4  |
| <b>Development/Differentiation</b> | <i>ADMP2</i>       | 0.4  | 0.2  |
|                                    | <i>Alix</i>        | 2.0  | 2.8  |
|                                    | <i>Blimp</i>       | 1.0  | 2.7  |
|                                    | <i>BP10</i>        | 0.0  | 2.4  |
|                                    | <i>BRA</i>         | 2.8  | 2.8  |
|                                    | <i>DELTA</i>       | 0.1  | 0.2  |
|                                    | <i>δ-2-catenin</i> | -0.7 | -0.5 |
|                                    | <i>FOXA</i>        | 4.3  | 4.6  |
|                                    | <i>FoxG</i>        | 1.9  | 1.0  |
|                                    | <i>Foxo</i>        | 3.8  | 3.7  |
|                                    | <i>GFI1</i>        | 2.5  | 2.2  |
|                                    | <i>GOOS</i>        | 7.2  | 7.9  |
|                                    | <i>hat</i>         | -6.4 | -5.2 |
|                                    | <i>H3.3</i>        | 0.0  | 4.0  |



|                       |               |      |      |
|-----------------------|---------------|------|------|
|                       | <i>JNK</i>    | 7.5  | 8.2  |
|                       | <i>KIF19</i>  | -0.3 | 7.2  |
|                       | <i>nodal</i>  | -0.1 | 8.7  |
|                       | <i>NOTCH</i>  | 0.0  | 0.3  |
|                       | <i>OneCut</i> | 4.8  | 7.9  |
|                       | <i>SMAD6</i>  | 0.8  | 0.5  |
|                       | <i>sox9</i>   | 5.2  | 6.1  |
|                       | <i>TAK1</i>   | 7.0  | 7.5  |
|                       | <i>tcf4</i>   | 7.1  | 7.2  |
|                       | <i>TCF7</i>   | 6.0  | 6.5  |
|                       | <i>VEGF</i>   | -0.5 | 0.2  |
|                       | <i>Wnt5</i>   | 0.8  | 0.2  |
|                       | <i>Wnt6</i>   | 2.9  | 2.9  |
|                       | <i>Wnt8</i>   | 0.1  | 3.3  |
| <i>Skeletogenesis</i> | <i>BMP5-7</i> | 0.0  | 1.2  |
|                       | <i>C-jun</i>  | -0.1 | 0.0  |
|                       | <i>Nec</i>    | 5.1  | 6.0  |
|                       | <i>p16</i>    | 0.9  | 1.4  |
|                       | <i>p19</i>    | 5.2  | 6.8  |
|                       | <i>SM30</i>   | 5.8  | 13.6 |
|                       | <i>SM50</i>   | 10.0 | 10.6 |
|                       | <i>uni</i>    | -3.6 | 0.0  |
| <i>Detoxification</i> | <i>CAT</i>    | 0.2  | 0.5  |
|                       | <i>MDR1</i>   | 2.6  | 2.7  |
|                       | <i>MT</i>     | 3.6  | 3.6  |
|                       | <i>MT4</i>    | 2.7  | 2.0  |
|                       | <i>MT5</i>    | 2.3  | 0.5  |
|                       | <i>MT6</i>    | 4.2  | 4.3  |
|                       | <i>MT7</i>    | 2.3  | 2.6  |
|                       | <i>MT8</i>    | 14.7 | 17.1 |

**Supplementary Table S15.** Chemical analyses of heavy metals on sea water collected a time zero (t<sub>0</sub>, corresponding at the beginning of the experiments) and after one week of treatment with zeolite and activated carbon. Data are expressed as µg/L and the standard deviation is also reported for the values that are higher than the reference values.

| Heavy metals |    | t <sub>0</sub> | 1 week |
|--------------|----|----------------|--------|
| <b>Al</b>    |    | < 10           | < 10   |
|              | SD |                |        |
| <b>Sb</b>    |    | < 2            | < 3    |
|              | SD |                | 0.6    |
| <b>As</b>    |    | 24.6           | 21.5   |
|              | SD | 5.2            | 0.7    |
| <b>Ba</b>    |    | < 30           | 90     |
|              | SD |                | 16.9   |
| <b>Be</b>    |    | < 5            | < 5    |
|              | SD |                |        |
| <b>B</b>     |    | 4179.1         | 4802   |
|              | SD | 919.4          | 771.8  |
| <b>Cd</b>    |    | < 5            | < 5    |
|              | SD |                |        |
| <b>Co</b>    |    | < 2            | < 2    |
|              | SD |                |        |
| <b>Cr</b>    |    | 10             | 7      |
|              | SD | 2.3            | 2.3    |
| <b>Fe</b>    |    | < 50           | < 50   |
|              | SD |                |        |
| <b>Mn</b>    |    | 2.1            | < 1    |
|              | SD | 0.4            |        |
| <b>Hg</b>    |    | < 0.5          | < 0.5  |
|              | SD |                |        |
| <b>Mo</b>    |    | 17.7           | 24.9   |
|              | SD | 4.1            | 2      |
| <b>Ni</b>    |    | < 10           | < 10   |
|              | SD |                |        |
| <b>Pb</b>    |    | < 1            | < 1    |
|              | SD |                |        |
| <b>Cu</b>    |    | < 10           | < 10   |
|              | SD |                |        |
| <b>Se</b>    |    | 99.9           | 69.5   |
|              | SD | 22             | 37.5   |
| <b>V</b>     |    | 194.3          | 205    |
|              | SD | 41             | 6.4    |
| <b>Zn</b>    |    | 13.2           | 13.8   |
|              | SD | 2.6            | 0.2    |

**Supplementary Table S16.** Chemical analyses of ammonia, nitrates, nitrites and phosphates on sea water collected at time zero (t<sub>0</sub>, corresponding at the beginning of the experiments) and after one week (1 week) of treatment with zeolite and activated carbon. Data are expressed as mg/L and the standard deviation is also reported for the values that are higher than the reference values.

