

The Status of Kuwait's 2011/2012 Shrimp Fisheries

Hussain M. Al-Foudari, James M. Bishop and W. Chen

Ecosystem-based Management of Marine Resources Program, Environmental and Life Sciences Research Center, Kuwait Institute for Scientific Research, Kuwait
e-mail: hussainalfoudari@gmail.com

Abstract. Kuwait's 2011/2012 shrimp catching season commenced on 1 August 2011, and ended on 31 January 2012. Fishermen landed 1,507 t of shrimp, with 10,760 boat-days of United Fisheries of Kuwait (UFK) effort. When compared to the previous season, this represented 25, 21 and 3% increases in landings, effort and catch per unit effort (CPUE), respectively. Despite the 25% increase in landings, this is well below the long-term average of 2,024 t. The 2011/12 landings were dominated by the dhow fleet, which landed 56% of the 2010/11 shrimp catch and accounted for 59% of the total effort in UFK boat-days. Landings by UFK vessels consisted of 53% *Penaeus semisulcatus* and about 47% *Metapenaeus affinis*. Landings by unlicensed dhow-boat accounted for 69% of the total dhow-fleet shrimp landings during the 2011/12 season. Forty-three percent of the shrimp landings originated from waters outside Kuwait's jurisdiction. Since 2010, Kuwait's shrimping fleet has undergone change. Formerly, the fleet consisted of 35 industrial steel-hull trawlers and 25 dhow boats. Currently, there are 71 vessels licensed to trawl for shrimp: 8 industrial boats and 63 fiberglass dhows. This change was accomplished by replacing the industrial boats with fiberglass dhow boats at a ratio of 1 to 1.4 ± 0.2 industrial boats to dhows. The total non-shrimp catch (by-catch) landed by the industrial fleets was 255 t. The UFK boats accounted for 143 t, while the National Fishing Company boats landed 112 t. Crabs dominated the UFK by-catch landings with 56 t. The total effort of the 2011/12 season was greater than that required for maximum optimum economic and biological yields. Preventing unlicensed dhow boats from shrimp trawling should be a management priority for future seasons.

Key words: by-catch, fleet composition, international waters, fiberglass dhow-boats.

Introduction

One of the most important aspects of fisheries management is the collection of catch and effort statistics, and their analysis. The data collection of commercial shrimp landings is necessary to relate stock assessment to the commercial landings. These statistics allow current season success to be judged in the context of past seasons. Data collection from commercial landings is part of the ongoing 36-mo project titled 'A Comprehensive Management Strategy for Long-term Sustainability of Kuwait Shrimp Stocks', which began on 1 April 2011 (8). Until recently, Kuwait's shrimp fleets were classified into two major components: the dhow-boat fleet and the industrial fleet. Formally, 25 dhow-boats constructed of wood were licensed to trawl. The industrial fleet was comprised of three companies: the United Fisheries of Kuwait (UFK), who also operates vessels owned by the Bubyen Fisheries Company (BFC) and the National Fishing Company (NFC). Kuwait had 35 double-rig industrial boats.

Because of declining catches and increased operating costs, Kuwait's shrimping fleets have undergone major changes. Industrial steel boats have been exchanged for fiberglass dhow-boats (single-rig) over the past two seasons. The exchange ratio of industrial vessels to fiberglass dhow-boats was $1:1.4 \pm 0.2$ and all wooden dhow-boats have been exchanged for fiberglass, which requires less maintenance.

Trawling is a non-selective method of fish capture, and non-target species usually account for the majority of the catch. These non-target species are known as by-catch, and most are discarded at sea (6). In temperate and subtropical waters, ratios of unsorted by-catch to shrimp are about 5:1, whereas in tropical areas, this ratio approaches 10:1. In Kuwait, shrimp fishermen keep all by-catch that is marketable and discard the rest. In this report, by-catch is defined as all non-shrimp catch landed by shrimping vessels during a season. During the 1999/2000 shrimping season, Kuwait fishermen landed a total of 777 t of by-catch, which accounted for 33% of the total (shrimp and non-shrimp) landings. Dhow-boats accounted for 32% of the landed by-catch, while the industrial fleets accounted for the remaining 68% (3).

Reported herein are the results of the shrimp catch, effort and species composition, as well as by-catch of the 2011/2012 shrimp season.

Materials and Methods

Kuwait's 2011/12 shrimping season opened in 'international' waters on 1 August 2011 and in Kuwait's territorial waters on 1 September 2011. International waters are defined as those outside, but adjacent to, Kuwait's territorial waters. The season in both areas closed on 31 January 2012, for a season length of 242 days in the international waters and 211 days in territorial waters (Table 1). Because the effort executed by all fleets in international waters was not recorded separately from that of the territorial waters, the season opening was considered to be 1 August 2011. The methodologies used in collecting data from the artisanal and industrial fisheries are described in detail (7, 4).

The dhowboat landings data, collected every fifth day throughout each season, were obtained from interviews with captains of all dhow-boats that had landings that day. The interviews included the following queries: days spent fishing, trawl tows per day, hours per tow, fishing ground, and total shrimp catch. The dhow-boat catch was recorded as the number of 20 kg baskets of small, medium, and large shrimp collected during that trip. When available, a three- to five- kilogram sample of each size category was purchased on each interview day from a dhow-boat to obtain the monthly species composition and size-frequency distributions. A computer program was created using a spreadsheet-based format (Microsoft Excel) to calculate all of the above estimations and raise the length-frequency to the catch rate.

The industrial boat data were obtained from Kuwait's two commercial fishery companies, which provided the information at the end of each calendar month. These

data were summarized into catch, effort, and catch per unit-effort (CPUE) for each company, as well as overall CPUE using UFK's catch rates as the standard (4). The biological data for the industrial fleet catches were not collected. UFK landings are reported as either white- or hard-shell catches. The white-shell catch was 100% *Penaeus semisulcatus*, and the hard-shell catch was more than 90% *Metapenaeus affinis*. Analysis of variance (ANOVA) was used to compare mean engine horsepower among the dhow-boats of the three shrimping fleets to determine if they differed significantly.

Table 1. Start, close date, duration of the close season and total effort for Kuwait's shrimp seasons from 1979/80 through 2011/12.

