Systematics, taxonomy, phylogeny and zoogeography of the *Capoeta damascina* species complex (Pisces: Teleostei: Cyprinidae) inferred from comparative morphology and molecular markers

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To my family, with deep gratitude

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Abstract

Capoeta damascina (Teleostei: Cyprinidae) is one of the most common freshwater fish species, found throughout the Levant, Mesopotamia, Turkey and Iran. According to the state of knowledge prior to this study, *C. damascina*, which is distributed over a wide range of isolated water bodies, was not a well-defined species. It was questionable whether it represents a single species or a complex of closely related species with high intraspecific and compaFratively low interspecific variability.

The goal of this study was to investigate the taxonomy, systematic position of the *C. damascina* species complex and the phylogenetic relationships among its members, based on morphological features as well as molecular phylogeny. Samples obtained from throughout the geographic range of this species complex were subjected to comparative morphological analyses in order to define, properly diagnose and separate species within the *C. damascina* complex. To elucidate phylogenetic relationships among members of the *C. damascina* species complex, samples were subjected to genetic analyses, using two molecular markers targeting the mitochondrial cytochrome oxidase I (COI, n = 103) and the two adjacent divergence regions (D1-D2) of the nuclear 28S rRNA genes (LSU, n = 65). Based on morphological and molecular genetic data, six closely related species were recognized within the *C. damascina* complex: *C. buhsei*, *C. caelestis*, *C. damascina*, *C. saadii*, *C. umbla* and an undescribed species, *Capoeta* sp.1. Analyses of the morphometric and meristic data obtained in this study revealed phenotypic variability among the various populations within a species and among the different species. Such differences in morphological characters reflect genetic differences, environmentally induced phenotypic variation or both, as the meristic phenotype of fish is sometimes a consequence of environmental parameters acting on the genotype.

Based on phylogenetic analyses, two main lineages were identified within the *C. damascina* species complex: a western lineage represented by *C. caelestis*, *C. damascina* and *C. umbla* and an eastern lineage represented by *C. buhsei*, *C. saadii* and *Capoeta* sp.1. The close phylogenetic relationships between *C. damascina* and *C. umbla* and the sharing of same haplotypes between one specimen of *C. damascina* from Euphrates and another of *C. umbla* from Tigris reflect one of three possibilites: recent speciation, mitochondrial introgression or a combination of both.

The results obtained in this study indicate that speciation of the above-mentioned six taxa is quite recent and that their dispersal and present-day distribution can be related to Pleistocene events. The drying out of the Persian Gulf, probably during one of the first glacials of the Pleistocene, led the ancestor of the *C. damascina* species complex in Mesopotamia to reach the rivers of the Gulf and of Hormuz basins and differentiate there, giving rise to the eastern lineage (ancestor of *C. buhsei*, *C. saadii* and *Capoeta* sp.1). As connections presumably existed among the different river drainages and basins in Iran during the wet periods of the Pleistocene, the

ancestor of *C. buhsei*, *C. saadii* and *Capoeta* sp.1 was subsequently able to colonize the various Iranian drainages and differentiate there, giving rise to *C. buhsei*, *C. saadii* and *Capoeta* sp.1.

After the separation from the eastern lineage, the western lineage, represented by the ancestor of *C. damascina*, *C. umbla* and *C. caelestis*, most likely reached the Levant from the Tigris-Euphrates system during the Pleistocene glacials, when river connections existed in the regions of the upper courses of Ceyhan Nehri (southern Turkey) and some western affluents to the Euphrates. From Ceyhan Nehri, it dispersed into other rivers in southern Turkey during Pleistocene periods of low sea levels until it reached Göksu Nehri and evolved into *C. caelestis*. The sister population differentiated into *C. damascina* and *C. umbla*. Based on the results obtained in this study, it is likely that *C. damascina* colonized the Levant and southern Turkey during the Pleistocene glacials. This is well supported by the low genetic variability among the *C. damascina* populations. Direct connections existed among the river drainages in the Levant during the Pleistocene periods of low sea level, thus serving as a pathway for the dispersal of *C. damascina*.

The results of this study provide a coherent picture of the taxonomic position, phylogenetic relationships and evolutionary history of the *C. damascina* species complex and explain present patterns of distribution considering paleogeographic events.

Kurzfassung

Der Damaskus-Weißling *Capoeta damascina* (Pisces: Teleostei: Cyprinidae) kommt in der Levante, in Mesopotamien und in Teilen der Türkei und des Iran vor. Dort ist er eine der häufigsten Fischarten. Aufgrund der Trockenheit dieser Region besteht der Lebensraum dieser Art aus vielen von einander isolierten Gewässern. Vor der hier vorgelegten Studie war nicht klar, ob es sich bei *C. damascina* um eine Art handelt, oder aber um einen Komplex nah verwandter Arten, die sich durch hohe intraspezifische und geringe interspezifische Variabilität auszeichnen.

Ziel der vorliegenden Untersuchungen war es, anhand morphologischer und molekulargenetischer Daten die phylogenetische Position des *C. damascina*-Artenkomplexes zu ermitteln und die Verwandtschaftsbeziehungen der Arten untereinander zu klären. Um die Arten gegeneinander abzugrenzen und wichtige diagnostische Merkmale zu ermitteln, wurden Fischsammlungen großer europäischer Museen vergleichend-morphologisch untersucht. Dabei galt den Typen der nominellen Arten dieses Komplexes besonderes Augenmerk. Zur Klärung der Verwandtschaftsbeziehungen wurden Sequenzen der mitochondrialen Cytochrom-c-Oxidase (COI, n = 103) und der zwei benachbarten variablen Regionen (D1-D2) des nukleären 28S-rRNA-Gens (LSU, n = 65) mit Hilfe unterschiedlicher phylogenetischer Rekonstruktionsalgorithmen ausgewertet. Als Ergebnis werden innerhalb des *C. damascina*-Artenkomplexes die folgenden sechs Arten als gültig anerkannt: *Capoeta buhsei*, *C. caelestis*, *C. damascina*, *C. saadii*, *C. umbla* und die bisher unbeschriebene Art *Capoeta* sp. 1. Die Analyse der morphometrischen und meristischen Daten zeigt ein hohes Maß an phenotypischer Variabilität zwischen den unterschiedlichen Populationen derselben Art, sowie zwischen den verschiedenen Arten. Dieses Phänomen ist genetischen Faktoren, dem Einfluss von Umweltbedingungen bzw. einer Kombination aus beidem zu erklären.

Die phylogenetischen Analysen zeigen zwei genetische Linien innerhalb des *C. damascina*-Artenkomplexes: eine westliche Linie mit den Arten *C. caelestis*, *C. damascina* und *C. umbla*; so wie eine östliche Linie mit den Arten *C. buhsei*, *C. saadii* und *Capoeta* sp. 1. Die enge Verwandtschaft zwischen *C. damascina* und *C. umbla* zeigt sich unter anderem dadurch, dass ein Exemplar von *C. damascina* aus dem Euphrat den selben COI-Haplotypen aufweist wie ein Exemplar von *C. umbla* aus dem Tigris. Hierfür gibt es drei mögliche Erklärungen: Mitochondriale Introgression, nahe zurückliegende Artbildung oder eine Kombination aus beidem.

Die Ergebnisse zeigen, dass es sich bei den sechs genannten Taxa um junge Arten handelt und ihre Entstehung und heutige Verbreitung im Wesentlichen durch pleistozäne Ereignisse geprägt wurde. Die Besiedlung des Iran erfolgte vermutlich während einer der früheren pleistozänen Meeresspiegeltiefstände und führte zur Abspaltung der östlichen Linie von der mesopotamischen Ausgangspopulation. Die östliche Linie konnte in humiden Phasen des Pleistozäns die verschiedenen

Flusssysteme des südlichen und zentralen Iran besiedeln wo sich die Arten *C. buhsei*, *C. saadii* und *Capoeta* sp. 1 bildeten.

Nach der Abspaltung der östlichen Linie breitete sich die westliche Linie von Mesopotamien in die Levante aus. Dies geschah ebenfalls während des Pleistozäns, als die Oberläufe der westlichen Zuflüsse des Euphrats mit dem Ceyhan verbunden waren. Vom Ceyhan aus erfolgte die Ausbreitung in die Flüsse der südlichen Türkei, die zu Perioden niedriger Meeresspiegelstände über die verlängerten Unterläufe miteinander verbunden waren. Auf diese Weise wurde der Seyhan/Göksu besiedelt und die Art *C. caelestis* entstand. Die Schwesterpopulation differenzierte sich in die Arten *C. damascina* und *C. umbla*. Sehr wahrscheinlich besiedelte *C. damascina* während des späten Pleistozäns die Levante und die südliche Türkei. Dies wird durch die geringe genetische Differenzierung der Art belegt. Direkte Süßwasserverbindungen, die als Ausbreitungsroute für *C. damascina* zwischen den Gewässersystemen der Levante dienten, existierten zu Zeiten niedriger Meeresspiegelstände.

Die hier vorgelegte Arbeit beinhaltet eine detaillierte Neubewertung des taxonomischen Status der behandelten Arten. Sechs nah verwandte Arten werden als gültig anerkannt. Das rezente Verbreitungsmuster dieser Arten wird vor dem Hintergrund der geologischen Entwicklung des Verbreitungsgebietes, ökologischer Faktoren so wie der Verwandtschaftsbeziehungen zwischen den Arten und ihrer Evolutionsgeschichte erklärt.

Zusammenfassung

Der Vordere Orient ist die einzige Übergangszone, die drei biogeographische Großräume, die Paläarktis, die Afrotropis und die Orientalis miteinander verbindet. Diese Landbrücke ermöglicht seit dem Miozän einen Faunenaustausch zwischen Eurasien und Afrika. Gleichzeitig wirkt sie jedoch durch zunehmende Aridität und eine dadurch bedingte Fragmentierung von Süßwasserhabitaten als Faunenfilter. Das Ergebnis ist eine beachtenswerte Biodiversität mit einem hohen Grad an Endemismus bei Süßwasserorganismen. Süßwasserfische sind für zoogeographische Studien in besonderem Maße geeignet, da ihre Ausbreitung von direkten Verbindungen zwischen den Abflusssystemen abhängt und damit die paleogeographische und hydrographische Entwicklung ihres Verbreitungsgebietes wiederspiegelt.

Der Damaskus-Weißling *Capoeta damascina* (Pisces: Teleostei: Cyprinidae) ist eine Süßwasserfischart, die im Vorderen Orient weit verbreitet und häufig ist. Ihr Verbreitungsgebiet erstreckt sich über viele voneinander isolierte Flusssysteme der Levante, der südlichen Türkei, Mesopotamiens bis hin zum südlichen und zentralen Iran. *Capoeta damascina* ist durch ein hohes Maß an Variabilität der Körperform, meristischer Merkmale und der Färbung innerhalb einer Population und zwischen den einzelnen Populationen charakterisiert, was dazu führte, dass in der Vergangenheit zahlreiche Synonyme beschrieben wurden, deren Gültigkeit bis heute kontrovers war. Vor der hier vorgelegten Studie war der taxonomische Status von *C. damascina* weitgehend unklar. Auch blieb es zu entscheiden, ob es sich um eine Art oder einen Komplex mehrerer, nah verwandter Arten handelt. Bisherige Studien über die Taxonomie, Systematik, Phylogenie und Zoogeographie von *C. damascina* und verwandter Arten sind fragmentarisch, was eine systematische Revision dringend erforderlich machte.

Die Ziele dieser Studie waren es, die Taxonomie und Systematik des *C. damascina*-Artenkomplexes zu klären, die Verwandschaftsbeziehungen der Arten untereinander aufzuzeigen und die biogeographische Entwicklung der Gruppe vor dem Hintergrund paläogeographischer Verhältnisse während des Pleistozäns zu rekonstruieren.

Aus der Fragmentierung von Habitaten resultierten hohe intra- und interspezifischen Variabilität innerhalb dieses Artenkomplexes. So war es notwendig, Typen aller nominellen Arten so wie umfangreiche Serien von ergänzendem Material aus dem gesamten Verbreitungsgebiet zu untersuchen. Zu diesem Zweck wurden Sammlungen der großen europäischen Museen bearbeitet, zusätzliches Material von Kollegen entliehen und eigene Expeditionen nach Syrien, Jordanien, Libanon und in den Iran durchgeführt.

Um die Arten innerhalb des *C. damascina*-Artenkomplexes zu diagnostizieren und gegeneinander abzugrenzen, wurden von etwa 800 Exemplaren 21

morphometrische und 13 meristische Daten erhoben. Um die Abgrenzung der Arten gegeneinander zu objektivieren und die Unterschiede zu quantifizieren, wurde der so gewonnene Datensatz mittels statistischer Verfahren, wie der Kovarianzanalyse (analysis of covariance, ANCOVA) und dem Mann-Whitney-Test, ausgewertet. Dabei stellten die morphometrischen Daten eine besondere Herausforderung dar, da hier durch geeignete Transformationsmethoden das allometrische Wachstum einiger Merkmale berücksichtigt werden musste. Zusätzlich wurden die Daten einer Hauptkomponentenanalyse (principal component analysis, PCA) unterzogen.

Die Analyse der morphometrischen Daten der untersuchten Arten und Populationen ergab, dass sich diese Merkmale, trotz der statistisch signifikanten Unterschiede, nur sehr begrenzt zur Abgrenzung von Arten eignen, da fast immer ein ausgeprägter Überscheidungsbereich existiert. Da sich diese Unterschiede zu einem großen Teil auf ökologische Faktoren und nur zu einem geringen Teil auf genetische Ursachen zurückführen lassen, erwiesen sie sich als ungeeignet für die taxonomische Analyse.

Meristische Merkmale, wie z.B. die Schuppenzahl in der Seitenlinie, oberhalb und unterhalb der Seitenlinie, die Schuppenzahl um den Schwanzstiel, die Zahl der Kiemenreusendornen auf dem unteren Teil der ersten Kiemenbogens so wie Wirbelzahlen eigneten sich hingegen gut zur Abgrenzung von Arten innerhalb des *C. damascina*-Komplexes. ANCOVA und Mann-Whitney-Test ergaben signifikante Unterschiede zwischen den Arten. Auch zwischen den Populationen derselben Art, vor allem bei *C. damascina*, wurden teilweise statistisch signifikante Unterschiede gefunden. Diese waren aber für die taxonomische Bewertung nicht relevant, da erhebliche Merkmalsüberschneidungen auftraten. Dies trifft auch auf andere meristische Merkmale, wie die Zahl der verzweigten und unverzweigten Flossenstrahlen in der Rückenflosse, die Zahl der Flossenstrahlen in Brust- und Bauchflosse, die Zahl der verzweigten Strahlen in der Analflosse und die Zahl der Barteln zu. Auch hier wurden signifikante Unterschiede gefunden, die sich aber auf Grund der hohen Merkmalsüberschneidung nicht für die Unterscheidung der Arten und Populationen eigneten. Die meristischen Unterschiede spiegeln genetische Unterschiede, umweltbedingte phänotypische Variabilität oder eine Kombination aus beidem wider.

Auf Grund der vergleichend-morphologischen Analyse wurden die folgenden sechs nah verwandten Arten als gültig anerkannt: *C. buhsei*, *C. caelestis*, *C. damascina*, *C. saadii*, *C. umbla* und die bisher unbeschriebene Art *Capoeta* sp. 1. Die Morphologie, die Färbung, der Sexualdimorphismus, die Verbreitung sowie biotische und abiotische Parameter des Lebensraums dieser Arten werden detailliert beschrieben, mit der Ausnahme von *C. caelestis*, da von dieser Art kein Material zur Verfügung stand. *Capoeta angorae* erwies sich als ein Synonym von *C. damascina*.

Neben der vergleichend-morphologischen Analyse ist die molekulare Phylogenie ein vielversprechender Ansatz, um unbeantwortete Fragen zu diesem Artenkomplex zu klären. Dazu wurden DNA-Sequenzen von zahlreichen Individuen des *C. damascina*-Artenkomplexes und anderer Vertreter der Gattung *Capoeta* (*C. aculeata*, *C. barroisi*, *C. erhani*, *C. mandica*, *C. mauricii*, *C. pestai*, *C. trutta* und *C. turani*) ermittelt und analysiert. Als Marker wurden das mitochondriale Cytochrom-c-Oxidase-Gen (COI) und die zwei benachbarten variablen Regionen (D1-D2) der großen Untereinheit des nukleären 28S-rRNA-Gens (LSU) ausgewählt. Die COI ist sehr variabel und verspricht eine gute Auflösung auch bei nah verwandten Arten und sogar unterhalb des Artniveaus, während die Kombination eines mitochondrialen und eines nukleären Markers das Aufdecken von Hybridisierungsereignissen oder Mitochondrialer Introgression erlaubte.

