Agricultural and Marine Sciences, 13:43-52 (2008)

Length and Weight Relationships for 31 Species of Fishes Caught by Trawl Off the Arabian Sea Coast of Oman

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علاقات الطول والوزن لإحدى وثلاثون نوعا من الأسماك المصطادة بطريقة الجرف من ساحل بحر العرب لسلطنة عمان

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الخلاصة: جمعت قياسات الطول والوزن لإحدى وثلاثون نوعا من الأسماك التي صادف صيدها في بحر العرب لساحل عمان بواسطة سفينة الجرف القاعية وذلك خلال الفترة بين مارس ٢٠٠٧ ومارس ٢٠٠٨. ولقد تم قياس الطول الكلي والطول الشوكي والوزن الكلي لما مجموعه ٣٢٦١ عينة متى ما كان ذلك ممكنا. العديد من الأنواع التجارية الشائعة المصطادة تمر بعملية نزع الأحشاء داخل مصنع السفينة. ولقد تم جمع قياسات أوزان هذه الأنواع قبل وبعد نزع الأحشاء وقبل التغليف وتم حساب معامل التغير لاثني عشر نوعا من هذه الأسماك. تمت مقارنة العلاقات التي تم الحصول عليها في هذه الدارسة مع الدراسات الأخرى من نفس الأنواع.

ABSTRACT: Length and weight measurement for 31 fish species encountered in the Arabian Sea, off the Oman Coast, were collected by demersal trawling during March 2007 and March 2008. A total of 3,261 specimens were measured for total length, or fork length, where appropriate, and green weight. Several commonly caught commercial species undergo onboard processing (dressing) prior to packaging, and dressed weight to green weight regressions and conversion factors were calculated for 12 of these species. The relationships obtained in this study were compared with those of other studies for the same fish species. These data are fundamental to understanding the biological parameters of fishes, and can be applied to fisheries stock assessment and management models.

Keywords: Demersal trawling, Arabian Sea, length-weight relationships.

Introduction

An industrial demersal trawl fishery exists off the coast of the Sultanate of Oman, operating between north of Masirah Island to the Al-Hallaniyat Islands in the Arabian Sea, in depths between 50 to 150m (Fig. 1). This fishery was initiated by the government of the Sultanate of Oman in the late 1970's to develop an alternative economy to petroleum products (Johannesson, 1991).

In 1986, seven foreign trawlers and two Omani vessels were operating in the Oman demersal trawl fishery (McClure, 1987). By 2003, the number of industrial vessels trawling in the Oman demersal trawl zone had expanded to 20, all of which were foreign (Anon., 2004). Reported landings peaked in 1997 at 34,549 mt (accounting for 29% of the total Oman landings for that year), and landings for 2003 were reported to be 19,608 mt (14% of the total Oman landings).

Human (2007) reported the species composition and quantum of fishes caught during a brief survey of the demersal fishing area. The Marine Science and