Fishing Season	Season start date	Season close dates		Close season Duration(day)	Total effort
		From	Through		
1979/1980	**	1 Apr. 1980	30 Jun. 1980	91	6460
1980/1981	1 July 1980	1 Feb. 1981	30 Jun. 1981	150	3220
1981/1982	1 July 1981	1 Feb. 1982	30 Jun. 1982	150	9430
1982/1983	1 July 1982	1 Apr. 1983	30 Jun. 1983	91	9310
1983/1984	1 July 1983	1 Apr. 1984	30 Jun. 1984	91	13270
1984/1985	1 July 1984	16 Feb. 1985	30 Jun. 1985	135	10690
1985/1986	1 July 1985	1 Mar. 1986	31 July 1986	92	11500
1986/1987	1 Aug. 1986	1 Apr. 1987	31 Aug. 1987	153	10400
1987/1988	1 Sept. 1987	16 Apr. 1988	31 Aug. 1988	138	7150
1988/1989	1 Sept. 1988	1 Apr. 1989	31 Aug. 1989	153	5240
1989/1990	1 Sept. 1989	1 May 1990	31 Aug. 1991	459	4010
1990/1991	No Fishing				
1991/1992	1 Sept. 1991	1 Mar. 1992	31 Aug. 1992	184	1416
1992/1993	1 Sept. 1992	16 Mar. 1993	31 Aug. 1993	169	8740
1993/1994	1 Sept. 1993	16 Mar. 1994	31 Aug. 1994	169	17615
1994/1995	1 Sept. 1994	16 Feb. 1995	31 Aug. 1995	197	10191
1995/1996	1 Sept. 1995	16 Feb. 1996	31 Aug. 1996	198	12416
1996/1997	1 Sept. 1996	1 Mar 1996	31 Aug. 1997	184	11005
1997/1998	1 Sept. 1997	1 Feb. 1998	31 Aug. 1998	212	5364
1998/1999	1 Sept. 1998	16 Jan. 1999	31 Aug. 1999	228	7624
1999/2000	1 Sept. 1999	1 Feb. 2000	31 Aug. 2000	213	10236
2000/2001	1 Sept. 2000	1 Mar. 2001	31 Aug. 2001	184	11510
2001/2002	1 Sept. 2001	11 Feb. 2002	31 Jul. 2002	171	9338
2002/2003	1 Aug. 2002	1 Feb. 2003	31 Aug. 2003	212	13115
2003/2004	1 Sept. 2003	1 Feb. 2004	14 Aug. 2004	196	8353
2004/2005	15 Aug 2004	1 Feb. 2005	31 Jul. 2005	181	8202
2005/2006	1 Aug. 2005	1 Feb. 2006	31 Jul. 2006	181	11809
2006/2007	1 Aug. 2006	16 Jan. 2007	14 Aug. 2007	211	8827
2007/2008	15 Aug. 2007	16 Jan. 2008	31 Jul. 2008	197	6803
2008/2009	1 Aug. 2008	16 Jan. 2009	31 Jul. 2009	197	8331
2009/2010	1 Aug. 2009	1 Jan. 2010	31 Jul. 2010	212	7291

2010/2011	1 Aug. 2010	16 Jan. 2011	31 Jul. 2011	227	8868
2011/2012	1 Aug. 2010	31 Jan. 2012		242	10760

Total effort in United Fisheries of Kuwait (UFK) boat-days

** No official opening date prior to introduction of closed season

Results and Discussion

Current composition of the shrimping fleet

In 2010, Kuwait's industrial shrimping fleet consisted of 35 steel-hull vessels: 20 owned or operated by UKF, and 15 owned and operated by NFC. Since then, the licenses of seven UFK vessels have been exchanged for nine fiberglass dhow-boat licenses, two of which were sold to private individuals. Licenses of five other industrial trawlers were sold to private individuals, who exchanged the licenses for nine fiberglass dhow boats. This left UFK with eight industrial trawlers and seven fiberglass dhow-boats for a fleet total of 15 vessels. The engine size of UFK's fiberglass dhow-boats ranges from 400 to 445 hp with an average of 438.6 ± 6.4 hp. Their average length, width, and depth are 22.9 ± 0.8 m, 6.2 ± 0.2 m, and 3.2 ± 0.2 m, respectively.

The NFC's fleet consisted of 15 steel-hull vessels, and all of the licenses have been exchanged for licenses for fiberglass dhow-boats. The NFC's current fleet of fiberglass dhow-boats numbers 11, with the additional licenses having been sold to private individuals. The characteristics of the NFC's shrimping fleet are as follows: 415 hp average engine size; 22.6 m average length; 6.2 m average width; and 3.0 m average depth.

Following effort limitations in the late 1980s, a total of 25 wooden dhow boats were licensed to trawl. Over the years, this number has increased and currently stands at 45. Additionally, the smaller wooden dhow-boats have been replaced with larger fiberglass dhow-boats that have more powerful engines. The dhow-boat fleet has also increased, through the recent exchanges of industrial steel-hull vessels with fiberglass dhow-boats. The fiberglass dhow-boats range from 12.6 to 25.5 m in length, averaging 21.4 ± 0.3 m. The fleet averages 6.1 m in width (4.8 to 9.3 m) and 2.4 ± 0.1 m in depth (1.5 to 3.4 m). The average engine size is 388 ± 9.6 hp.

These changes have resulted in Kuwait's three fleets becoming more homogenous. Of the current 71 vessels, only eight are industrial (UFK) with the remainder being dhow boats. The three fleets are managed differently, however, they will continue to be identified and treated as they have been in the past, that is, as an artisanal fleet, UFK fleet and NFC fleet. The fishing power of the boats was tested for statistical differences.

Test for significant differences in engine horsepower among trawling fleets

The descriptive statistics of the engine horsepower for the artisanal, UFK, and NFC are provided in Table (2). Overall, no significant differences were found among or within fleets (Table 3). T-tests between fleets (Table 4), however, found significant differences in horsepower between UFK and NFC boats ($P < 0.01$) and between dhow and UFK boats ($P < 0.01$). No significant difference ($P > 0.05$) was found between engine horsepower between the dhow-boat fleet and the NFC fleet. These differences show that it is important to continue recording landings statistics by individual fleet in order to compare CPUEs and to standardize CPUE.

Table 2. Summary of the descriptive statistics of the engine horsepower for Kuwait's different fiberglass (dhow) fleets.

Fleet	No. of vessels	Engine size (hp)			Variance	Standard deviation
		Total	Average	Range		
Dhow	45	17458	387.96	240-650	4174.225	64.61
UFK*	7	3070	438.57	400-450	289.286	17.01
NFC**	11	4475	406.82	405-425	36.364	6.03

*UFK = United Fisheries of Kuwait; **NFC = National Fishing Company

Table 3. ANOVA* results for significant differences in horsepower among Kuwait's different fishing vessels.

