

A Preliminary Survey of Fishes in the Arabian Gulf after War Time Oil Spillage

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ABSTRACT. A preliminary survey of the fish fauna of the coastal waters of the western side of the Arabian Gulf, between Kuwait and Qatar was carried out during leg IV of the R/V MT. Mitchell (23 April – 3 May 1992). About 40 fish species were recorded during this survey. *Leiognathus fasciatus* was the most common forming 29% of the total catch, followed by *Lethrinus* spp. (12%) and *Pelates quadrilineatus* (12%). Both the species richness and fish population density exhibited wide and irregular variation at the different stations. Significant numbers of juveniles of 14 different species were captured indicating successful spawning and recruitment since the Gulf War (Jan.-Feb. 1991). Analysis of adult specimens of Lethrinidae showed no significant change in growth; sexual maturation and spawning were normal

Introduction

The Arabian Gulf is a semi-enclosed body of water (24°-30'.30"N), covering an area of 226000 km² with a mean depth of 35 meters, salinity range of 37-50‰ and temperature range of 15-40°C (Purser 1973). Being a major oil-production area, it is subjected to accidental spills either through oil-field activities and/or tanker accidents. In addition, the area has an unfortunate history with three some incidents during the last 10 years, where millions of barrels of crude oil were discharged into the Gulf. During the Gulf War (January to February 1991), Iraqi troops spilt oil on the Arabian Gulf from the Kuwaiti oil-wells. The oil experts estimated the quantity to be 8.0-11.5 million barrels. In addition to that, chemical oil dispersants are used routinely for marine oil spill clean-up operations and may also have adverse effects on the marine ecosystem (Ukeles 1965; Lewis 1971; Ballen *et al.* 1972; Wilson 1976; Mommaerts 1973; Breakley and Boaden 1974; Czyzewska 1976; Ordzie and Garofalo 1981).

In 1992 there was evidence that oil spillage in Kuwaiti, Saudi and Bahraini waters during the Gulf war killed many species at that time, but there was no data on long term effects of marine life in the Gulf.

The Regional Organization for the Protection of the Marine Environment (ROPME), and the National Oceanic and Atmospheric Administration (NOAA) organized a 100 day cruise to study the oil effect.

This report presents results from studies carried out on leg 4 of the expedition under the theme "Impacts on Fishery Organisms and Biology Systems". The study focused on fish species distribution, and biological characteristics.

Materials and Methods

Growth and fecundity of the dominant species were determined for comparison with pre-war data for this area, mainly for the fishes of the family Lethrinidae which constitute 26% of the commercial landings in Qatar and Saudi Arabia.

Leg 4 commenced on the 23rd of April, 1992 at the western side of the Arabian Gulf from Kuwait and worked towards Qatar till May 3, 1992 at Doha (Fig. 1 & Table 1).