Die phylogenetische Analyse der molekularen Sequenzdaten der *Capoeta*-Arten erfolgte mit Hilfe der Maximum-Parsimonie-Methode (MP) sowie der Bayesianischen Analyse (BA) und basiert auf 103 COI-Sequenzen und 65 LSU-Sequenzen. Zur Verbesserung der phylogenetischen Auflösung wurden zudem beide Datensätze zu einem 'total evidence'-Datensatz zusammengefügt. Weiterhin wurden Haplotypennetzwerke generiert, mit denen sich die Sequezvariabilität, die der phylogenetischen Analyse zugrunde liegt, darstellen ließ. Die Ergebnisse dieser beiden Ansätze wurden mit paläogeographischen Ereignissen, die das Verbreitungsgebiet der Arten geprägt haben, korreliert, um so die Evolutionsgeschichte der Arten und phylogenetischen Linien innerhalb des Artenkomplexes zu rekonstruieren.

Bei der phylogentischen Analyse zeigten sich zwei Linien innerhalb des *C. damascina* Artenkomplexes: eine westliche Linie, welche die Arten *C. damascina*, *C. umbla* und *C. caelestis* umfasst und eine östliche Linie, die sich aus den Arten *C. saadii*, *C. buhsei* und *Capoeta* sp. 1 zusammensetzt. Der COI-Datensatz und der 'total evidence'-Datensatz zeigen, dass *C. damascina* und *C. umbla* eng mit einander verwandt sind und gemeinsam die Schwestergruppe zu *C. caelestis* bilden. *Capoeta buhsei* und *Capoeta* sp.1 bilden die Schwestergruppe zu *C. saadii*. Der LSU-Marker löst die Verwandschaftsverhältnisse zwischen den Arten nicht auf, bestätigt aber die Monophylie von *C. buhsei*, *C. saadii*, *Capoeta* sp. 1 und *C. umbla*. Nach dem COI-Datensatz ist *C. umbla* eine Untergruppe von *C. damscina*, wogegen der LSU-Datensatz und der 'total evidence'-Datensatz *C. umbla* und *C. damascina* als monophyletische Gruppen ausweist, ihre verwandtschaftliche Stellung zueinander jedoch nicht eindeutig auflöst. Die Haplotypennetzwerke zeigen, dass die meisten Individuen der Populationen von *C. damascina* einen von zwei häufigen Haplotypen besitzen, oder einen Haplotypen, der diesen sehr ähnlich ist. Außerdem hat ein Individuum von *C. umbla* aus dem Tigris den selben Haplotyp wie ein Exemplar von *C. damascina* aus dem Euphrat. Dafür gibt es drei mögliche Erklärungen: Es könnte sich um eine unvollständige Aufspaltung der beiden Schwesterarten oder um einen Fall mitochondrialer Introgression oder aber um eine Kombination aus beidem handeln.

Die Verwandschaftsverhältnisse zwischen den geographisch definierten Populationen von *C. damascina* werden nicht aufgelöst, da es kaum genetische Unterschiede zwischen ihnen gibt. Das deutet auf eine sehr kurze geographische Isolation oder fortgesetzten Genfluss hin. Im Gegensatz dazu zeigen die Populationen von *C. saadii* nur wenig Übereinstimmung bei den Haplotypen. Dies deutet auf eine länger bestehende geographische Trennung hin, allerdings beruht dieses Ergebnis auf einer relativ geringen Stichprobegröße und die Bedeutung dieses Unterschiedes kann daher nicht abschließend beurteilt werden.

Die Ergebnisse zeigen, dass es sich bei den sechs genannten Taxa um junge Arten handelt und dass ihre Entstehung und heutige Verbreitung im Wesentlichen durch pleistozäne Ereignisse geprägt wurde. Die Besiedlung des Iran erfolgte vermutlich während einer der früheren pleistozänen Meeresspiegeltiefstände, als der Persische Golf austrocknete und die iranischen Flüsse des Golf- und des Hormuz-Beckens mit dem Euphrat-Tigris-System verbunden waren. Dies führte zur Abspaltung der östlichen Linie von der mesopotamischen Ausgangspopulation. Zu dieser Zeit war der Rud-e Kor Teil des Rud-e Mand-Abflusssystems und die Vorläufer von *C. buhsei*, *C. saadii* und *Capoeta* sp.1 erreichten das Rud-e Kor-System über diese Verbindung. Möglicherweise erfolgte darauf hin eine Ausbreitung zurück ins Tigris-System und von dort, durch Verbindungen zwischen den Oberläufen der Zuflüsse in humiden Klimaphasen ins Daryacheh-ye Namak-Becken. Die Populationen im Golf-, Rud-e Kor- und Hormuz-Becken entwickelten sich zu *C. saadii* und die im Tigris und im Daryacheh-ye Namak-Becken spalteten sich in *Capoeta* sp. 1 und *C. buhsei* auf. Diese Populationen waren geographisch gut voneinander isoliert und so konnten sich die mitochondrialen Linien differenzieren. Der nukleare Marker zeigt diese Differenzierung bisher nicht, was darauf hindeutet, dass diese Isolation eher jung ist.

Nach der Abspaltung der östlichen Linie breitete sich die westliche Linie von Mesopotamien her in die Levante aus. Dies geschah während humider Phasen des Pleistozäns, als die Oberläufe der westlichen Zuflüsse des Euphrat mit dem Ceyhan verbunden waren. Von Ceyhan aus erfolgte die Ausbreitung in die Flüsse der südlichen Türkei, da diese in Perioden niedriger Meeresspiegelstände über die verlängerten Unterläufe verbunden waren. Auf diese Weise oder durch Kontakt zwischen den Oberläufen wurde der Seyhan/Göksu besiedelt und die Art *C. caelestis* entstand. Die Schwesterpopulation differenzierte sich in die Arten *C. damascina* und *C. umbla*. Sehr wahrscheinlich besiedelte *C. damascina* während des späten Pleistozäns die Levante und die südliche Türkei. Dies wird durch die geringe genetische Differenzierung zwischen den zahlreichen, heute voneinander isolierten Populationen dieser Art belegt. Direkte Süßwasserverbindungen zwischen den

Gewässersystemen der Levante existierten zu Zeiten niedriger Meeresspiegelstände. Sie dienten als Ausbreitungswege für *C. damascina*.

Die hier vorliegende Arbeit stellt eine detaillierte Neubewertung des taxonomischen Status der behandelten Arten dar. Sechs nah verwandte Arten werden als gültig anerkannt. Das rezente Verbreitungsmuster dieser Arten wird vor dem Hintergrund der geologischen Entwicklung des Verbreitungsgebietes, ökologischer Faktoren so wie der Verwandtschaftsbeziehungen zwischen den Arten und ihrer Evolutionsgeschichte erklärt.

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A	number of anal-fin rays (unbranched A: number of unbranched anal rays; branched A: number of branched anal rays)
A	Adenine
a	slope
ABI	Applied Biosystems
aff.	affinis
AIC	Akaike Information Criterion
ALL	number of scales above the lateral line
ANCOVA	Analysis of Covariance
&	and
ANOVA	Analysis of Variance
AUBM	American University of Beirut Museum
AUBM OS	American University of Beirut Museum Osteichthyes
b	intercept
BA	Bayesian analysis
B. barbus	*Barbus barbus*
'*B.' intermedius*	*'Barbus' intermedius*
B.C.	Before Christ
BD	body depth
Bik-F	Biodiversität und Klima-Forschungszentrum
BLL	number of scales below the lateral line
BMNH	British Museum (Natural History), London
BP	Before Present
bp	base pair
branched C	number of branched caudal-fin rays
b.s.l	below sea level
C	Cytosine
C.	*Capoeta*
ca.	circa (from Latin, meaning "approximately")
C. b.	*Capoeta barroisi*
CBSU	Collection of the Biology Department of Shiraz University
C. c.	*Capoeta capoeta*
C. capoeta	*Capoeta capoeta/Cyprinus capoeta*
C. carpio	*Cyprinus carpio*
CCP	circumpendicular scale counts
CD	caudal peduncle depth
CL	caudal peduncle length
COI	cytochrome oxidase I
°C	degrees

D	number of dorsal-fin rays (unbranched D: number of unbranched dorsal rays; branched D: number of branched dorsal rays)
D. Maharlu basin	Daryacheh-ye Maharlu basin
D. Namak basin	Daryacheh-ye Namak basin
DAAD	Deutscher Akademischer Austausch Dienst
ddH$_2$O	double distilled water
DNA	deoxyribonucleic acid
dNTP	deoxyribonucleotide triphosphate
ED	eye diameter
EDTA	Ethylenediaminetetraacetic acid
e.g.	*exempli gratia* (from Latin, meaning “for example”)
=	equal
et al.	*et alii* (from Latin, meaning “and others”)
etc.	et cetera (from Latin, meaning “and other things/and so on”)
ex NMW	an exchange specimen from NMW
Fig./Figs	figure/figures
FSJF	Fischsammlung Jörg Freyhof
(f1)	1 fish
G	Guanine
g	gram
GPS	Global Positioning System
>	greater than
≥	equal to or greater than
$GR_{\text{Lower limb count}}$	number of gill rakers on the lower limb of the first gill arch
GR_{Total}	number of gill rakers on the first gill arch
GTR+I	generalized time reversible model with invariant sites
HKY+I+G	Hasegawa-Kishono-Yano model with invariant sites and gamma distribution
HL	head length
H$_2$O	water
i.e.	id est (from Latin, meaning “that is/which means”)
IOW	interorbital width
IR	Iran
k	number of pairwise tests
ka	kiloannum (10^3 years)
km	kilometer
km^2	square kilometer
LA	length of the longest anal-fin ray
LAB	length of the anal-fin base
LD	length of the longest dorsal-fin ray

LDB	length of the dorsal-fin base
<	less than
LL	number of scales in the lateral-line series from the first pore-bearing scale to the last scale on the caudal fin
$LL_{\text{Caudal fin base}}$	number of scales in the lateral-line series from the first complete scale to the last scale at the level of the hypural plate or to the last scale terminating at the beginning of the caudal-fin base
LOEWE	Landes Offensive zur Entwicklung Wissenschaftlich-ökonomischer Exzellenz
log	logarithm
LP	length of the pelvic fin
LPB	length of the posterior barbel
LPC	length of the pectoral fin
LSU	large subunit
M	molar
m	meter
Ma	megaannum (10^6 years)
mg	milligram
min	minute
µl	microliter
ml	milliliter
mm	millimeter
MNHN	Muséum National d'Histoire Naturelle, Paris
MP	Maximum Parsimony
N	unresolved nucleotides
N.	Nahr/Nehir/Nehri
(N)	north
n	sample size
ng	nanogram
NMW	Naturhistorisches Museum, Wien
N-S	north-south
#	number
P	total number of pelvic-fin rays
p.	page
p	probability
PAUP*	Phylogenetic Analysis Using Parsimony (and Other Methods)
Pb	lead
PBS	Phosphate Buffered Saline
PC	Principal Component
Pc	total number of pectoral-fin rays

PCA	Principal Component Analysis
PCR	Polymerase Chain Reaction
%	Percent
PhD	Doctor of Philosophy
+	plus
POL	postorbital length
PP	posterior probability
pp.	pages
PrOL	preorbital length
PT	pharyngeal teeth
R.	River/Rud/Rud-e
RMNH	Rijksmuseum van Natuurlijke Historie, Leiden
RNA	Ribonucleic acid
S	svedberg
S.	*Scaphiodon*
(S)	south
SA	preanal length
SD	predorsal length
SD	standard deviation
16S rDNA	16S ribosomal DNA
SL	standard length
SMF	Senckenberg Museum, Frankfurt am Main (Senckenberg Forschungsinstitut und Naturmuseum)
SP	prepelvic length
sp.1	species 1
SPSS	Statistical Package for the Social Sciences
SYR	Syria
T	Thymine
TAE	Tris-Acetate-EDTA
TBR	tree bisection and reconnection
TL	total length
USA	United States of America
UV	Ultra-Violet
V	Volt
V.	*Varicorhinus*
VC	vertebral count
vs.	versus
WM	width of the mouth
x	times

I. Introduction

The Middle East is the only transition zone between three major biogeographic units, the Palaearctic, the Afrotropical and the Oriental realms. It served as an important crossroad of biotic exchange on a global scale resulting in an outstanding biological diversity, among which are freshwater fishes (DURAND et al. 2002, KRUPP et al. 2009).

Freshwater fishes are very suitable for zoogeographic studies since their movement from one drainage basin to another depends on freshwater connections. Thus, their distribution patterns reflect the paleogeography of an area and the history of the hydrographic systems (COAD 1987). A good example of this phenomenon is the family Cyprinidae, whose members served as a model in many biogeographical (e.g. BRIOLAY et al. 1998, DURAND et al. 2000, TSIGENOPOULOS & BERREBI 2000) and molecular phylogenetic studies (e.g. GILLES et al. 1998, DURAND et al. 2002). While some focused on the zoogeography and molecular phylogeny of this family (e.g. MAYDEN et al. 2009), others analyzed specific genera, subgenera or species (e.g. ALMAÇA 1988, BERREBI et al. 1996, DURAND et al. 1999, TSIGENOPOULOS & BERREBI 2000), thus shedding light on the evolutionary history of this family.

Capoeta Valenciennes in Cuvier & Valenciennes, 1842 is an example of a widespread cyprinid genus in the Middle East, whose taxonomic status is largely unsettled (KRUPP & SCHNEIDER 1989). Being found in a wide range of habitats, species in this genus display considerable morphological variability and the extent of morphological plasticity and genetic variability remain to be determined. As a consequence, there is considerable disagreement about the status of several species, such as *Capoeta damascina* (Valenciennes in Cuvier & Valenciennes, 1842) whose present distributional range raises very interesting biogeographical and evolutionary questions regarding its origin and radiation. Previous studies on its systematic status, biogeographical dispersal and molecular phylogeny are inadequate and thus a revision is definitely needed.

1.1. The Genus *Capoeta*: A Brief Overview

The genus *Capoeta* was erected by VALENCIENNES in CUVIER and VALENCIENNES' "Histoire naturelle des Poissons" in 1842, who described two species: *Capoeta fundulus* from Cyrus (Kura) River and *Capoeta amphibia* from Bombay. He also provided a description of *C. macrolepidota* from Java which is, along with *C. amphibia*, no longer placed in the genus *Capoeta*. In 1843, HECKEL erected the genus *Scaphiodon* and described *S. tinca* from Brussa (Bursa), *S. trutta* and *S. umbla* from the Tigris River in Mossul (Mosul), *S. fratercula* and *S. socialis* from/around Damascus and *S. peregrinorum* and *S. capoeta* from Aleppo. In 1849, he described four additional new species from Persia: *S. amir*, *S. niger*, *S. macrolepis* and *S. saadii*. KEYSERLING (1861) described five new species: *S. chebisiensis* from a canal in

Chebis, *S. rostratus* from a canal in the vicinity of Jezd (Jazd), *S. gracilis* from rivers near Isphahan (Esfahan), *S. heratensis* from Heri Rud (Hari Rud) at Herat and *S. asmussii* near Herat. In 1865, DE FILIPPI described a new species, *C. sevangi*, from Lake Goktscha (Sevan), Armenia. GÜNTHER (1868) considered *Scaphiodon* a synonym of *Capoeta* and included some additional species in this genus, which were previously placed in *Chondrostoma, Dillonia* and *Gymnostomus*. In 1909, BOULENGER placed *Capoeta* in the genus *Varicorhinus* Rüppell, 1835. BERG (1964) regarded *V. sevangi*, *V. gracilis* and *V. heratensis* as subspecies of *V. capoeta* and *V. sieboldi* and *V. tinca* as separate species. KARAMAN (1969) revised the genus *Capoeta* (*Scaphiodon* being considered a synonym) and distinguished it from the African *Varicorhinus* based on the following combination of characters: *Capoeta* has a denticulate last unbranched dorsal-fin ray (as opposed to smooth in *Varicorhinus*), very small to medium-sized scales (large in *Varicorhinus*), a narrow lachrymal bone covering only a small part of the upper side of the rostrum (large and covering most of the rostrum in *Varicorhinus*), long and narrow suborbital bones (short and wide in *Varicorhinus*), posterior maxillary process not reaching the center of the jugal (extending back to the center of the jugal in *Varicorhinus*) and long lower jaw (short in *Varicorhinus*). KARAMAN recognized seven valid species: *Capoeta barroisi* Lortet in Barrois, 1894; *C. buhsei* Kessler, 1877; *C. capoeta* (Güldenstädt, 1773); *C. fusca* Nikolskii, 1897; *C. pestai* (Pietschmann, 1933); *C. tinca* (Heckel, 1843) and *C. trutta* (Heckel, 1843). He also recognized 11 subspecies within *C. capoeta* [*C. c. aculeatum* (Valenciennes in Cuv. & Val., 1844); *C. c. angorae* (Hankó, 1924); *C. c. bergamae* Karaman, 1969 (a new subspecies from southwest Anatolia); *C. c. capoeta*; *C. c. damascinus*; *C. c. gracilis* (Keyserling, 1861), *C. gibbosa* Nikolskii, 1897 being considered a synonym; *C. c. heratensis* (Keyserling, 1861); *C. c. kosswigi* Karaman, 1969 (a new subspecies from Van Gölü (Lake Van)); *C. c. macrolepis* (Heckel, 1849); *C. c. sieboldi* (Steindachner, 1864) and *C. c. umbla* (Heckel, 1843)], most of which were considered distinct species by subsequent authors (KRUPP & SCHNEIDER 1989, COAD & KRUPP 1994, BANARESCU 1999, BOGUTSKAYA & NASEKA 2004, TURAN et al. 2006b, ÖZULUĞ & FREYHOF 2008).