Source of variation	SS	df	MS	F	p-Value	F crit
Between Groups	16837.7	2	8418.86	2.719	0.07405	3.15
Within Groups	185765.3	60	3096.09			
Total	202603.0	62				

*ANOVA = Analysis Of Variance; SS= Sum Of Squares ; MS = Mean Square; F crit = F critical ; df = Degrees Of Freedom ; F = F-test

Table 4. T-test results for significant differences in horsepower between UFK*, NFC and dhow-boats.**

Parameter	UFK and NFC	Dhow-boat and UFK	Dhow-boat and NFC
Observations (no. of vessels)	7 vs. 11	45 vs. 7	45 vs. 11
Df	7	37	47
t Stat	4.752952	-4.37113	-1.92449
P(T<=t), two-tailed	0.002076	<0.001	0.060358
t Critical, two-tailed	3.499483	2.715409	2.01174
Conclusion	Highly significant	Highly significant	Not significant

*UFK = United Fisheries of Kuwait; **NFC = National Fishing Company

Overall landings and effort

The total shrimp catches by the three fleets in the 2011/12 season was estimated to be 1507 t, with a CPUE of 140 kg/UFK boat-day (Table 5). When compared to the previous season, this represented 25, 21 and a 3% increase in landings, effort and CPUE, respectively (Table 6). Catches for the 2011/12 season, however, were lower than the long-term average (Fig. 1), indicating a low population abundance, probably resulting from weak recruitment. The dhow-boat fleet landed about 56% of this total (Fig. 2). *Penaeus semisulcatus* totaled approximately 53% of the total UFK catch (Table 7). Overall, monthly landings ranged from a high of 471 t in September 2011, to a low 108 t in January 2012 (Table 5). The daily catch per UFK boat-day (280 kg) was the highest in September 2011, and then declined to its lowest (56 kg, Table 5) by the end of the season in January 2012. When compared to the corresponding months of the 2010/11 season, the catch and CPUE in the 2011/12 season decreased in August and September, but increased from October through January (Table 6). At 10760 UFK boat-days, the total fishing effort during the 2011/12 season was 21% higher than that of the previous season, but the 2011/12 season was 15 days longer (242 vs. 227). This effort was well over the 3000 to 5000 UFK boat-days of effort to maximize the bio-economic yield for Kuwait's shrimp fishery (5).

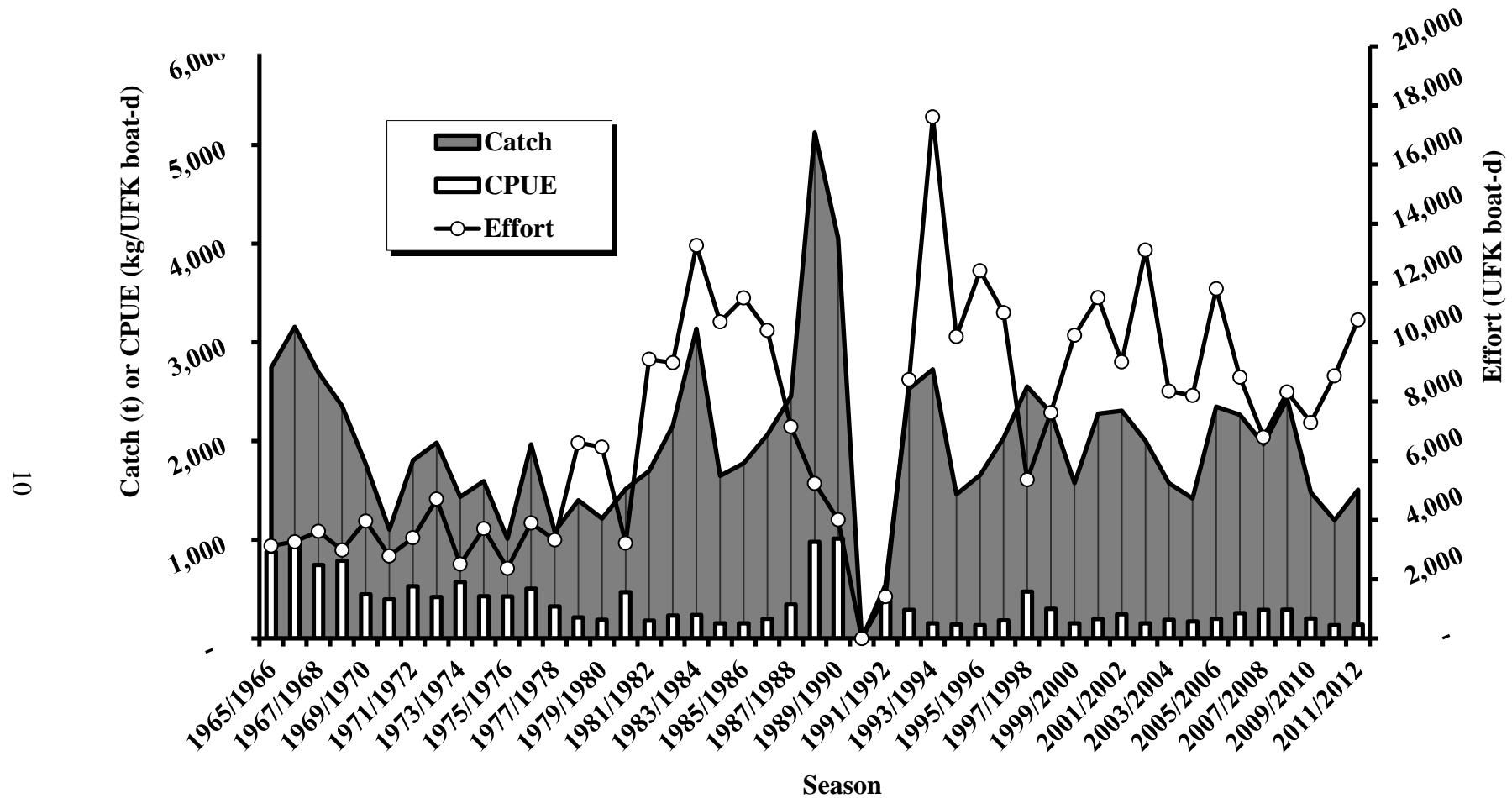
Table 5. Shrimp catch, efforts and catch-per-unit-effort (CPUE) for three fleets in the 2011/12 season.

Month	Dhow-boat			UFK*			NFC**			Total		
	Estimated catch (t)	Effort (h)	CPUE (kg/h)	Catch (t)	Effort (boat d)	CPUE (kg/boat d)	Catch (t)	Effort (boat d)	CPUE (kg/boat d)	Catch (t)	Effort (boat d)	CPUE (kg/boat d)
Aug 2011	117.490	22672	5.182	20.530	155	132.452	15.340	NA	NA	153.360	1158	132.452
Sep 2011	211.804	37053	5.716	99.616	356	279.820	159.160	NA	NA	470.580	1682	279.820
Oct 2011	164.398	30118	5.458	71.268	292	244.068	71.690	NA	NA	307.356	1259	244.068
Nov 2011	138.660	31161	4.450	21.113	126	167.563	69.000	NA	NA	228.773	1365	167.563
Dec 2011	139.159	35390	3.932	8.250	116	71.121	91.400	NA	NA	238.809	3358	71.121
Jan 2012	67.731	40626	1.667	** *	** *	***	40.000	NA	NA	107.731	1938	55.600
Total	839.242	197020	4.260	220.777	1,045	211.270	446.590	NA	NA	1506.609	10760	140.025

*UFK: United Fisheries of Kuwait; **NFC: National Fishing Company; NA: Not available.