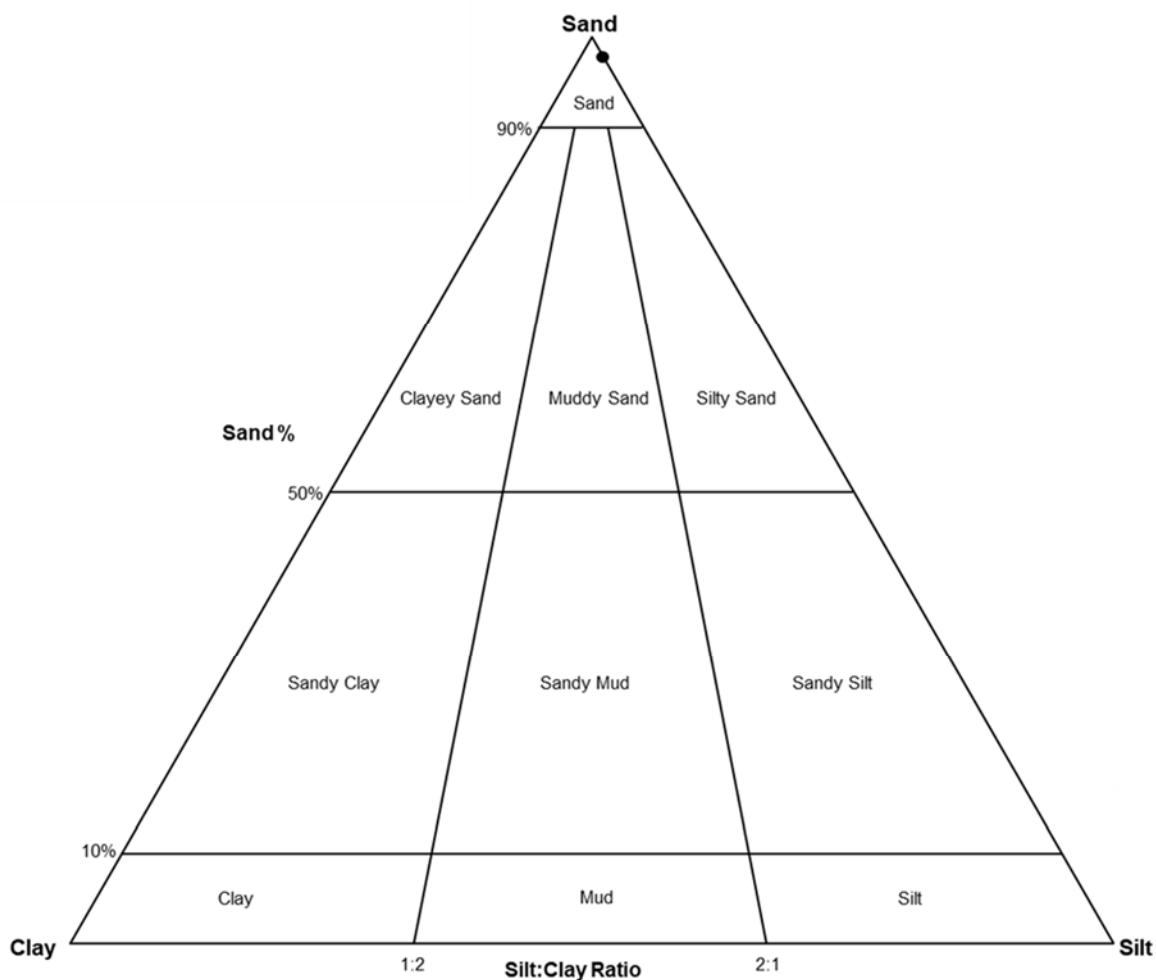
| Sample         | Ammonia | Nitrite | Nitrate | Phosphates |     |
|----------------|---------|---------|---------|------------|-----|
|                |         |         |         |            | SD  |
| t <sub>0</sub> | < 0.05  | < 0.05  | < 1     | < 0.15     |     |
| 1 week         | < 0.05  | < 0.05  | < 1     | 0.3        | 0.3 |

**Supplementary Table S17.** Sample names, condition and paired reads for each sample. Control: samples deriving from adults reared in tanks with water and sediment without contaminants; Treated 1, samples deriving from adults reared in tanks with sediment contaminated with PAHs; Treated 2, samples deriving from adults reared in tanks with sediment contaminated with PCBs;