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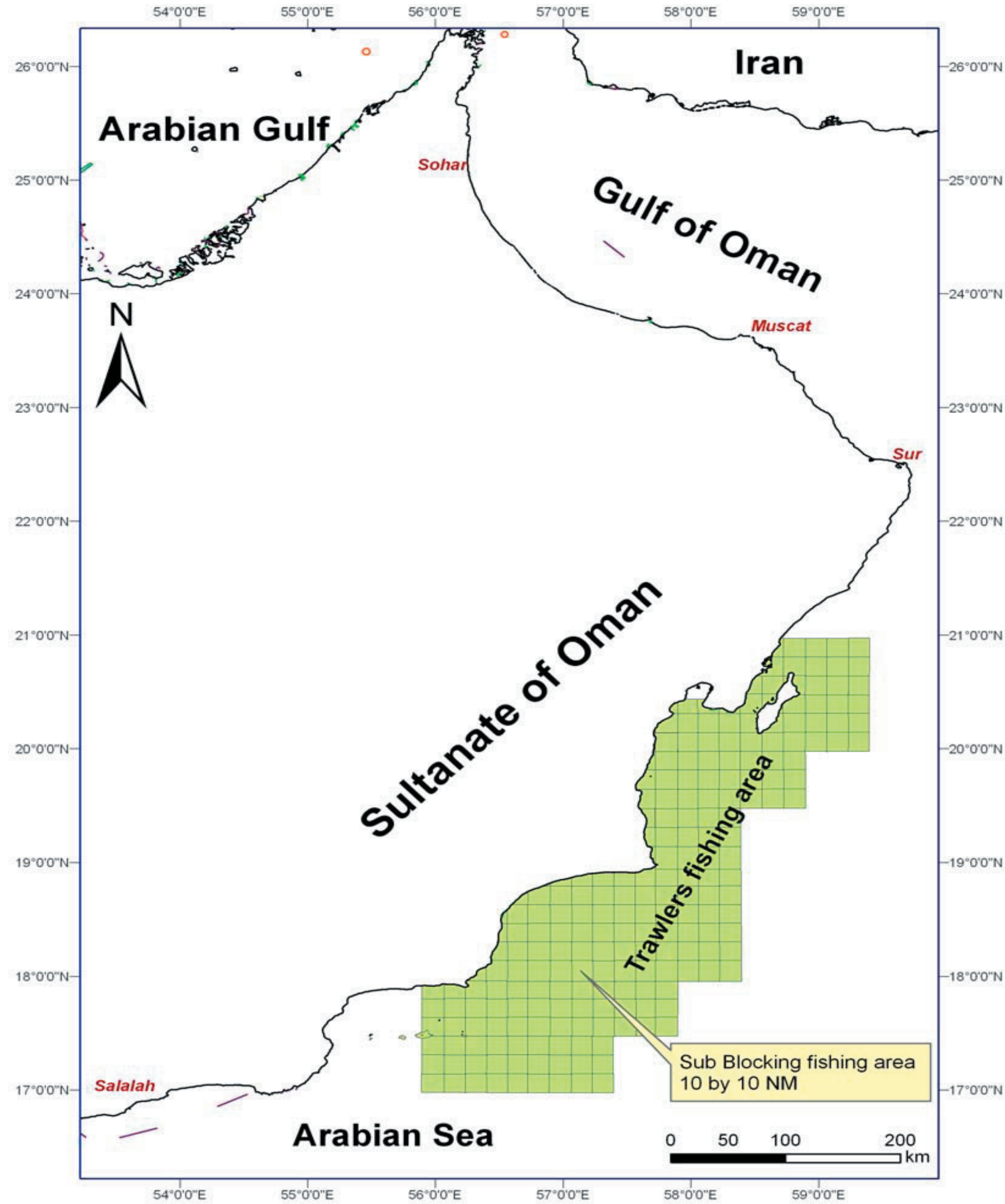

Figure 1. Chart of the Sultanae of Oman showing the demersal trawl fishery zone (Lubna Al-Kharusi).

Fisheries Centre is currently undertaking a project to investigate the biology, and assess the stocks of 13 species of commercially important demersal fishes (see Al-Nahdi *et al*., 200x; Al-Waeli *et al*., 200xa; and Al-Waeli *et al*., 200xb in this issue). In addition to this, the Ministry of Fisheries Wealth is currently conducting a 15-month project, the *Fish Resources Assessment Survey of the Arabian Sea Coast of Oman*, to estimate the current biomass of the fisheries resources in the Arabian Sea, off the Oman coast. This survey is due to be completed in September 2008.

The last survey and assessment of this fishery was by the *R.V. Rastrelliger* from late 1989 to late 1990 (Johannesson, 1991), some 17 years ago. In that study, the demersal stock of the entire Omani coastline, from the Musandam Peninsula to Salalah was assessed. The only other major fisheries resources assessment conducted along the Omani coastline was by the *R.V. Dr. Fridtjof Nansen*, which conducted demersal biomass estimates using acoustic methods in 1983 and 1984 (Strømme, 1986). A small scale fisheries resources assessment was conducted in the Arabian Gulf and the northern Gulf of Oman during 2003-2004 (Valinassab *et al.*, 2006). These studies did not provide length or weight relationships.

Length and weight relationships are basic, yet represent fundamental data that are essential to understanding the biological parameters of fishes, which can then be applied to fisheries stock assessment and management (Gonzales *et al*., 2000; Muto *et al*., 2000; Morato *et al*., 2001; Can *et al*., 2002; Wigley *et al*., 2003; Abdurahiman *et al*., 2004; and Frota *et al*., 2004). This study provides length and weight relationships for 31 fish species encountered during a recent survey of the Oman demersal fishing zone. Additionally, most of the more commonly caught, commercially important species undergo processing (dressing) prior to packaging. Landings of these species are reported in dressed weight, therefore it is essential to know the dressed weight to green weight (total wet weight) conversion factors to convert landed weight into total weight for fisheries modelling and management purposes.