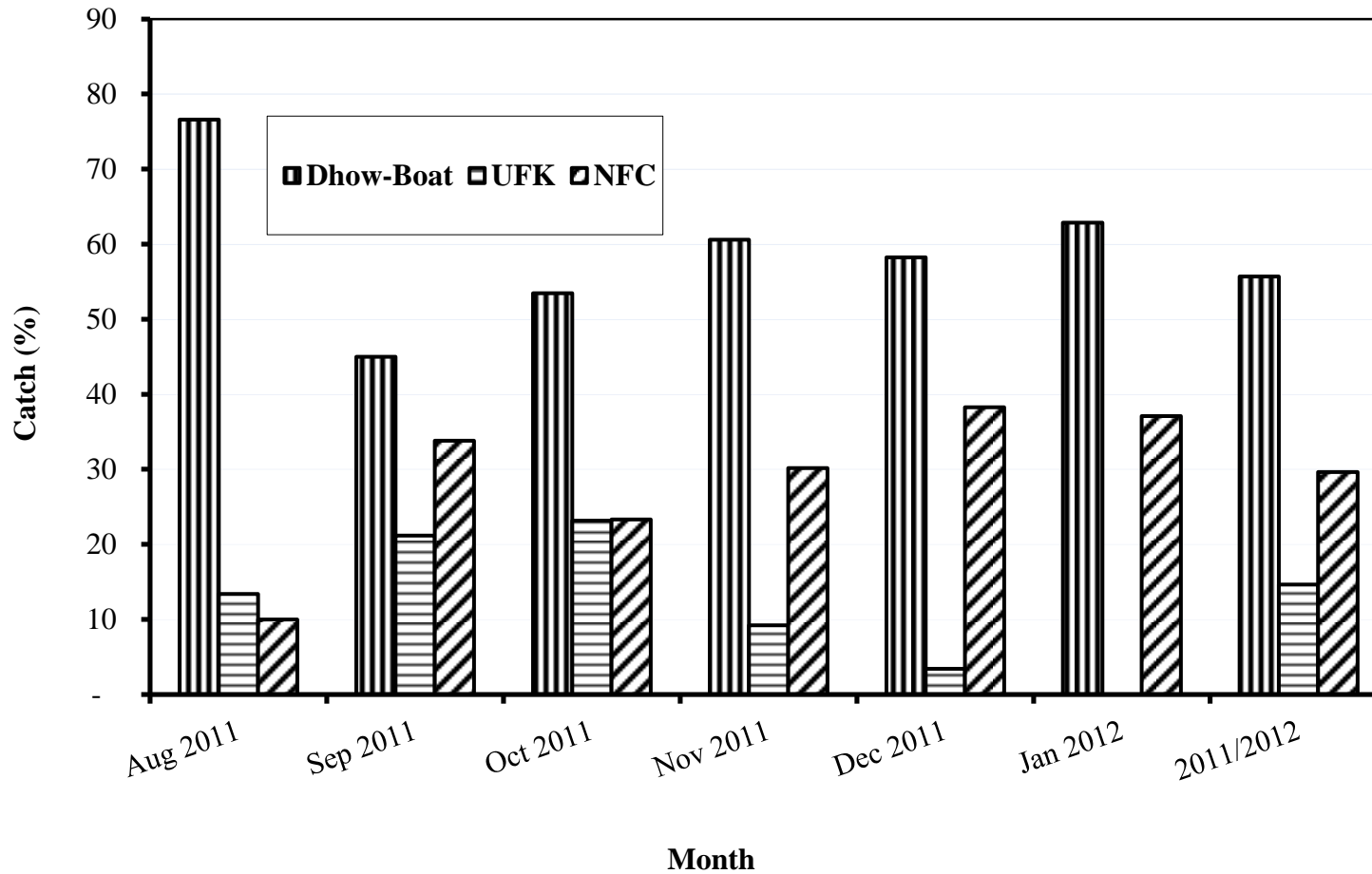
NB: The season opened on 1 August 2011, and closed on 31 January 2012.

***UFK has been banned since 31 December 2011.



CPUE = catch per unit effort, UFK = United Fisheries of Kuwait, SE = Standard error. Overall average landings equal about 2,024 t/y, SE = 117.977, Minimum = 543 t, Maximum = 5,126 t.

Figure 1. Total catch, effort, and catch-per-unit-effort (CPUE) of Kuwait's shrimp fishery; 1965/1966 - 2011/2012.



UFK :United Fisheries of Kuwait; NFC: National Fishing Company

Figure 2. Comparison of Kuwait's 2011/2012 overall shrimp catch by fleet.

Table 6. Comparison of Kuwait's 2011/2012 and 2010/2011 overall shrimp catch, efforts and catch-per-unit-effort (CPUE).

Month	Total catch (kg)	Total effort (U FK* boat-days)	CPUE (kg/U FK boat-day)
Aug-2011	153360	1158	132.452
Aug-2010	200889	968	207.562
Difference (%)	-23.66	19.63	36.19
Sep-2011	470580	1682	279.820
Sep-2010	506408	1513	334.598
Difference (%)	-7.07	11.12	-16.37
Oct-2011	307356	1259	244.068
Oct-2010	217692	1657	131.351
Difference (%)	41.19	-24.02	85.81
Nov-2011	228773	1365	167.563
Nov-2010	188845	1674	112.844
Difference (%)	21.14	-18.42	48.49
Dec-2011	238809	3358	71.121
Dec-2010	62930	1253	50.242
Difference (%)	279.48	168.08	41.56
Jan-2012	107731	1938	55.600
Jan-2011	23740	1803	13.167
Difference (%)	353.80	7.46	322.28
2011/2012**	1,506609	10760	140.025
2010/2011***	1,200504	8868	135.379
Difference (%)	25.50	21.33	3.43

* U FK = United Fisheries of Kuwait

** Season began on 1 August 2011 and closed on 31 January 2012

*** Season began on 1 August 2010 and closed on 15 January 2011

United Fisheries of Kuwait

In the 2011/12 season, U FK vessels landed 221 t of shrimp (15% of the total catch) with 1045 U FK boat-days of effort (Fig. 2). The catch and CPUE were high in September,

and then declined monthly to the end of December 2011. The UFK fleet stopped fishing voluntarily in December due to weak catches. When compared with the previous season, the UFK catch and effort were lower by 35% and 46%, respectively, resulting in a 19 % increase in CPUE (Table 5) (1).

Landings by UFK consisted of 53% *P. semisulcatus* and about 47% *M. affinis* (Table 7). Uncharacteristically, the industrial fleet captured less *P. semisulcatus* than the dhow-boat fleet, whose species composition consisted of 57% *P. semisulcatus* (Table 8). *P. semisulcatus* dominated the catches in the deeper waters off Kuwait's southeast coast, where the industrial fleet formerly fished. With more dhow-boats in the UFK fleet, however, catch differences between the fleets have diminished as they all fish in more or less the same areas. The percent of *P. semisulcatus* composition for the 2011/2012 catch by UFK was lower than that of the previous year (53 vs. 64%) (Fig. 3).

Table (7): Total white- and hard-shell catches and percentages landed by United Fisheries of Kuwait (UFK) fleet for 2011/2012.