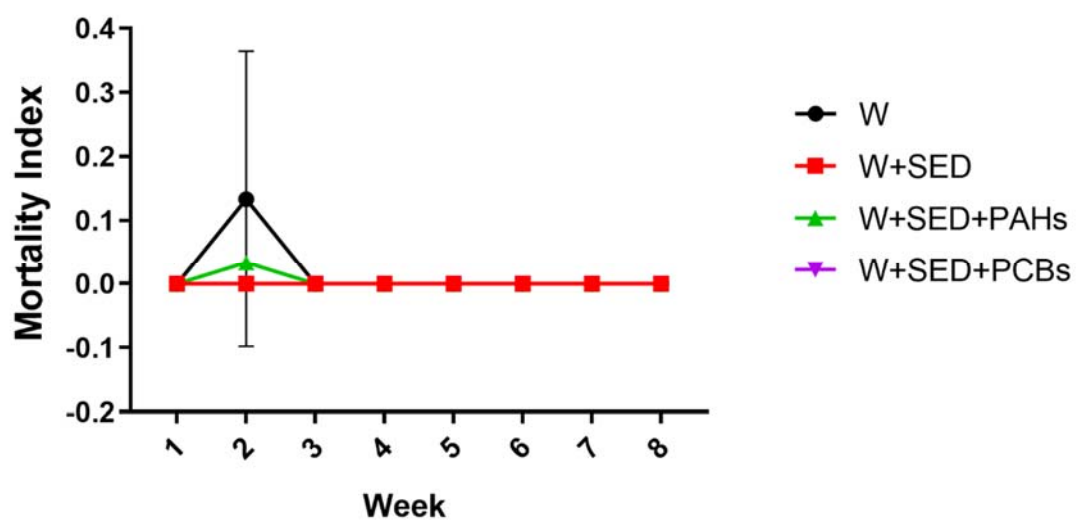
| Samples | Sample_Name | Condition | #Paired Reads |
|---------|-------------|-----------|---------------|
| 1       | Control_1   | Control   | 21,023,491    |
| 2       | Control_2   |           | 18,633,056    |
| 3       | Control_3   |           | 20,875,354    |
| 4       | Treated1_1  | Treated1  | 18,430,344    |
| 5       | Treated1_2  |           | 18,277,648    |
| 6       | Treated1_3  |           | 20,716,663    |
| 7       | Treated2_1  | Treated2  | 20,751,933    |
| 8       | Treated2_2  |           | 19,621,258    |
| 9       | Treated2_3  |           | 20,793,011    |

**Supplementary Table S18.** The number of reads obtained for the samples.

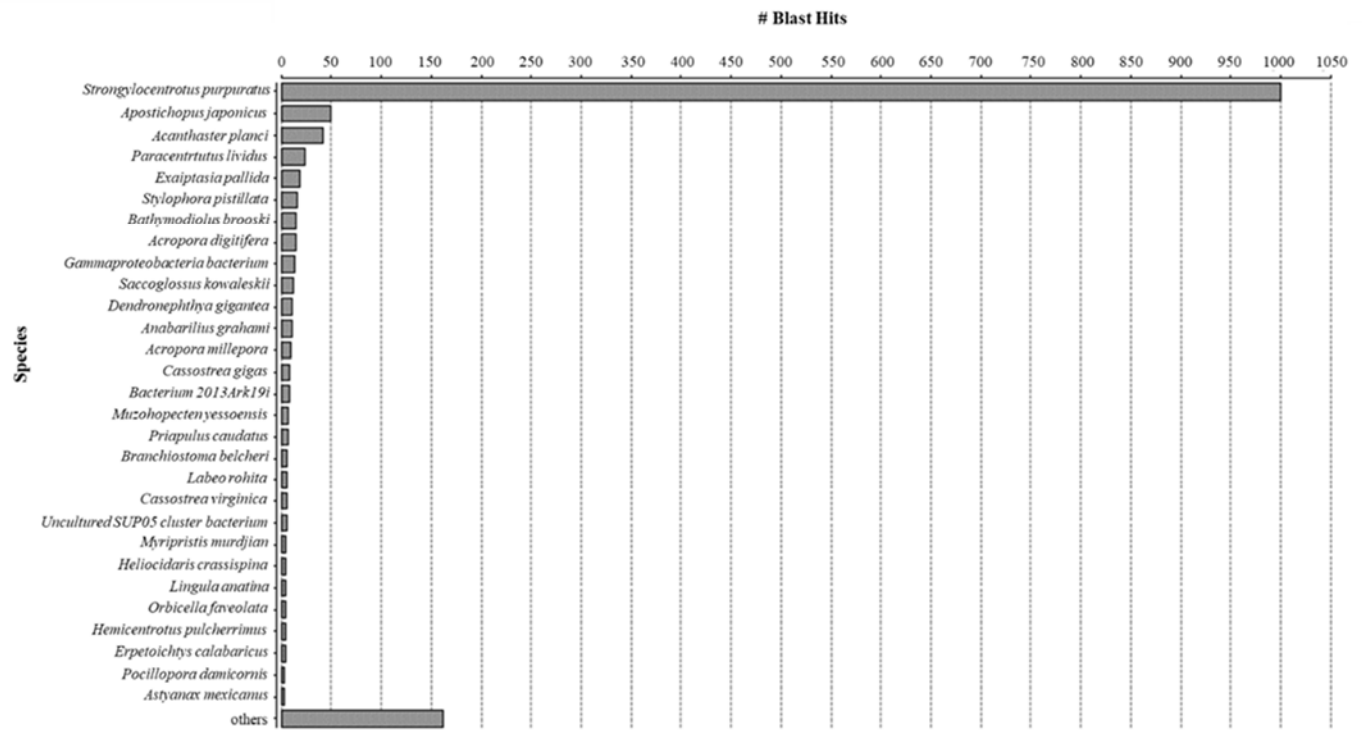
| Sample      | #Reads      |
|-------------|-------------|
| Pool_R1_001 | 179,122,758 |
| Pool_R2_001 | 179,122,758 |



**Supplementary Figure S1.** Data of the sediment grain size analyzed with GradiStat software (version 8.0 based) to calculate particle size statistics for sieve or laser granulometer data.