Materials and Methods

The area demarcated for demersal trawling within the Sultanate of Oman is south of 21ºN, north of 17ºN, in water not less than 50m deep, or not closer than 10nm to the coast, in the Arabian Sea within the Omani EEZ (Fig. 1). Sampling was conducted in this area from 5th March - 24th March, 2007, during commercial fishing operations (bottom trawling). Between 27th February - 18th March, 2008, fishes were sampled from the demersal trawl zone, and areas of the Arabian Sea, in a depth range between 20-200m, extending south of the demersal trawl zone to the Yemen border, during part of the third cruise of the *Fish Resources Assessment Survey of the Arabian Sea Coast of Oman*.

The *F.V. Al-Mustaqila I*, a factory stern trawler with a gross tonnage of 1226 tonnes and overall length (L.O.A) of 45.2m (Chris Carey, personal communication), was used as a sampling platform. A trawl net of multiple mesh sizes (110mm in the cod-end), a ground rope of 100m, and a door spread whilst trawling approximately 100m wide at 100m depth was used during commercial fishing operations. The wingtip spread was approximately 35m, and the opening of the mouth of the trawl was between 5.5-6m (monitored by sensors on the headline). The trawl warps used were 32mm dyform warps. The trawling speed was approximately 4 knots.

The same vessel is being used for the *Fish Resources Assessment Survey of the Arabian Sea Coast of Oman*. The trawl warps are the same, however the bottom trawl gear is different to that used for commercial fishing. For that survey, a trawl net of multiple sizes with a cod-end mesh size of 40mm, a ground rope of 100m, and a door spread whilst trawling approximately 100m wide at 100m depth was used during commercial fishing operations. The wingtip spread was approximately 35m, and the opening of the mouth of the trawl was between 5.5-6m (monitored by sensors on the headline). The trawling speed was approximately 3.5 knots (Neil Bagley, personal communication).

Fishes were collected and sorted inside the onboard fish processing factory. Species were identified using Smith & Heemstra (1986), Al-Abdessalaam (1995), Randall (1995), or Carpenter *et al.* (1997). All length and weight measurements were taken on freshly captured fishes. During commercial fishing, fish were measured on a measuring board, and the same balance was used for the entire cruise. For fish measured during the *Fish Resources Assessment Survey of the Arabian Sea Coast of Oman*, data were captured directly onto a NIWA (National Institute of Water and Atmospheric Research Ltd., New Zealand) computer controlled digitising work station. These data have been incorporated into the total database for that survey.

Linear measurements were taken in a straight line and did not follow the natural curves of the animal (see Compagno, 2001; and Human, 2006). Total length (TL) was the greatest straight line measurement from the anterior tip of the snout to the posterior tip of the caudal fin, with the caudal fin lying straight and not in its natural position, and was applied to fishes lacking a forked tail and sharks. Fork length (FL) was the straight line measurement from the anterior tip of the snout to the anterior margin of the fork in the caudal fin, in fish with a forked caudal fin. All length measurements were taken to the nearest 5mm, and all weight measurements to the nearest 5g during commercial fishing, whereas, all length measurements were taken to the nearest 1mm, and all weight measurements to the nearest 1g during the *Fish Resources Assessment Survey of the Arabian Sea Coast of Oman*.

To determine dressed weight to green weight conversion factors, fish were sorted by species into bins (typically 4-10kg per bin, consisting of 1 to 6 specimens depending on size) and weighed for green weight (GW). The bin was then given to factory workers who processed the fish. The processing of bony fishes involved removal of the head, tail, and entrails; while processing of sharks involved removal of the head, fins, tail, entrails, and a section of the abdomen from the insertion of the pelvic fin to the insertion of the pectoral fins. The fish were then placed back into the bin and reweighed for dressed weight (DW).

Regressions were performed on length-weight relationships. In all length-weight regressions, the data were fitted with either power or exponential curves, depending on which type of curve provided the best fit based on least squares. All GW-DW relationships were linearly regressed, and conversion factors were determined for the latter.

