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Morphological Deformities in fresh and marine water fishes, Basrah, Iraq

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A B S T R A C T

Samples of fishes (116 species) were collected during April 2015 to Jun 2016 from East Hammar marsh and Khor Abdullah to detect morphological deformities. Nine types of deformities were recorded belongs to three main types of deformities (Vertebral deformity, Fins deformity and malformed mouth). Higher level of deformities were recorded in *Carassius gibelio* (7 type), *Tenualosa ilisha* (3 type), *Pampus argenteus* (3 type) and Planiliza abu (2 type)while in *Carasobarbus luteus*, *Alburnus mossulensis*, *Acanthobra mamarmid*, *Planiliza subviridis* and *Acanthopagrus arabicus* were one type for each species. All types of deformities were described and supported by photos. Malformed Mouth recorded in seven species of fish as first time in Iraq. Tail loss and partial or total loss of dorsal Fin recorded in fresh water and marine water fishes (*C. gibelio* and *P. argenatus*) as first time in Iraq. Split fine and Anal Fin Deformity considered as the first cases in Iraq in *C. luteus* and *C. gibelio* consequently. Undulation of caudal fin was recorded in two species, one of these from fresh water (*C. gibelio*) and anther from marine water (*P. argenteus*), the recording of this case in this species is considered as first in Iraq while skeletal anomalies recorded as the first case in *C. gibelio* in Iraq. By This study, we try to focus on the relationship between environmental change and some indicators like deformities, which possible give us imaginations about effects of this change on fish health.

Key words: Deformities, Fishes, Basrah, Freshwater, Marine water, Basrah, Iraq.

Introduction:

There are many reports about abnormalities of fishes from different part of the world. Morphological abnormalities in fish are common and occur in many species in wild and cultured fish. (Browder *et al*., 1993; Sun *et al*., 2009; Alarape *et al*., 2015; Jawad, 2014; Harris *et al*., 2014; Jawad and Liu, 2015 and Jawad *et al*., 2015). Skeletal anomalies are a fundamental problem in fish development, and can reduce their survival (Jawad *et al*., 2015). In addition, assessing morphological deformities is one of the most straightforward method to study the effects of contamination on fish because of the ease of recognition and examination when compared with other types of biomarkers (Sun *et al*., 2009).

Harris *et al*. (2014) considered skeletal malformation of farmed fish are continual challenge for the aquaculture industry and a deeper understanding of the development of skeletal anomalies and the genetic and environmental causes of their formation will greatly facilitate efforts to reduce the prevalence of these diseases in many species of farmed fish. Diggles (2013) referred the prevalence of deformed fish in the wild is usually very low. Therefore, we think monitoring these conditions and study it is very important to notice and understand the effect of environmental change on fish and other animal.

Material and method:

The samples were collected during April 2015 to Jun 2016 from two areas:

1- **East Hammar marsh:** East Hammar marsh is an extensive area of wetlands. It is located in the upper corner formed by the meeting of the Euphrates and Shat Al-Arab rivers. The Shatt Al-Arab River flows southwards along the eastern edge of the marsh. After inundation in April 2003, the marsh received water mainly from the Shatt Al-Arab River. Therefore, it is tidal marsh affected by semidiurnal tide from Arabian Gulf. Fish were sampled in the East Hammar marsh: Harer site N 30° 35' 35.50", E 47° 41' 50.05", using different types of fishing gears: seine net, gill nets and cast nets. Fish species were identified depending on Beckman (1962), Coad (2010) and Carpenter *et al*. (1997) (Tab. 1).

2- **Khor Abdullah:** Khor Abdullah is a shallow funnel shape of depths more than 10 m with about 1 km intertidal zone. The substratum is mainly muddy at the southern entrance and sandy-silt at the northern tip. The depths at the southern entrance are between 7-10 m, which gradually increases toward Bubyan Island. The length of the Khor is about 60 km from Umm Qasr to Khor Al-Amaya with a width range of 1-4 km. Khor Abdullah is classified as open marine lake. Marine fish species were collected from trawl catches of fishing research vessels from the Iraqi marine water, northwest Arabian Gulf: khor Abdulla site N 29° 49' 31.36", E 48° 39' 47.23". They were immediately preserved in

crashed ice for subsequent analysis. Fish species were identified depending on Carpenter *et al*. (1997), Froese, and Pauly (2017) (Tab. 2).
All types of deformities were described, categorized and supported by photos.

