

Abundance of fish caught by stake-traps (*hadra*) in the intertidal zone in Doha, Kuwait Bay

F. S. ABOU-SEEDO

Department of Zoology, University of Kuwait, P.O. Box 5969, Safat 13060, Kuwait

ABSTRACT

Fin fishes of the intertidal zone of the northern Arabian Gulf were collected from a *hadra*, a traditional stake-trap in which fishes move passively with the flood and ebb tide.

Bi-weekly sampling from January 1982 to December 1984 yielded a total of 76 species representing 36 families. Best represented was the family Carangidae, with 10 species, whilst the Mugilidae and Sparidae were the most abundant numerically with 10,062 and 2,321 individuals, respectively. The 4 most abundant fish include *Liza carinata* (7,636), *Valamugil seheli* (1,982), *Thryssa hamiltonii* (1,043), and *Nematalosa nasus* (1,070). The remaining species were represented by less than one thousand individuals in the catch over the period of study.

INTRODUCTION

Until recently, the ichthyofauna of the inshore waters of the Arabian Gulf has been the subject of few studies. Regan (1905) produced a list of Arabian Gulf fishes, but many were deep water forms. In 1944 Blegvad & Loppenthin surveyed fishes along the Iranian coast, and reported on offshore as well as inshore species. More recently, White & Barwani (1971), Wray (1979), Sivasubramaniam & Ibrahim (1982), and Kuronuma & Abe (1972, 1986) produced pictorial identification guides of the more common Arabian Gulf ichthyofauna. Only recently, however, have the fishes that frequent the intertidal zones been specifically considered (Relyea 1981; Wright 1988a,b).

From the wide variety of fish caught by *hadra* (intertidal stake traps), Clayton & Abo-Seedo (1986) concluded that the intertidal zone was important for local fisheries. In 1980, fish captured by *hadra* accounted for 23% of the artisanal fish landings (Morgan 1980, 1981), but have since declined to 18% in 1983 (Hakim *et al.* 1984) and to 9.7% in 1984 (Hakim *et al.* 1985). This decline was due to both the exponential growth of other artisanal fisheries (Hakim *et al.* 1984) and to coastline development (Hakim *et al.* 1985). Other than interviews with fishermen operating *hadra*, few data concerning fishes that utilize Kuwait's intertidal zone have been collected. The present study was initiated to determine species composition and seasonality of fishes from the intertidal zone as revealed by *hadra* catches.

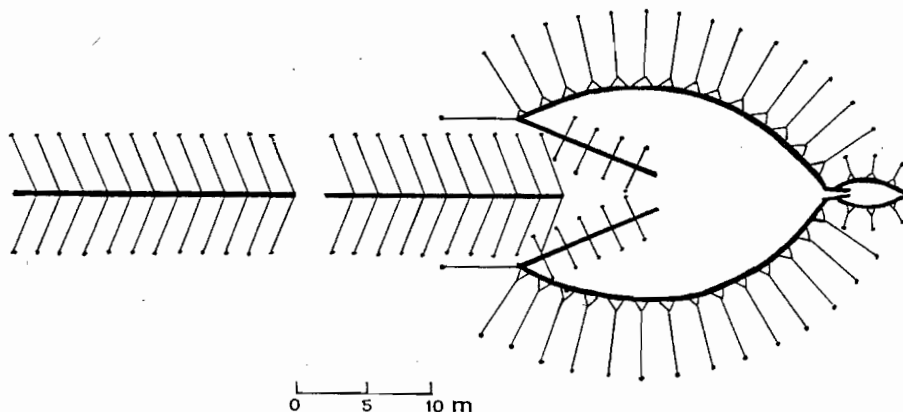


Fig. 1. "Hadra" (intertidal stake trap) plan view. The thick lines indicate hadra wire mesh netting 30 mm, and the thin lines indicate the supporting guy ropes.