Results and Discussion

A systematic list of the species reported in this study is given in Table 1, which also lists the family to which the species belong, and the English common name. Due to space constraints, graphs of all of the regressions will not be presented here. The length and weight regressions are tabulated as follows: TL-GW (11 species; n = 1194; Table 2); FL-GW (20 species; n = 1904; Table 3); and GW-DW (9 species; n = 163) with gross conversion factors for converting DW to GW, and vice versa, given in Table 4.

It was possible to compare only a few species presented here to studies that had been conducted previously. Of the literature examined for this study, all presented length-weight relationships as a power curve, or an alogarithmic transformation thereof, in the form:

$$Wt = a.L^b \qquad (1)$$

where Wt is weight, L is length, a is a scaling constant, and b is an allometric growth coefficient.

The allometric growth coefficient from equation (1) has been used as an indicator of a wide range of biological parameters, including - rate of weight gain relative to growth in length, rate of gonad development, rate of feeding, growth rate, ontogenetic change, sexual dimorphism, maturity, age structure, and condition; as well as a predictor of weight at age; for biomass estimation and stock assessment purposes (Morato *et al*., 2001; Can *et al*., 2002; Abdurahiman *et al*., 2004; and Frota *et al*., 2004). However, it has been noted that the allometric growth coefficient is highly variable due to factors such as inter- and intra-population differences, gender, seasonality, annual variability, food availability (quantity and quality), reproductive state, migratory activities, temperature, salinity, as well as sampling biases such as length range of the sample population due to gear selectivity (Muto *et al*., 2000; Morato *et al*., 2001; Can *et al*., 2002; Frota *et al*., 2004; Akyol *et al*., 2007; and see Wigley *et al*. (2003) for a comparison of the effects of season, gender and length range, within an area).

Most of the literature examined for this study gave ranges and statistical significance values for allometric growth coefficients, however, given the variability and number of factors that influence the allometric growth coefficient, it is very difficult to assign true biological meaning to this coefficient (see Frota *et al*., 2004). The allometric growth coefficient can best be considered as a general indicator of the condition (ie. weight of the fish relative to length) of a fish species within restricted temporal and spatial limits. Additionally, this study found that exponential curves provided a better description of length-weight data for some species, and the type of length measurement used, compared to power curve regressions, indicated by higher R^2 values (data not shown).

Table 1. Systematic listing of fish species, including family and English common name, for which length-weight relationships are reported in this study.

Family	Species	Common Name
Carcharhinidae	*Rhizoprionodon acutus*	Milk shark
Muraenesocidae	*Muraenesox cinereus*	Daggertooth pike conger
Clupeidae	*Dussumieria elopsoides*	Slender rainbow sardine
Ariidae	*Arius bilineatus*	Roundsnout sea catfish
Ariidae	*Arius dussumieri*	Blacktip sea catfish
Synodontidae	*Saurida undosquamis*	Brushtooth lizardfish
Synodontidae	*Synodus dermatogenys*	Clearfin lizardfish
Synodontidae	*Trachinocephalus myops*	Snakefish
Triglidae	*Lepidotrigla bispinosa*	Bullhorn gurnard
Platycephalidae	*Kumococius rodericensis*	Spiny flathead
Carangidae	*Alectis indicus*	Indian threadfish
Carangidae	*Carangoides chrysophrys*	Longnose jack
Carangidae	*Decapterus russelli*	Indian scad
Carangidae	*Seriola rivoliana*	Almaco jack
Haemulidae	*Pomadasys commersonnii*	Spotted grunt
Nemipteridae	*Nemipterus randalli*	Randalls threadfin bream
Lethrinidae	*Lethrinus nebulosus*	Spangled emporer
Sparidae	*Argyrops spinifer*	King soldierbream
Sparidae	*Cheimerius nufar*	Santer seabream
Sparidae	*Pagellus affinis*	Arabian pandora
Sciaenidae	*Argyrosomus hololepidotus*	Southern meagre
Pinguipedidae	*Parapercis alboguttata*	Bluenose sandperch
Paralichthyidae	*Psuedorhombus arsius*	Largetooth flounder
Trichiuridae	*Trichiurus lepturus*	Largehead cutlassfish
Scombridae	*Sarda orientalis*	Striped bonito
Scombridae	*Scomber japonicus*	Chub mackerel
Drepanidae	*Drepane longimana*	Barred sicklefish
Balistidae	*Sufflamen fraenatus*	Bridled triggerfish
Ostraciidae	*Tetrosomus gibbosus*	Thornback trunkfish
Tetraodontidae	*Lagocephalus guentheri*	Diamondback pufferfish
Diodontidae	*Cyclichthys spilostylus*	Yellowspotted burrfish