Results:

During this study a total of 75 marine species and 41 freshwater species were collected from Iraqi fresh and marine waters (Table 1 and 2). Nine types of deformities were recorded belongs to three main types of deformities: Vertebral deformity, Fins deformity and malformed mouth. Higher level of deformities were recorded in *Carassius gibelio* (7 type), *Tenualosa ilisha* (3 type), *Pampus argenteus* (3 type) and *Planiliza abu* (2 type) while in *Carasobarbus luteus*, *Alburnus mossulensis*, *Acanthobrama marmid*, *Planiliza subviridis and Acanthopagrus arabicus* were one type for each species (Table 3).

Table (1): Fish species collected from Al Hammar marsh

Order	Family	Species
Cypriniformes	Cyprinidae	*Mesopotamichthys sharpeyi*
		Luciobarbus xanthopterus
		Arabibarbus grypus
		Carasobarbus luteus
		Leuciscus vorax
		*Carassius gibelio**
		*Cyprinus carpio**
		*Hypophthalmichthys molitrix**
		*Hemiculter leucisculus**
		Alburnus mossulensis
		Acanthobrama marmid
		Cyprinius kais
		C. macrostomum
Perciformes	Cichlidae	*Oreochromis aureus**
		*O. niloticus**
		Coptodon zillii
Cyprinodontiformes	Cyprinodontidae	*Aphanius dispar*
		A. mento
	Poeciliidae	*Poecilia latipinna**
		*Gambusia holbrooki**

Siluriforme	Siluridae	*Silurus triostegus*
	Heteropneustidae	*Heteropneustes fossilis**
	Mastacembelidae	*Mastacembelus mastacembelus*
	Bagridae	*Mystus pelusius*
Mugiliformes	Mugilidae	*Planiliza abu*
		*Liza klunzingeri***
		*Planiliza subviridis***
Clupeiformes	Clupeidae	*Tenualosa ilisha***
		*Nematalosa nasus***
	Engraulidae	*Thryssa whiteheadi***
		*T. hamultonii***
	Pristigasteridae	*Ilisha compressa***
Perciformes	Sillaginidae	*Sillago sihama***
	Sciaenidae	*Johnius dussumieri***
	Leiognathidae	*Leiognathus bindus***
	Sparide	*Acanthopagrus arabicus***
		*Sparidentex hasta ***
	Gobiidae	*Bathygobius fuscus***
		*Boleophthalmus dussumieri***
	Scatophagidae	*Scatophagus argus***
Pleuronectiformes	Soleidae	*Brachirus orientalis***
Atherinoformes	Hemiramphidae	*Hyporhaphus limbatus***
	Belonidae	*Strongylura strongylura***

*Exotic species, **Marine sp

Table (2): Marine fishes from Khor Abdullah

Order	**Family**	**Species**
Myliobatiformes	Dasyatidae	*Pastinachus sephen*
		Maculabatis gerrardi
		Brevitrygon walga
		Himantura uarnak
		Pateobatis bleekeri
Myliobatiformes	Gymnuridae	*Gymnura poecilura*
Rhinoprisitformes	Rhinobatidae	*Glaucostegus granulatus*
Orectolobiformes	Hemiscylliidae	*Chiloscyllinm arabicum*
Clupeiformes	Clupeidae	*Tenualosa ilisha*
		Nematalosa nasus
		Anodontostoma chacunda
		Sardinella albella
		Sardinella gibbosa
		Sardinella longiceps
		S ardinella melanura
	Chircenturidae	*Chirocentrus dorab*
	Pristigasteridae	*Ilisha compressa*
	Engraulidae	*Thryssa whiteheadi*
		Thryssa hamultonii
		Thryssa vetriostris