Based on a single specimen, KARAMAN (1969) also described a new subspecies *C. barroisi persica* from Daryacheh-ye (Lake) Zariwar, Mariwan (Marivan), Iran. According to him, *C. b. persica* is distinguished from the nominal subspecies by having a more horseshoe-shaped mouth, blackish pectoral, pelvic and anal fins, a longer pectoral fin, a shorter anal fin and a deep body with very few but large black spots. Another subspecies *C. barroisi mandica* was described by BIANCO & BANARESCU (1982) from Mand River (Rud-e Mand, Iran) and mainly distinguished from *C. b. barroisi* and *C. b. persica* by the number of scales and gill rakers. KRUPP (1985) considered *C. b. persica* and *C. b. mandica* to be synonyms of the nominal subspecies.

BANARESCU (1999) considered *C. capoeta* a polytypic species encompassing about 10 subspecies distributed throughout southwestern Asia without listing them. He also recognized the existence of three additional valid species within the undefined "*C. capoeta* group": *Capoeta aculeata* (from the inland catchment areas of northern Iran), *C. macrolepis* [from the Rud-e Kor basin, a synonym of *C. aculeata* according to COAD & KRUPP (1994)] and *C. umbla* (from the Tigris-Euphrates river system), and nine others within *Capoeta*: *Capoeta barroisi*, *C. buhsei*, *C. fusca*, *C. gibbosa*, *C. pestai*, *C. saadi*, *C. sieboldi*, *C. tinca* and *C. trutta*. In his book on "The Inland Water Fishes of Iran", ABDOLI (2000) regarded *C. aculeata*, *C. barroisi*, *C. buhsei*, *C. damascina*, *C. fusca*, *C. saadi*, and *C. trutta* as valid species and *C. c. gracilis*, *C. c. heratensis*, and *C. c. intermedia* Bianco & Banarescu, 1982 as valid subspecies.

TURAN et al. (2006b) considered *C. angorae*, *C. bergamae*, *C. capoeta* and *C. kosswigi* as valid species and described *C. ekmekciae* from Çoruh Nehri drainage in Turkey. TURAN et al. (2006a) reviewed the *C. tinca* species group in Turkey and recognized three species: *C. tinca* (from rivers draining to Marmara Sea), *C. baliki* (a new species from rivers draining to the southwestern Black Sea) and *C. banarescui* (a new species from the Çoruh Nehri drainage). In 2008, TURAN et al. defined a group of species called the "*C. trutta* species-group" including *C. trutta*, *C. barroisi*, *C. pestai* and *C. erhani* (a new species from Ceyhan Nehri drainage). ÖZULUĞ & FREYHOF (2008) described *C. turani* from Seyhan Nehri drainage and considered it a member of the "*C. trutta* species-group". They also regarded *C. b. mandica* as a valid species and found it difficult to reach a conclusion regarding the taxonomic status of *C. b. persica* based on a single type specimen which might be non-standard.

Recently, TURAN (2008) studied Anatolian *Capoeta* species using mitochondrial 16S rDNA gene sequences to determine whether traditionally defined species and subspecies correspond to taxonomic entities. Based on systematic topology and genetic data, he considered *C. antalyensis*, *C. barroisi*, *C. damascina*, *C. pestai*, *C. tinca* and *C. trutta* as distinct species. He also rose four subspecies of *C. capoeta* (*C. c. angorae*, *C. c. bergamae*, *C. c. capoeta* and *C. c. sieboldii*) to species level. TURAN's study also suggested the existence of two undescribed species from Anatolia: one from Göksu Nehri and the other from Dalaman Nehri. The former was recently described by SCHÖTER et al. (2009) as *C. caelestis*. KÜÇÜK et al. (2009) re-examined *C. pestai* from Lakes Eğirdir and Beyşehir (Eğirdir Gölü and Beyşehir Gölü) basins and concluded that two species existed there: *Capoeta pestai* (from Eğirdir Gölü basin) and *C. mauricii* (a new species from Beyşehir Gölü basin).

When VALENCIENNES (1842) described the genus *Capoeta*, he did not select any types. He realized, as stated by BANARESCU (1999), that *Cyprinus capoeta* Güldenstädt, 1773 and *Cyprinus fundulus* Güldenstädt, 1787 from Kura River at Tbilisi were synonyms of *Capoeta fundulus* since he based his description of *C. fundulus* on his interpretation of an illustration of GÜLDENSTÄDT's *Cyprinus*. Therefore, he depicted the name *Capoeta* as the generic name. Since tautonomy was not considered during that time, he had chosen the species name *fundulus* instead of the older one *capoeta* (BANARESCU 1999). As KARAMAN (1969) revised the genus *Capoeta*, he considered *Cyprinus capoeta* (= *Cyprinus fundulus*) as the type species. Later on, KRUPP & SCHNEIDER (1989) considered *Capoeta fundulus* to be the type species by subsequent designation. In 1999, BANARESCU reviewed the nomenclatural status of this genus and agreed with KARAMAN (1969) regarding the type species (*Cyprinus fundulus* = *Cyprinus capoeta* by absolute tautonomy). He stated that BLEEKER (1863) was incorrect in selecting *C. amphibia* as the generotype since this species currently belongs to *Puntius*. In his "Catalogue of Fishes", ESCHMEYER (1998) agreed with BANARESCU (1999) concerning the type species of this genus and rejected the view of KRUPP & SCHNEIDER (1989). Currently, no specimens of the types, which may have been in GÜLDENSTÄDT's collection, are present in the collection of the Zoological Institute in Saint Petersburg (BANARESCU 1999).

Members of the genus *Capoeta* are medium-sized to large cyprinids characterized by having an elongate, cylindrical body and a short dorsal fin. They have four unbranched and seven to nine branched dorsal-fin rays, the last unbranched ray being ossified and serrated. All species have three unbranched and five branched anal-fin rays. Scales are usually small; the mouth is in a ventral position and the lower lip is covered with a horny sheath. One pair of barbels (rarely two) is present and the pharyngeal teeth are arranged in three rows. The shape of the mouth as well as the pharyngeal teeth are nearly identical in all species, which indicate their adaptation to the same mode of feeding habits. The combination of these characters distinguishes *Capoeta* from all other cyprinids (KRUPP 1985, KRUPP & SCHNEIDER 1989).

As presently recognized, the genus *Capoeta* includes about 23 species widely distributed in many river drainages and basins in southwestern Asia except the Arabian Peninsula (Table 1). However, the status of several species and subspecies is not yet clear. *Capoeta damascina*, for example, is far from being a well-defined species and its systematic status requires revision and further investigation. Although four subspecies of *C. capoeta* (*C. c. capoeta*, *C. c. gracilis*, *C. c. heratensis* and *C. c. sevangi*) are described (BERG 1964, COAD 1981, BANARESCU 1999, ABDOLI 2000), it is quite difficult to assess the validity of these subspecies without a comparative study of a long series of specimens from all over the distribution area and better information on localities of occurrence. Similarly and as mentioned by ÖZULUĞ & FREYHOF (2008) and TURAN et al. (2008), the taxonomic status of *C. barroisi persica* is not yet clear and this requires a thorough revision.

The genus *Capoeta* is a monophyletic, Palaearctic taxon (KRUPP 1985, KÜÇÜK et al. 2009). KARAMAN (1971) suggested its affinity with the European *Barbus* Cuvier & Cloquet, 1816 /*Aulopyge* Heckel, 1841 group based on the disposition of striae on the scales. Afterwards, HOWES (1982), based on jaw morphology, considered it closely related to *Cyprinion* Heckel, 1843 and its southern and East Asian relatives. According to KRUPP (1985), *Capoeta* shares synapomorphies with representatives of

Barbus sensu stricto, which are closer to *Capoeta* than to the *Barbus luteus* complex (= *Carasobarbus*). Based on stronger evidence and using cytochrome *b* sequences, DURAND et al. (2002) showed that one species of the genus *Capoeta* (*C. capoeta* from Lake Sevan) displayed close phylogenetic relationships with the Euro-Mediterranean *Barbus* sensu stricto group. This was further supported by TSIGENOPOULOS et al. (2003) who found, based on complete cytochrome *b* sequence data, that members of the genus *Capoeta* (*C. capoeta* from Lake Sevan, Armenia; *C. angorae* from Seyhan Nehri, Turkey and *C. trutta* from Tigris River, Turkey) formed a monophyletic group within the *Luciobarbus* lineage.

Table 1. Presently recognized *Capoeta* species (prior to this study).

Species	**Authority**	**Distribution**
C. aculeata	(Valenciennes in Cuv. & Val., 1844)	Tigris River, Daryacheh-ye Namak, Kavir, Kerman, Esfahan (Zayandeh Rud), and Rud-e Kor basins (Valenciennes in Cuv. & Val. 1844, Coad & Krupp 1994, Abdoli 2000).
C. angorae	(Hankó, 1924)	Seyhan and Ceyhan Nehri drainages (Hankó 1924, Turan et al. 2006b).
C. antalyensis	(Battalgil, 1943)	Aksu, Köprü and Gökdere streams near Antalya (Battalgil 1943, Erk'akan & Kuru 1983, Turan et al. 2006a).
C. baliki	Turan, Kottelat, Ekmekçi & Imamoglu, 2006a	Sakarya Nehri and Kızıl Irmak drainages (Turan et al. 2006a).
C. banarescui	Turan, Kottelat, Ekmekçi & Imamoglu, 2006a	Çoruh Nehri drainage (Turan et al. 2006a).
C. barroisi with two subspecies: - *C. barroisi barroisi* - *C. barroisi persica*	 Lortet in Barrois, 1894 Karaman, 1969	 Orontes River drainage (Lortet in Barrois 1894, Krupp 1987). Daryacheh-ye Zariwar in the Tigris basin of Iran (Karaman 1969).
C. bergamae	Karaman, 1969	Gediz Nehri and Büyük Menderes Nehri drainages (Karaman 1969, Turan et al. 2006b).
C. buhsei	Kessler, 1877	Daryacheh-ye Namak and Kavir basins (Kessler 1877, Coad 2008).
C. caelestis	Schöter, Özuluğ & Freyhof, 2009	Göksu Nehri (Schöter et al. 2009).
C. capoeta with four subspecies: - *C. c. capoeta* - *C. c. gracilis* - *C. c. heratensis*	 (Güldenstädt, 1773) (Keyserling, 1861) (Keyserling, 1861)	 Kura River drainage (Güldenstädt 1773, Banarescu 1999, Turan et al. 2006b). Rivers in the southern portion of the Caspian Sea basin from the Lenkoran region to the Atrek River basin and in the northern slope of the Kopet Dag mountains and eastward till Archman, Daryacheh-ye Urmia, Tigris (Iranian portion), Bejestan, Sirjan, Daryacheh-ye Namak, Esfahan, Gulf and Kavir basins (Keyserling 1861, Berg 1949, Saadati 1977, Coad 1995, Abdoli 2000). Helmand River, Hari Rud basin (including the Iranian part), Murgab River basin, Qonduz River and "north Afghanistan" (Keyserling 1861,

		Karaman 1969, Coad 1981).
- *C. c. sevangi*	de Filippi, 1865	Kura-Araxes River drainage, Lake Sevan basin as well as several small lakes such as Çildir, Gilli and Arpilitch (de Filippi 1865, Berg 1964, Banarescu 1999)
C. damascina	(Valenciennes in Cuv. & Val., 1842)	Ceyhan Nehri, Seyhan Nehri, Orontes, Litani and Jordan River drainages (including streamlets in the Dead Sea Valley), Nahr Quwayq, Damascus basin, Turkish, Syrian, Lebanese, Palestenian and Israeli coastal rivers, Tigris-Euphrates river system including the Iranian part, Daryacheh-ye Namak, Esfahan, Rud-e Kor, Daryacheh-ye Maharlu, Gulf, Kerman, Kavir, Lut, Hormuz and Hamun-e Jaz Murian basins (Valenciennes in Cuv. & Val. 1842; Lortet 1883; Krupp 1985, 1987; Goren & Ortal 1999; Abdoli 2000; Coad 1991, 1995, 2008; Krupp & Schneider 2008).
C. ekmekciae	Turan, Kottelat, Kırankaya & Engin, 2006b	Lower Çoruh Nehri drainage (Turan et al. 2006b).
C. erhani	Turan, Kottelat & Ekmekçi, 2008	Ceyhan Nehri drainage (Turan et al. 2008).
C. fusca	Nikolskii, 1897	Kavir, Hari Rud (including the Iranian part), Bejestan, Lut and Sistan basins (Nikolskii 1897, Coad 2008).
C. kosswigi	Karaman, 1969	Van Gölü basin (Karaman 1969, Turan et al. 2006b).
C. mandica	Bianco & Banarescu, 1982	Rud-e Mand (Bianco & Banarescu 1982, Özuluğ & Freyhof 2008).
C. mauricii	Küçük, Turan, Şahin & Gülle, 2009	Beyşehir Gölü basin (Küçük et al. 2009).
C. pestai	(Pietschmann, 1933)	Eğirdir Gölü basin (Pietschmann 1933).
C. sieboldii	(Steindachner, 1864)	Rivers draining into the Black Sea from Sakarya Nehri till Rioni (Rion) River (Steindachner 1864, Karaman 1969, Turan et al. 2006b).
C. tinca	(Heckel, 1843)	Rivers draining to the southern shore of Marmara Sea (e.g. Nilüfer Çayi and Kocabaş Çayi drainages) (Heckel 1843, Turan et al. 2006a).
C. trutta	(Heckel, 1843)	Nahr Quwayq, Orontes River drainage, Rud-e Zohreh in the Iranian Gulf drainage and Tigris-Euphrates river system including the Iranian part (Heckel 1843; Krupp 1985; Coad 2002, 2010).
C. turani	Özuluğ & Freyhof, 2008	Seyhan Nehri drainage (Özuluğ & Freyhof 2008).
C. umbla	(Heckel, 1843)	Tigris-Euphrates river system (Heckel 1843, Berg 1949, Karaman 1969).

1.2. The *Capoeta damascina* Species Complex

1.2.1. Taxonomy and Systematics

Capoeta damascina was briefly described as *Gobio damascinus* by VALENCIENNES (1842) in CUVIER & VALENCIENNES's "Histoire naturelle des Poissons". The description was based on one specimen collected by BOVÉ from the "fleuve de Damas" (river of Damascus, Syria). *Gobio damascinus* was mainly characterized by having three unbranched and 11 branched dorsal-fin rays; two unbranched and five branched anal-fin rays; 20 pectoral-, nine pelvic- and 19 caudal-fin rays and small scales numbering 70 in the lateral-line series.

In 1843, the Austrian zoologist HECKEL erected the genus *Scaphiodon* and described seven new species. Among them were *S. fratercula* from Damascus, *S. socialis* around Damascus, *S. capoeta* and *S. peregrinorum* from Aleppo, and *S. umbla* from the Tigris in Mosul (see section 1.1). In 1844, VALENCIENNES described a new species, *Chondrostoma syriacum*, from Abraham's River at the foot of Mount Sinai. HECKEL (1849) described three additional species from "Persia": *S. amir* [from the Araxes (Kor)], *S. niger* [from the Araxes/Benth-Amir (Band-e Amir)] and *S. saadii* (from Saadi water sources and in the vicinity of Persepolis). He noted the similarity between *S. amir* and *S. socialis* as well as between *S. amir* and *S. niger*. According to him, the similarity between the latter two species is comparable to that between *S. fratercula* and *S. socialis*. He considered the perpendicular position of the serrae on the last unbranched ossified dorsal-fin ray a character shared by *S. amir* and *S. niger*. He noted, even though with great doubt, the similarity of *Scaphiodon* (*Gobio*) *damascinus* to *S. fratercula* and *S. socialis* regarding mouth shape, pharyngeal teeth and ossified ray. He also placed *Chondrostoma syriacum* in the genus *Gymnostomus* due to the lack of an ossified dorsal ray.

KEYSERLING (1861) described five additional new species from "Persia", among which were *S. chebisiensis* and *S. rostratus* (see section 1.1). According to him, *S. chebisiensis* and *S. rostratus* are similar to *S. socialis* in body shape. In 1864, STEINDACHNER, who based his judgement on a large number of specimens collected from Asia Minor to Palestine, synonymized *S. socialis* with *S. capoeta*. Günther (1868) considered *Scaphiodon* a synonym of *Capoeta* and regarded *C. damascina*, *C. fratercula*, *C. amir*, *C. umbla* and *C. syriaca* as valid species. He also considered *S. capoeta* Heckel, 1843 (non sensu Güldenstädt, 1773), *S. socialis*, *S. chebisiensis* and *S. rostratus* as synonyms of *C. damascina* and noticed that *C. damascina* was variable with respect to the shape of the snout, size of the eye and lengths of anal and caudal fins. According to him, *S. peregrinorum* is not specifically distinct from *C. damascina*.