MATERIALS AND METHODS

One hadra (Fig. 1) located on the north shore of Doha Peninsula in Kuwait Bay (Fig. 2) was selected for the study. The rock substratum in this area (Khalaf *et al.* 1982) allowed easy access to the intertidally positioned hadra at low tide. All fish retained by the 30 mm wire mesh of the "catch pocket" were collected at bi-weekly intervals at low tide during daylight from January 1982 through December 1984. Water samples for salinity and temperature measurements were collected with each

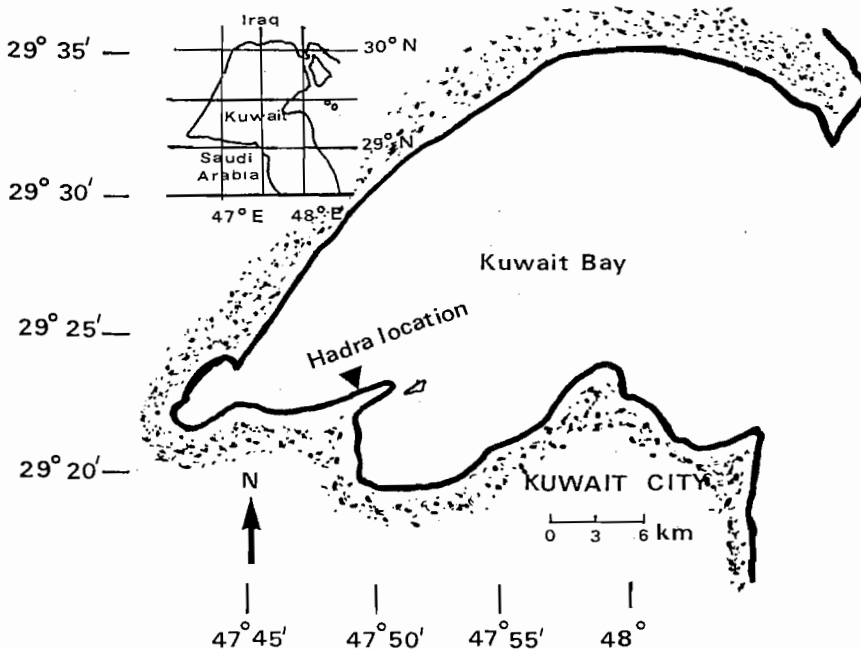


Fig. 2. A map showing location of study hadra in Kuwait Bay, Arabian Gulf.

fish catch. In the laboratory, sorted species were identified using the following references: Blegvad & Loppenthin (1944), Sabock & Gurr (1969), Kuronuma & Abe (1972), Relyea (1981) and Fischer & Bianchi (1984). Identified species were enumerated and individually weighed.

RESULTS

A total of 19,441 fishes representing 36 families and 76 species were caught over the period of study (Table 1). Catches in 1982, 1983, and 1984 contributed 39.2, 43.3 and 17.54% of the total, respectively. The catch of 1,749 *Liza carinata* in September 1983 was the highest for any month (Fig. 3) and was the main reason why the catch in 1983 exceeded that of either 1982 or 1984. Thirty-two species were represented by less than ten specimens (Table 1) and an overwhelming majority of the annual catch was represented by 14 species (Table 2). In 1982, these 14 species represented 89.21% of the annual total (6,790 individuals); in 1983, 89.28% of the annual total (7,518 individuals), and in 1984, 76.74% of the annual total (2,616 individuals). These data also illustrate the annual variability in the abundance. Whilst half of these fish (*Liza carinata*, *L. subviridis*, *Acanthopagrus latus*, *A. berda*, *Nematalosa nasus*, *Diplodus sargus*, and *Pomadasys stridens*), showed a peak in 1983, five species (*Valamugil seheli*, *Thryssa hamiltonii*, *Ilisha melastoma*, *Therapon puta* and *Sillago sihama*) declined in numbers over the 3 years. The number of *Sillago* sp. initially declined then stabilised, whilst those of *Leiognathus decorus* remained stable throughout.