Perciformes	Carangidae	*Caranx ignobilis*
		Caranx heberi
		Scomberoides commersonnianus
		Parastromateus niger
		Carangoides malabaricus
		Alepes djedaba
		Alepes melanoptera
		Alepes kleinii
		Alepes indicus
	Sciaenidae	*Johnius belangerii*
		Johnius sina
		Protonibea diacantha
		Otolitheus ruber
	Sillaginidae	*Sillago sihama*
		Sillago arabica
		Ilisha melastoma
	Teraponidae	*Pelates quadrilineatus*
		Terapon jarbua
		Terapon puta
		Terapon theraps
	Mullidae	*Upeneus tragula*
		Upeneus vittatus
		Upeneus sundaicus
	Gerreidae	*Gerres limbatus*
		Gerres filamentosus
	Sparidae	*Acanthopagrus bifasciatus*
		Acanthopagrus arabicus
		Sparidentex hasta
	Serranidae	*Epinephelus coioides*
Perciformes	Leiognathidae	*Photopectoralis bindus*
		Leiognathus oblongus
	Polynemidae	*Eleuthernoema tetradactylum*
	Trichiuridae	*Eupleurogrammus glossodon*
	Stromateidae	*Pampus argenteus*
Mugiliformes	Mugilidae	*Planiliza subviridis*
		Liza klunzingeri
		Valamugil speigleri
Siluriformes	Ariidae	*Netuma bilineatus*
		Plicofollis dussumieri
		Netuma thalassinius
Siluriformes	Plotosidae	*Plotosus lineatus*
Tetraodontiformes	Triacanthidae	*Triacanthus biaculeatus*
Pleuronectiformes	Cynoglossidae	*Cynoglossus arel*
Aulopiformes	Synodontidae	*Saurida tumbil*
		Rhunchorhamphus georgii
Scorpaeniformes	Scorpaenidae	*Pseudosynanceia melanostigma*
Batrachoidiformes	Batrachoididae	*Allenbatrachus grunniens*
Scorpaeniformes	Platycephalidae	*Grammoplites scaber*
		Platycephalus indicus
Pleuronectiformes	Soleidae	*Burglossa orientalis*
		Solea elongate
		Solea stanalandi
Beloniformes	Belonidae	*Strongylura strongylura*
	Hemiramphidae	*Hyporhaphus limbatus*

Table (3) Deformities in nine species of freshwater and marine water fishes.

No	Deformities	*T. ilisha*	*C. subviridis*	*A. mossulensis*	*A. marmid*	*A. arabicus*	*P. argenteus*	*C. gibelio*	*P. abu*	*C. luteus*
1	Lordosis	+	–	–	–	–	–	–	–	–
2	Skeletal anomalies	–	–	–	–	–	–	+	–	–
3	Tail Loss	–	–	–	–	–	+	+	–	–
4	Tail and Caudal Peduncle Loss	–	–	–	–	–	–	+	+	–
5	Undulation of Caudal Fin	–	–	–	–	–	+	+	–	–
6	Partially or Totally Loss of Dorsal Fin	–	–	–	–	–	+	+	–	–
7	Split fine	–	–	–	–	–	–	–	–	+
8	Anal Fin Deformity	+	–	–	–	–	–	+	–	–
9	Malformed Mouth	+	+	+	+	+	–	+	+	–

1- Lordosis:

Lordosis in fish is an abnormal ventral curvature of the vertebral column, accompanied by abnormal calcification of the afflicted vertebrae. **(**Kranenbarg *et al*., 2005). Lordosis recorded in *Tenualosa ilisha* only, we can notice easily effect it on the morphology of the fish body(figure, 1).

Fig. (1) Vertebral anomalies (Lordosis) in *T. ilisha*

2- Skeletal anomalies:

This type of deformities was recorded in *Carassius gibelio* skeletal anomalies noticed directly through abnormal shape of caudal and abdomen regions (Figure, 2)

C. gibelio *C. gibelio*

Fig. (2) Skeletal anomalies

3- Tail Loss:

Loss of tail fin occur for different reasons such as genetics, diseases and predation. In this study tail loss recorded in two species of fish *Pampus argenteus* and *C. gibelio* (figure 3).

C. gibelio *P. argenteus*

Fig. (3) Tail Loss

4- Tail and Caudal Peduncle Loss:

This case recorded in *C. gibelio* and *Planiliza abu* the caudal peduncle appears to have been cut with a knife (figure 4).