LORTET (1883) and TRISTAM (1884) considered *C. syriaca*, *C. fratercula*, *C. amir*, *C. socialis* and *C. damascina* as valid species whereas PELLEGRIN (1923), like

GÜNTHER (1868), considered all the aforementioned species as valid except *C. socialis*. Following BOULENGER (1909) who considered *Capoeta* a synonym of *Varicorhinus*, HANKÓ (1924) provided descriptions of *V. tinca*, *V. damascinus*, *V. capoeta*, *V. sieboldi* and *V. kemali* (= *Hemigrammocapoeta kemali*) from Asia Minor and described two new subspecies: *V. capoeta angorae* (from Bozanti = Pozantı) and *V. kemali turcicus* (from Ereğli). In 1928, PELLEGRIN noted the high similarity and closeness of *V. fratercula* to *V. damascinus*. GRUVEL (1931) placed *C. damascina*, *C. barroisi* and *C. trutta* in the genus *Varicorhinus* while keeping *C. fratercula* and *C. socialis* in *Capoeta*. TORTONESE (1934) did not accept the synonymy of *C. chebisiensis* with *C. damascina* and considered it a valid species. TORTONESE (1937-1938) pointed out to the morphological variability of *V. damascinus*, particularly in the lateral-line scale counts, shape of mouth, length of barbels, shape and size of fins and structure of the last unbranched dorsal ray. He considered *V. damascinus* to be closely related to *V. fratercula*, *V. amir* and *V. syriacus*. He also stated that characters in some of the species require more extensive analyses based on a long series of comparative materials.

In 1949, BERG noted that *C. fratercula* was apparently identical to *V. damascinus*. According to him, HECKEL compared fishes of greatly differing sizes and no allowance was made for allometry. He also stated that *V. syriacus* was most likely a synonym of *V. damascinus* because LORTET (1883) had reported *C. syriaca* from Lake Tiberias and the Jordan River and *C. damascina* from the same lake and from other places in Palestine and Syria. BERG (1949) also considered *Scaphiodon amir*, *S. saadii* and *S. niger* from Shiraz as synonyms of *V. damascinus* or "geographical forms" of the latter. He did not consider the arrangement of the serrae on the ossified dorsal-fin ray in *S. amir* and *S. niger* important, as this feature was also found in small specimens of *V. damascinus* from Jordan. KOSSWIG (1952), who conducted an extensive survey of Anatolian freshwater fishes, suggested synonymizing *V. capoeta* Heckel [sic.], *V. peregrinorum* Heckel, aff. *peregrinorum* sensu Battalgil, *V. umbla* Battalgil (non ? Heckel) and *V. capoeta* sensu Hankó with *V. damascinus*. It remained unclear to him whether *V. capoeta* Güldenstädt, *V. pestai* and *V. syriacus* should be included in *V. damascinus*. STEINITZ (1953) synonymized *Chondrostoma syriacum* with *V. damascinus*, discussed the variability within *V. damascinus* and stressed that a revision of this species was required.

In 1960, LADIGES stated that KOSSWIG's suggestion (1952) for the inclusion of *V. capoeta* Heckel, *V. peregrinorum* Heckel, aff. *peregrinorum* Battalgil, *V. umbla* sensu Battalgil (non ? Heckel) and *V. capoeta* sensu Hankó in *V. damascinus* should be accepted. He considered the inclusion of *V. capoeta* Güldenstädt and *V. pestai* in *V. damascinus* only acceptable upon examination of enough comparative material and included *S. saadi* in the synonymy of *V. damascinus*. KHALAF (1961) considered *V. umbla* from Iraqi waters a subspecies of *V. damascinus*. KÄHSBAUER (1963) gave very brief descriptions of *Capoeta amir*, *C. chebisiensis*, *C. niger*, *C. rostratus* and *C.*

saadii and regarded them as distinct species, placing them in the genus *Capoeta*. However, he kept *V. umbla* in the genus *Varicorhinus* and re-described it twice: once as *V. damascinus umbla* (from running water in Asia Minor and Iran) and once as *V. umbla* (from the Tigris River and its tributaries) without noting that they are the same taxon.

KARAMAN (1969) restricted *Varicorhinus* to African species, while placing Asian species in *Capoeta*. As mentioned above, he regarded *C. angorae*, *C. damascina, C. kosswigi* and *C. umbla* as subspecies of *C. capoeta*. He considered *C. c. angorae* to be closely related to *C. c. damascinus* and *C. c. bergamae*, and *C. c. kosswigi* to be close to *C. c. damascinus* and *C. c. umbla*. He stated that the Jordan River population of *C. c. damascinus* differs from the other remaining populations of the same subspecies by having a more rounded snout, weakly developed scales and a stronger ossified dorsal ray and thus should be regarded as a different subspecies. Although GOREN (1974) agreed placing *C. damascina* in the genus *Capoeta*, he did not accept its inclusion as a subspecies of *C. capoeta*. He considered it a valid species and based his judgement on the comparisons of the skulls of C. *capoeta* and *C. damascina*. In his doctoral thesis, SAADATI (1977) placed Iranian species in *Varicorhinus* but was aware of the previous taxonomic discussions. He considered *V. fratercula*, *V. damascinus* and *V. umbla* as distinct species. According to him, *V. fratercula* is possibly a subspecies of *V. capoeta* based on the close resemblance in scale counts, average number of gill rakers and the position of the dorsal fin. He also noted that *V. niger* from the Rud-e Kor in Fars is possibly a synonym of *V. fratercula*. He stated that *V. damascinus* may consist of more than one species and that *V. amir*, *V. buhsei* and *V. saadi* are probably nothing but synonyms or subspecies of *V. damascinus*.

In their publication on the cyprinids of Iran, BIANCO & BANARESCU (1982) recognized *C. saadi* as a valid species and noted its close relationship with *C. buhsei*. They also described a new subspecies, *C. capoeta intermedia* (objectively invalid because it is preoccupied by *Capoeta intermedia* Temminck & Schlegel, 1846), from Rud-e Mand, which they considered intermediate between *C. c. umbla* and *C. c. macrolepis* on the basis of the position and size of the mouth, lateral-line scale counts, gill raker number and coloration. KRUPP (1985) followed GOREN's (1974) view and refuted KARAMAN's classification. He considered the synonymy of *C. damascina* and *C. capoeta* extremely doubtful after examining topotypic material of *C. capoeta*. According to him, *C. capoeta* differs in many characters such as lateral-line scale and gill raker counts. He also stated that the shape of the head and the possession of a single pair of barbels in *Chondrostoma syriacum*, leave no doubt that it belongs to the genus *Capoeta* and considered it a synonym of *C. damascina*. He discussed the possibility that the holotype of *C. syriacum* is a specimen of *C. damascina* from the Jordan River, which may have been introduced into Abraham River by the monks of St. Katherina Monastery. He examined *C. damascina* populations from isolated drainage basins in the Levant and stated that differences in body shape and squamation patterns occurred among them, suggesting that naming subspecies should only be considered in the context of a revision of the entire area of distribution of the species. KRUPP & SCHNEIDER (1989) disagreed with KARAMAN (1969) regarding the Jordan River populations of *C. damascina* and noted, upon comparison with topotypic material, that they were identical to those from the Barada. They also noted that considerable problems existed in the northern and eastern *C. damascina* populations concluding that it is not a well-defined species.

COAD (1991, 1995) considered *S. amir*, *S. niger*, *S. saadii*, *C. c. intermedia* and questionably *S. umbla* as synonyms of *C. damascina* and stated, in 1996, that *C. damascina* may well prove to be a complex of species. COAD (1995) and ABDOLI (2000) regarded *C. buhsei* as a valid species. However, ABDOLI (2000) disagreed with COAD (1991, 1995) regarding the status of several species and subspecies and considered *C. c. intermedia* and *C. saadi* as valid taxa. TURAN et al. (2006b) stated that *C. c. angorae* satisfied the criteria of species of the Evolutionary Species Concept and thus regarded it as a distinct species. Based on genetic data using the 16S rDNA marker, TURAN (2008) suggested the conspecificity of *C. c. umbla* and *C. c. kosswigi* with *C. trutta* (see section 1.1) despite the morphological differences among them which, according to him, could be environmentally induced. However, he noted that the application of nuclear genes can help in clarifying this issue. SCHÖTER et al. (2009) stated that *C. angorae* and *C. caelestis* belong to a group of superficially similar, almost plain brown, slightly compressed species with narrow lips (*C. bergamae*, *C. damascina*, *C. kosswigi* and *C. umbla*).

Based on the state of knowledge prior to this study and owing to the great variation in body shape, meristic characters and color patterns among the different populations, the various proposed synonymies and the wide distributional range in many isolated river systems in the Middle East, *C. damascina* is certainly not a well-defined species. It should be regarded as a complex of closely related species, which according to the literature cited here above may include the following: *C. angorae*, *C. buhsei*, *C. caelestis*, *C. damascina*, *C. kosswigi*, *C. saadii* and *C. umbla*.

1.2.2. Etymology and Common Names

The generic name of *Capoeta* is derived from the specific name of *Cyprinus capoeta*. GÜLDENSTÄDT (1773) stated that the common name of the species described by him, *Cyprinus capoeta*, was “Capoëta” in Georgian. PALLAS (1814) and VALENCIENNES (1842) mentioned that Georgians and Armenians called the females of *C. capoeta*, which were packed with eggs, “Kapwaeti”. Based on this fact and as stated by COAD & KRUPP (1994), the natural and grammatical gender of *Capoeta*, which is derived from “Kapwaeta”, is feminine. The specific Latin name of *C. damascina* is derived from Damascus, the location from where the type specimens were collected.

Similarly, the specific Latin name of *C. caelestis* is derived from the place where the species was collected, Göksu Nehri (gök meaning heavenly and su meaning water in Turkish) (SCHÖTER et al. 2009).

Several common names exist for the *C. damascina* species complex. According to BALIK (1995), "Siraz balığı" is the common Turkish name of *C. c. angorae* (valid as *C. angorae*). ABDOLI (2000) and COAD (2002, 2008) stated that "Shamshiri" (meaning sword-like) and "Mahi sibili" (meaning moustached fish at Karaj) are the common names of *C. buhsei*.

As far as *C. damascina* is concerned, many common names exist for this species and its synonyms. HECKEL (1843) stated that *S. peregrinorum* and *S. capoeta* (synonyms of *C. damascina*) from Aleppo were called "Kellur" and "Kersin handscherli" respectively. LORTET (1883) mentioned that fishermen in Tiberias called all *Capoeta* species "Hefafi". He stated, giving M. Blanche as a reference, that the Arabic name of *C. fratercula* (synonym of *C. damascina*) was "Samak nahri" (= "river fish"). MASTERMAN (1908) mentioned that *C. damascina* is locally called "Hafafi" and BEN-TUVIA (1978) mentioned that the Arabic name is "Hafafi" and the Hebrew name is "Hafaf". MASTERMAN (1908) also stated that *C. syriaca* and *C. socialis* (synonyms of *C. damascina*) were known, by the fishermen in Tiberias, as "Hafafi banduk" (= bastard hafafi) since they believed that they were the result of interbreeding of the true "Hafafi" with some other species. GRUVEL (1931) noted that, *V. damascinus*, in the Orontes and Lake Antioch (Amik Gölü), was well known under the name "Asphar". According to ABDOLI (2000) and COAD (2002, 2008), there are many common names of *C. damascina* in Iran including the following: "Zardeh" (referring to the yellow-tinged flank in this fish), "Siah mahi" (meaning black fish), "Tu'ini", "Gel cheragh" (meaning mud-eater or mud grazer) and "Tu'ini gelkhorak" (meaning mud-eater or mud-grazer). The Arabic names, "Kellur" or "Kollur" (Kollur haijari the "pilgrim or migrating kollur", Kellur jileki the "strawberry-colored kollur", Kollur ahmar the "red kollur" and Kollur ashkar the "brown kollur") and "Tela shami", were also listed by COAD (2002) referring to *C. damascina* in Aleppo. In 2010, he also listed the following common names: "Toueni, Toyueni, Twena, Bertin, Bartin, Tin, Zardah masih and Tela shami", referring to *C. damascina* from the Iraqi waters. Regarding *C. caelestis*, *C. kosswigi* and *C. saadii*, no common names are mentioned in the literature.

1.2.3. Biology

Studies on the biology of the *C. damascina* species complex are very few and most of them are related to *C. damascina*.

Like other species in the genus *Capoeta*, members of the *C. damascina* species complex are herbivorous, feeding mainly on algae and periphyton, which they scrape from the substrate using the horny sheath on their lower lip (TÜRKMEN et al. 2002, Turan et al. 2006b). For example, *C. damascina* is a bottom fish, generally feeding on benthic diatoms (e.g. *Navicula* and *Synedra*) and filamentous algae (e.g. *Rhizoclonium*, *Ulothrix* and *Oscillatoria*) but it can readily ingest detritus and small invertebrates when available (e.g. Chironomidae, Hydroptilidae, Formicidae and Tabanidae) (Ben-Tuvia 1978, Khalaf 1985, Krupp & Schneider 1989, Fishelson et al. 1996, Abdoli 2000). Similar to *C. damascina* and as stated by Abdoli (2000), the diet of *C. buhsei* and *C. saadii* also consists of algae and insects.

Like salmons, *C. damascina* is a strong counter-current swimmer, capable of jumping very strongly and rapidly (Fishelson et al. 1996). It usually grows to 250-350 mm in size and may attain up to 500 mm (Ben-Tuvia 1978). It is of relatively low economic importance, being occasionally offered in fish markets (Krupp & Schneider 2008). Khalaf (1987) studied the reproductive cycle of this species in three coastal rivers in Lebanon and found that spawning begins in May and ends in June. According to him, males of *C. damascina* mature at 180 mm and females at 200 mm. However, according to Ben-Tuvia (1978), Krupp & Schneider (1989) and Stoumboudi et al. (1993), *C. damascina* from the southern Levant spawns between January and March depositing its eggs among gravel and pebbles in small streams. Stoumboudi et al. (1993) also found that males in Lake Tiberias may mature between 160 and 250 mm total length and females between 200 and 250 mm.

In the upper Jordan River, Fishelson et al. (1996) reported the migration of this species upstream to its spawning sites in winter (December to February), this process being initiated by rainfall and flooding following the first rains and a drop in temperature to 16-18 °C. During this migration, they swim a distance of up to 25 km and an altitude of 400-900 m, where they, contrary to salmon, undergo a period of fattening at their spawning sites. The females, followed by a few males, excavate shallow nests in which their adhesive eggs are deposited. Thus, dozens of nests are found close to each other covered by sand and gravel stirred up by the excavation activity. After spawning, the adults return downstream to the river mouth. In Iran, *C. damascina* and similarly *C. buhsei* and *C. saadii*, spawn during the spring season (Abdoli 2000). Such differences in the spawning periods of the different populations might be attributed to variations in temperature regimes at different latitudes and altitudes.

Türkmen et al. (2002) investigated the reproduction strategy, age and growth of *C. capoeta umbla* (valid as *C. umbla*) in the Karasu (Euphrates River system), Turkey. They found that the spawning period was between May and July and was different from that reported for the same species by Özdemir (1982) (March-June) and Şen (1988) (April-July) due to different environmental conditions. According to them, males of *C. c. umbla* reach their first maturity at smaller fork lengths (169 mm) than females (209 mm).

The karyotypes of fish identified as *C. damascina* and *C. c. umbla* (valid as *C. umbla*) were studied by Gorshkova et al. (2002) and Kiliç Demirok & Ünlü (2001) from Wadi Karak, 15 km east of the Dead Sea (Jordan) and the Tigris River (Turkey) respectively. These authors found that *C. damascina* and *C. umbla* were hexaploid taxa (2n = 148-150 in *C. damascina* and 2n = 150 in *C. umbla*).

1.2.4. Habitat and Distribution

Nothing is reported in the literature about the habitat of the *C. damascina* species complex, except for *C. damascina*. *Capoeta damascina* is found in a wide range of habitats such as lakes, springs, qanats, and slow to fast-running rivers and is adapted to extreme conditions (GOREN 1974, KRUPP & SCHNEIDER 1989, COAD 1996).

The overall distributional range of the *C. damascina* species complex covers the entire Levant, Mesopotamia, Iran and the southern and eastern parts of Turkey (Table 1). It is found in many rivers of the eastern Mediterranean coast such as Göksu, Seyhan, Ceyhan, and Syrian, Lebanese, Palestenian, and Israeli coastal rivers (LORTET 1883; KRUPP 1985, 1987; GOREN & ORTAL 1999; TURAN et al. 2006b; SCHÖTER et al. 2009). It is also reported from the Orontes River drainage, Nahr Quwayq, Litani River drainage, Damascus basin and the Jordan River drainage basin (including rivers draining into the Dead Sea) (KRUPP 1985). It occurs in the Tigris-Euphrates river system (KARAMAN 1969, BANISTER 1980, COAD 1991, KRUPP & SCHNEIDER 2008) and in the Van Gölü basin (KARAMAN 1969, TURAN et al. 2006b). In Iran, it is reported from 11 out of 18 drainage basins: Tigris (part of the Tigris-Euphrates river system), Daryacheh-ye (Lake) Namak, Esfahan, Rud-e Kor, Daryacheh-ye Maharlu, Gulf, Kerman, Kavir, Lut, Hormuz and Hamun-e Jaz Murian basins (ABDOLI 2000; COAD 1995, 2008).