The family Mugilidae, represented by *Mugil tade*, *Liza carinata*, *Valamugil seheli* and *L. subviridis*, numerically dominated the catches. In terms of richness, however,

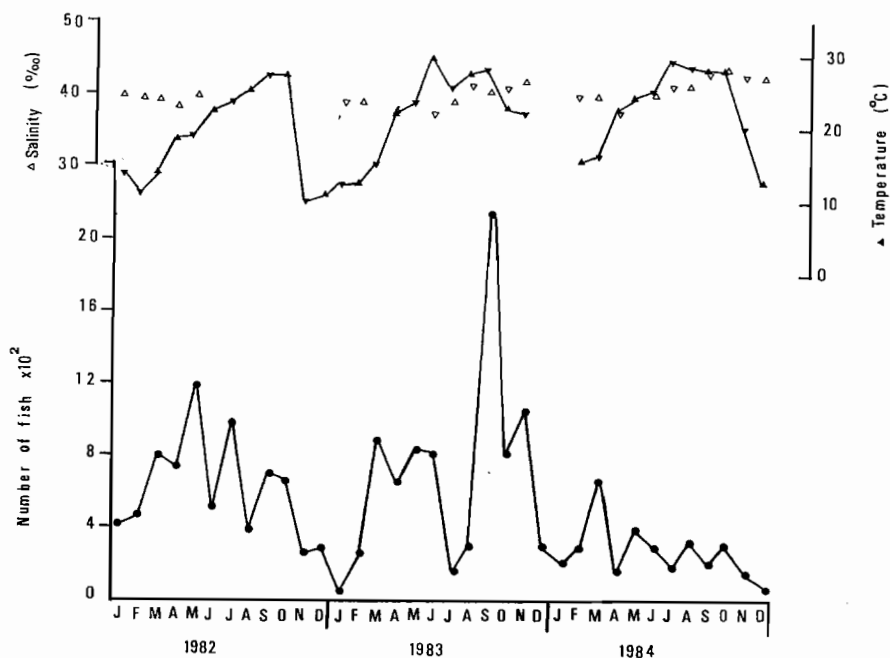


Fig. 3. Monthly total number of fish collected from Doha in the years 1982, 1983, and 1984, together with water temperature and salinity.

Table 1. Total number of each species caught by hadra at Doha in Kuwait during January 1982 to December 1984