Month	White-shell		Hard-shell	
	Catch (t)	Percent	Catch (t)	Percent
Aug 2011	19063	92.85	1467	7.15
Sep 2011	53115	53.32	46501	46.68
Oct 2011	34701	48.69	36567	51.31
Nov 2011	4918	23.29	16195	76.71
Dec 2011	4,941	59.89	3309	40.11
Jan 2012	*	*	*	*
Total	116738	52.88	104039	47.12

*UFK has been banned since 31 December 2011

When comparing the UFK catch and CPUE of *P. semisulcatus* for 2011/12 with 2010/11, there were decreases of 46.4% and 1% in total catch and CPUE, respectively (Table 9). The catches of *P. semisulcatus* in 2011/12 decreased in August through December compared to the corresponding months during in the 2010/11 season.

Table 8. Total catch, catch-per-unit-effort (CPUE) and percentages for the main species landed by Kuwait's dhow boat fleet for the 2011/12 season.

Month	<i>Penaeus semisulcatus</i>			<i>Metapenaeus affinis</i>			<i>Parapenaeopsis styliifera</i>			Other Species			Total		
	Catch (t)	Percent	CPUE (kg/h)	Catch (t)	Percent	CPUE (kg/h)	Catch (t)	Percent	CPUE (kg/h)	Catch (t)	Percent	CPUE (kg/h)	Catch (t)	Effort (h)	CPUE (kg/h)
Aug 2011	111.134	94.59	4.902	4.523	3.85	0.200	1.657	1.41	0.073	0.176	0.15	0.008	117.490	22672	5.182
Sep 2011	110.371	52.11	2.979	93.045	43.93	2.511	7.223	3.41	0.195	1.165	0.55	0.031	211.804	37053	5.716
Oct 2011	76.889	46.77	2.553	75.853	46.14	2.519	10.439	6.35	0.347	1.217	0.74	0.040	164.398	30118	5.458
Nov 2011	57.696	41.61	1.852	63.908	46.09	2.051	15.627	11.27	0.501	1.428	1.03	0.046	138.660	31161	4.450
Dec 2011	83.760	60.19	2.367	32.118	23.08	0.908	21.792	15.66	0.616	1.489	1.07	0.042	139.159	35390	3.932
Jan 2012	34.299	50.64	0.844	16.980	25.07	0.418	15.429	22.78	0.380	1.023	1.51	0.025	67.731	40626	1.667
Total	474.149	56.50	2.407	286.429	34.13	1.454	72.167	8.60	0.366	6.498	0.77	0.033	839.242	197020	4.260

Table 9. Comparison of Kuwait's 2011/2012 and 2010/2012 UFK^a *P. semisulcatus* shrimp catch, effort and catch-per-unit-effort (CPUE).

Month	Total Catch (kg)	Total Effort (UFK boat-days)	CPUE (kg/UFK boat-day)
Aug 2011	19063	155	122.987
Aug 2010	62396	354	176.260
Difference (%)	-69.45	-56.21	-30.22
Sep 2011	53115	356	149.199
Sep 2010	61819	443	139.546
Difference (%)	-14.08	-19.64	6.92
Oct 2011	34701	292	118.839
Oct 2010	45998	473	97.247
Difference (%)	-24.56	-38.27	22.20
Nov 2011	4918	126	39.032
Nov 2010	39330	436	90.206
Difference (%)	-87.50	-71.10	-56.73
Dec 2011	4941	116	42.595
Dec 2010	7546	165	45.733
Difference (%)	-34.52	-29.70	-6.86
Jan 2012*			
Jan 2011	790	60	13.167
Difference (%)			
2011/2012**	116738	1,045	111.711
2010/2011***	217879	1,931	112.832
Difference (%)	-46.42	-45.88	-0.99

^a UFK = United Fisheries of Kuwait.

*UFK stopped fishing on 31 Dec. 2011.

**Season started on 1 August 2011 and closed on 31 January 2012.

***Season started on 1 August 2010, and closed on 15 January 2011.

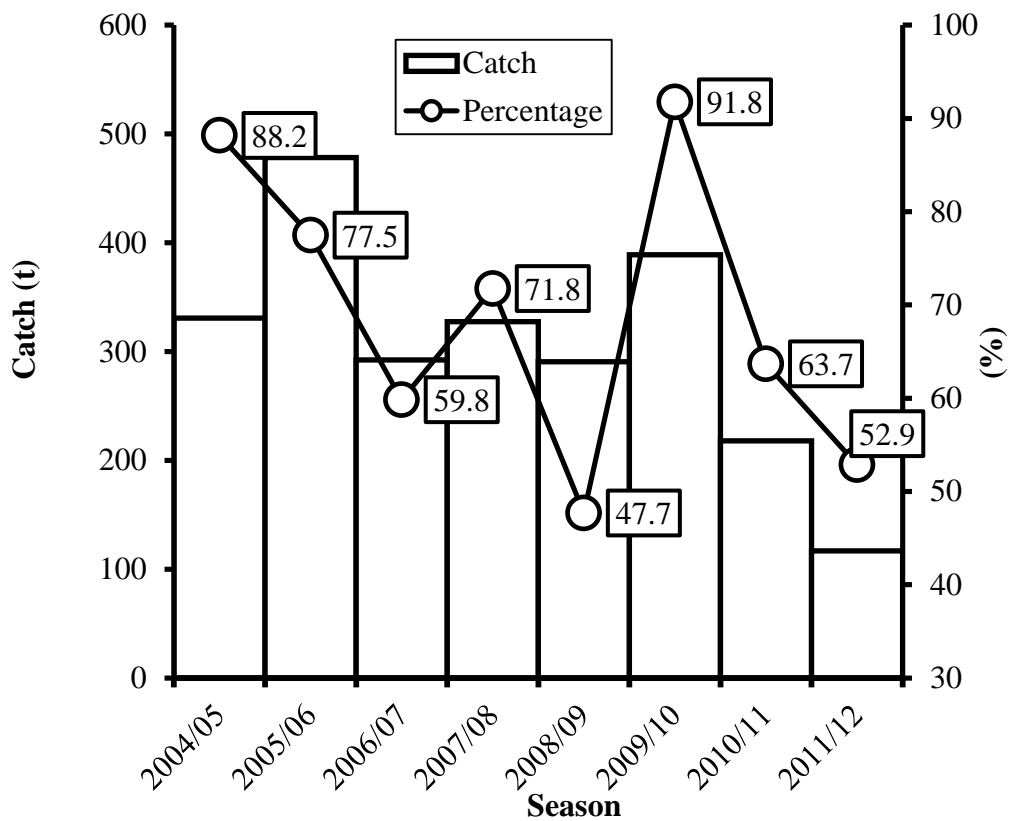


Figure 3. Comparison of the total *P. semisulcatus* catch and its percentages of total catch for the UFK fleet since 2004/05.

M. affinis contributed approximately 47% of the total UFK landings, with monthly landings ranging from 7% in August 2011 to 77% in November 2011 (Table 7). The percent of *M. affinis* in the 2011/12 season catch was high compared to the 2010/11 season (47 vs. 36%; Fig. 4). This increase in *M. affinis* catch could be because of successful recruitment stages during the closed season. When compared to the previous season, the UFK CPUE of *M. affinis* increased by 55% (Table 10).