1.3. Paleogeography and Hydrography of the Study Area

“Freshwater fishes are uniquely significant in zoogeography”

(DARLINGTON 1975)

The Middle East, which lies at the juncture of Eurasia and Africa and between the Mediterranean Sea and the Indian Ocean, went through a complex geologic evolution during the last 15-20 million years.

Up to the Lower Miocene, the Tethys Ocean, which during the Mesozoic era existed between the ancient continents of Gondwana and Laurasia, separated Africa and Arabia from Europe and Asia thus acting as a faunal and floral barrier. Towards the Middle Miocene (ca. 15 Ma), the collision of the Arabian Plate with Eurasia resulted in the closure of the Tethys and the consequent establishment of the Middle Eastern land bridge (WOLFART 1987, STANLEY 2001). It also resulted in the orogenesis of the Zagros Mountains during the late Tertiary (KRINSLEY 1970, TAKIN

1972). Following the formation of the Middle Eastern land bridge, faunal elements of different origins (Palaearctic, Afrotropical and Oriental) colonized this region and many new species evolved in the transition area (KRUPP et al. 2009).

The tectonic events, which started in the Middle East since the Upper Miocene and which had a considerable influence on the fluviatile catchments basins in this region, were mainly associated with the Levantine graben and, to a lesser extent, with the Zagros fold movements and fault activities in central Iran (TAKIN 1972, HOROWITZ 1979, JACKSON & MCKENZIE 1984, BERBERIAN & YEATS 1999). Although the development of the Levantine graben and its uplifted margins were initiated in the Miocene, most of its structural development occurred in the Plio-Pleistocene period (HOROWITZ 1979, 2001). The Levantine graben is an approximately 800 km stretch of land, extending from the Taurus Mountains to the north to the Gulf of Aqaba to the south and wedged in between the eastern shores of the Mediterranean and the Syrian Desert (HOROWITZ 1979, KRUPP 1987, MART et al. 2005). This graben has witnessed a series of subsidences and uplifts such as: the Yizre'el Valley depression in Palestine and Israel, which was formed during the Upper Miocene and which drained the confluence of the Litani River and Jordan River into the Mediterranean during the Pliocene, the uplifting of the eastern edge of the Levantine graben which interrupted some of the freshwater connections with the Mesopotamian basin during the Upper Pliocene, the uplifting of the Metulla-Marj Uyun block, which cut the connection between the Litani River and the Jordan River drainage basin during the Pleistocene and the downwarping of the al-Ghab and Jordan Valleys during the Pleistocene in the northern and southern Levant, which affected the courses of the Orontes and Jordan rivers (DE VAUMAS 1957, HOROWITZ 1979).

Parallel to these events, the Middle East has witnessed climatic changes especially during the Pleistocene, which along with the tectonic processes played a major role in shaping the geomorphological features of this region and its hydrography. This in turn had major effects on today's composition and distribution of freshwater fishes. Therefore, the hydrography and the geological development of the drainages and basins (Figs 1, 2), where the *C. damascina* species complex is found, are summarized here below.

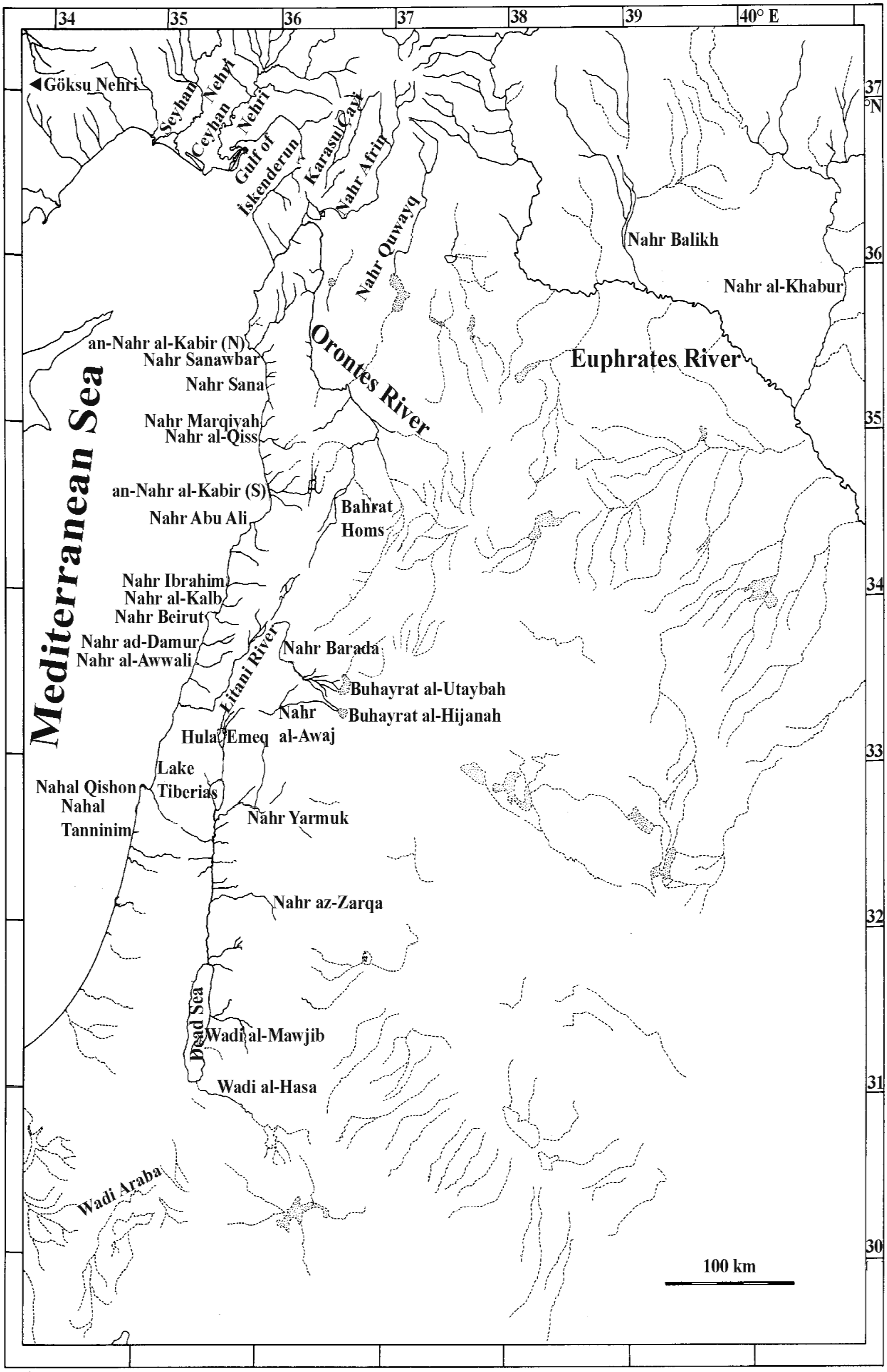

Fig. 1. Drainage basins in the Levant.

1.3.1. The Orontes River Drainage

The Orontes River (Fig. 1, Table A1 [figures and tables starting with "A" refer to those in the "Annex"]) is the longest river in the Levant with a length of about 600 km (DE VAUMAS 1957). It rises from Ayn az-Zarqa in al-Labwah village in Lebanon very close to the source of the southward flowing Litani River (GRUVEL 1931). Running north parallel to the coast, it falls about 600 m through a very steep rocky gorge and then expands in the plain of Bahrat Homs (Lake Homs or Qattinah). This is a semi-artificial lake, having been dammed in the 2nd millennium B.C. (BROSSE 1923, GRUVEL 1931); however, a natural lake existed in this plain during the Pleistocene (DE VAUMAS 1957). After leaving Bahrat Homs, the river continues its way until it reaches Hamah. At the rocky barrier of Jisr al-Hadid, the river is diverted to the west and enters the vast swampy plain of al-Ghab. Covering an area of about 300 km^2, the swampy plain of al-Ghab was transformed into land and was cultivated at the beginning of the 1950s, where a network of irrigational channels and storage dams were established. Exiting the al-Ghab, the Orontes crosses the basaltic barrier near Karkour and enters, after capturing the Küçük Asi, into the plain of the Amik Gölü. Two large tributaries from the north rising from the southern slopes of the Nur Dağları (Amanus Mountains), the Afrin (149 km in length) and Karasu Çayi (90 km in length), reach the Orontes through the Amik Gölü (which has been drained). Turning sharply to the west, the lower Orontes cuts through a basaltic sill at Antakya and then plunges southwest into a gorge before descending to the Mediterranean (GRUVEL 1931, KRUPP 1985, POR 1989).

During the Upper Miocene and Pliocene, the upstream segment of the Orontes flowed via the Proto-Orontes towards the Euphrates, while Nahr Afrin drained into its lower segment. The central course of the Orontes was connected to Nahr Quwayq, which also drained into the Euphrates. During the Lower Pleistocene, the al-Ghab Valley, which was formed during the Miocene, subsided resulting in the uplifting of Gabal az-Zawiyah (az-Zawiyah Mountain). The uplifting of Gabal az-Zawiyah, which extended towards the Palmyra fold belt, cut the connections between the Proto-Orontes and the Euphrates (DE VAUMAS 1957, KINZELBACH 1980, POR 1989). However, the connection between Nahr Quwayq and Euphrates was not interrupted (KRUPP 1987). At that time, the present Orontes River consisted of three unconnected courses, separated from each other by mountain plateaus. As postulated by WEULERSSE (1940) despite the lack of geological evidence, the upper course represented by the segment from the present headwaters to the basalt dam near Homs used to discharge (at least temporarily) into the Mediterranean via an-Nahr al-Kabir (S). The central course, at that time represented by the isolated al-Ghab basin, was connected to a watercourse in the Nahr Marqiyah area in the central part of the coastal rivers of Syria (DE VAUMAS 1957). As suggested by KINZELBACH (1980, 1987) based on biological evidence, a connection also existed between this basin and an-Nahr al-Kabir (N) via Nahr al-Abyad whose upper reaches were at that time a source of an-Nahr al-Kabir (N). The lower course, represented by the Amik Gölü and determined by Nahr Afrin and Karasu, opened to the Mediterranean via the Kuçuk Asi (DE VAUMAS 1957). During the Pleistocene periods of low sea levels (1.82 Ma-11 ka BP), the lower course of the Orontes was connected to Ceyhan Nehri whose confluence reached another coastal river, an-Nahr al-Kabir (N) (KINZELBACH 1987, KRUPP 1987). The basaltic extrusions which erupted during the Quaternary separated the Orontes from the coastal rivers (KINZELBACH 1980, POR 1989).

The confluence of the three formerly separated segments of the Orontes is, without doubt, very recent (around 6,000 years ago) caused by the effect of retrogressive erosions (GRUVEL 1931, WEULERSSE 1940, DE VAUMAS 1957, KINZELBACH 1980).

1.3.2. The Litani River Drainage

Exceeding 140 km in length, the Litani River (Fig. 1, Table A1) is the longest river in Lebanon with an average annual flow of about 920 million cubic meters (AMERY 1993).

Rising west of Ba'labakk, the Litani flows in a south-westward direction through the al-Biqa'a Valley between the Lebanon and Anti-Lebanon Mountains and empties into the Mediterranean Sea north of Tyre in southern Lebanon. While passing through this fertile valley, its upper reaches receive water from the eastern slopes of the Lebanon Mountains. At the southern region of the al-Biqa'a Valley, the course of the Litani is interrupted by the artificial Buhayrat al-Qirawn (Lake Qirawn) which was created by the Litani River Dam. After leaving this lake, the river runs southward to Beaufort Castle near Marj Uyun and then bends sharply west and empties into the Mediterranean Sea. The river's lower course, known as al-Qasimiyah, irrigates the al-Qasimiyah/Ras al-Ayn region, which is one of Lebanon's most extensive farming regions. The Litani provides, in addition to irrigation, a major source for water supply and hydroelectricity within southern Lebanon (AMERY 1993).

During the Pliocene, the Litani River flowed southward into, at that time, the south-to-north flowing Jordan system and the confluence of these two rivers drained into the Mediterranean via Nahal Qishon using the Yizre'el Valley as a pathway (HOROWITZ 1979, 2001). Up to the Lower Pleistocene, a connection existed between the Orontes and Jordan-Litani system caused by the movement of the water-shed between Litani and Orontes (DE VAUMAS 1957, WOLFART 1967), thus allowing faunal exchange between them (KRUPP 1987). The uplifting of the Metulla-Marj Uyun block during the Pleistocene (ca. 2 Ma BP) separated the Litani from the Jordan River and caused the former to change its course and turn west into the Mediterranean (HOROWITZ 1979).

1.3.3. The Jordan-Dead Sea Drainage Basin

The Jordan-Dead Sea drainage basin (Fig. 1, Table A1) is located within the Jordan Valley, which occupies the southern part of the Levantine graben. The Jordan River, which is 251 km in length, rises in Mount Hermon where it is formed by the confluence of three main rivers: Nahr Hasbani which flows from Lebanon, Nahr Baniyas arising from a small spring at Baniyas and Nahr al-Liddani which is the largest tributary of the Jordan River (within the Israeli territory). Running in N-S direction, it flows into Hula Emeq (Lake Hula) and its surrounding swamps, which were drained in the 1950s. After this draining, a nature reserve, with a large shallow pond and swamps, was set up. Exiting Hula Emeq, the Jordan pushes through the basalt barrier until it reaches Lake Tiberias after 17 km. This is the largest natural lake in the Middle East and the lowest freshwater lake on earth: 209 m below sea level (b.s.l) with a surface of about 170 km^2 and a depth of 43 m. After leaving the lake, the Jordan River meanders through the plain of al-Ghawr before entering the Dead Sea. In the al-Ghawr section, two major tributaries of the Jordan River: Nahr Yarmuk and Nahr az- Zarqa, enter from the east. Other springs and small rivers enter from the west, some with saline water and high temperature (> 20 ^{o}C). The Dead Sea is the deepest hypersaline lake in the world (almost 400 m b.s.l), which is about 75 km in length and 10-15 km in width. It is divided into two basins: a deep northern one (about 380 m deep) and a shallow southern one (about 2-3 m deep) separated by Lisan Peninsula. Small springs and rivers drain into this terminal lake, but these days no surface watercourses ever reach it, except for Wadi al-Hasa after heavy rain (KRUPP 1985, POR 1989, GOREN & ORTAL 1999, HOROWITZ 2001).

The present Jordan-Dead Sea drainage basin is the result of tectonic activities, which have started during the Miocene/Pliocene transition. During this transition, the Yizre’el Valley was formed and the lowering of the Jordan Valley began. During the Pliocene and as mentioned earlier, the Jordan River flowed from south to north and drained along with the Litani River, via Nahal Qishon, towards the Mediterranean. During the Lower Pleistocene, the lowering of the Jordan-Wadi Araba graben continued and two endorheic basins were formed, one in the Hula and the other in the Dead Sea region. At that time, the Jordan was no longer connected to the Litani but rather flowed in a south-eastward direction into the Jordan Valley. Between 1.5 and 1.25 Ma BP, the Hula basin became part of the Dead Sea drainage system by breaching the Korazim block, which had previously separated them. During the Pleistocene glacials, the Jordan-Dead Sea graben was occupied by a series of successive lakes. A large shallow freshwater lake (Lake Samra), covering an area from 50 km south of the Dead Sea to Lake Tiberias, existed during the Riss Glacial (425 ka-130 ka BP). At the same time, the Hula basin was entirely flooded by a lake and the two lakes (Lake Samra and Hula Emeq) were connected by a river. Between ca. 70,000 and ca. 18,000 years ago, Lake Samra turned into the saline Lake Lisan, which shrank and retreated to form the present Dead Sea (HOROWITZ 1979, 2001). This lake used to be less saline than the present Dead Sea as indicated by fossil remnants of diatoms, fish, etc. (BENDER 1975).

The last tectonic activity, which took place about 18,000 years ago, lowered the valley by 300-400 m to the present -794 m b.s.l at its bottom. This very marked subsidence led to the deepening of Hula Emeq and the northern Dead Sea and gave rise to Lake Tiberias (14-18 ka BP) (POR 1989; HOROWITZ 1979, 2001). As a consequence, the present drainage pattern of the Jordan-Dead Sea basin was formed.

1.3.4. Rivers of the Eastern Mediterranean Coast

The rivers of the eastern Mediterranean coast include those of the southeastern part of Turkey and the coastal rivers of Syria, Lebanon, Palestine and Israel (Fig. 1). Most of them are short rivers containing water throughout the year, peaking at maximum levels during the spring and early summer months and reaching minimum water levels during the late summer and early autumn.