Family	Species name	Local name	No. of fish caught
Orectolobidae	<i>Rhynchobatus annulatus</i>		1
Rhinobatidae			
Hemiscylliidae	<i>Chiloscyllium griseum</i>	Hayyasa	3
Dasyatidae	<i>Dasyatis</i> sp.	Lokmah	1
Clupeidae	<i>Ilisha melastoma</i>	Sawayah	590
	<i>Hilsa ilisha</i>	Suboor	26
	<i>Sardinella fimbriata</i>	Oom	488
	<i>Sardinella longiceps</i>	Oom	2
	<i>Sardinella sindensis</i>	Oom	7
	<i>Sardinella acuta</i>	Oom	2
	<i>Nematalosa nasus</i>		1,070
Engraulidae	<i>Thryssa hamiltonii</i>	Boefchach	1,043
Chirocentridae	<i>Chirocentrus nudus</i>	Hiff	105
Synodontidae	<i>Saurida tumbil</i>		1
Ariidae	<i>Arius bilineatus</i>	Chimh	110
Plotosidae	<i>Plotosus anguillaris</i>		41
Exocoetidae	<i>Hemiramphus marginatus</i>	Sils	131
Belonidae	<i>Tylosurus crocodilus</i>	Hakool	31
	<i>Tylosurus strongylura</i>	Hakool	9
	<i>Tylosurus leiurus</i>	Hakool	1
	<i>Ablennes hians</i>	Hakool	1
Synancejidae	<i>Pseudosynanceia melanostigma</i>	Firyalah	1
Platycephalidae	<i>Platycephalus maculipinna</i>	Wahara	1
	<i>Platycephalus indicus</i>	Wahara	80
Serranidae	<i>Epinephalus tawina</i>	Hamoor	2
Theraponidae	<i>Therapon puta</i>	Zamrool	424
	<i>Pelates quadrilineatus</i>	Yemyam	11
Apogonidae	<i>Apogon unnotatus</i>		7
	<i>Apogon pharoanis</i>		
Sillaginidae	<i>Sillago sihama</i>	Hasoom	164
	<i>Sillago</i> sp.	Hasoom	140
Carangidae	<i>Caranx kalla</i>	Hamam	359
	<i>Caranx leptolepis</i>	Gorfah	84
	<i>Scomberoides lysan</i>	Kabate	101
	<i>Scomberoides guttatus</i>	Kabate	5
	<i>Trachinotus blochii</i>	Kasoor	3
	<i>Alectis indicus</i>	Othaimy	1
	<i>Carangoides malabaricus</i>		1
	<i>Scomberoides tol</i>		6
	<i>Scomberoides commersonianus</i>		30
Leiognathidae	<i>Leiognathus decorus</i>	Siny	372
Gerridae	<i>Gerres oyena</i>	Badah	138
	<i>Gerres filamentosus</i>	Badah	55
Pomadasyidae	<i>Pomadasys stridens</i>	Yimam	933
	<i>Pomadasys maculatum</i>		1
	<i>Plectorhinctus schotaf</i>	Yanam	13
	<i>Scolopsis ruppelli</i>	Ebzaimy	12
Sparidae	<i>Acanthopagrus latus</i>	Sheim	724
	<i>Acanthopagrus berda</i>	Mozaizy	872
	<i>Diplodus sargus</i>	Mochwah	529
	<i>Rhabdosargus sarba</i>		64
	<i>Acanthopagrus cuvieri</i>	Mozaizy	132

Table 1. (continued)

Family	Species name	Local name	No. of fish caught
Sciaenidae	<i>Otolithes argenteus</i>	Newaiby	102
	<i>Johnius anius</i>	Esh mahy	46
	<i>Johnius carrutta</i>		42
Mullidae	<i>Upeneus tragula</i>	Hamer	13
	<i>Upeneus asymmetricus</i>	Hamer	2
	<i>Upeneus sulphureus</i>	Hamer	19
Ephippidae	<i>Ephippus orbis</i>	Mishit	2
Scatophagidae	<i>Scatophagus argus</i>	Shing	61
Mugilidae	<i>Valamugil seheli</i>	Maid	1,982
	<i>Liza carinata</i>	Biyah	7,636
	<i>Liza subviridis</i>	Biyah	443
	<i>Mugil tade</i>		1
Sphyraenidae	<i>Sphyraena obtusata</i>	Edwaim	26
	<i>Sphyraena jello</i>		2
Polynemidae	<i>Eleutheronema tetradactylum</i>	Sheem	4
Siganidae	<i>Siganus oramin</i>	Safy	18
Trichiuridae	<i>Trichiurus muticus</i>	Ea'Sabah	69
Bothidae	<i>Pseudorhombus arsius</i>	Khofaah	3
Soleidae	<i>Solea elongata</i>	Khofaah	5
	<i>Synaptura orientalis</i>		2
Triacanthidae	<i>Pseudotriacanthus strigilifer</i>	Cholaibow-Eldow	6
Balistidae	<i>Stephanolepis diapros</i>		1
Tetraodontidae	<i>Lagocephalus lunaris</i>	E'-nezah	13
	<i>Chelonodon patoca</i>	E'-nezah	12
	<i>Arothron stellatus</i>	E'-nezah	1
Total: 36	76		19,441

Table 2. The annual total number (N) of each species and their relative abundance (%) for the 14 most abundant species in the catch