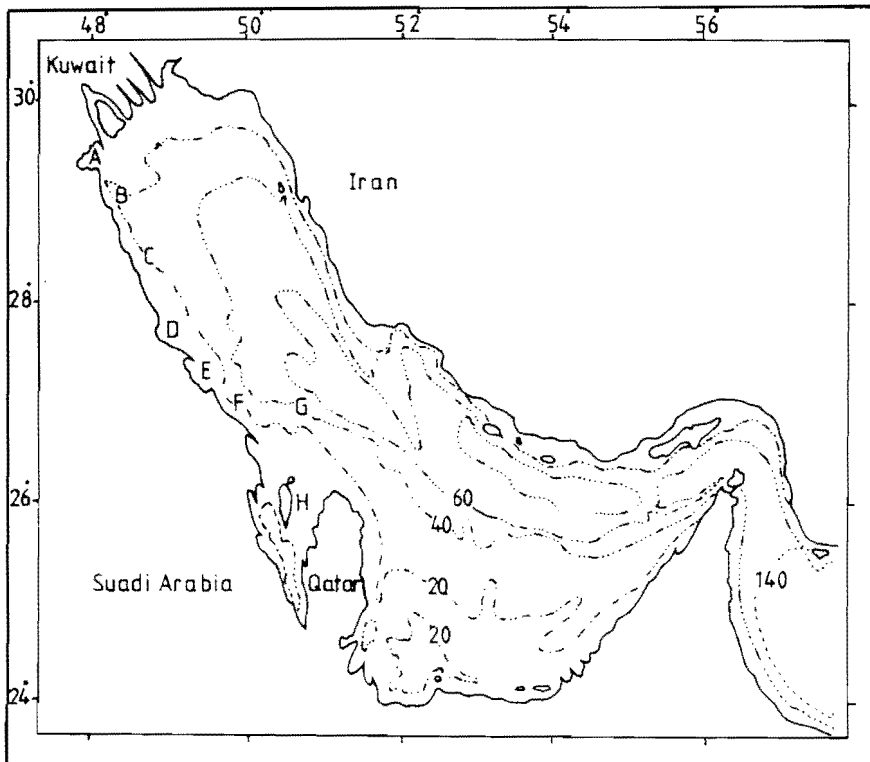


FIG. 1. The station sites and Bathymetry of the Gulf.

TABLE 1. The information in leg 4.

St. no.	Date	Time of operation	Latitude	Longitude	Max Depth	Location
A	23 Apr 92	8 am - 8 pm	29°29' N	48°02' E	30	Jun al Kuwait
B	25 Apr 92	8 am - 8 pm	28°58' N	48°22' E	17.9	Ras al Qualayah
C	26 Apr 92	8 am - 8 pm	28°22.2' N	48°37.70' E	18.3	Dawhat al Asli
D	27 Apr 92	8 am - 8 pm	27°42.1' N	49°15.1' E	13.3	Manifah
E	28 Apr 92	8 am - 8 pm	27°23.6' N	49°36.9' E	21.3	Abo Ali, north
F	29 Apr 92	8 am - 8 pm	27°21.6' N	49°52.8' E	32	Dawal Abu Ali
G	30 Apr 92	8 am - 8 pm	27°2.45' N	50°41.75' E	34	Rennie Shoals
H	01 Apr 92	8 am - 8 pm	26°8.27' N	50°49.64' E	14	Bahrain / Qatar
I	02 May 92	8 am - 8 pm	25°56.05' N	51°39.39' E	18	Ras Lafan

Work was conducted from NOAA research vessel "MT Mitchell", which was equipped with a small demersal otter trawl with 7.5 m mouth opening, 10.8 m long with a mesh size of 38 mm in the body of the net and 6.4 mm mesh in the liner of the cod end. Tows were less than 30 min in duration, typically in water depths of less than 20 m. Trawl samples were opportunistically supplemented by fish traps, baited hooks and angling. Additional samples were also purchased from fishing boats operating in the vicinity of some of the sampling stations. The samples thus represented qualitative collections and cannot be regarded as quantitative samples of fish abundance.

Total length (L), total weight (Wt), sex and species were recorded for each fish. Samples were taken from flesh, gills, liver, heart, stomach, otoliths and ovaries for subsequent laboratory analysis. Otoliths were stored dry and ovaries were preserved in 10% buffer formaldehyde solution. Only large fish of commercial interest were considered.

Fecundity, total length, total weight and age relationship were determined for the dominant species. Aging was carried out by reading otoliths rings using conventional techniques.

The ovaries of ripe females were weighed to the nearest 0.01 gram, and cut into 6 to 8 pieces and preserved in 70% alcohol for 24 hours to remove formaldehyde. Three sub-samples (weighed to the nearest 0.0001 gram), were usually taken for counting. The eggs, which contained more than one oil globule of different stages, were then carefully placed on egg counting slides, with a few drops of a solution of 15% sodium hydroxide to loosen the adhesive layer and counter under a binocular

microscope ($\times 5$). In all cases the average of all counts was used for fecundity estimate.

$$F = \frac{W \times N}{S} \quad (1)$$

Where :

F = Total egg number, or absolute fecundity, W = Total ovary weight, S = Sub-sample weight, and N = Sub-sample egg number.