Except for the 2008/2009 season, where *M. affinis* prevailed, *P. semisulcatus* has dominated the landings for the last 21 seasons. Landings of *P. semisulcatus* declined to a historical low in the 2011/2012 season (Fig. 3), indicating very weak recruitment. The primary factors for this decrease appear to be increasing fishing pressure during the open season as well as illegal trawling during the closed season. Additionally, the decreased discharge of the Shatt Al-Arab has resulted in major environmental changes taking place in the northern Gulf.

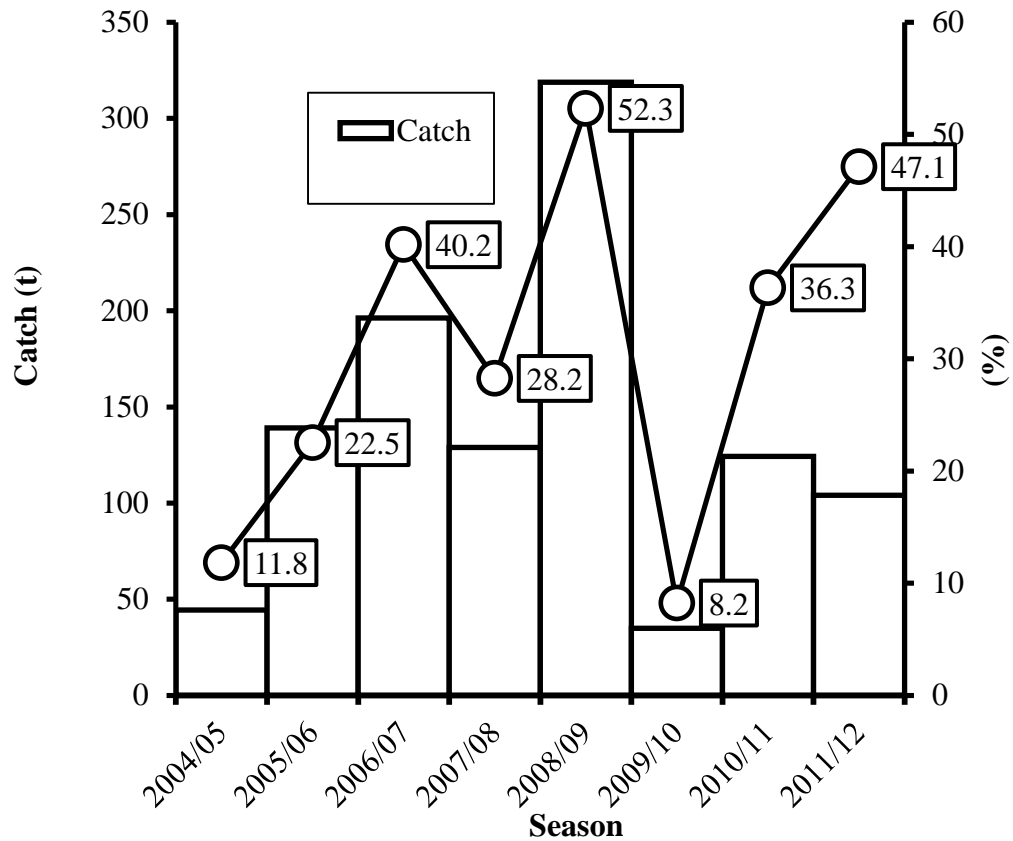


Figure 4. Comparison of the total *M. affinis* catch and its percentages of the total catch for the UFK fleet since 2004/05.

The NFC's landings showed a trend similar to that of the UFK from August through November. In December, however, the landings increased from 69 t in November to 91 tons (Table 5). The highest landings were recorded in September 2011 with 159 t and the lowest occurred in August 2011 (Table 5). No data are available for the NFC's effort. The NFC's total catch of 447 t represented 30% of the 2011/12 total, exceeding the catch of the previous season (447 vs. 214 t; Table 5, (1)).

Table 10. Comparison of Kuwait's 2011/2012 and 2010/2011 UFK^a *M. affinis* shrimp catch, effort and catch-per-unit-effort (CPUE).

Month	Total Catch (kg)	Total Effort (UFK boat-days)	CPUE (kg/UFK boat-day)
Aug 2011	1467	155	9.465
Aug 2010	11082	354	31.305
Difference (%)	-86.76	-56.21	-69.77
Sep 2011	46501	356	130.621
Sep 2010	86458	443	195.165
Difference (%)	-46.22	-19.64	-33.07
Oct 2011	36567	292	125.229
Oct 2010	16132	473	34.106
Difference (%)	126.67	-38.27	267.18
Nov 2011	16195	126	128.532
Nov 2010	9846	436	22.583
Difference (%)	64.48	-71.10	469.16
Dec 2011	3309	116	28.526
Dec 2010	734	165	4.448
Difference (%)	350.82	-29.70	541.25
Jan 2012*			
Jan 2011	0	60	0.000
Difference (%)			
2011/2012**	104039	1,045	99.559
2010/2011***	124252	1,931	64.346
Difference (%)	-16.27	-45.88	54.72

^a UFK = United Fisheries of Kuwait.

* UFK stopped fishing on 31 December 2011.

** Season began on 1 August 2011, and closed on 31 January 2012.

*** Season began on 1 August 2010, and closed on 15 January 2011.

Dhow-boat Fishery

The overall catch of the dhow-boat fleet in the 2011/12 season was higher than that of the 2010/2011 season (839 vs 645 t). The highest catch was observed in September, and then catches declined monthly as the season progressed. Since Kuwait's liberation in 1991, the dhow-boat fleet catches have dominated the combined industrial catches in terms of effort and landings for 14 of the 21 seasons (Fig. 5). Dhow-boats landed about 56% of the 2011/12 season catch and accounted for 59% of the total effort in UFK boat-days (Fig. 5).

International Waters and Unlicensed Trawlers

The total shrimp catch in August 2011 (153 t, Table 6) was made completely outside of Kuwait's territorial waters. All trawling vessels, both licensed and unlicensed, are allowed to trawl in international waters during the shrimping season. The unlicensed fleets contribute substantially to the catch and effort statistics.

The shrimp landed by unlicensed dhow boats amounted to 580 t (69%) of the total dhow-boat shrimp landings during the 2011/12 season (Table 11). The total shrimp landings from international waters were (641t) 43% of the total shrimp landings during the 2011/12 season. If the shrimp caught in international waters are separated from the total landings, then Kuwait's territorial waters account for only 866 t, which is very low when compared to historical catch data. Approximately 100 unlicensed dhow boats trawled for shrimp during the 2011/12 season. These unlicensed vessels have increased in number to the point that their catches dominate shrimp landings. Al-Foudari (2) reported that 55 unlicensed dhow-boats accounted for 41% of the total dhow boat landings.