	Species	1982		1983		1984	
		N	%	N	%	N	%
1	<i>Liza carinata</i>	2,781	36.54	3,667	43.55	1,188	34.85
2	<i>Valamugil seheli</i>	1,232	16.19	642	7.62	108	3.17
3	<i>Liza subviridis</i>	112	1.47	178	2.11	153	4.49
4	<i>Acanthopagrus latus</i>	135	1.77	332	4.94	257	7.54
5	<i>Acanthopagrus berda</i>	200	2.63	511	6.07	161	4.72
6	<i>Thryssa hamiltonii</i>	699	9.18	218	2.59	126	3.70
7	<i>Ilisha melastoma</i>	400	5.26	146	1.73	44	1.29
8	<i>Therapon puta</i>	280	3.68	94	1.12	52	1.53
9	<i>Nematalosa nasus</i>	260	3.42	651	7.73	159	4.66
10	<i>Diplodus sargus</i>	199	2.61	243	2.89	87	2.55
11	<i>Pomadasys stridens</i>	198	2.60	647	7.68	88	2.58
12	<i>Leiognathus decorus</i>	116	1.52	121	1.44	135	3.96
13	<i>Sillago sihama</i>	90	1.18	46	0.55	28	0.82
14	<i>Sillago</i> sp.	88	1.16	22	0.26	30	0.88
	Subtotal	6,790	89.21	7,518	89.28	2,616	76.74
	Remaining specimens	821	10.79	903	10.72	793	23.26
	Total	7,611	100.00	8,421	100.00	3,409	100.00

the Family Carangidae dominated with 10 species, followed by the Clupeidae and Sparidae with 7 species each. The common species of the latter families, *Nematalosa nasus*, *Ilisha melastoma*, *Sardinella fimbriata* (Clupeidae) and *Acanthopagrus latus*, *A. berda* and *Diplodus sargus* (Sparidae), were far more abundant than the commonest carangids (*Caranx kalla* and *Scomberoides lysan*).

Surface water temperatures ranged from a low of 10°C in November 1982 to a high of 30°C in July 1983 (Fig. 3). The low water temperatures extended from November until February, and as the water temperature started to increase in March 1982 and 1983, so did the number of fish caught. This trend continued until the water temperature reached a maximum in June and July when the fish catch dropped again. Salinity ranged from 37.5‰–43‰ throughout the study (Fig. 3).

DISCUSSION

In 1981, 129 hadras were operated in Kuwait's coastal waters, and an estimated return on investment in one example equalled 138% (Hopkins *et al.* 1984). Considering the high investment return, it is likely that hadra will continue to be employed to fish the intertidal zone. Because hadras catch fish passively by utilizing the tidal flood and ebb, catch composition is likely to be less biased with respect to gear selectivity. This study examined catches of one hadra only, so conclusions will be site specific. Additionally, the 30 mm wire mesh would not retain many of the smaller juveniles of most species.

Arabian Gulf ichthyofaunal lists have been compiled predominantly from trawling and fish market collections (Blegvad & Loppenthin 1944; Kuronuma & Abe 1972; Randall *et al.* 1978). Only the unpublished reported by Dames & Moore (1983) and the recent study by Wright (1988a & b) present data comparable to those of this study, and although findings are generally in agreement, some exceptions are notable.

Mugilidae dominated the catches numerically in all studies of Kuwait Bay ichthyofauna. The most abundant species was *L. carinata* (Al-Khatib 1986), previously known as *Mugil macrolepis* (Joglekar 1979; Relyea 1981; Dames & Moore 1983; Clayton & Abo-Seedo 1986). *L. carinata* was present all year except in December when it moves offshore for spawning (Al-Khatib 1986).

Twenty species of Carangidae are reported from the Arabian Gulf (Kuronuma & Abe 1972; Relyea 1981). That half of the representatives of this family were captured in the intertidal zone of a single location demonstrates the importance of this area for juveniles. Similarly, eight of the 10 sparids recorded from the Gulf (Kuronuma & Abe 1972) were caught in the intertidal zone of Kuwait (this study; Dames & Moore 1983). Among 15 species of clupeids in the Gulf (Kuronuma & Abe 1972), seven were reported to be common (Relyea 1981), but only 2 were present in this study.