The following relationships were fitted as follows :

$$F = a L^b \quad (2)$$

where (L), length in cm, and a & b are constants.

$$F = +a Wt^b \quad (3)$$

where (Wt), weight in g, and a & b are constants.

$$Wt = a L^b \quad (4)$$

Length and weight data were also analyzed with respect to age as determined from otoliths.

Results and Discussions

Distribution

A total number of 41 different taxa were caught during the present survey (Table 2). The most abundant fish species were *Leiognathus fasciatus* (Lacepede) 29%, *Pelates quadrilineatus* (Bloch) 12% and members of the family Lethrinidae 12%, all accounted for more than 50% of the total catch (Fig. 2).

Three species of Lethrinidae, *i.e.* *Lethrinus lentjan* (Lacepede), *Lethrinus kallopterus* (Bleeker) and *Lethrinus nebulosus* (Forsk.) were recorded.

The number of fish caught at each station is shown in Fig. 3. These numbers, however, do not necessarily represent true abundance since for certain reasons fishing was curtailed at some stations. However, the relative population density of the fish recorded varied widely at the different stations. Station A has the largest density with 47% of the total number of fish specimens recorded followed by station D (18%), station E (15%) and station F (10%).

Concerning species richness at the different stations and within the limitations mentioned above, it is apparent that stations A and E by far harboured the largest number of species, followed by station F and D (Table 2). At station A (Jun al Kuwait) the catch was dominated by juvenile *Leiognathus fasciatus* with 174 individuals in the samples. At two stations no fish were captured; station C (Dawhat al Asli) and station H (Bahrain/Qatar). At station D (Manifah) and station G (Rennie Shoals) few commercial size fish were caught; the catch comprising mostly small juveniles.

TABLE 2. (Contd.)

Latin name	A1	A2	TA	B	C	D	E	F	G	H	I	Sum
<i>Rhinopterus adspersa</i>		1	1									1
<i>Arothron stellatus</i>							1					1
<i>Rachycentron canadus</i>							1					1
<i>Gerres filamentosus</i>								1				1
<i>Scomberomorus commersoni</i>									1			1
Total catch	261	81	342	28	0	135	115	78	27	0	24	749
Mollusca												
<i>Loligo vulgaris</i>	2	3	5	2								7
<i>Sepia</i> spp.				1			1					2
Crustacea												
<i>Panaeus semisulcatus</i>				2								2

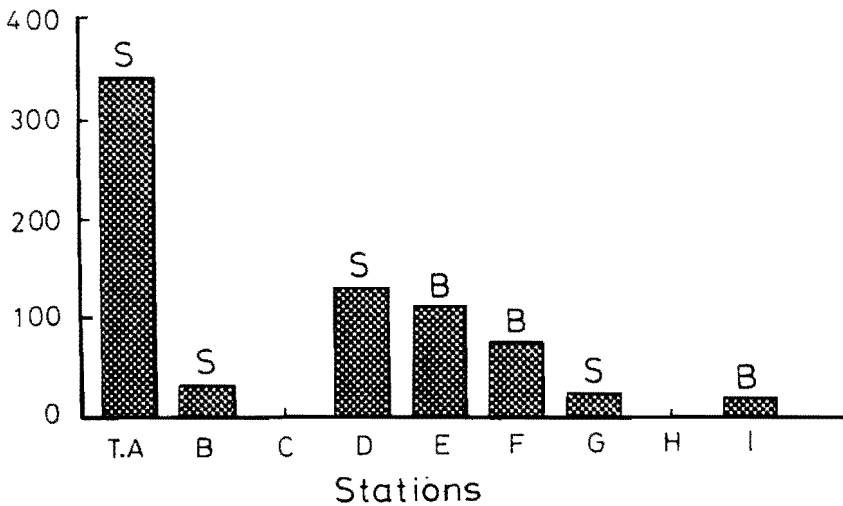


FIG. 3. The variation of the total number of fish specimens collected at the different stations (S = small fish and B = big fish).