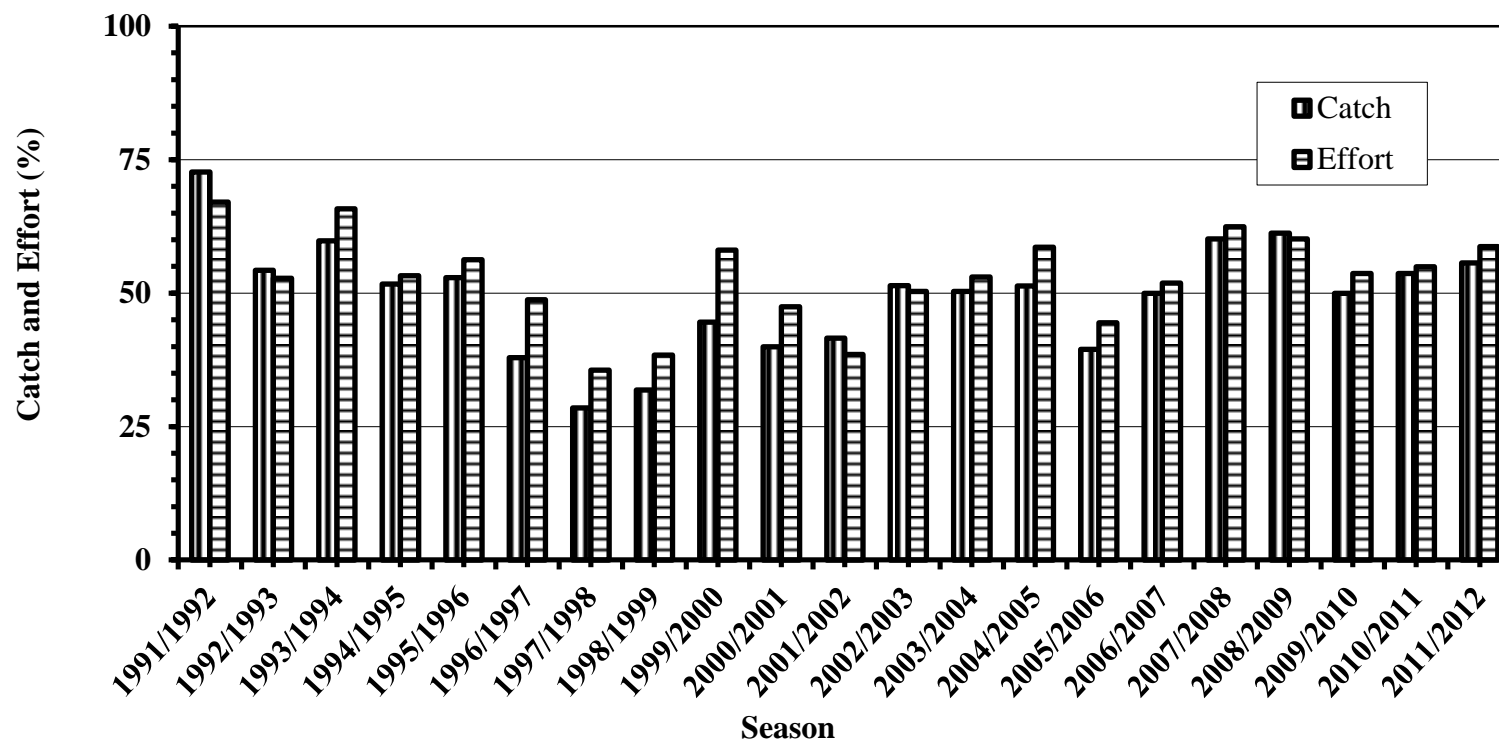


Figure (5): Percentages of catch and effort for the dhow-boat fleet in Kuwait's total shrimp fishery catch and effort.

Table 11. Shrimp catch, effort and catch-per-unit-effort (CPUE) for dhow-boats in the 2011/12 Season.

Month	Estimated Total Catch (t)	Percentage of catch		Catch (t)	
		Unlicensed	Licensed	Unlicensed	Licensed
Aug 2011	117.5	79.4	20.6	93.3	24.9
Sep 2011	211.8	68.2	31.8	144.4	67.3
Oct 2011	164.48	69.4	30.6	114.2	50.2
Nov 2011	138.7	67.7	32.3	93.9	44.7
Dec 2011	139.2	63.2	36.8	87.9	51.3
Jan 2012	67.7	68.2	31.8	46.2	21.6
Total	839.2	69.2	30.8	580.42	258.8

NB: The season opened on 1 August 2011, and closed on 31 January 2012.

By-catch

No by-catch data were recorded from the dhow-boat fleet. The total landings, including shrimp as well as the non-shrimp by-catch, by the UFK fleet and the NFC fleet amounted to 921 t, of which 255 t (28%) were by-catch. The dhow-boats operated by UFK landed 364 t, of which 143 t (39%) was by-catch (Table 12). The most important species, by volume, in descending order were crab (52 t), nuwaiby (16 t) and sha'em (13 t; Table 12). The monthly by-catch-to-shrimp ratios for the UFK fishery from August 2011 through December 2011, ranged from 0.7:1 in August to 2.4:1 in December (Table 12). The increase in the by-catch-to-shrimp ratio as the season progressed was due to a decreasing shrimp catch, not vice versa. Overall, the fish by-catch-to-shrimp ratio was 0.6:1 for the UFK fleet (Table 12).

Landings by NFC boats totalled 558.5 t, of which 111.9 t (44%) were non-shrimp by-catch (Table 13). Depending on month, the NFC boats' by-catch-to-shrimp ratio ranged from <0.1:1 to 0.7:1, and overall, averaged 0.2:1 (Table 13). This ratio was only one-third that of the UFK landings ratio, i.e., 0.6:1 (Table 12).

Table 12. The estimated total shrimp by-catch by species from the United Fisheries of Kuwait (UFK) shrimp fishery during the 2011/12 season.

Species	Catch (kg)							(%)
	Aug 2011	Sep-2011	Oct-2011	Nov-2011	Dec-2011	Jan 2012**	2011/2012	
Hamoor	145	339	83	60	257		884	0.6
Nuwaiby	199	3148	3305	4942	4,826		16420	11.5
Sha'um	94	559	559	7,501	4,701		13414	9.4
Zobaiddy	14	573	546	112	148		1393	1.0
Nagroor	54	34	12	2	16		118	<0.1
Khobat	62	1	59	21	-		143	0.1
Kanad	233	509	308	81	24		1155	0.8
Crab	1373	33481	18412	2,526	552		56344	39.5
Lobster	17	1	0	0	0		18	<0.1
Other	13050	11243	12057	6,626	9,693		52669	36.9
Total by-catch	15241	49888	35341	21,871	20217		142558	100.0
Shrimp*	20530	99616	71268	21,113	8250		220777	
By-catch: Shrimp	0.7:1	0.5:1	0.5:1	1.0:1	2.4:1		0.6:1	

*Total shrimp catch data are taken from Table 2.

** UFK boats stopped trawling on 31 December 2011.

Table 13. Estimated total shrimp and by-catch from the National Fishing Company (NFC) shrimp fishery during the 2011/12 season.