In the case of the Engraulidae, Teraponidae, Polynemidae, Soleidae, Sciaenidae and Leiognathidae, fewer species were reported in this study than in that of Dames & Moore (1983). With respect to the Leiognathidae, Sciaenidae, Soleidae and Pomadasysidae, there are fewer species than are reported for the inshore fishes of the Gulf by Relyea (1981). For example, whilst Relyea (1981) recorded 7 species of leiognathids, Dames & Moore (1983) caught only 6 species, the most abundant of which was *Leiognathus daura* (= *L. decorus*) and the only species of this family recorded

from the hadra at Doha. In contrast, the present study recorded 4 species of Pomadasyidae whilst Dames & Moore (1983) reported only 3 species. *Pomadasys stri-dens* was the most common in both studies. Twelve species of Pomadasyidae are reported in the Gulf (Kuronuma & Abe 1972; Relyea 1981).

The systematics of the Ariidae have until recently (Al-Hassan *et al.* 1988) been confused so the earlier records (Kuronuma & Abe 1972, 1986; Relyea 1981) of abundance are unclear. Al-Hassan *et al.* (1988) reported that *Arius bilineatus* was the commonest ariid, as it was in this study.

Of the two species of Platycephalidae caught in this study Relyea (1981) reported *Platycephalus indicus* to be the more common. The absence of *P. tuberculatus* can be attributed to its deep water preference (Dames & Moore 1983).

Result of this study and those of Relyea (1981), Dames and Moore (1983) and Wright (1988a & b) show that data collected from hadra on species composition and seasonality are equally as good as those from any other single piece of gear. Further studies should concern catch differences between adjacent hadra as well as between hadra in different areas.

ACKNOWLEDGMENTS

I thank Kuwait University who supported this work through Grant SDZ 048; Dr D. Clayton for his advice and critically reviewing the manuscript; Mrs R. M. Ali and Mr E. Belal for technical help and Kuwait Institute for Scientific Research for providing some water temperature and salinity data.

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(Received 1 March 1989, revised 12 December 1989)

وفرة الأسماك المصادة بواسطة الحضرة
في الدوحة ، جون الكويت

فدوى صالح أبوسيدو
قسم علم الحيوان بكلية العلوم ، جامعة الكويت
ص . ب ٥٩٦٩ ، الصفاة ١٣٠٦٠ ، الكويت

خلاصة

تم جمع عينات الأسماك الزعنفية الخاصة بمنطقة المد والجزر بشمال الخليج العربي من منطقة الدوحة ، جون الكويت ، وذلك باستخدام الطريقة التقليدية (الحضرة) أو المصايد الوتدية . احتوت العينات التي جمعت في الفترة من يناير ١٩٨٢ حتى ديسمبر ١٩٨٤ على ٧٦ نوعا من الأسماك تنتمي إلى ٣٦ فصيلة ، عشرة أنواع منها تنتمي إلى فصيلة كارانجيدي *Carangidae* وهي الأكثر وفرة في عدد الأنواع ، بينما فصيلتا موجيليدي *Mugilidae* وسباريدي *Sparidae* كانتا الأكثر وفرة من حيث عدد الأفراد والذي بلغ ١٠,٠٦٢ و ٢٣٢١ سمكة ، على التوالي . أما الأربعة أنواع الأكثر وفرة فقد تضمنت كلا من الميد *Liza carinata* (٧,٦٣٦ سمكة) ، والميد *Valamugil seheli* (١,٩٨٢ سمكة) ، وبوفجيج *Thryssa hamiltonii* (١,٠٤٣ سمكة) ، والعم يواف *Nematalosa nasus* (١,٠٧٠ سمكة) ، وكانت الأنواع الباقية موجودة ولكن عدد الأسماك في كل منها كان أقل من الألف في مجموع الصيد الذي تم على مدار فترة الدراسة .

