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Some Effects of the 1990/91 Gulf War on Hamoor (*Epinephelus tauvina*) From the Saudi Arabian East Coast

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Abstract - The 1990/91 Gulf War produced a heavy oil slick and a thick plume from oil fires in Kuwait, causing heavy oiling of the Saudi Arabian coast and low air temperatures and SSTs from February to at least October 1991. Ripe hamoor (*Epinephelus tauvina*) were taken in Saudi Arabian waters in spring 1991 but were absent in spring 1992. Parasite infestations were more frequent and heavier in spring 1992. These changes may have been caused by toxic effects of the oil, and would not appear in 1991 because fish were ripe when the pollution started. Data on pre- and postwar pollutant levels do not allow identification of possible causal agents. Sampling problems to be addressed in future baseline studies are discussed: samples need to be stratified by age.

The most important species fished in the Gulf between Iran and the Arabian peninsular are the shrimp, *Penaeus semisulcatus* and various groupers, mostly *Epinephelus* spp. dominated by *E. tauvina*. Mathews et al. (1993a, in press) documented the significant effects of pollution caused by the 1990/91 Iraq/Kuwait War on the shrimp stocks and fisheries of the western Gulf, but little work has been done on the effects of pollution on the fish stocks.

Groupers are taken widely in the Gulf, and Mathews and Samuel (1987) provided growth and mortality estimates for six species including the dominant *E. tauvina* (sometimes referred to as *E. suilis*) which is taken throughout the Gulf (Kuronuma and Abe

1972; FAO 1981). Mathews and Samuel (1992) summarize available growth and mortality data for *E. chlorostigma, E. latifasciatus, E. jayakari, E. areolutus, E. bleekeri* and *Cephalopholis miniatus*, as well as the dominant commercial species *E. tauvina* and the much rarer *E. malabaricus*. *E. tauvina* is an Indo-Pacific species and is widely regarded as an important commercial species in the Indo-Pacific area. It is popular in Gulf countries, Malaysia and Indonesia, and is cultured in Kuwait (e.g., Teng et al. 1981) and Malaysia (Teng, pers. comm.). Because of their importance, it is appropriate to draw attention to what is known about the effects of war-related pollution on groupers.

The 1990/91 Gulf War resulted in a major oil spill reported to contain from 4,000,000 to 12,000,000 barrels; this resulted in heavy oiling of the coast by prevailing anticlockwise currents in the Gulf (Mathews et al. 1993a, in press). At the same time a heavy smoke plume, caused by the firing of over 700 Kuwaiti oil wells by departing Iraqi troops, was swept by prevailing southeasterly winds along the Saudi Arabian coast. This reduced air temperatures beneath the plume by up to 8-10°C, and reduced mean SST (sea surface temperatures) by 2.9°C near Manifa, >200 km south of the oil fires (Mathews et al. 1993b; McCain, in press). Mathews et al. (1993b) showed that reduction in environmental temperature reduced shrimp (*Penaeus semisulcatus*) landings. They fitted a surplus production model which included effort and temperature and found a statistically significant fit, concluding that decreased temperature from March to May 1991 reduced spawning.

The lack of data precludes similar work on finfish populations. It is likely, however, that environmental changes associated with the 1990/91 Gulf War could also have impacted some of the Arabian fish populations.

A large fish processing plant which lands over 5,000 $t \cdot year^{-1}$ of fish and over 2,000 $t \cdot year^{-1}$ of shrimp, was visited in Dammam, East Coast Province, Saudi Arabia, in April-June 1992. When fish are processed, they are cleaned, opened with a sharp knife, skinned, gutted and cut into fillets. Any parasites in the muscles are removed by scraping them clean prior to filleting. Gut and gonad parasites are noted when the body cavity contents are removed. Systematic data records are not normally made but some data were obtained for the 1991-92 spawning seasons. The 1991 season spans the period of most intense pollution and overhead smoke: the oil

spills and fires were started in February 1991. The spills continued until at least July 1991 and the fires were not quenched until at least October 1991 (Mathews et al. 1993a, in press). By the 1992 spawning season, however, both the spills and fires had ceased. Data on gonad maturation were not recorded but gonadal condition is observed with attention by responsible, trained staff familiar with maturation stages (Laevastu 1965). They were interviewed and their anecdotal observations were summarized.

Landings of hamoor (*Epinephelus tauvina*) were made from the whole of Saudi Arabian Gulf waters, i.e., from fishing grounds near the Kuwaiti to the Bahraini border, covering 250 km. Fishing occurs down to about 25 m.