Located in the southeastern part of Turkey, Göksu Nehri (Fig. 1, Table A1) is a river of about 260 km in length, which drains the water of central Taurus to the Mediterranean Sea, 16 km southeast of Silifke. North to the mouth of the Orontes, many rivers flow into the Mediterranean in the Gulf of İskenderun area; the most important ones being Ceyhan Nehri and Seyhan Nehri (Fig. 1, Table A1). The Ceyhan Nehri is a river in southern Turkey of about 509 km in length. It rises in the Nurhak Mountains northeast of Elbistan and is fed by the Hurman Nehri and numerous other small streams, as it flows southeast past Elbistan. It is then joined by the Aksu on the outskirts of Kahramanmaraş and changes its course toward the southwest before reaching the Mediterranean Sea. Seyhan Nehri is the longest river (ca. 560 km) in Turkey flowing into the Mediterranean via a broad delta. Its headwaters are in Tahtali Dağ (Tahtali Mountains) and its main tributaries are Yenice İrmağı and Göksu Nehri, which unite at Aladağ near Adana.

Rivers draining the western flanks of the al-Qusayr and al-Masyaf Plateaus as well as an-Nusayriyah Mountains in Syria arise south to the mouth of the Orontes. These include an-Nahr al-Kabir (N), Nahr Sanawbar, Nahr Sana, Nahr Marqiyah and Nahr al-Qiss (Fig. 1, Table A1). The most important and the largest is an-Nahr al-Kabir (N) with a length of about 80 km and a catchment area of 1,040 km^2 (KRUPP 1985).

The an-Nahr al-Kabir (S) (Fig. 1, Table A1) lies in the border area between Syria and Lebanon and is fed by a number of karstic springs. Its watershed area is ca. 295 km^2 within Lebanon and ca. 655 km^2 within Syria (SHABAN et al. 2005). South to the mouth of this river, numerous Lebanese coastal rivers such as Nahr Abu Ali, Nahr Ibrahim, Nahr al-Kalb, Nahr Beirut, Nahr ad-Damur and Nahr al-Awwali (Fig. 1,

Table A1) descend from the western flank of Mount Lebanon and have a maximum length of about 30-40 km (KRUPP 1985, POR 1989).

About 10 small rivers and their tributaries occupy Palestine's and Israel's coastal area, originating from small springs merging at the foot of the mountains. One of the most important and largest rivers in this coastal area is Nahal Qishon (Fig. 1, Table A1), which flows through the Yizre'el Valley. Other small coastal rivers include Nahal Keziv and Nahal Tanninim (Fig. 1, Table A1).

Studies on the paleogegraphic history and development of the rivers of the eastern Mediterranean coast are very scarce. It is the merit of KINZELBACH (1987) that the history of connections among these rivers was discussed, based on biological evidence.

During the Pleistocene glacials, a great amount of water was confined in the glacial areas of Eurasia and North America and above all at the pole caps. This resulted in a drop of sea level of the world's oceans of more than 100 m (BUTZER 1961, KASSLER 1973, WOLFART 1987). As a consequence and as postulated by KINZELBACH (1987) based on his studies of freshwater invertebrates in the northern Levant, various direct connections among rivers along the Mediterranean coast existed during these periods of low sea level.

1.3.5. The Damascus Basin

The Damascus basin is a closed (endorheic) basin, incised by valleys furnished with water divides, which feed the rivers of this drainage, mainly Nahr Barada (ca. 80 km in length) and Nahr al-Awaj (ca. 70 km in length) (Fig. 1, Table A1).

Nahr Barada rises on the eastern flank of the Anti-Lebanon Mountains and its main sources are the springs of Ain al-Fijah and Barada. Running in a south-eastward direction, it arrives at Damascus where it divides into several branches that irrigate the oasis of al-Ghutah and then empties into Buhayrat al-Utaybah (Lake Utaybah). Nahr al-Awaj rises from Mount Hermon and flows eastward before terminating in Buhayrat al-Hijanah (Lake Hijanah) (KRUPP 1985). According to WOLFART (1967), Nahr Barada and Nahr al-Awaj reached the aforementioned lakes only during strong water flow, which reflects the status of these lakes that are at the moment dried out completely.

The first steps in the present-day structural development of the Damascus basin were initiated during the Upper Pliocene as a result of the tectonic activities caused by the subsidence of the Damascene plain and the upheaval of the southeastern Syrian highlands (WOLFART 1967). Until then, this basin used to drain into the Mesopotamian basin through the oasis of Palmyra. At the same time, the Damascus and Palmyra basins served as an intermediate link between Euphrates and the Jordan-Litani system (WOLFART 1967, HOROWITZ 2001). Although nothing is mentioned in the literature regarding the timing or precise position of these connections, the composition of the freshwater fishes and invertebrate fauna shared by the Jordan-Dead Sea drainage basin, Euphrates and Damascus basin provides evidence (KINZELBACH 1987, KRUPP 1987). The uplifting of the southern Syrian highlands during the Upper Pliocene ended the connection between the Damascus basin and the Euphrates, while maintaining that between the Damascus basin and the Jordan-Dead Sea drainage basin (KINZELBACH 1987, HOROWITZ 2001).

The present endorheic basin of Damascus with its former lakes came into existence only after the basaltic eruptions of the Hauran and Gabal ad-Duruz during the Upper Pleistocene, which cut its connection with the Jordan-Dead Sea drainage basin (Mitchell 1959, KINZELBACH 1987, HOROWITZ 2001, KRIENITZ et al. 2007).

1.3.6. The Tigris-Euphrates River System

Lying between the major drainages of the Nile in Africa to the west, the Indus in southern Asia to the east and the Caspian and Black Sea drainages to the north, the Tigris-Euphrates river system (Figs 1, 2) is the major drainage basin of the Middle East. Tigris and Euphrates are the two main rivers of this system that join together to form the Shatt-al-Arab, which drains into the Persian Gulf (COAD 1991).

Between the Murat Nehri and the Euphrates River, the Tigris River (Table A1) originates from Hazar Gölü in the Taurus Mountains, which is located 25 km south of Elaziğ in Turkey (COAD 1991). Exceeding 1900 km in length, this river flows for about 400 km through the Turkish territory before bordering Syria and Iraq. It is fed by a number of left bank tributaries from the Zagros Mountains, remarkably the Great Zab, the Little Zab, Nahr Diyalah and Rudkhaneh-ye Karkheh thus making it a larger and swifter river than the Euphrates (COAD 1991).

The Euphrates River (Table A1) emerges from the confluence of Murat Nehri and Karasu near the city of Keban in Turkey. The sources of these two headstreams lie between the endorheic Van Gölü and the Black Sea. This river flows through Turkey, Syria and Iraq and its length exceeds 2700 km. It flows through steep canyons and gorges in its upper reaches until it enters Syria near the town of Jerablus. In Syria, it receives water from two tributaries: Nahr al-Khabur and Nahr Balikh. It continues its flow in a south-eastern direction until it enters Iraq. Northwest of Basra in southern Iraq, it merges with the Tigris River to form the Shatt-al-Arab with its extensive marshes (BANISTER 1980, COAD 1991). The Shatt-al-Arab, constituting part of the border between Iraq and Iran, runs about 200 km in a south-eastward direction before emptying into the Persian Gulf (BANISTER 1980). It receives water from its Iranian tributary, Rud-e Karun. Rud-e Karun has a length of about 820 km and is fed by many tributaries, Rud-e Dez being the most important among them (BANISTER 1980, COAD 2002).

Following the regression of the Tethys towards the Middle Miocene, a land and a freshwater bridge between Eurasia and Africa was created, interrupted by a short-termed Miocene transgression, which connected the Mediterranean Sea for a last time with the Persian Gulf. The Tigris-Euphrates river system was formed during the Pliocene when mesohaline conditions following the transgression disappeared and primary freshwater fishes were able to colonize this basin. Although its origin lies in the Pliocene, the Tigris-Euphrates river system did not stabilize except during the Lower Pleistocene (KRUPP 1983, WOLFART 1987). As mentioned above, the Tigris-Euphrates river system was connected with river systems in the Levant. In addition to that, connections between the western affluents of the Euphrates River and upper courses of the Ceyhan Nehri existed during the Pliocene (and probably remained continuous during the Pleistocene) and such pathways were used, as suggested by KINZELBACH (1987), by some freshwater mussels and snails (*Melanopsis praemorsa olivieri* and *Unio crassus brugerianus*).

Although Nahr Quwayq (Fig. 1, Table A1) lies geographically within the Levant, it belongs hydrographically to the Pleistocene Tigris-Euphrates river system (KRUPP 1987). During the Pliocene, Nahr Quwayq was periodically connected to the Euphrates and the Proto-Orontes. During the Pleistocene, the connection between the Proto-Orontes and Euphrates via the Quwayq was interrupted by the uplifting of the Gabal az-Zawiyah. For some time, Nahr Quwayq continued to drain towards the Euphrates (DE VAUMAS 1957). According to its fish fauna, the contact between the Quwayq and the Euphrates was lost very recently, turning the former into an endorheic basin (KRUPP 1987). BANISTER (1980) stated that this separation might be attributed to a greater extent to aridity than to the presence of a physiographical barrier, because their watersheds are extremely low. Nahr Quwayq rises from the highlands of southern Turkey and flows southward through the northern Syrian city of Aleppo before it ends in an endorheic basin south of it. Today, Nahr Quwayq is almost dry for most of the year, except in very few areas near its source.

The isolated Van Gölü basin (Fig. 2, Table A1) was formerly part of the Tigris-Euphrates system (BANISTER 1980). At some time during the Pleistocene (ca. 2 Ma-11 ka BP), a lava flow from the Nemrut volcano blocked the westward drainage of this basin from the Murat Nehri thus creating the endorheic Van Gölü basin (KURU 1971, AYDAR et al. 2003). Van Gölü is the largest lake in Turkey located in the region of eastern Anatolia close to the Iranian border. This saline lake receives its water from numerous small streams that descend from the surrounding mountains. It has an area of about 3,755 km^2 and an average depth of about 171 m (DEGENS et al. 1984).

1.3.7. The Western and Southwestern Iranian Coastal Rivers

The western and southwestern Iranian coastal rivers include watercourses draining into the Persian Gulf and the Strait of Hormuz, which connect the Persian Gulf with the Gulf of Oman (Fig. 2).

The Iranian Gulf drainage (Fig. 2) is a basin located east of the Persian Gulf and comprises rivers which drain the southern Zagros Mountains. At its northern edge, lying very close to the Tigris tributaries, the Rud-e Zohreh (Fig. 2, Table A1) is formed by the convergence of the rivers of Tang-e Sheeb and Fahlian. Rud-e Zohreh runs across the Khuzestan plains and then flows off west into the Persian Gulf. Other major rivers include Rud-e Helleh and Rud-e Mand. Rud-e Helleh (Fig. 2, Table A1) is the confluence of the Dalaki (205 km) salt water and Shapur (231 km) freshwater rivers, which drain the lower Zagros ranges west of Shiraz. Rud-e Helleh forms a delta of complex brackish and freshwater marshes and lagoons thus making it the largest freshwater marsh system (Helleh marshland) on the Persian Gulf coast of Iran. Taking its source from the heights northwest of Shiraz, Rud-e Mand (Fig. 2, Table A1) is 480 km long and occupies a basin of about 60,000 km^2. It is fed by a number of tributaries and forms a delta with an area of 46,700 hectares (COAD 2002).

The Hormuz basin (Fig. 2) consists of a number of watercourses, which empty into the Strait of Hormuz. The major river in this basin is the Rud-e Kol (Fig. 2, Table A1) with its tributaries the Rud-e Shur and Rud-e Rasul.

During the Pleistocene glacials, when the global sea level dropped by at least 100 m, the Persian Gulf, which was only 110 m deep, dried up completely (BUTZER 1961, KASSLER 1973, KRUPP 1983, COAD 1987). In the dry Gulf basin, a river valley conveyed the waters of Mesopotamia to the Gulf of Oman and rivers of the Gulf and Hormuz basins were then tributaries to the Tigris-Euphrates river system (KRUPP 1983, COAD 1987). Only some 17,000 years ago, the sea began to rise again until it reached its present level some 5,000 years ago (KASSLER 1973, KRUPP et al. 2009). Based on the zoogeographic analysis of the Iranian freshwater fishes, COAD (1987) stated that some drainage basins (e.g. Gulf and Hormuz) might also have been connected to each other through headwater captures thus facilitating the transfer of faunal elements.

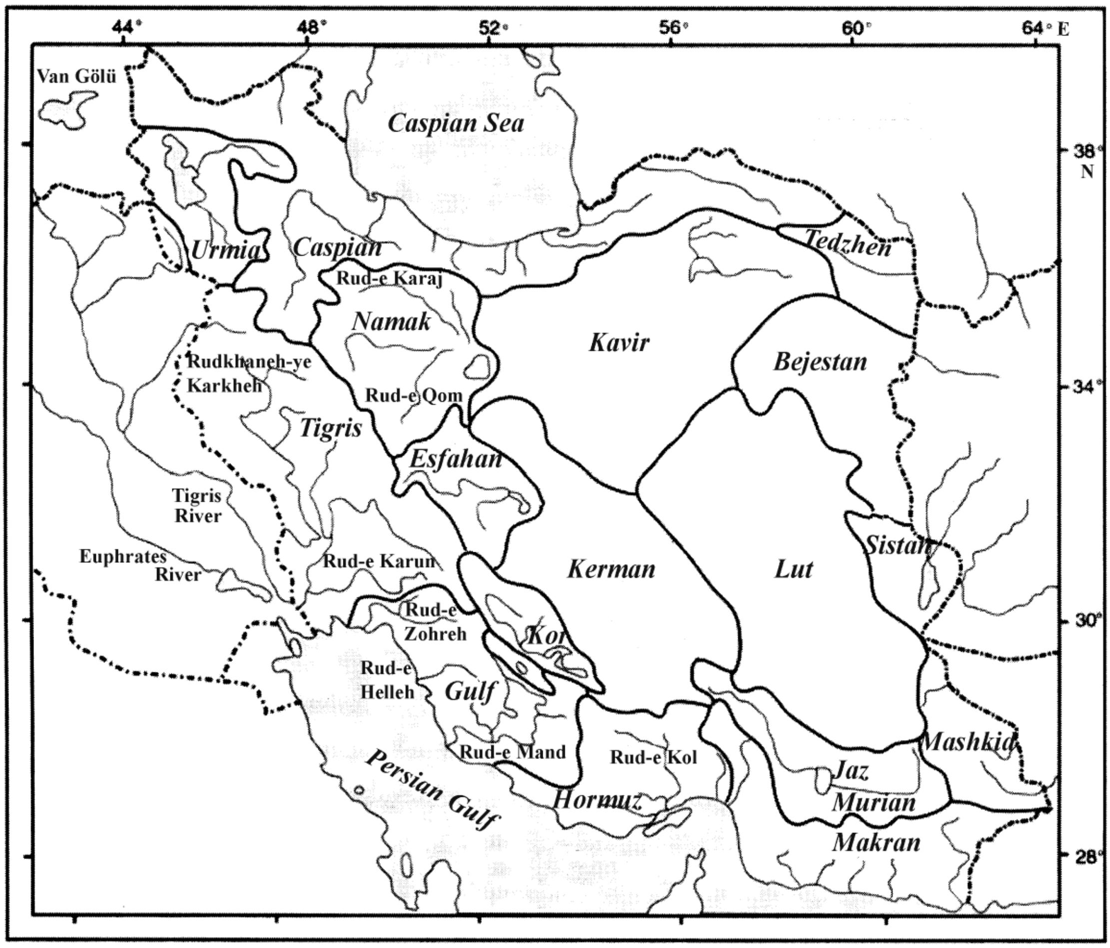

Fig. 2. Drainage basins in Iran (the Maharlu basin lies between the Rud-e Kor and the Gulf basins). Drawing from COAD (1996) with modifications.

1.3.8. The Endorheic Iranian Basins

These include the basins bordered by the Elburz Mountains to the north and by the Zagros Mountains to the west, consisting of Daryacheh-ye Namak, Kavir, Lut, Esfahan, Hamun-e Jaz Murian, Rud-e Kor, Daryacheh-ye Maharlu and Kerman basins (Fig. 2). The other internal basins (Sistan, Bejestan, Hamun-e Mashkid, Lake Urmia, Sistan and Tedzhen) were excluded since there are no records of species belonging to the *C. damascina* species complex (ABDOLI 2000, COAD 2008). The interior basins constitute about 70 % of the surface of Iran and consist of watercourses, which drain into a lake or are lost in the desert. Since they are surrounded by mountain plateaus, these basins lie within a vast rain shadow and become increasingly arid from west to east and from north to south.

The collision between the Arabian Plate and Eurasia during the Middle Miocene resulted in the compression of the Iranian Plateau, which is part of the Eurasian Plate wedged between the Arabian and Indian Plates and situated between the Caspian Sea and Kopet Dag Mountains to the north, the Persian Gulf and Strait of Hormuz to the south, the Zagros Mountains to the west and Indus River to the east. This compression resulted in the orogeny of several mountain chains (e.g. Zagros, Elburz, etc.) and to tectonic movements in central Iran, which also resulted in the upheaval of mountains of lower altitudes on its eastern side (KRINSLEY 1970, TAKIN 1972). These mountains played a major role in delineating the internal basins of Iran.