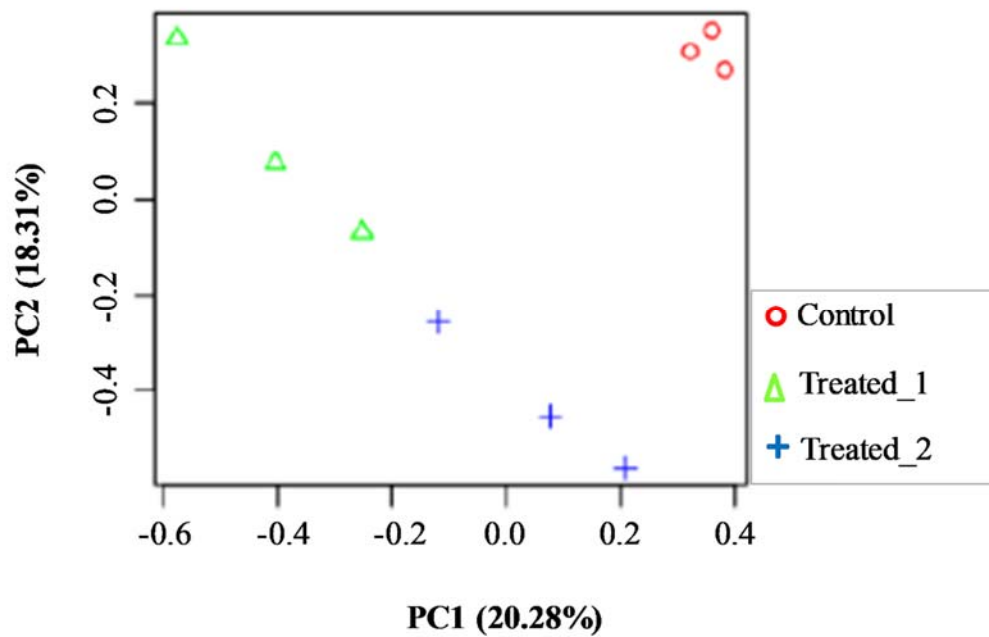


**Supplementary Figure S2.** Mortality index (calculated as the number of individuals died in a given time period/total number of individuals for the three experimental conditions) of the adult sea urchin *P. lividus* during the two months of exposure to the sediment contaminated with PAHs at 192  $\mu\text{g/Kg}$  and PCBs 0.15  $\mu\text{g/L}$  and in control condition represented by sediment without contaminants.