Several species showed a northern or southern trend of distribution in the Gulf. Thus the following species were rather confine to the northern part of the west coast of the Gulf: *Leiognathus fasciatus*, *Pelates quadrilineatus*, *Solea bleekeri*, *Lutjanus*

johni, Nemipteridae, *Lutjanus malabricus* and *Alectis indicus*, while Lethrinidae, *Epinephelus areolatus* and *Lutjanus* spp. were more or less restricted to the southern part. A few commercial species were captured by angling but direct purchase from fishermen was most successful at some stations. The small demersal trawl used was very inefficient in sampling commercial fish, as it mostly captured fingerlings.

Fecundity and Growth

The Lethrinidae are important commercial species in the Gulf, and were subjected to detailed analysis as exemplified by *Lethrinus nebulosus*.

a: *L. lentjan* and *L. kallopterus*

The log fecundity with log weight regression line fitted to the individual observations gives the fecundity – weight relationship (Fig. 4).

$$\text{Log F} = 0.75126 + 0.7968 \text{ Log Wt}$$

Where $r = 0.6691$ and $P = < 0.005$

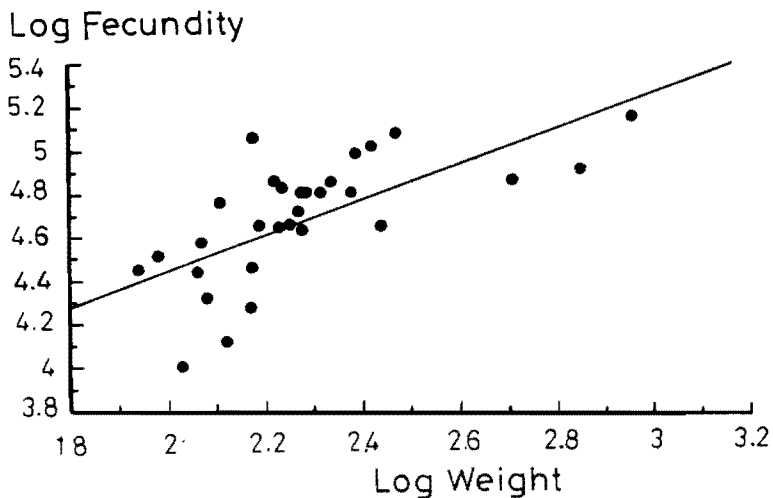


FIG. 4. The relationship between log weight and log fecundity for *L. lentjan* and *L. kallopterus*.

Length – Fecundity Relationship

$$\text{Log F} = 94.27 + 1.9941 \text{ Log L}$$

Where $r = 0.4697$ and $P = < 0.005$ (Fig. 5).

Length – Weight Relationship

The length – weight relationship of the *L. lentjan* and *L. kallopterus* are given by the equation (Fig. 6) :

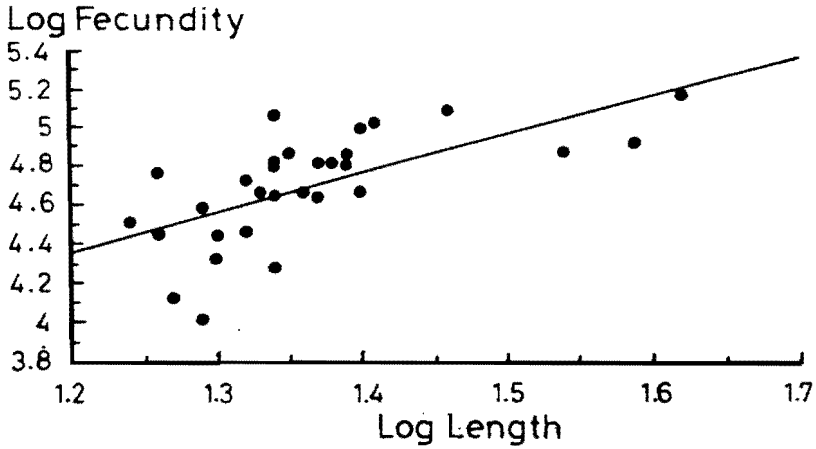


FIG. 5. The relationship between log length and log fecundity for *L. lentjan* and *L. kallopterus*.