Synodontidae

The brushtooth lizardfish appears to be a common bycatch species both in the Arabian Sea, and in the eastern Mediterranean Sea. Abdallah (2002) reported the length-weight relationship for the brushtooth lizardfish as $Wt = 0.003TL^{3.30}$ ($R^2 = 0.953$; N = 465) from the trawl fishing ground off Alexandria, Egypt, while Can *et al.* (2002) reported $Wt = 0.0117TL^{2.7971}$ ($R^2 = 0.90$; N = 100), and Akyol *et al.* (2007) reported $Wt = 0.0046TL^{3.109}$ ($R^2 = 0.951$; N = 80), from Turkish waters in the Aegean Sea. Abdurahiman *et al*. (2004) reported $Wt = 1.34x10^{-6}TL^{3.306}$ ($R^2 = 0.99$; N = 2774) from Karnataka, India, Arabian Sea. Fork length was measured for this species in the current study (Table 3), therefore, while it is not possible to make a direct comparison between this study and other studies, the allometric growth coefficients between studies are equivalent for this species from different geographic locations and different time periods, suggesting that the brushtooth lizardfish has consistent growth parameters over time and space.

Frota *et al*. (2004) reported the length-weight relationship for snakefish off Brazil as $Wt = 7x10^{-4}FL^{3.881}$ ($R^2 = .976$; N = 21). The lower values for both the scaling constant and the allometric growth

Table 2. Summary of the regression of total length (TL) against green weight (Wt), including species common name, sample size, regression equation, R^2 value, and size range, for 11 species of fishes caught using demersal trawl gear off Oman. Length is in millimetres and weight is in grams.

Common Name	N	Regression	R^2	TL Size Range
Arabian pandora	68	$Wt = 2x10^{-5}TL^{2.9424}$	0.9811	100 - 425
Barred sicklefish	157	$Wt = 2x10^{-5}TL^{3.0841}$	0.9176	257 - 419
Bridled triggerfish	117	$Wt = 2x10^{-5}TL^{3.0406}$	0.9926	130 - 355
Chub mackerel	112	$Wt = 3x10^{-6}TL^{3.195}$	0.9526	210 - 390
Daggertooth pike conger	35	$Wt = 33x861e^{0.0037TL}$	0.7541	700 - 1040
King soldier bream	85	$Wt = 3x10^{-5}TL^{2.8572}$	0.9707	250 - 640
Largehead cutlassfish	390	$Wt = 2x10^{-7}TL^{3.2066}$	0.8551	675 - 1210
Largetooth flounder	74	$Wt = 4x10^{-6}TL^{3.1671}$	0.9945	82 - 391
Striped bonito	51	$Wt = 8x10^{-6}TL^{3.0324}$	0.9723	400 - 655
Thornback trunkfish	71	$Wt = 16.885e^{0.0132TL}$	0.8629	158 - 250
Yellowspotted burrfish	34	$Wt = 7x10^{-4}TL^{2.4868}$	0.9225	191 - 391

Table 3. Summary of the regression of fork length (FL) against green weight (Wt), including species common name, sample size, regression equation, R^2 value, and size range, for 20 species of fishes caught using demersal trawl gear off Oman. Length is in millimetres and weight is in grams.