**Supplementary Figure S3.** Blastx top hit species distribution (reported as number) of matches with known sequences.

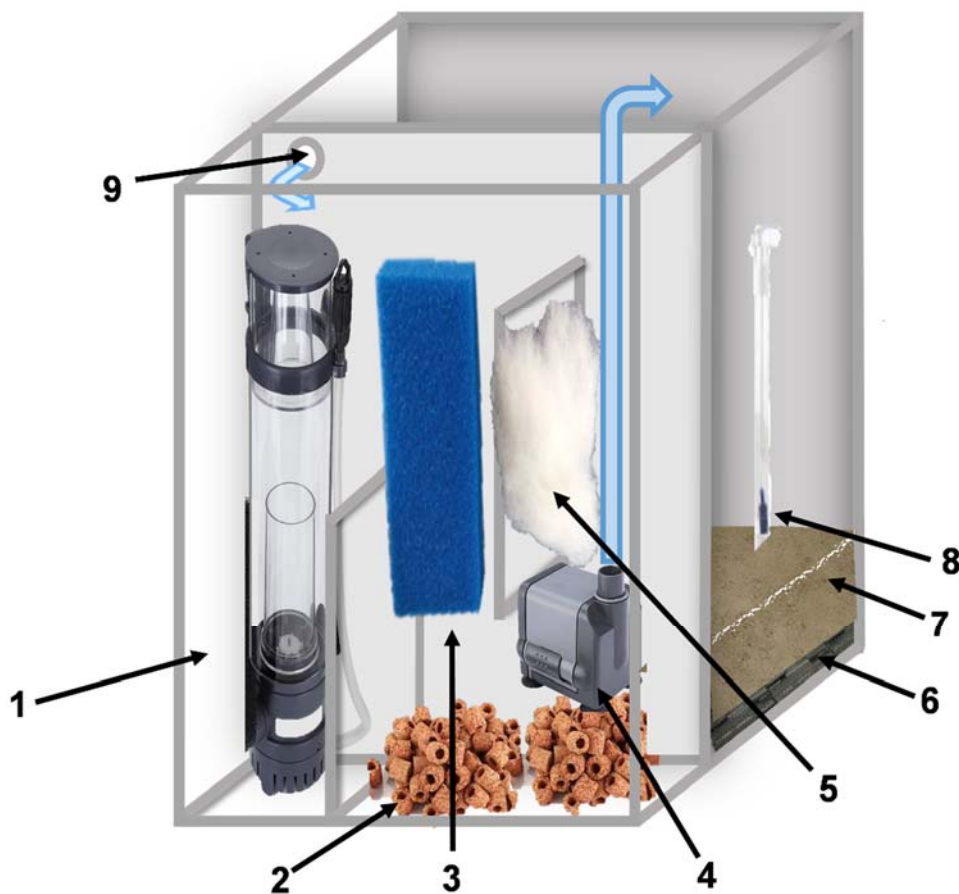




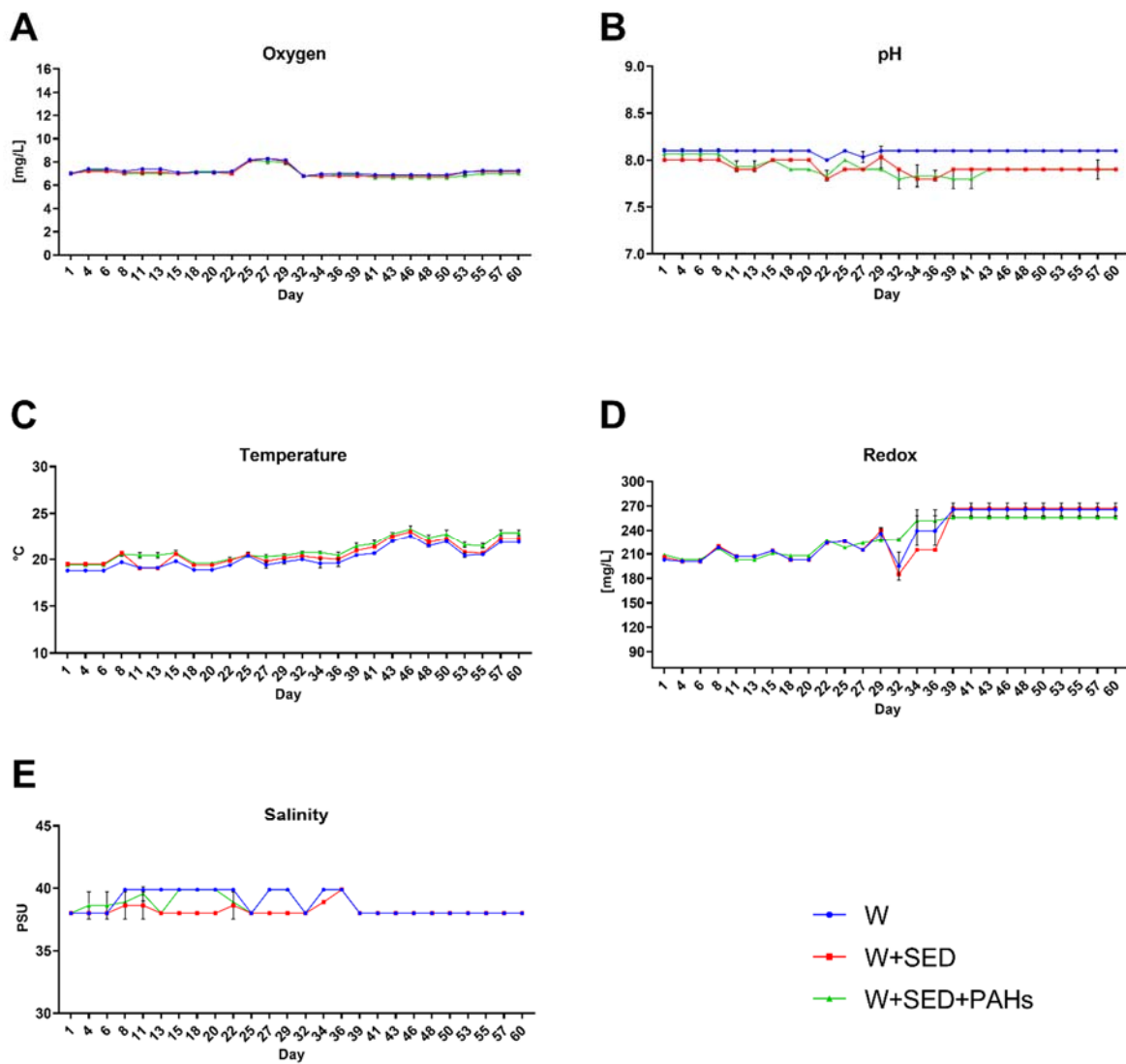
**Supplementary Figure S4.** Principal Component Analysis (PCA) to evaluate the correlation of samples: Control, Control1, C2 and C3, plutei from adult sea urchin *P. lividus* reared for two months in tanks with sediment without contaminants); the triplicated for plutei deriving from adults exposed for two months to sediment contaminated with PAHs (Treated 1\_1, 1\_2 and 1\_3); the triplicated for plutei deriving from adults exposed for two months to sediment contaminated with PCBs (Treated 2\_1, 2\_2 and 2\_3).