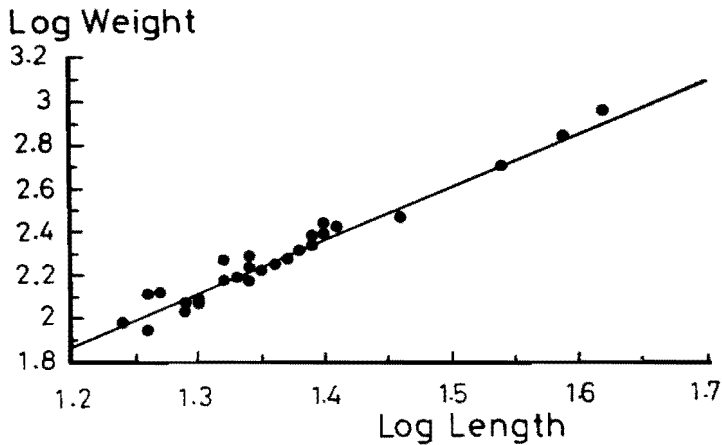


FIG. 6. The relationship between length and weight for *L. lentjan* and *L. kallopterus*.

$$\text{Log W} = 0.06566 + 2.5403 \text{ Log L}$$

Where $r = 0.6461$ and $P = < 0.005$

Age

Ages were extracted by counting otolith ring. Ages ranged from 2 to 7 years. Fig. 7.1 shows the relationship between the age and length and Fig. 7.2 shows the relationship between age and weight.

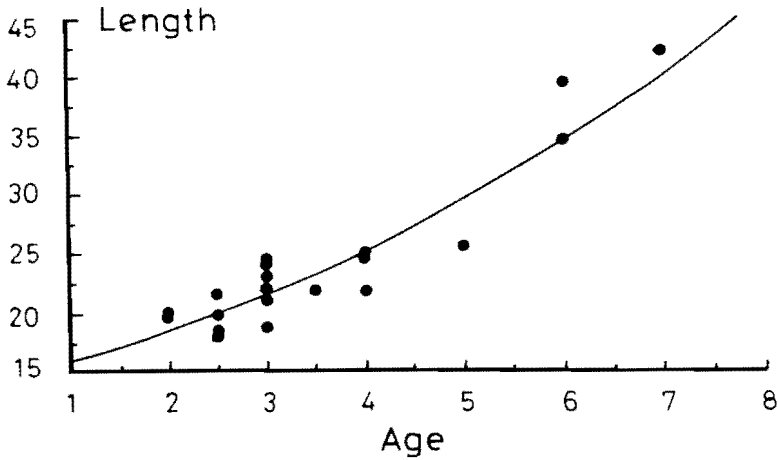


FIG. 7.1. The relationship between age and length ($r = 0.924$ and $P = < 0.00002$).

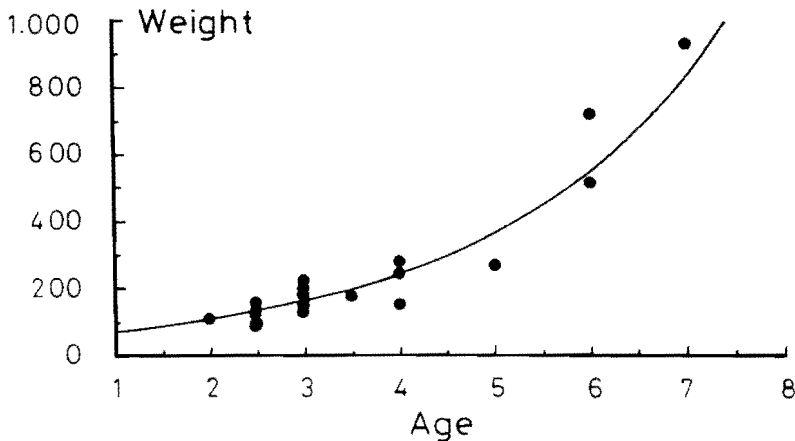


FIG. 7.2 The relationship between age and weight ($r = 0.906$ and $P = < 0.001$).

b: *Lethrinus nebulosus*

A previous study by Ibrahim *et al.*, (1989) on this species provides a basis for comparison with pre-war conditions. Spawning takes place in April to May, so present samples were taken during the spawning season. The following computations were made on the fish of *L. nebulosus*.