Common Name	N	Regression	R^2	FL Size Range
Arabian pandora	68	$Wt = 4x10^{-5}FL^{2.8851}$	0.984	90 - 385
Blacktip sea catfish	79	$Wt = 134.4e^{0.0053FL}$	0.876	330 - 630
Bluenose sandperch	65	$Wt = 4x10^{-6}FL^{3.1647}$	0.9586	72 - 180
Brushtooth lizardfish	200	$Wt = 3x10^{-6}FL^{3.2185}$	0.9889	60 - 319
Bullhorn gurnard	167	$Wt = 6x10^{0-5}FL^{2.6944}$	0.9888	45 - 217
Chub mackerel	112	$Wt = 5x10^{-6}FL^{3.1769}$	0.9583	190 - 350
Clearfin lizardfish	91	$Wt = 0.3791e^{-0.0318FL}$	0.8772	80 - 141
Diamondback pufferfish	35	$Wt = 2x10^{-5}FL^{3.0134}$	0.9837	74 - 440
Indian scad	83	$Wt = 5x10^{-6}FL^{3.1762}$	0.9694	75 - 217
King soldier bream	85	$Wt = 6x10^{-5}FL^{2.8206}$	0.9738	215 - 575
Longnose jack	89	$Wt = 8x10^{-5}FL^{2.7666}$	0.9827	233 - 660
Randalls threadfin bream	98	$Wt = 0.6977e^{0.03FL}$	0.9479	70 - 129
Roundsnout sea catfish	180	$Wt = 1x10^{-5}FL^{3.0973}$	0.9784	222 - 447
Santer seabream	145	$Wt = 3x10^{-5}FL^{2.9356}$	0.994	104 - 575
Slender rainbow sardine	35	$Wt = 3.6748e^{0.0157FL}$	0.7682	155 - 196
Snakefish	82	$Wt = 9x10^{-7}FL^{\cdot 3.5225}$	0.9149	76 - 154
Spangled emporer	136	$Wt = 2x10^{-5}FL^{2.9998}$	0.9949	239 - 603
Spiny flathead	40	$Wt = 1x10^{-5}FL^{2.9576}$	0.978	72 - 271
Spotted grunt	63	$Wt = 2x10^{-3}FL^{2.2189}$	0.6665	589 - 715
Striped bonito	51	$Wt = 4x10^{-6}FL^{3.2119}$	0.9779	365 - 580

Table 4. Summary of the regression of green weight (GW) against dressed weight (DW), including species common name, sample size, regression equation, and R^2 value, for 12 commercially important fish species from the Oman demersal trawl zone that were processed aboard the F.V. Al-Mustaqila I before being landed. Also included are the conversion factors for converting dressed weight (DW) to green weight (GW), and vice versa. Weights are in kilograms.

Common Name	N	Regression	R^2	DW Weight Range	DW → GW	GW → DW
Almaco jack	22	$GW = 1.6618 \times DW + 0.139$	0.9762	2.310 - 5.770	1.707	0.585
Indian threadfin	14	$GW = 1.7386 \times DW - 0.0866$	0.9644	1.555 - 5.715	1.715	0.583
King soldier bream	28	$GW = 1.6886 \times DW + 0.1887$	0.9770	0.495 - 6.090	1.754	0.570
Largehead cutlassfish	22	$GW = 1.477 \times DW - 0.1226$	0.9654	2.575 - 6.510	1.449	0.690
Milk shark	23	$GW = 2.1471 \times DW + 0.1177$	0.9827	0.620 - 5.235	2.232	0.448
Southern meagre	13	$GW = 1.6189 \times DW + 0.527$	0.9833	1.160 - 7.840	1.834	0.545
Spangled emperor	15	$GW = 1.8158 \times DW + 0.1854$	0.9913	0.655 - 6.280	1.739	0.575
Spotted grunt	7	$GW = 1.7872 \times DW + 0.2126$	0.9939	1.160 - 4.840	1.909	0.524
Striped bonito	19	$GW = 1.5005 \times DW + 0.1282$	0.9919	1.140 – 6.840	1.539	0.650

coefficient obtained in this study (Table 3) indicate that snakefish have a poorer general condition in the Arabian Sea off Oman compared to that off Brazil at the time of that study.

Carangidae

Abdurahim *et al*. (2004) provided a length-weight relationship of $Wt = 0.073TL^{2.306}$ for male Indian scad ($R^2 = 0.86$; N = 199), and $Wt = 0.024TL^{2.647}$ for female Indian scad ($R^2 = 0.93$; N = 150), from off India. The scaling constant was found to be much lower, and the allometric growth coefficient much higher in the current study (Table 3) compared to that of Abdurahim *et al*. (2004), and although fork length was used in the current study compared to total length used by Abdurahim *et al*., it is unlikely that this difference alone accounts for the differences in parameters, and may indicate that Indian scad in the Arabian Sea measured during this study are of better general condition than those of India at the time of Abdurahim *et al*.'s study.