| Stress  | Skeletogenesis  | Development/<br>Differentiation  | Detoxification   |
|---|---|--|--|
| <i>hsp70</i><br><i>hsp60</i><br><i>hsp56</i><br><i>MTase</i><br><i>GS</i><br><i>cytb</i><br><i>p38 MAPK</i><br><i>14-3-3ε</i><br><i>caspase 3/7</i><br><i>caspase-8</i><br><i>NF-kB</i><br><i>p53</i><br><i>HIF1A</i><br><i>ERCC3</i><br><i>ARF1</i><br><i>GRHPR</i><br><i>SDH</i><br><i>PARP</i> | <i>SM30</i><br><i>SM50</i><br><i>BMP5-7</i><br><i>Nec</i><br><i>uni</i><br><i>p16</i><br><i>p19</i><br><i>Jun</i> | <i>hat</i><br><i>sox9</i><br><i>BP10</i><br><i>Blimp</i><br><i>Alix</i><br><i>Wnt5</i><br><i>Wnt6</i><br><i>Wnt8</i><br><i>δ-2-catenin</i><br><i>nodal</i><br><i>tcf4</i><br><i>TCF7</i><br><i>FoxG</i><br><i>FOXA</i><br><i>Foxo</i><br><i>GFI1</i><br><i>Onecut/Hnf6</i><br><i>TAK1</i><br><i>VEGF</i><br><i>JNK</i><br><i>ADMP2</i><br><i>BRA</i><br><i>DELTA</i><br><i>Gooscoid</i><br><i>H3.3</i><br><i>Kif19</i><br><i>NOTCH</i><br><i>SMAD6</i> | <i>MT</i><br><i>MT4</i><br><i>MT5</i><br><i>MT6</i><br><i>MT7</i><br><i>MT8</i><br><i>MDR1</i><br><i>CAT</i> |

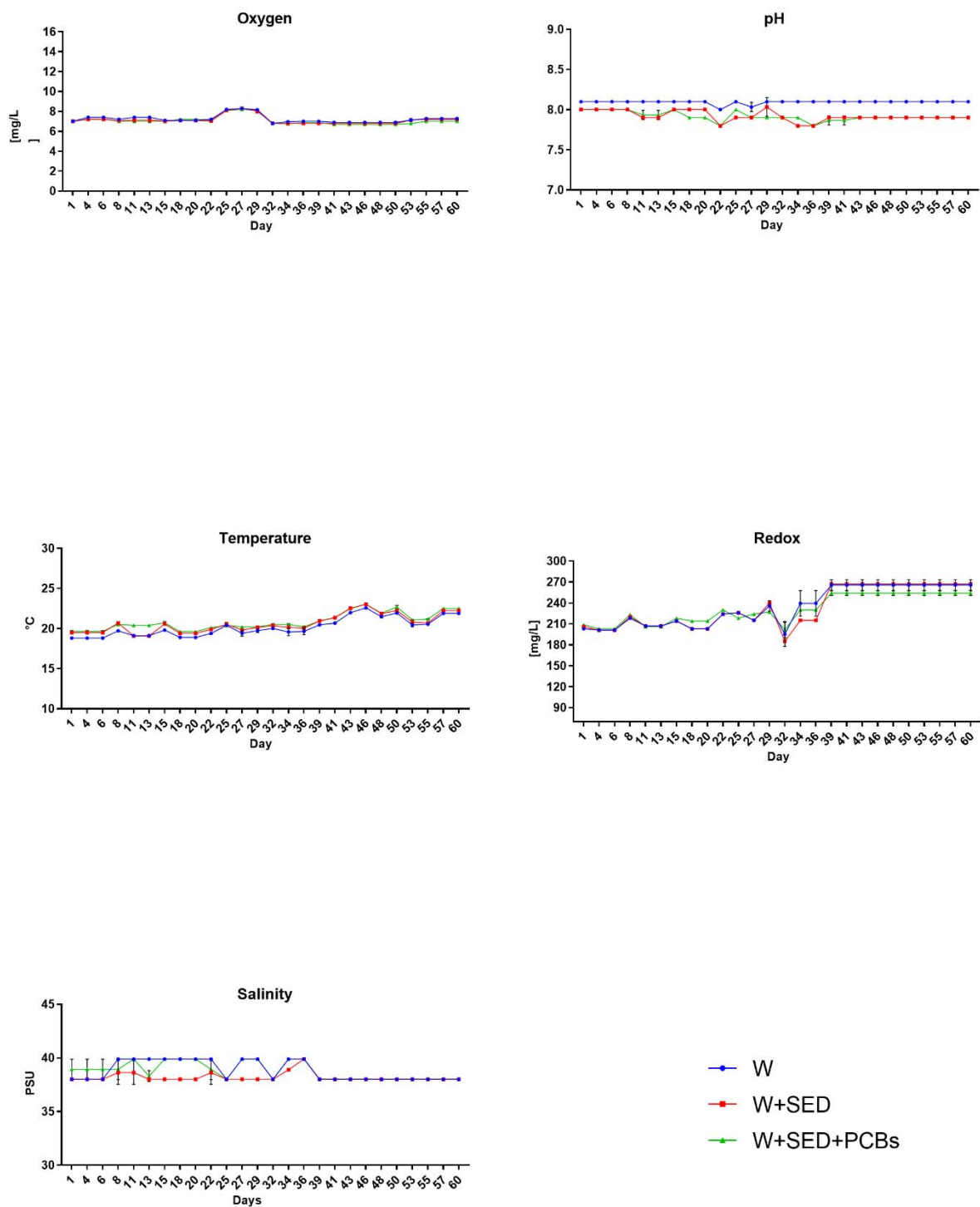
**Supplementary Figure S5.** Summary of the sixty-two genes analyzed by Real Time qPCR involved in stress, skeletogenesis, development/differentiation and detoxification process. Bibliographic references for the identification of these genes see Varrella et al. (2014), Varrella et al. (2017), Ruocco et al. (2017), Esposito et al. (2020).