Weight-Fecundity Relationship

The log fecundity with log weight regression line fitted to the individual observations give the relationship :

$$\text{Log } F = 0.7040 + 1.5630 \text{ Log } Wt$$

Where $r = 0.9596$, and $P = < 0.0005$ (Fig. 8).

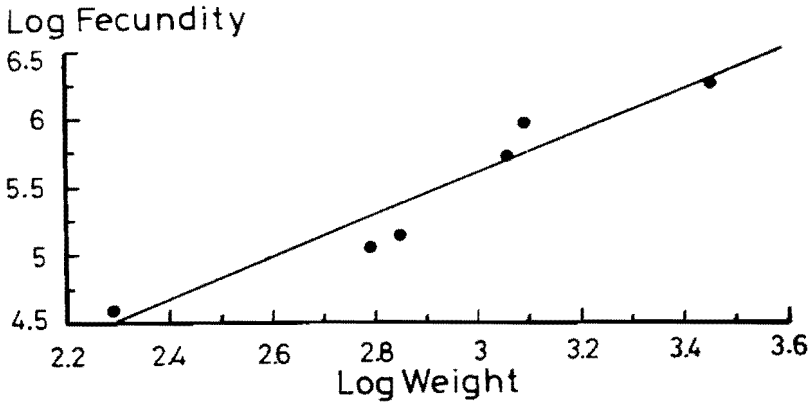


FIG. 8. The relationship between log weight and log fecundity for *L. nebulosus*.

Length-Fecundity Relationship

When plotting the absolute fecundity with the log length, a straight relation is evident. The relationship between log fecundity and log length is expressed in the form,

$$\text{Log } F = 0.01595 + 4.5458 \text{ Log } L$$

Where $r = 0.9569$, and $P = < 0.0005$ (Fig. 9).

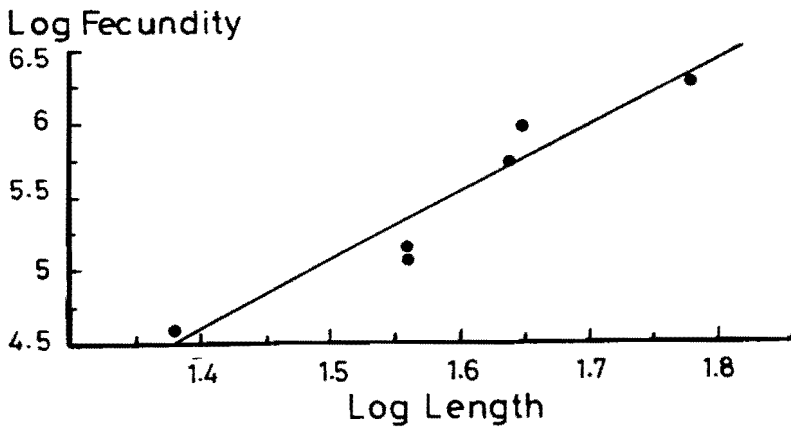


FIG. 9. The relationship between log length and log fecundity for *L. nebulosus*.

Length-Weight Relationship

Ibrahim *et al.* (1989) found that the length-weight relationship was given by the equation :

$$W = 0.02 L^{2.89} \text{ for } L. \textit{nebulosus} \text{ in Qatar waters.}$$

The length-weight relationship of *L. nebulosus* in present work is given by the equation:

$$W = 0.01889 \times L^{2.9125}$$

Where W = weight in grams, L = length in centimeters, $r = 0.9986$, and $P = < 0.015$ (Fig. 10).