Lethrinidae

Spangled emporer was studied from all coastal waters off Oman by Al-Mamry (2006) who reported for males a length-weight relationship of $Wt = 2x10^{-5}TL^{2.859}$ ($R^2 = 0.976$; N = 502); females $Wt = 2x10^{-5}TL^{2.856}$ ($R^2 = 0.971$; N = 779); and sexes combined $Wt = 2x10^{-5}TL^{2.847}$ ($R^2 = 0.973$; N = 1281). The length-weight relationships for this species restricted to the Arabian Sea off Oman (McIlwain *et al*., 2006) are males $Wt = 5.21x10^{-2}FL^{2.732}$ ($R^2 = 0.94$; N = 407); females $Wt = 3.09x10^{-2}FL^{2.867}$ ($R^2 = 0.98$; N = 377); and sexes combined $Wt = 3.43x10^{-2}TL^{2.839}$ ($R^2 = 0.97$; N = 784). The results obtained in the current study (Table 3) are similar to those studies above, indicating that the general condition of spangled emporer off Oman has remained constant.

Sparidae

Weight-length relationships for Arabian pandora of $Wt = 2.38x10^{-2}FL^{2.975}$ (males; $R^2 = 0.95$; N = 718), $Wt = 2.39x10^{-2}FL^{2.973}$ (females; $R^2 = 0.92$; N = 630), and $Wt = 2.38x10^{-2}FL^{2.974}$ (sexes combined; $R^2 = 0.94$; N = 1348) were provided by McIlwain *et al*. (2006) from the Arabian Sea of Oman. Both the scaling constant and the allometric growth coefficient were found to be lower in the current study (Table 3), indicating that the general condition of Arabian pandora in the Arabian

Sea off Oman had decreased slightly during the time interval between the two studies.

Al-Mamry (2006) reported length-weight relationships for king soldier bream of $Wt = 5x10^{-5}TL^{2.692}$ ($R^2 = 0.968$; N = 398) for males, $Wt = 6x10^{-5}TL^{2.642}$ ($R^2 = 0.976$; N = 347) for females, and $Wt = 6x10^{-5}TL^{2.666}$ ($R^2 = 0.977$; N = 745) for sexes combined, from all coastal waters of Oman. McIlwain *et al*. (2006) studied king soldier bream captured off Oman in the Arabian Sea only, and found the following weight-length relationships for that species: $Wt = 8.86x10^{-2}FL^{2.626}$ ($R^2 = 0.97$; N = 492) for males, $Wt = 8.42x10^{-2}FL^{2.64}$ ($R^2 = 0.98$; N = 438) for females, and $Wt = 8.6x10^{-2}FL^{2.635}$ ($R^2 = 0.98$; N = 930) for sexes combined. These values were slightly smaller than that reported here (Table 3), which may indicate that the condition of the fish have improved slightly during the period between the two studies.

Santer seabream were studied from the Arabian Sea off Oman by McIlwain *et al*. (2006), and gave length-weight relationships for males $Wt = 3.15x10^{-2}FL^{2.872}$ ($R^2 = 0.99$; N = 458), females $Wt = 3.38x10^{-2}FL^{2.849}$ ($R^2 = 0.98$; N = 499), and for sexes combined $Wt = 3.12x10^{-2}FL^{2.875}$ ($R^2 = 0.98$; N = 957). In the current study (Table 3), the scaling constant was lower, however, the allometric growth coefficient was higher, indicating that growth rate may have increased at the cost of general condition and may reflect the impact of heavy fisheries pressure on this species in this area.

Paralichthyidae

Weight-length relationships for largetooth flounder from off of India were given for males $Wt = 4x10^{-3}TL^{3.256}$ ($R^2 = 0.98$; N = 147), and females $Wt = 3x10^{-3}TL^{3.378}$ ($R^2 = 0.99$; N = 160) by Abdurahiman *et al*. (2004). These values indicate that the general condition of largetooth flounder was better off India at that time period than off Oman in the Arabian Sea at the time of this study (Table 3).