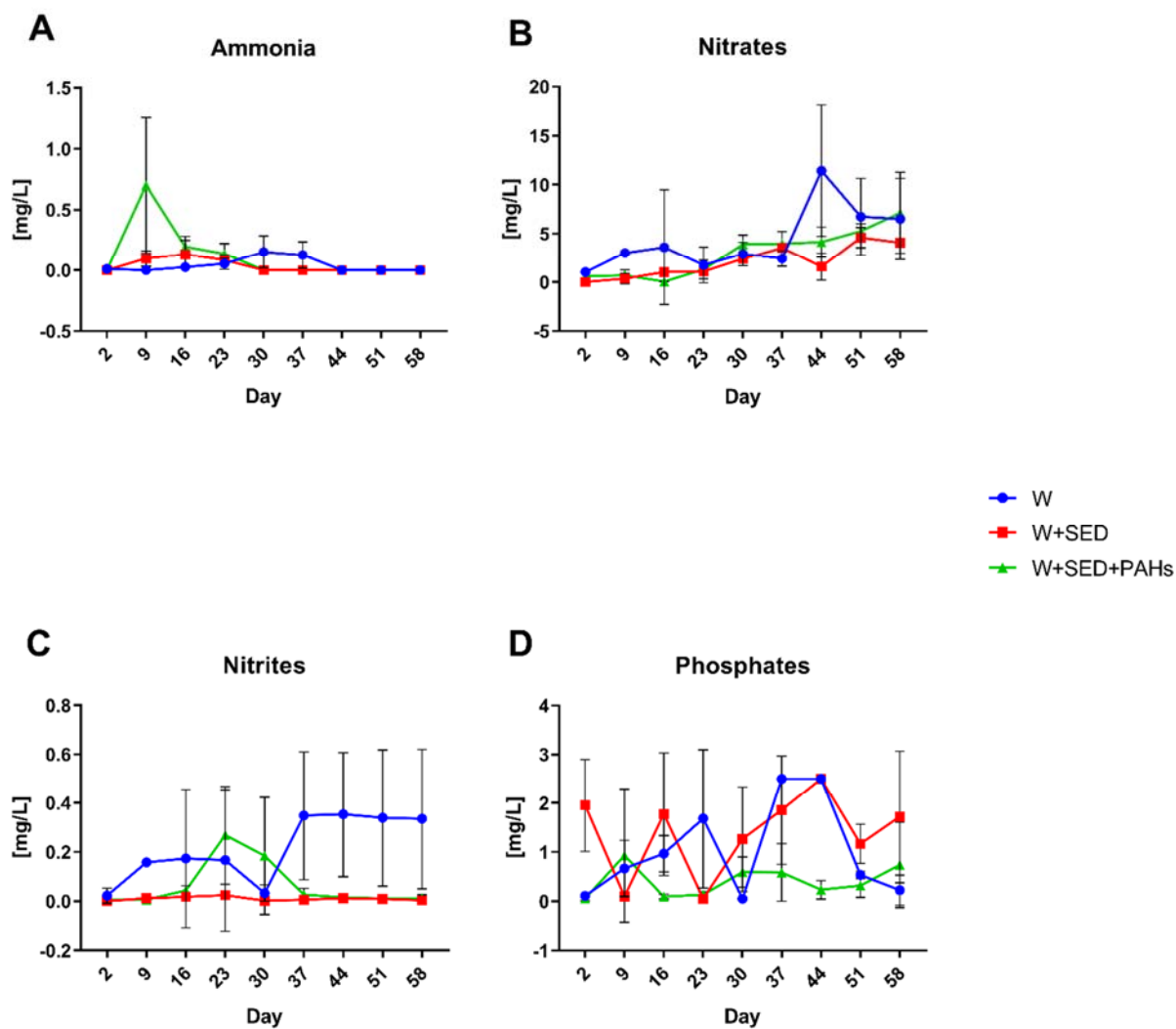
**Supplementary Figure S6.** Schematic representation (frontal view) of one of the twelve experimental tanks of the mesocosms, with the description of all the elements: (1) protein skimmer to remove organic matter, such as food particles and faecal pellets, using a pump in which establishes a contact between air and water flow, producing fine bubbles by Venturi effect. The water movement promotes the binding of molecules on the bubbles until their interface was saturated. When the bubbles increase on the top of water skimmer, condensed them into a foam collected in the cup. (2) Porous ceramic rings act as biologic filters, favoring the growth of nitrifying bacteria able to oxidize the ammonia into nitrites and then to nitrates. Bacterial activator is also added to promote the growth of *Nitrobacter* and *Nitrosomonas* species that adhere on the porous surface of these filters. (3) Synthetic sponge for a mechanical filtration that together with (5) perlon wool (consisting of thin glass fibres) for trapping particulate matter, such as faecal pellets and sediment suspended particles. (3) Pump for water recirculation. (6) Under-gravel filter to create a constant flow of water through (7) the sediment. (8) Air bubble stone for the aeration and oxygenation the water. (9). Flow of the water from tank to the filter compartment.