Very little information is available in the literature on the paleogeographic history of the endorheic Iranian basins, which makes it difficult to understand how these basins developed and to which extent their watercourses were connected to each other or to other exorheic basins in the geological past. However, few studies on the distribution and zoogeography of the Iranian freshwater fishes carried out by SAADATI (1977) and COAD (1987) based on systematic ichthyological research have contributed to a better understanding of some of the connections among the various basins. According to these authors, pluvial (wet) conditions prevailing during certain periods of the past (e.g. during the Pleistocene glaciations) may have resulted in connections among these basins, either through headwater captures or possibly via small lakes and more extensive watercourses. This is in agreement with what had been stated by BOBEK (1959) and KRINSLEY (1970), based on geomorphological and paleoclimatological evidence. BOBEK (1963) indicated that the Rud-e Kor basin was part of the Rud-e Mand drainage and that the connection between these two systems was cut by the aggradation of Kuh-e Estahbanat (Estahbanat Mountain) during the Würm Glacial (70 ka-11 ka BP).

1.4. Aims of the Study

Given the fragmentation of river systems in the Middle East and the confusing taxonomic status of *Capoeta damascina*, attributable to the high intraspecific variability among a large number of isolated populations, this species was not well defined prior to this study. It was questionable whether it represents a single species or (more likely) a complex of closely related species.

The aims of this study are to:

- define *C. damascina* and the *C. damascina* species complex.
- clarify the systematic status of individual species within this complex.
- elucidate the phylogenetic relationships among them and among populations within each species.
- understand the biogeographical history of this complex, in order to construct a paleogeographic scenario, which explains the evolutionary history and distributional pathways of migration within this complex.

To achieve such goals, a revision of the taxonomic position of the *C. damascina* species complex and relationships among its various species and populations was pivotal. This was initially carried out based on comparative morphology. Besides a systematic re-examination of morphological characters, the inclusion of molecular-based phylogeny is particularly promising and is expected to be the key to many unanswered questions in this species complex. Consequently, mitochondrial and nuclear DNA sequences were used to elucidate phylogenetic relationships among the various members of the *C. damascina* complex and among the populations within each species. Phylogenetic relationships were then projected against paleogeographical events, in order to shed light on phylogeographic histories determining the geographic distribution of lineages within this species complex. This analysis was expected to provide a coherent picture and a new insight into the evolution of this species complex.

II. Materials and Methods

2.1. Samples

This study covers most of the geographic areas where members of the *C. damascina* species complex are known to occur.

Existing collections of the *C. damascina* species complex from the Middle East housed in various natural history museums were examined morphologically. These include type and non-type specimens of wet collections (usually fixed in 10 % formaldehyde and preserved in 70 % ethanol) and dry collections deposited in the following museums:

- SMF: Senckenberg Museum, Frankfurt am Main. Currently, it is known as Senckenberg Forschungsinstitut und Naturmuseum.
- MNHN: Muséum National d'Histoire Naturelle, Paris.
- NMW: Naturhistorisches Museum, Wien.
- BMNH: The Natural History Museum (formerly British Museum [Natural History]), London.

Additionally, specimens from Lebanon, Turkey and Iran were obtained as loans from the American University of Beirut (Natural History) Museum, Beirut (AUBM), Collection of the Biology Department of Shiraz University, Shiraz (CBSU) and the private collection of Dr. Jörg Freyhof from Leibniz Institute of Freshwater Ecology and Inland Fisheries, Berlin (FSJF: Fischsammlung J. Freyhof).

However, these collections do not cover the entire geographical range of this species complex and a considerable number of these materials are in poor condition. Therefore, in addition to studying museum and personal collections, fish specimens were collected from a wide range of water bodies to obtain fresh formalin-fixed specimens for morphological examination and ethanol-fixed samples for DNA studies. To accomplish this goal, five field expeditions were carried out between 2006 and 2008 to the following countries: Islamic Republic of Iran (2006-2008), Republic of Lebanon (2008), Syrian Arab Republic (2008) and Hashemite Kingdom of Jordan (2008) funded by the German Academic Exchange Service (DAAD) and supervised by Dr. Friedhelm Krupp of the SMF in the framework of the DAAD project "Establishment of a Middle Eastern Biodiversity Research, Training and Conservation Network".

The sampling sites were chosen after a thorough study of the distribution of the *C. damascina* species complex from available literature sources. These include small and large rivers, lakes and marshes.

Fishes were caught using several methods, the most important being electric fishing using an electric fishing device EFGI 650 (Jürgen Bretschneider Spezialelektronik, Germany). This method is efficient and not selective and thus helps in providing a broad overview of the fish fauna at the sampling location. Fishes were also collected using cast and dip nets and hook and lines. Ecological data (type, size and depth of water bodies; physical measurements, color and clarity of water and type of vegetation and soil present) were also recorded (a sample of the field data sheet is included in the Annex).

For morphological analyses, fish specimens were fixed in 10 % buffered formaldehyde solution (formalin) in the field for about two to three weeks after being properly labeled and stored in plastic bottles. Following fixation and after being shipped to Frankfurt, specimens were soaked in water for about one week in a laboratory at SMF, where water was changed every two days. Then, they were transferred to 70 % ethanol for long term preservation. Besides collecting fish specimens for morphological analyses, fin clips or small whole specimens were also collected in the field, fixed in 96 % ethanol for molecular genetic analyses.

2.2. Morphological Analyses

Since the current taxonomy of the *C. damascina* species complex is primarily based on morphometric and meristic characters, initial morphological analyses were conducted in this study. These methods remain essential for the identification and delimitation of species, subspecies and populations and allow for comparisons with older descriptions.

A total of approximately 800 specimens of the *C. damascina* species complex were examined thoroughly, identified and subjected to morphological analyses. A pre-selected set of about 21 morphometric measurements and 13 meristic counts were taken. Morphometric measurements were conducted with an electronic digital caliper, Mitutoya CD-8″ model (Mitutoya Corporation, Japan), to the nearest 0.01 mm. The digital caliper was linked to a computer interface, using the software program WinWedge for Windows v1.2' (TAL Technologies, USA). Meristic counts were taken under a dissecting microscope M5A type (Wild Heerbrugg, Switzerland). For measuring fish greater than 208 mm total length, a ruler or a measuring tape was used. Measurements and counts mainly followed HUBBS & LAGLER (1958) and KRUPP (1983).

2.2.1. Morphometric Characters

The following morphometric characters were measured (Fig. 3):

Total length (TL): distance between a line perpendicular to the tip of the snout and a line perpendicular to the farthest tip of the caudal fin.

Standard length (SL): distance between a line perpendicular to the tip of the snout and a line perpendicular to the end of the hypural plate, whose position was determined by flexing the caudal fin. Standard length was usually used as an index of body length or size.

Predorsal length (SD): distance between a line perpendicular to the tip of the snout and a line perpendicular to the origin of the dorsal fin.
Prepelvic length (SP): distance between a line perpendicular to the tip of the snout and a line perpendicular to the origin of the pelvic fin.
Preanal length (SA): distance between a line perpendicular to the tip of the snout and a line perpendicular to the origin of the anal fin.
Head length (HL): distance between a line perpendicular to the tip of the snout and a line perpendicular to the posterior margin of the opercular bone.
Caudal peduncle length (CL): distance between a line perpendicular to the posterior margin of the anal-fin base and a line perpendicular to the end of the hypural plate.
Body depth (BD): greatest depth of the body.
Caudal peduncle depth (CD): least depth of the caudal peduncle.
Length of the dorsal-fin base (LDB): distance between the origin of the dorsal-fin base and its posterior margin.
Length of the anal-fin base (LAB): distance between the origin of the anal-fin base and its posterior margin.
Length of the longest dorsal-fin ray (LD): distance between the structural base of the longest dorsal-fin ray and its tip.
Length of the pectoral fin (LPC): distance from the base of the uppermost, outermost, or anteriormost pectoral-fin ray to the farthest tip of the fin.
Length of the pelvic fin (LP): distance from the base of the uppermost, outermost, or anteriormost pelvic-fin ray to the farthest tip of the fin.
Length of the longest anal-fin ray (LA): distance between the structural base of the longest anal-fin ray and its tip.
Length of the posterior barbel (LPB): distance from the anterior margin of the posterior barbel to its tip.
Horizontal eye diameter (ED): distance between the horizontal margins of the eyeball.
Interorbital width (IOW): least bony width of the interorbitals.
Preorbital length (PrOL): snout length, distance from the tip of the snout to the anterior margin of the eye.
Postorbital length (POL): distance from the posterior margin of the eye to the posterior margin of the opercular bone.
Width of the mouth (WM): greatest transverse distance across the corners of the mouth.

All measurements were done on the left side of the fish unless a left fin (pectoral/pelvic) was badly deformed or broken. Badly-deformed specimens were not measured at all.

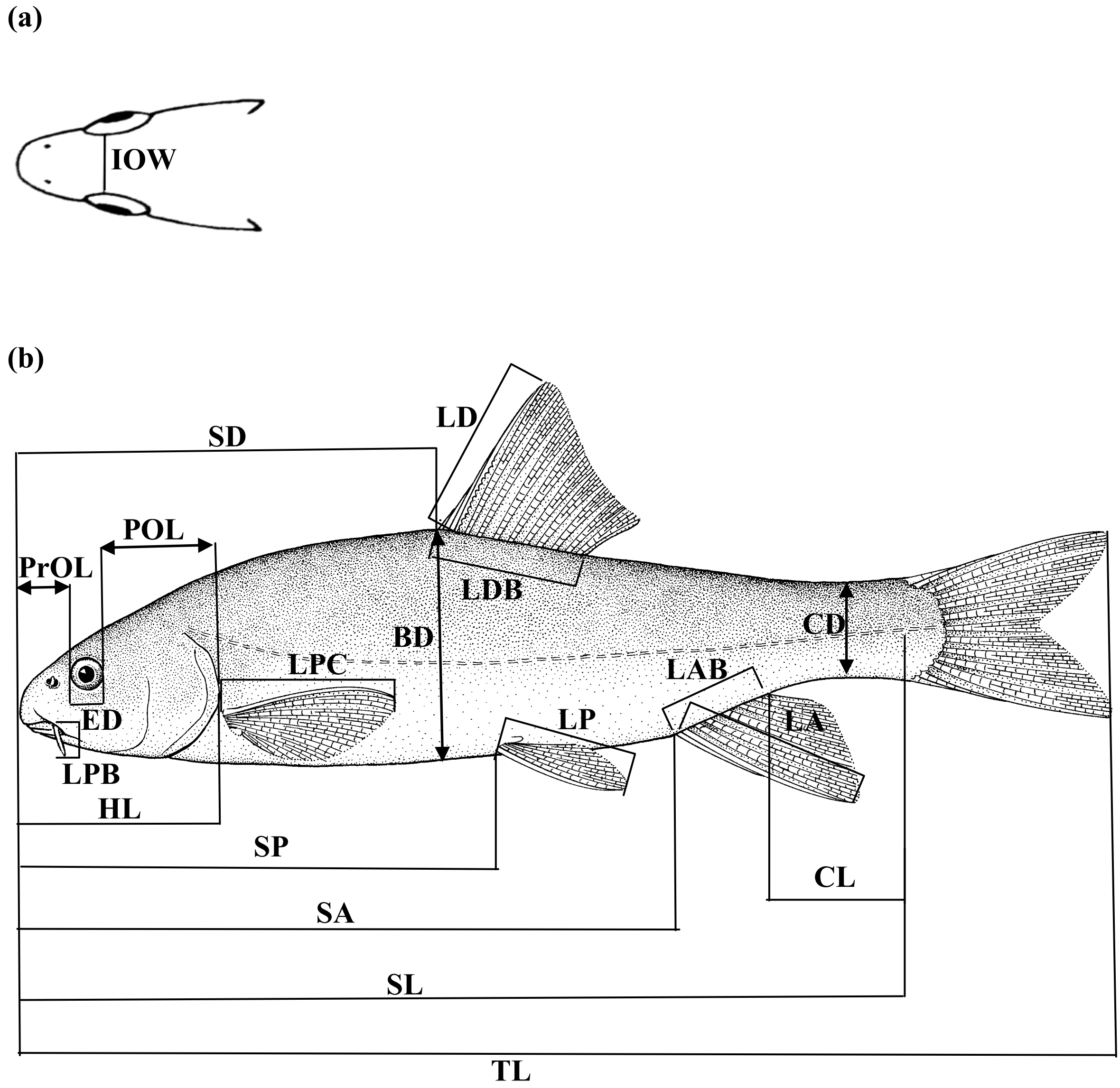

Fig. 3. Morphometric measurements carried out on specimens of the *Capoeta damascina* species complex: (a) picture from KOTTELAT & FREYHOF (2007); (b) picture of *C. damascina* from KRUPP & SCHNEIDER (1989).

2.2.2. Meristic Characters

Number of dorsal-fin rays (D): comprises both the number of unbranched and branched dorsal-fin rays, which were counted separately. Roman numerals refer to unbranched rays and Arabic numerals to branched ones. Since the last two branched dorsal-fin rays are often articulated on the same pterygiophore, they were counted as one.

Total number of pectoral-fin rays (Pc): number of unbranched and branched pectoral-fin rays.

Total number of pelvic-fin rays (P): number of unbranched and branched pelvic-fin rays. A small splint at the origin of the pelvic fin might sometimes exist but it was excluded from the count here.

Number of anal-fin rays (A): comprises both the number of unbranched and branched anal-fin rays. They were counted as designated under **(D)**.

Number of branched caudal-fin rays (Branched C): comprises the total number of branched rays in the caudal-fin.

Scales above the lateral line (ALL): number of scales or scale rows between the lateral line and the anterior margin of the dorsal-fin origin. Scales on the dorsal midline were counted as half.

Scales below the lateral line (BLL): number of scales or scale rows between the lateral line and the anterior margin of the anal-fin origin. Scales on the ventral midline were counted as half.

Caudal peduncle/Circumpendicular scale count (CCP): number of scales around the least circumference of the caudal peduncle.

Lateral-line scale count (LL): number of scales in the lateral-line series from the first pore-bearing scale to the last scale on the caudal fin.

Gill-raker count ($GR_{Lower\ limb\ count}$): number of gill rakers on the lower limb of the first gill arch. Counts were made on the right side of the fish.

Total number of barbels: number of posterior and anterior barbels.

Pharyngeal teeth (PT): number of teeth on the pharyngeal bone. The pharyngeal bones were removed after careful cutting of the flesh below the gill arches using a razor blade and cleaned using a pincer. The teeth in each row were then counted and given in a formula in order from left to right. Being symmetrical on both sides in the *C. damascina* species complex, the pharyngeal teeth were usually removed from the right side of the fish. In case of damage on the right side, the pharyngeal teeth were removed from the left side.

Vertebral counts (VC): total number of the abdominal and caudal vertebrae (including those of the Weberian apparatus [counted as four] and the hypural plate [counted as one]) obtained from radiographs (see SUWOROW 1959 for distinction between abdominal and caudal vertebrae). Radiographs of specimens deposited in SMF were done with the help of the technical assistant Horst Zetzsche on “Structurix D4 Pb Vacupac” films (Agfa, Germany) using a cabinet X-ray system (Faxitron, USA). The X-ray exposure was 60 Volt for three minutes for large fish and 40 V for three minutes for small fish. Radiographs of specimens housed in other museums were done by the technical assistants working in those institutions.

All counts were done on the left side of the fish unless otherwise stated. In case of a badly-deformed pectoral or pelvic fin, missing scales or damaged/missing gill rakers on one side, counts were taken on the other side.

Numbers in parentheses refer to rare counts. It is worth mentioning that the number of specimens stated in the “Material examined” part in the “Results” section refers only to the number of examined fish and thus might not always refer to the total number of the fish in the lot of a sample.

In addition to the measurements and counts applied, a number of qualitative morphological characters like the shape of the mouth and lips, shape of head, presence of spots, shape and length of fins, shape of gill rakers and other striking attributes were also examined and documented. Sex was also checked in a number of specimens (n = 10) of the various members of the *C. damascina* species complex in order to investigate whether sexual dimorphism in certain characters (e.g. mouth shape, anal-fin shape and length etc.) existed.

2.2.3. Statistical Analyses

In order to separate species and populations, morphometric and meristic data were analyzed and evaluated using a range of statistical methods.

2.2.3.1. Morphometrics

Since size is associated with individual growth in fish, it is considered as a contingent source of variability especially in morphometrics (LLEONART et al. 2000). The traditional approach of using the ratio of every measurement against body size (SL) was not used since it does not remove the size effect (HADDON & WILLIS 1995). This approach usually retains the size-dependent shape of the population due to allometry (LLEONART et al. 2000). Comparison of regression lines can account for the index of body length or size as well as the measured character and that is why ratios were not considered useful in this sense (HADDON & WILLIS 1995). Morphometric variables were log-transformed and linear regression equations were fitted between standard length (on the x-axis) and the measured characters (on the y-axis). To identify and quantify differences in the measured characters among the different species and populations, the regression equations were evaluated using Analysis of Covariance (ANCOVA) and the slope (a) and the intercept (b) of each population were separately tested against those of other populations. It is worth mentioning that intercepts do not relate to the y-axis but rather to the line $x = \log(120)$. This line represents the middle of the data set of all the populations at SL = 120 mm and thus no extrapolation is needed. Different slopes would indicate that the growth pattern (degree of change in a character relative to the index of size at all sizes of fish) is different between the two tested populations and that different intercepts would imply different relative body proportions (HADDON & WILLIS 1995).