Month	Shrimp (kg)	By-catch (kg)	By-catch (%)	By-catch:Shrimp
Aug-2011	15340	2960	2.64	0.2:1
Sep-2011	159160	13080	11.69	<0.1:1
Oct-2011	71690	53240	47.57	0.7:1
Nov-2011	69000	19470	17.40	0.3:1
Dec-2011	91400	23175	20.71	0.3:1
Jan-2012	40000	NA	NA	NA
Total	446590	111925	100.00	0.2:1

NA = Not available

Conclusion

Fishermen landed 1507 t of shrimp for the 2011/12 season, about 25% less than the long-term average of 2024 t. To land this volume, however, 10760 UFK boat-days of effort were required, which is nearly 100% greater than that recommended for maximum biological return (maximum biomass), and 270% more than that required to maximize economic return. This extra effort makes the fishery inefficient, resulting in higher operating costs and lower profits for the industry. This inefficiency results in higher consumer prices as well. A priority for the regulatory authority should be to reduce the number of vessels active in the fishery and to prevent unlicensed dhow boats from trawling. Illegal trawling by dhow boats is a major and chronic problem as they have dominated the fishery in both effort and landings volume. The dhow boats alone landed 56% of the total landings and accounted for 59% of the total effort.

The international waters are open access areas and there are no management regulations for shrimp stocks in these waters. These shrimping grounds are extremely important to Kuwait's fisheries because they accounted for 43% of the 2011/12 shrimp landings. International cooperation among regional countries to managed stocks, both shrimp and fish, in fishing grounds outside territorial waters should be a priority.

Changes in vessel composition of Kuwait's shrimping fleets have resulted in more and larger dhow boats, thus increasing the overall fishing power for trawlers. Although this change has resulted in more homogenous fleets overall, significant differences were found in engine horsepower between UFK and NFC boats ($P < 0.01$) and between dhow fleet and UFK boats ($P < 0.01$). No significant differences ($P > 0.05$) were found between the dhow-boat fleet and the NFC fleet. These differences show that it is important to continue recording landings statistics by individual fleet in order to compare CPUEs and to standardize CPUE.

Acknowledgements

Gratitude is extended to the staff of the Public Authority for Agriculture Affairs and Fish Resources (PAAAFR) for their cooperation and help in providing personnel for the project and catch and effort information. Additionally, gratitude is extended to the managers of the United Fisheries of Kuwait and the National Fishing Company for their cooperation and support in providing the project with the monthly catch and effort data. Special thanks to the Kuwait Foundation for the Advancement of Sciences (KFAS), PAAAFR and the Kuwait Institute for Scientific Research (KISR) for providing financial assistance. The support of KISR Research Vessel Pool is greatly appreciated.

References

1. Al-Foudari, H. M. (2011). Status of Kuwait's 2010/2011 shrimp fishery. Kuwait Institute for Scientific Research, Report No. KISR10610, Kuwait.
2. Al-Foudari, H. M. (2005). Status of Kuwait's 2003/2004 shrimp fishery. Kuwait Institute for Scientific Research, Report No. KISR7503, Kuwait.
3. Al-Foudari, H. M. (2000). Status of Kuwait's 1999/2000 shrimp fishery. Kuwait Institute for Scientific Research, Report No. KISR5826, Kuwait.
4. Bedford, B. (1982). The 'industrial' fishery. Kuwait Institute for Scientific Research, Report No. KISR648, Kuwait.
5. Mohammed, H. M. A., Bishop, J. M. and Ye. Y. (1998). Kuwait's post Gulf War shrimp fishery and stock status from 1991/92 through 1995/96. *Reviews in Fisheries Science*, **6**(4): 253-280.
6. Pascoe, S. (1997). Bycatch management and the economics of discarding. Food and Agriculture Organization, FAO Fisheries Technical Paper 370, Geneva, Switzerland.
7. Van Zalinge, N. P.; El-Musa, M., Al-Hossaini, M., and Abdul-Ghaffar, A. R. (1981). The Kuwait shrimp fishery and the shrimp resources in Kuwait's waters. Kuwait Institute for Scientific Research, Report No. KISR395, Kuwait.
8. W. Chen, Bishop, J.M., Al-Foudari, H.M., Almatar, S., and Al-Yamani, F.Y. (2011). A comprehensive management strategy for the long-term sustainability of Kuwait's shrimp stocks. Kuwait Institute for Scientific Research, Report No. KISR8401R, Kuwait.

وضع مصايد الروبيان في الكويت للموسم 2011/2012

حسين الفودري وجيمس بيشوب وويزهونج شن

برنامج إدارة الموارد البحرية القائمة على النظام البيئي، مركز أبحاث البيئة والعلوم الحياتية، معهد الكويت للأبحاث العلمية، الكويت

الخلاصة. بدأ موسم صيد الروبيان 2012/2011 في الأول من أغسطس 2011 واستمرحتى الحادي والثلاثون من يناير 2012، وبلغت كمية الروبيان التي تم اصطيادها 1,507 طنا وبلغ عدد أيام الصيد 10,760 يوما. وبمقارنة موسم 2012/2011 مع موسم 2011/2010 يتضح أن هناك زيادة في كميات مصيد الروبيان وعدد أيام الصيد ومعدلات صيد الروبيان مقداره 25، 21 و 3%، على التوالي. ورغم الزيادة في كميات المصيد إلا أنها أقل من معدل المصيد المقدّر بـ 2,000 طن. وقد استحوذت المراكب الخشبية على 56% من إجمالي كميات المصيد و 59% من إجمالي عدد أيام الصيد. وبلغت نسبة تواجد الروبيان في المصيد للمراكب الحديدية "مصيد شركة الأسماك المتحدة" 53% نوع *P. semisulcatus* و 47% نوع *M. affinis*. وبلغت كميات مصيد الروبيان لمراكب الأهالي الغير مرخصة للجر القاعي 69% من مجموع الصيد الكلي لاسطول المراكب الاهلية خلال موسم الصيد 2012/2011. وبلغت كميات مصيد الروبيان من المياه الدولية 43% من مجموع المصيد الكلي لمصائد الروبيان الكويتية. وتبين ان عدد مراكب اسطول الاهالي المرخصة للجر القاعي قد زاد عددها بينما قل عدد مراكب الشركات وذلك بتحويل بعض تراخيص سفن الصيد الصناعية إلى سفن نوع فيبر كلاس بنسبة 1.4 صناعي إلى فيبر كلاس. وبلغت كميات المصيد الجانبي المطروحة في الأسواق للمراكب الحديدية 255 طنا، منها 143 طنا "لمصيد شركة الأسماك المتحدة"، و 111 طنا لمصيد شركة الأسماك الكويتية، وكان القيقب أو سرطان البحر هو أكثر الأنواع التي تم اصطياده جانبيا. وكان جهد الصيد في الموسم 2012/2011 قد استغرق أياما أكثر من الحد الأمثل وذلك للحصول على إنتاجية عالية، لذا فإنه من الضروري التشديد على عدم السماح للمراكب الغير مرخصة للجر ألقاعي للصيد في الموسم القادم، وذلك حماية للمخزون.

الكلمات المفتاحية: المياه الدولية، الكويت، تعريف المخزون، الترقيم، تقييم المخزون.