C. gibelio *P. abu*

Fig. (4) Tail and Caudal Peduncle Loss

5-Undulation of Caudal Fin:

The caudal fin deformity was recorded in two species *C. gibelio* and *P. argenteus* that main it is found in fresh and marine fishes. Abnormal caudal fin in this case has lost the dorsal and ventral lobes and can detect it directly when we compared it with normal fishes externally (figure 5).

C. gibelio *P. argenteus*

Fig. (5) Undulation of Caudal Fin

6- Partially or Totally Loss of Dorsal Fin:

Dorsal fin deformity recorded also in fresh water fish *C. gibelio* and marine fish *P. argenteus*. The deformed dorsal fin takes different type and in some cases was sever (figure, 6)

C. gibelio *C. gibelio* *P. argenteus*

Fig. (6) Partially or Totally Loss of Dorsal Fin

7- Split fine:

This type of deformities included split the fins with various kind and levels but it considered as simple as in other deformities. Split fine recorded in *Carasobarbus luteus* only (figure, 7)

C. luteus

Fig. (7) Split fine

8- Anal Fin Deformity:

This type of deformity was found in two forms, the first is the loss of a part of the fin as in *T. ilisha* fish and the second form is merging and ripple of the anal fin in *C. gibelio* (figure, 8).

T. ilisha

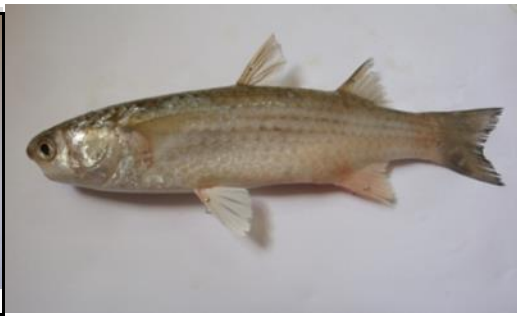
C. gibelio

Fig. (8) Anal Fin Deformity

9- Malformed Mouth:

Oral deformity was recorded in seven species of fish and was considered the most common form of deformity during this study. It was noticed in *Acanthopagrus arabicus*, *P. abu*, *T. ilisha*, *Alburnus mossulensis*, *Acanthobrama marmid*, *C. gibelio* and *Plianiliza subviridis* (figure, 9). The damages in the mouth were different and appeared on the fishes in many unusual and obvious forms.

A. arabicus

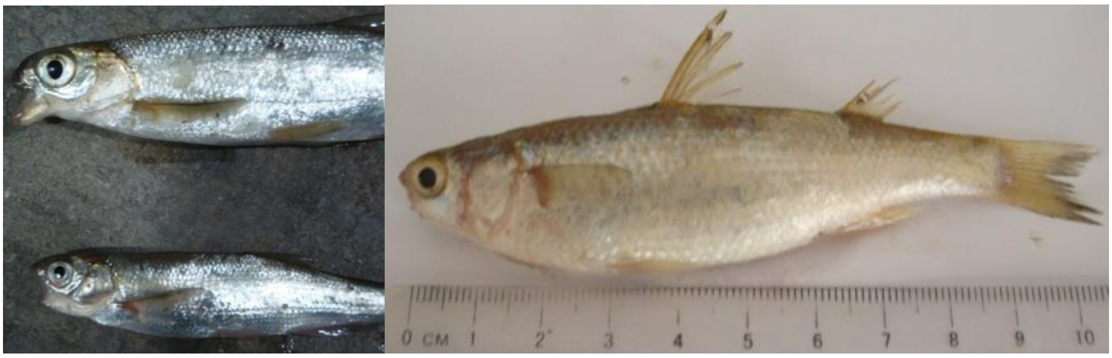


P. subviridis

A. marmid

A. marmid

C. gibelio *C. gibelio* *T. ilisha*



A. mossulensis *P. abu*

Fig. (9) Malformed Mouth

Discussion:

A little studies in Iraq about deformities of fish because the cases were rare, but in last year's we noticed it has increased. The first report was by Al-Hassan (1982) about vertebral abnormalities in four species of fish (*B. sharpeyi*, *C. luteus* collected from the Garmat Ali River at the junction of Shat Al-Arab and Euphrates River. Jawad *et al.* (2014) were recorded one case in two fish species(*C. lutus* and *T. ilisha*), which collected from Al-Hammar marsh, north of Basrah province 600 km south of Baghdad city capital. A case of vertebral deformity reported by Jawad *et al.* (2015) in one species (*L. xanthopterus*) obtained from Al-Huwaza marsh, Maisan province, and south of Iraq. The last study was also to Jawad *et al.* (2016) in the Euphrates River, at Nasria marsh area south of Iraq and recorded one case in *Mastacembelus Mastacembelus*.