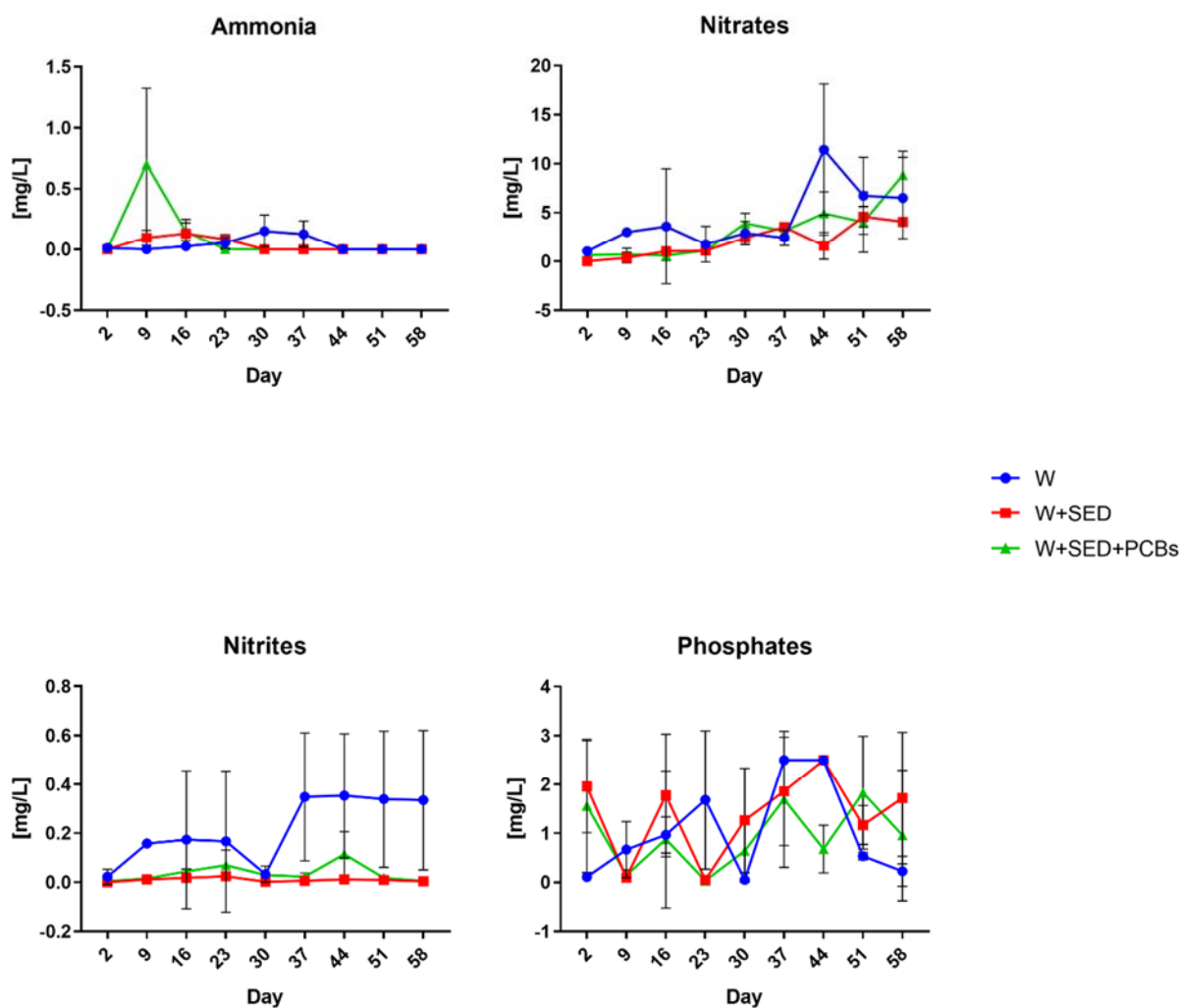
**Supplementary Figure S7.** Physical parameters (dissolved oxygen, pH, redox, temperature and salinity) of sea water checked three times a week in tanks at the three different experimental conditions: W, W+SED, W+SED+PCBs.



**Supplementary Figure S8.** Physical parameters (dissolved oxygen, pH, redox, temperature and salinity) of sea water checked three times a week in tanks at the three different experimental conditions: W, W+SED, W+SED+PAHs.



**Supplementary Figure S9.** Chemical parameters (ammonia, nitrates, nitrites and phosphates) of sea water checked once a week in tanks at the four different experimental conditions: W, W+SED, W+SED+PCBs. On X axis the days at which the data were collected.



**Supplementary Figure S10.** Chemical parameters (ammonia, nitrates, nitrites and phosphates) of sea water checked once a week in tanks at the four different experimental conditions: W, W+SED, W+SED+PAHs. On X axis the days at which the data were collected.