Wild Siamese-twins in black tip sea catfish, *Arius dussumieri* (Valencienes, 1840) from Gulf of Oman.

S M Al-Jufaily[1], Laith, A Jawad[2] & A N Al-Azi[1]
(1) College of Agriculture and Marine Science, P.O. Box 34 Al-Khud 123, Sultanate of Oman. E-mail: sjufaily@squ.edu.om
(2) 15 Birkinshaw Grove, Riverstone Terraces, Upper Hutt, Wellington, New Zealand. (Corresponding author).

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Siamese twins represent a condition in which two animals are conjoined to varying degrees. The occurrence of the phenomenon is well documented in different vertebrate groups (Witschi, 1952). Jussieu (1754) reported the first case among fish (*Carassius* sp.). It is common in both farmed and wild fish stock species (Hulata and Rothbard, 1978, Huang et al., 1987, Roberts, 1989, Bruno, 1990), where in the latter; only few cases survive beyond the absorbed yolk sac stage (Gordolla, 1968).

During a regular daily examination of the fishing yield in Al-Qareen village, Musnaa area, Batinah Region, 120 km north of Muscat, Gulf of Oman, Oman (June 2004), a twinned black tip sea catfish was found entangled in a traditional gillnet set at a depth of 3-5 m. They were in the post yolk sac-stage, fused against their caudal peduncle (Figure 1), and separate in an area in front of the anus. The twins measured 52.5 mm in total length. The nature of the fusion suggested that each of the two fish had separate internal organs except for a common anal opening. Each had its own dorsal and pectoral fins, and shared a common anal, pelvic and deformed caudal fins. The meristic characters of both twins are similar to those of the adult fish (Fischer & Bianchi, 1984).

A radiograph demonstrated the presence of overlapping caudal vertebral column for each fish (Figure 2). The two fish appeared to have separated from an area at the 21st vertebra (counting from the posterior end of the twins). Vertebral anomalies were noticed in the different body regions. The common caudal fin skeleton was completely deformed. All the hypurals and epiurals bones were deformed and appeared in a single irregular bony structure. Vertebrae of the lower twin were compressed at the dividing region (Figure 2,3). The centra of vertebrae 1-4 and 13-15 of both fishes were deformed and fused together with their neural and haemal spines free and normal. The 8th vertebra (counting from the splitting point) of the upper fish (Figure 4) had lost its posterior part and appeared compressed between the 7th and 9th vertebrae. Compressed, 11th & 12th vertebrae (counting from the dividing region of the lower fish (Figure 4) but not otherwise deformed were observed with their neural and haemal spines not deformed. Minor abnormalities including non-aligned and wavy neural and haemal spines of both fish from different body regions were also noted (Figures 2-4). The fin rays of the common anal fin were deformed and their connection to the underlying pterygiophores were lost. The last four fin rays of the dorsal fin of the upper fish was reduced in size while the remaining two appeared normal, but fused together. The dorsal fin rays of the lower fish were normal (Figures 2-4). The extracted otoliths of the upper fish are deeper than those of the lower fish.

Witsch (1952) suggested that over-ripeness of eggs leads to variety of developmental abnormalities resulted from decreased cohesion and interrelation between cells as well as between parts of inductive and of organ-forming regions. At this stage (post yolk-sac), there is no indication that the Siamese twin occurrence is a result of natural factors. On the other hand, the skeletal anomalies in the twins have various causes, but are usually considered to originate from mutations and from teratogenic effects of adverse environmental factors, such as mutagenic chemicals in the water (Longwell et al., 1992, Lien, 1997), or developing embryos and young individuals (Brown and Nunez, 1998, Vogel, 2000).

It seems likely that adverse environmental factors such as chemical pollution of the habitat may have played a role in producing skeletal abnormalities in the present twins. High levels of certain pollutants recorded from the Gulf of Oman (ROPME, 1999, De Mora et al., 2004) might have a direct effect on the developing stages. Pollution sources include thermal water from the power stations and hypersaline water from desalination plants (ROPME, 1999), wastewater

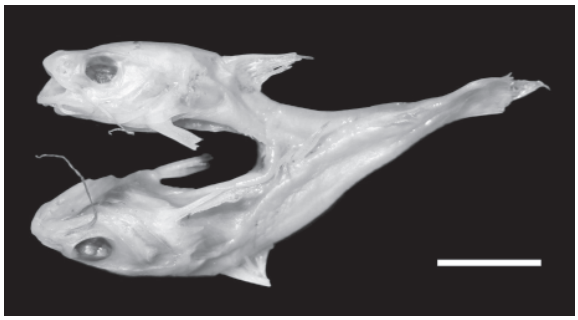

Figure 1. Conjoined twins of *Arius dussumeiri* (Valencienes, 1840). Scale bar =1cm

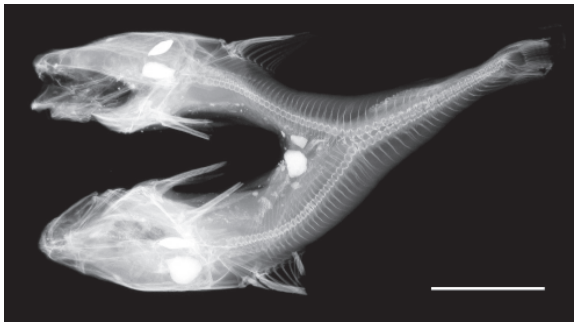

Figure 2. Radiograph of conjoined twins showing skeletal abnormalities. Scale bar = 1 cm.

Figure 3. Radiograph of conjoined twins showing skeletal abnormalities in the posterior region of the body. Scale bar =1cm.

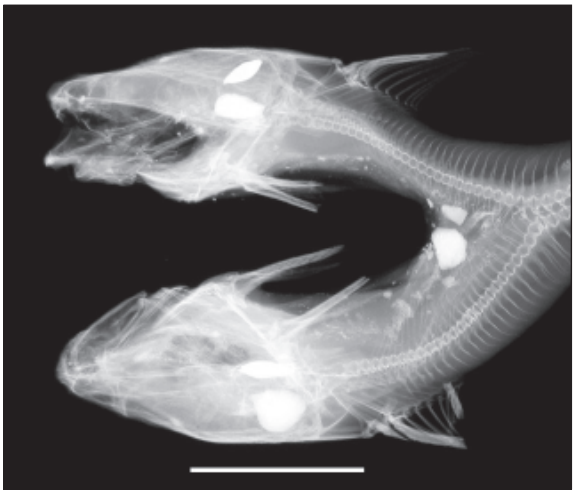

Figure 4. Radiograph of conjoined twins showing skeletal abnormalities in the anterior region of the body. Scale bar = 1cm.

treatment sites (Al-Sabahi, 1997), solid waste (Linden et al., 1990), recreation and tourism facilities (Salm, 1989, 1991, 1993), and oil refineries (Al-Kharus, 1996). The main pollutants present in the coastal water of the Gulf of Oman are heavy metals and hydrocarbon contaminants and organic pollutants (Fowler, 2002) such as the pesticide DDT, which has been implicated as a cause of skeletal deformities in other fish species (Bengtson et al., 1985).

Vertebral deformities such as those reported here in the Siamese twin may affect the biology of the fish indirectly through inhibiting its free-swimming movements (Sadler, 1990). An increased incidence of skeletal deformities among commercial fish species would suggest environmental deterioration and hence signal the need for prompt remedial action.

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