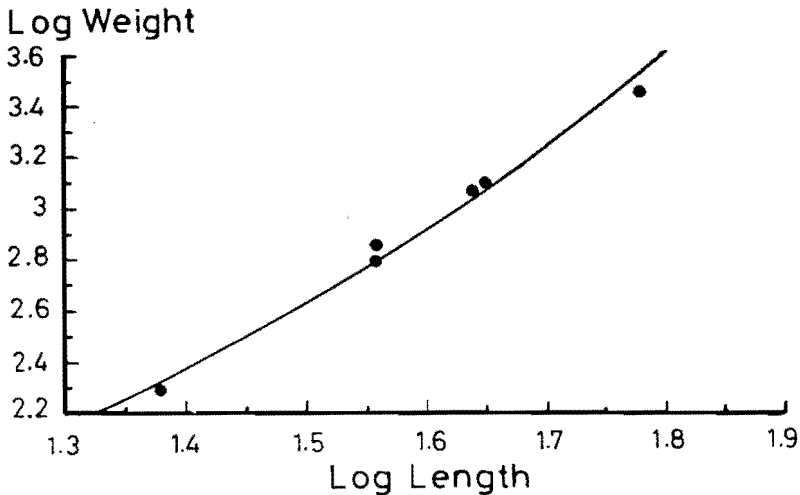


FIG. 10. The relationship between length and weight for *L. nebulosus*.

Conclusion

The fish collections in the present survey cannot be regarded as exhaustive but some useful indications are evident. The large number of juvenile *Leiognatus fasciatus*, which would be less than one year old indicates that successful spawning and recruitment of this species has taken place since the Gulf war. Significant number of juvenile were also present of the following species: *Pelates quadrilineatus* (Bloch), *Rastreliger kanagurta* (Cuvier), *Lutjanus malabricus* (Bloch), *Alectis indicus* (Ruppell), *Solea bleekeri* (Boulenger), *Lutjanus johni* (Bloch), Nemipteridae, *Ilisha melstoma* (Schneider), *Siganus canaliculatus* (Park), *Parupeneus heptacanthus* (Lacepede), *Arius thalassinus* (Ruppell), *Epinephelus areolatus* (Forsskal) and *Lutjanus* spp.

The comparison of weights and lengths of *L. nebulosus* with pre-war data shows that there has been no apparent effect on growth of this species. All three species of

Lethrinidae that were investigated showed apparently normal sexual maturation with high levels of fecundity in females. There was no previous data on fecundity as a basis for comparison. Some fish were observed to be spent so we conclude that spawning in the Lethrinidae was normal. There appear to be no long-term effects of oil pollution on these species.

This study emphasizes that for the purposes of assessing any future adverse environmental effects, base-line data on length, weight, age and fecundity of the major species are necessary.

Acknowledgement

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دراسة مبدئية لأسماك الخليج العربي عقب التلوث البترولي الناجم عن حرب الخليج

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المستخلص . تمت دراسة بيئة أسماك المياه الساحلية للجزء الغربي من الخليج العربي على طول المنطقة الواقعة بين دولتي الكويت وقطر خلال المرحلة الرابعة من رحلة السفينة الأمريكية (ماونت متشل) في الفترة من ٢٣ أبريل إلى ٣ مايو ١٩٩٢ م .

وخلال هذه الدراسة تم تسجيل حوالي ٤٠ نوعاً من الأسماك . وقد وجد أن جنس *Leiognathus fasciatus* أكثر الأنواع انتشاراً (٢٩٪) يليه جنس *Lethrinus spp.* (١٢٪) وكذلك جنس *Pelates quadrilineatus* (١٢٪) . وقد لوحظ وجود اختلافات واسعة في أعداد وأنواع الأسماك في المحطات المختلفة .

كما تم اصطياد عدد كبير من صغار ١٤ جنساً مختلفاً من الأسماك مما يوحي بعودة الأسماك وتكاثرها في هذه المناطق بعد حرب الخليج (يناير - فبراير ١٩٩١م) .

أشارت النتائج النهائية على الأسماك البالغة من عائلة الـ *Lethrinidea* إلى عدم وجود اختلافات أساسية في النمو والبلوغ الجنسي وأن عملية التكاثر بدت طبيعية جداً .