The spawning period (March-May) observed for hamoor in Saudi Arabia corresponds to the normal spawning period for hamoor in Kuwait from 1978 to 1988 (Mathews and Samuel, unpubl. data). Size at sexual maturation in the Saudi Arabian stock (35-45 cm TL) was comparable to that reported in Kuwait (Hussein and Abdulla 1977). Hamoor >45 cm TL processed during February-May 1991 had large, swollen and mature gonads in stages IV, V and VI (Table 1). Similar hamoor processed from February to May 1992 had very small gonads (stages I-II). Ripe gonads were, however, seen in hamoor >45 cm TL imported from the United Arab Emirates, >200 km further south, and processed in the same way.

Parasitic manifestations of hamoor were more intense and frequent in the 1992 spawning season, than in 1991 (Table 2).

Table 1. Comparing reproductive activity of hamoor in 1991 and 1992.

	March-May 1991	March-May 1992
Portion of mature hamoor >35-45 cm TL (%)	>75	0

NB: Anecdotal information obtained through discussions and where feasible (April-June 1992) confirmed by personal observations at the SAFISH plant, Dammam, East Coast Province, Saudi Arabia.

Table 2. Parasite burden of hamoor (*Epinephelus suilis*) in fish caught by vessels operating in the Saudi Gulf fishery.

	March-May 1991	March-May 1992
Percentage of fish infested	93.7%	100.0%
Mean number of parasites/fish	37	100

The suspension of spawning in early 1992 may have been caused by stress related to the pollution events of the 1991 oil slicks and fires (Mathews et al. 1993a). Such stress effects would not be noted in spring of 1991 because the fish were already maturing or mature by the time the pollution occurred. The long-term effect of the pollution suggests that the reductions in air and water temperature, which would have ceased with the extinction of the oil fires in October 1991 (Mathews et al. 1993a, in press, 1993b), did not affect the maturation of hamoor, which was suspended only in 1992. It is therefore possible that the toxic effects of the pollutants may have been responsible for the suppression of hamoor spawning. Mathews et al. (in press) noted that toxic effects of pollutants may have produced morbidity and therefore unusually high mortality rates in the shrimp fishery. The higher 1992 infestation levels may also have been caused by pollution-related stress, which could take time to manifest because of the period likely to be needed for completion of the parasites' life cycles (about 1 year?).

As there is no other record of such a severe spawning interruption over so large an area, it is impossible to predict when the hamoor will spawn again. Hamoor are long lived (up to 22 years; Mathews and Samuel 1987) so that the loss of 1-2 years' spawning may not have a serious long-term effect.

There are relatively few observations on pollutant levels in Gulf fish, so that it is not possible to identify any particular pollutant as the possible cause of changes in infestation and maturation. In any case, sampling procedures for Gulf fish have usually ignored the possible effects of age on pollutant accumulation in fish tissues: adequate baselines are therefore not always available. For instance, Mathews et al. (1984) and Anderlini et al. (1986) reported Hg levels in *Lutjanus coccineus* (commonly called *L. malabaricus* in the Gulf literature) with higher levels in large old fish (<1.0 $\mu g \cdot g^{-1}$ dry weight in small fish <20 cm TL and <4 years old, to >15 $\mu g \cdot g^{-1}$ for larger fish >50 cm TL and 8-25 years old). Levels of Cd, Cu, Fe and Mn (Anderlini et al. 1986) also increased significantly (by 5-20 times) with size and age. On the other hand, Readman et al. (1992) reported hydrocarbon levels from 8-50 $\mu g \cdot g^{-1}$ dry weight from *Arius thalassinus* in Kuwait, *Lethrinus nebulosus* from Saudi Arabia, *Epinephelus tauvina* from Bahrain and Oman, *E. jayakari* from Bahrain, *Acanthopagrus bifasciatus* from Bahrain, and *E. suilis* from the United Arab Emirates, all sampled after the 1990/91 Gulf

War. Mathews and Samuel (1992) summarized available data on maximum age in the Kuwaiti populations: they reach 15 years in *A. bifasciatus*, 19 years in *A. thalassinus*, 20-30 years in *Epinephelus* spp., and up to 46 years in the Kuwaiti *L. coccineus* population. The Kuwaiti populations are probably part of Gulf wide stocks of these species (FAO 1981; Baddar 1982; Mansour 1982; Baddar 1987; Baddar and Mathews 1991) and Kuwaiti ages are likely to be representative of those found elsewhere in Gulf fish populations. Therefore, it is likely that the failure of Readman et al. (1992) to determine the age of the fish sampled may have led to a great deal of variation in the concentrations of pollutants reported. Sampling problems should be addressed more systematically where baseline and impact-related pollutant levels in long-lived Gulf, and indeed tropical, fish are to be monitored and compared.

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