There are six reports about fish deformities from the Arabian Gulf (Juma *et al.*, 2010; Almatar and Weizhong, 2010; Jawad and Al-Mamry, 2012; Jawad *et al.*, 2013; Jawad, 2014a and Jawad, 2014b). The present study is first on fishes from Iraqi marine coastal.

Deformities of fish were known and occurred in fish farm and wild fish, but many reports refer to that, reasons of this case did not detect exactly up to now. Some studied mentioned it caused as a result of human activities, environmental contaminants (chemical additions), scarcity or change in structure of nutrients, oxygen deficiency, sudden changes in temperature, water current, mutation, inbreeding, parasitic infestation, mechanical trauma, and attack from predators (Carl, 1979; Fagbuaro, 2009; Amitabh and Firoz, 2010; Tave *et al.*, 2011 and Malekpouri *et al.* 2015). In this report, we did not study or detect the reasons of deformities, but surely many of the facts, which mentioned above effected directly.

Sun *et al*. (2009) used the morphological deformities of fish as biomarkers of contaminated water. Therefore, we find that studying and monitoring this case is very important to understand how affect the environmental changes on aqua animals like fish.

Lordosis is one of the skeletal deformities, which described in several species of fish. The first case in Iraq was reported by Jawad *et al*. (2014) in two fish species (*C. lutus* and *T. ilisha*) were collected from freshwater of Basrah city, while in this study recorded in *T. ilisha* only. Jawad (2014) mentioned causes of these deformities is not well understood, but nutritional, environmental and genetic causes have been cited.

Skeletal anomalies occurred with different type like coalescence, compact of vertebrates and loss of vertebral parts and surly effect on swimming of fish consequently effect on survival rate through suffering in getting on food, moving and run from predators. In freshwater, the first report was by Al-Hassan (1982) in four species (*M. sharpeyi*, *C. luteus*, *L. xanthopterus* and *Aphanius dispar*). In Jawad *et al.* (2015) recorded vertebral coalescence in *L. xanthopterus*. Jawad *et al*. (2016) recorded sever deformity in *M. mestacembelus*. In this study, we recorded one case in *C. gibelio*. Kessabi *et al*. (2013) mentioned two possible relationships between this anomaly and several types of pollutants presents in the environment. Negrin-Baes *et al*. (2015) study inheritance of skeletal deformities in *Sparus aurata* and found that these deformities have a genetic origin.

Fins deformities recorded in this study with a different type (Tail Loss, Tail and Caudal Peduncle Loss, Partially or Totally Loss of Dorsal Fin, Split fine and Anal Fin Deformity). Tail Loss and Partially or Totally Loss of Dorsal Fin recorded in fresh water and marine water fishes (*C. gibelio* and *Pampus argenatus*) as first time in Iraq. Tail and Caudal Peduncle Loss recorded also as first time in Iraqi fresh water fishes (*C. gibelio* and *Planiliza abu*). Split fine and Anal Fin Deformity considered as the first cases in Iraq in *C. luteus* and *C. gibelio* consequently. Some deformities seem to cause by preying while many of these cases caused by genetic changes. Tyler *et al*. (2014) mentioned that we are unable to determine whether the underlying developmental mechanisms triggering these abnormalities were genetic or pathological. The prevalence of deformities such as split fins were significantly related to various water quality parameters including low DO and high ammonium, lead and zinc concentration (Sun *et al*., 2009). Many reports were studying these abnormalities in the Arabian Gulf (Sulmaiman and Weizhong, 2010; Jawad and Al-Mamry, 2012; Jawad *et al*., 2013 and Jawad, 2014a).