Trichiuridae

The largehead cutlassfish is a common catch in the Indian Ocean and the Atlantic Ocean, but most length-weight relationships come from the Atlantic Ocean. Sheridan *et al*. (1984) reported a length-weight relationship of $Wt = 5.248x10^{-8}TL^{3.37}$ ($R^2 = 0.97$; N = 853) from the northern Gulf of Mexico, northwest Atlantic Ocean. All other reports from the Atlantic Ocean come from off the Brazilian coast in the southwest Atlantic Ocean. Bernardes & Rossi-Wongtschowski (2000) reported $Wt = 1x10^{-7}TL^{3.220}$ ($R^2 = 0.986$; N = 2471), while in the same year Muto *et al*. (2000) reported $Wt = 1.342x10^{-7}TL^{3.192}$ ($R^2 = 0.945$; N = 485), from different regions of the Brazilian coast. Later, Frota *et al*. (2004) gave the length-weight relationship of this species using preanal length, $Wt = 0.0338LPA^{2.653}$ ($R^2 = 0.966$; N = 111) from Brazil. Two studies report length-weight data for this species from the Arabian Sea. Abdurahiman *et al*. (2004) reported for males $Wt = 0.001TL^{2.819}$ ($R^2 = 0.91$; N = 200), and females $Wt = 0.001TL^{3.029}$ ($R^2 = 0.95$; N = 200), from southwest India, while Al-Nahdi *et al*. (200x) reported for males $Wt = 2.67x10^{-6}TL^{2.803}$ ($R^2 = 0.91$; N = 52), females $Wt = 6.77x10^{-7}TL^{3.113}$ ($R^2 = 0.91$; N = 245), and for sexes combined $Wt = 1.23x10^{-6}TL^{2.989}$ ($R^2 = 0.92$; N = 388). Both the scaling constant and the allometric growth coefficient are similar between all studies, including the current study (Table 2), indicating that the condition of fish and the growth parameters of this species are similar between the Arabian Sea and the western Atlantic.

Scombridae

The allometric growth factor reported here for chub mackerel (Table 3) is less than that reported by Santos *et al*. (2002) who gave a length-weight relationship of $Wt = 2.1x10^{-3}TL^{3.408}$ for this species from off of Portugal, however, this may be an artefact of the use of total length in that study, compared to the use of fork length in the current study. Although length-weight relationships were not provided by Mallicoate & Parrish (1981), they conducted a detailed growth analysis of this species from off California, USA, in the western Pacific.

Balistidae

Sahayak (2005) provided the length-weight relationship for bridled triggerfish from Indian seas as $Wt = 9.05x10^{-10}TL^{2.7296}$ ($R^2 = 0.9301$; N = 514). The larger scaling constant and allometric growth coefficient indicate that this species had a better general condition at the time of this study in the Arabian Sea (Table 2), compared to off India in 2005.

Conclusion

This study provides length and weight relationships for fishes from the Arabian Sea coast of Oman using demersal trawl gear. Many weight-length relationships for the fishes found in the Arabian Sea off the coast of Oman are reported for the first time.

Given the intensity at which this zone is being fished (Human, 2007), as well as the fishing intensity that is occurring in other fishing sectors of Oman (Anon, 2004; and Henderson *et al*., 2007), it is hoped that the data presented in this study will aid in improving the management of the fisheries off the Arabian Sea coast of Oman.

Acknowledgements

The authors are indebted to all of the crew aboard the *F.V. Al-Mustaqila I*, particularly Nikolayevich Vyacheslav Gettun and Viktor Terentyev during the 2007 cruise. Mohamed Al-Jabri (Protein Products International) and Ernie Chadwick (previously of PPI) arranged seatime for the authors during commercial fishing operations. The authors were generously allocated hold space for storage of frozen specimens, and numerous factory workers assisted with the processing of fishes for the green weight-dressed weight comparisons.

The authors thank the captains of cruise OMA0801 *Fish Resources Assessment Survey of the Arabian Sea Coast of Oman*, Chris Carey and John Baxter, and the crew. Special thanks are extended to the voyage leader, Neil Bagley, and the rest of the scientific staff from NIWA.

Figure 1 was generously supplied to the authors by Lubna Al-Kharusi.

Earlier drafts of the manuscript were reviewed by Johan Groeneveld, N. Jayabalan, and Lubna Al-Kharusi (Marine Science and Fisheries Centre).

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