Malformed Mouth recorded in seven species of fish as first time in Iraq (table 3). We noticed that type of deformities is occurring as a phenomenon worthy of attention, it has formed more than 77% of cases, which recorded in this study. Jaw deformity is known to be caused by many factors such as mechanical injury, nutritional deficiency, environmental condition, parasitism or genetic aberration (Quigley 1995). Al-Harabi (2001) distended or compressed head of deformed fish may be due to the ossification or compression of the bones. Some studies referred to there are relationship between deformities and dissolve oxygen and other parameter while Sajeevan and Anna-Mercy (2016) provide, it is unable to correlate deformities with water quality parameters by hatching fishes in an optimum level of water quality however; there have been deformities such as malformed mouth.

Undulation of Caudal Fin was recorded in two species, one of these from fresh water (*C. gibelio*) and anther from marine water (*P. argenatus*). The recording of this case in this species is considered as first in Iraq. This case reported in the Arabian Gulf and Arabian Sea and conclude to environmental and pollution factors such as, Cd, Hg, Pb and Zn cause the caudal fin deformities (Jawad and AL-Mamry, 2012)

In the southern of Iraq have been clear climatic and environmental changes in the region, especially, high temperature, low freshwater flow from the Tigris and Euphrates rivers and increase salinity, as well as increases pollution due to increased activities for oil extraction and export. All of these factors, in varying degrees, have significantly affected the incidence of malformation. Jawad *et al*. (2015) mentioned It is difficult to determine the cause of this abnormality; multiple causes can be suggested (genetic, climatic condition, malnutrition, parasites, pollution, etc...).The increase in the number of gene family members due to duplication can also allow buffering against the effects of mutation which may be occur by many factors. (Harris *et al*., 2014).

The increasing incidence of deformity gives an important indicator and invite us to doing studies on the causes of these cases and try to identify the mechanism of its impact, in addition, morphological deformities of fish can use as a biomarker in contaminated water like study of Sun *et al*. (2009).

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التشوهات المظهرية في اسماك المياه العذبة والبحرية, البصرة العراق

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الملخص

تم جمع عينات من الأسماك (118 نوعًا) خلال الفترة من أبريل 2015 إلى يونيو 2016 من أهوار شرق الحمار وخور عبد الله للكشف عن التشوهات المظهرية. تم تسجيل تسعة أنواع من التشوهات تنتمي إلى ثلاثة أنواع رئيسية من التشوهات (تشوه العمود الفقري وتشوه الزعانف والفم المشوه). تم تسجيل أعلى مستوى من التشوهات في اسماك الكرسين *Carassius gibelio* (سبعة انواع) وثلاثة انواع من التشوهات في كل من اسماك الصبور *Tenualosa ilisha* واسماك الزبيدي *Pampus argenteus* ونوعين في اسماك الخشني *Planiliza abu* بينما سجل نوع واحد من التشوهات في الأنواع: الحمري *Carasobarbus luteus* والسمنان الطويل *Alburnus mossulensis* والسمنان العريض *Acanthobra mamarmid* و البياح الاخضر *Planiliza subviridis* والشانك *Acanthopagrus arabicus* . تم وصف جميع أنواع التشوهات ودعمها بواسطة الصور. سجل خلال الدراسة تشوه الفم في سبعة أنواع من الأسماك لأول مرة في العراق. سجل فقدان الذيل والفقدان الجزئي والكلي للزعنفة الظهرية في نوع واحد من أسماك المياه العذبة(*C. gibelio*) والمياه البحرية (*P. argenatus*)لأول مرة في العراق. اعتبرت حالات انشقاق الزعنفة الظهرية وتشوه الزعنفة المخرجية أول حالة في العراق في اسماك *C. luteus* و *C. gibelio*. تم تسجيل تموج الزعنفة الذيلية في نوعين ، أحدهما من المياه العذبة (*C. gibelio*)وآخر من المياه البحرية (*P. argenteus*) واعتبر تسجيل هذه الحالة في هذا النوع هو الأول في العراق بينما سجلت التشوهات الهيكلية لاول مرة في اسماك *C. gibelio* . من خلال هذه الدراسة حاولنا التركيز على العلاقة بين التغير البيئي وبعض المؤشرات مثل التشوهات والتي من شأنها أن تقدم لنا تصورات حول آثار هذا التغيير على صحة الأسماك.

كلمات مفتاحية: تشوهات، اسماك مياه عذبة، مياه بحرية، البصرة، العراق