When performing multiple pairwise tests, the probability of false positives (or type I error) increases with the number of tests. To solve this problem, Bonferroni correction was applied (SACHS 1999). Thus, a new alpha was calculated and the probability (p) was tested at the new corrected alpha rather than at the 0.05 significance level:

Bonferroni-corrected significance level: 0.05/[k], where k is the number of pairwise tests. Statistical differences exist only, if the probability is less than the Bonferroni-corrected alpha.

Since statistical analyses for quantifying differences in the slopes and intercepts among populations and species were carried out simultaneously on the same data set, the number of pairwise tests was compiled in both (i.e. slopes and intercepts comparisons).

Statistical analyses applied for the evaluation of the morphometric data were done using the statistical computing program R-2.10.1 for Windows (R DEVELOPMENT CORE TEAM 2007). No statistical analyses were applied to populations with a sample size lower than 15, since such analyses may result in misleading conclusions due to the inadequate sample size. For this reason, these populations were compared with the other remaining populations based on the plots of the relative morphometric measurements (expressed as a percentage of SL) versus SL since plotting log (measured character) vs. log (SL) will compress the data in such a way that it becomes difficult to compare species and populations and reveal differences. It is important to note that, in such a case, only pronounced differences among the populations were stated. Hence, extreme care was taken when drawing conclusions on such populations (represented by small sampling size). In addition, some of these populations could not be compared with other samples since they contained fish of completely different body sizes (e.g. *C. saadii* from the Rud-e Kol drainage).

2.2.3.2. Meristics

Testing for Allometric Growth

Since many characters in fishes grow allometrically and assuming that allometric growth is similar in closely related species, this phenomenon was tested in one common species as an example. A long series of *C. damascina* specimens from the Jordan River drainage basin, including all size classes, was examined for this purpose. The data of each meristic character were arranged according to SL and divided into three equal groups. The first and the last groups were taken and tested statistically using the Mann-Whitney test (ZAR 1999). Significant differences between the two groups indicate a growth dependent on size which means that the counts differ as the fish grow in size.

Comparisons among Populations

In order to identify and quantify differences among the various populations examined, each meristic character, growing independent of size, was tested using the non-parametric Kruskal-Wallis test. This test was used instead of the Analysis of Variance

(ANOVA) test because the assumptions for the normality and homogeneity of variances of the distributions were violated (ZAR 1999). If significant differences in meristic characters existed among the populations, Mann-Whitney test was then used to investigate which populations accounted for such a difference. Populations were tested against each other in a pairwise manner and only those equal to or greater than 15 were included in the statistical analyses. As was the case in morphometrics (section 2.2.3.1) and since multiple pairwise tests were performed, Bonferroni correction was also applied. Statistical analyses were done using the Statistical Package for Social Sciences software, SPSS 11.0 for Windows (SPSS Inc., USA). However and in case of growth dependent on size, the same statistical tests used for morphometric data were then applied to investigate differences in characters among populations.

Since no statistical tests were applied for populations with sample sizes below 15, they were only compared based on the frequency distribution of the meristic characters.

2.2.4. Principal Component Analysis

Morphological data were also evaluated using Principal Component Analysis (PCA). PCA is a powerful model-free and distribution-free tool to manipulate multivariate data sets. It is an ordination technique used to explore variability by reducing the data set of specimens of different taxa (SNOEKS & KONINGS 2004, VREVEN 2005). Using this tool in SPSS 11.0, data were analyzed, separately, on the correlation matrix of the log-transformed measurements and untransformed meristical data. All fully examined specimens were included in the analyses. In order to entail as many specimens as possible, three morphometric characters (BD, WM and LPB) were excluded from such analyses as they were not measured in all specimens due to deformation. Vertebral counts were also excluded because the total number of vertebrae was counted in very few specimens. To retrieve as much relevant information as possible, the loadings of the variables were determined up to the fifth factor. In order to allow for a size-free comparison of specimens, the first factor, which accounts mainly for size, was discarded in the morphometric analysis.

2.3. Molecular Genetic Analyses

A total of 72 specimens of the *C. damascina* species complex were subjected to DNA studies. Samples of other *Capoeta* species (*C. aculeata*, *C. barroisi*, *C. erhani*, *C. mandica*, *C. mauricii*, *C. pestai*, *C. trutta* and *C. turani*), deposited in SMF or obtained as loans from FSJF, were included in the molecular genetic analyses (n = 32) in order to study their phylogenetic relationships with the *C. damascina* species complex. The data (number, standard length, locality, collection date, collectors and museum numbers) of all the *C. damascina* species complex samples included in the phylogenetic analyses are found under “Material examined” in the “Results” section except those of *C. caelestis*, which along with other additional comparative materials of *Capoeta* species are listed in the Annex.

The molecular analyses used in this study were carried out in the Grunelius-Möllgaard Laboratory for Molecular Evolution Research and the LOEWE Biodiversity and Climate Research Centre (BiK-F).

2.3.1. DNA Extraction

Samples used for DNA extraction (n = 104) were either muscle tissues taken from the region below the base of the dorsal fin or fin clips fixed in 96 % ethanol (except for SMF 17353 and AUBM OS3682 which were preserved in 70 and 95 % ethanol). Prior to DNA extraction, about 25 mg of the sample were cut using sterile razor blades and placed inside sterile Eppendorf tubes. Subsequently, they were washed twice, one hour each time, with 1 ml Phosphate Buffered Saline (PBS) solution (pH 7.2) (Biochrom, Germany) to remove the fixative. After the PBS was discarded, total genomic DNA was extracted with the DNeasy Blood and Tissue kit (QIAGEN, Germany) according to manufacturer’s instructions (animal tissues protocol).

2.3.2. DNA Amplification

2.3.2.1. Polymerase Chain Reaction (PCR)

The extracted DNA of *Capoeta* samples was amplified, via PCR, using primer pairs of two molecular sequence markers. The first one targets the mitochondrial cytochrome oxidase I (COI) gene and the second addresses the two adjacent divergence regions (D1-D2) of the large subunit (LSU or 28S) ribosomal RNA gene. A total of 103 DNA samples were amplified using the COI marker and 65 using the LSU.

Approximately 655 base pairs (bp) were amplified from the 5' region of the COI gene using the following primer pair adapted from WARD et al. (2005):

FishF1-5'TCAACCAACCACAAAGACATTGGCAC3'

FishR1-5'TAGACTTCTGGGTGGCCAAAGAATCA3'

Regarding the LSU gene, the forward primer was developed by SONNENBERG et al. (2007) and modified here whereas the reverse pimer was designed based on the partial LSU sequence of *Barbus barbus* from GenBank (GenBank: EF417164.1; SONNENBERG et al. 2007) and tested using the Primer3 software (ROZEN & SKALETSKY 2000). This primer pair targets an approximately 616 bp fragment of the D1-D2 region of the LSU ribosomal gene and its sequences are shown below:

D1-D2 LSU F-5'ACAAGTACCGTGAGGGAAAGTTG3'

D1-D2 LSU R-5'GGCCTTCACCTTCATTGC3'

2.3.2.2. PCR Assays

Standard PCR was performed in a total volume of 25 µl reaction mixture containing 1 µl of each primer (10 pmol/µl), 5 µl of the DNA template (30-50 ng/µl) and 18 µl of sterile double distilled water (ddH_2O) in 0.2 ml thin-walled PCR tubes enclosing the illustra™ puReTaq Ready-To-Go PCR beads (GE Healthcare, USA). Each bead yields a reaction containing stabilizers, Bovine Serum Albumin (BSA), ca. 2.5 units of PuReTaq DNA polymerase, dNTPs and reaction buffer. The PCR tubes were then placed in a Peltier Thermal cycler (MJ Research (Bio-Rad), USA). A negative control (no DNA template) was included in every PCR assay. The cycles used for the amplification of the targeted genes are summarized in Table 2.

Table 2. PCR conditions for each set of the used primer pairs.

	Primers		**# of cycles**
	FishF1+ FishR1	D1-D2 LSU F + D1-D2 LSU R	
Initial denaturation	94 °C for 1 min	94 °C for 1 min	1
Denaturation	94 °C for 0.5 min	94 °C for 0.5 min	40
Annealing	52 °C for 1.5 min	55 °C for 1.5 min	
Elongation	72 °C for 1 min	72 °C for 1 min	
Final extension	72 °C for 10 min	72 °C for 10 min	1
Final hold	4 °C forever	4 °C forever	-

2.3.3. Gel Electrophoresis

A 25 µl aliquot of each of the PCR products was mixed with 1.5 µl 5x loading dye (0.25 g bromophenol blue, 4 g saccharose, 5 ml H_2O, 5 ml Tris-EDTA [1x]). PCR products were then run on 1 % agarose gel containing 10 µl SYBR® Safe DNA gel stain (Invitrogen, USA). Electrophoresis was carried out in 1x TAE buffer (0.04 M Tris-acetate and 0.001 M EDTA) at 90 V for 90 min. A 100 bp ruler (Roth, Germany) was used as a DNA size marker. After the run was completed, the bands were visualized under Ultra-Violet (UV) light and photographed using the Alpha Imager system (Alpha Innotech, USA).

In some cases and only when using the D1-D2 primers, more than one band were observed on the gel: one at the exact specified size and another which is either higher or lower than the previous one. This could be evidence for the presence of pseudogenes or for polymorphism where multiple copies of ribosomal genes are present in the genome retaining more or less identical sequences. In such cases, the PCR products at both bands were sequenced and both sequences were blasted to identify which one was the partial LSU sequence.

2.3.4. Gel Extraction

Using the Safe Imager apparatus (Invitrogen, USA), the double-stranded PCR products were excised from the gel with clean razor blades and transferred into sterile Eppendorf tubes. Then, they were extracted and purified from agarose gel and amplification and other enzymatic reactions with the QIAquick Gel Extraction kit (QIAGEN, Germany) following the "QIAquick Gel Extraction Kit protocol using a microcentrifuge".

2.3.5. Sequencing Reactions

The purified PCR products were sequenced according to the protocol of the Big Dye® v3.1 Cycle Sequencing Kit (Applied Biosystems, Germany) in the BiK-F laboratory and read on an ABI 3730 capillary sequencer (Applied Biosystems, Germany). Sequencing was done with the same primers used in the PCR reactions. In order to control sequence accuracy and to resolve any ambiguous bases, the PCR products were sequenced in both directions.

2.3.6. Phylogenetic Analyses

Sequences were proof-read and assembled using the Lasergene SeqMan II software (DNA Star 6 Inc., USA) and were manually checked for inconsistencies. They were aligned using the ClustalW algorithm (THOMPSON et al. 1994) with default parameters within MEGA4.0.2 software (TAMURA et al. 2007) and visually inspected. Blast searches were performed in order to check if other than fish sequences were amplified as a consequence of sample contamination. Alignment gaps were marked with "-", and unresolved nucleotides and unknown sequences were indicated with "N". Sequences were analyzed in PAUP* 4.0b10 (SWOFFORD 1998) in order to determine the number of variable and parsimony-informative sites. All sequence data are available upon request and will be deposited in GenBank upon the publication of the study. Sequences of *Cyprinus carpio* (COI: CoxI X61010.1, CHANG et al. 1994/LSU: AF133089.2, VERA et al. 1997) and *Barbus barbus* (COI: AB238965.1, SAITOH et al. 2006/LSU: EF417164.1, SONNENBERG et al. 2007) obtained from GenBank were also included in the analyses but only that of *C. carpio* was used to root the trees. This is because *C. carpio* does not cluster with members of the genus *Capoeta* and *Luciobarbus* lineage/*Barbus* sensu stricto group, which were shown to display close phylogenetic relationships with each other based on mitochondrial gene sequences (DURAND et al. 2002, TSIGENOPOULOS et al. 2003), but is closely related to them (SAITOH et al. 2006).

Phylogenetic trees from aligned sequences were constructed using two approaches for both markers. Maximum Parsimony (MP) analysis was performed using PAUP* 4.0b10 and Bayesian analysis (BA) was carried out using MrBayes 3.1.2 (HUELSENBECK & RONQUIST 2001). For MP analysis, heuristic searches were conducted using the tree bisection and reconnection (TBR) branch-swapping option. One thousand bootstrap replicates were performed with five independent search runs per replicate and random addition of sequences. Samples with the same haplotypes were excluded and were only represented by one sequence. For BA, the best-fit model of molecular evolution was determined with Mr. Modeltest 2.3 (NYLANDER 2004) in PAUP* 4.0b10 according to the Akaike Information Criterion (AIC). The subsequent analysis was carried out with the most appropriate model using MrBayes 3.1.2 for six million generations with four chains, a sample frequency of 1,000 generations and a burn-in of 1001 in two separate runs.

A total of 66 COI and LSU sequences were combined in a total evidence tree to improve the overall resolution among the clades. The total evidence tree was analyzed using MP and BA. For MP analysis, samples with the same haplotypes were excluded and were only represented by one sequence. Heuristic searches were conducted using the TBR branch-swapping option. One thousand bootstrap replicates were performed with five independent search runs per replicate and random addition of sequences. For a Bayesian reconstruction of phylogeny, the analysis was carried out using MrBayes 3.1.2 for five million generations with four chains, a sample frequency of 1,000 generations and a burn-in of 1001 in two separate runs. The data set was divided into two partitions, one for the COI and one for the LSU. The models of evolution for each partition were specified as stated above.

Haplotype networks were constructed for the COI sequences using the TCS 1.21 program (CLEMENT et al. 2000) to display the mitochondrial sequence variation underlying the phylogenetic analysis. The two resulting networks detail the relationships of haplotypes and the number of mutational steps required to interconvert haplotypes. The connection limit was set to 10 mutation steps.

2.4. Distribution Maps

Distribution maps of the various members of the *C. damascina* species complex examined in this study were made using the ArcGIS software (ESRI, Germany) linked to Global Positioning System (GPS). They were modified and labeled using the Adobe Photoshop CS software, version 8 (Adobe Systems, USA).

III. Results

3.1. Diagnosis of the Genus *Capoeta*

Species in the genus *Capoeta* are medium-sized to large cyprinids, characterized by the following combination of characters: elongate and usually cylindrical body, compressed in some species; short dorsal fin with (3) 4-5 (6) unbranched and 7-9 (10) (11) branched rays, last unbranched dorsal-fin ray ossified and usually serrated (without serration in very few species); anal fin with 3 unbranched and 5 (rarely 6) branched rays; more than 40 scales in the lateral line; tip of snout well in front of the upper lip; mouth ventral, lower lip covered with horny sheath; usually one pair of barbels (two in very few species); pharyngeal teeth in three rows: 2.3.4-4.3.2 or 2.3.5-5.3.2.

3.2. The Species of the *C. damascina* Complex

A detailed description of each species in the *C. damascina* complex is given below, including diagnosis, coloration, sexual dimorphism, and habitat and distribution.

3.2.1. *Capoeta buhsei* Kessler, 1877

Capoeta buhsei KESSLER, 1877: 85, Persia ("iz Persii", apparently near Tehran).

Varicorhinus nikolskii DERZHAVIN, 1929: 74-75, fig. 2, Karaj River near Tehran ("Keredsh flumen").

Varicorhinus buhsei. – BERG 1949: 805, fig. 16, vicinity of Tehran.

Capoeta buhsei. – KARAMAN 1969: 36-37, figs 2, 3, plate 1 (fig. 2), plate 6 (fig. 5), vicinity of Tehran.

Varicorhinus damascinus (partim). – SAADATI 1977: 74-75, Namak Lake basin.

Capoeta buhsei (partim). – BIANCO & BANARESCU 1982: 88, near Tehran, Djodje.

Capoeta buhsei. – COAD 1995: 14, Namak Lake basin.

Capoeta buhsei. – ABDOLI 2000: 120-121, Daryacheh-ye Namak basin.

Capoeta buhsei. – COAD 2008: 75-77, Namak Lake basin (in the Damavand River, Jajrud, Karaj River and Dam, Sharra River, Kar River, Qareh Su, Abhar River and Qom River) and Kavir basin (in the Hableh Rud and the Shurab near Semnan).

Material examined: (1) 3, 83.00-112.36 mm SL, Iran: Jajrud, 35° 44.475' N 51° 41.648' E, 17.II.2008, N. Alwan, K. Borkenhagen & A. Kazemi, SMF uncatalogued (IR08/01). – (2) Fin clip from FSJF 2206, Iran: Taghra Rud between Ja'fari and Dolatabad, 34° 42.954' N 50° 27.286' E, 17.IV.2007, A. Abdoli & J. Freyhof, specimen identified by J. Freyhof, FSJF 10 (in 96 % alcohol). – (3) 4, 101.77-132.99 mm SL, Iran: Rud-e Qom in Qom, 34° 22.623' N 50° 36.105' E, 05.III.2008, N. Alwan, K. Borkenhagen, M. Ghanbari Fardi & A. Kazemi, SMF uncatalogued (IR08/36). – (4) 1, 68.60 mm SL, Iran: Qareh Su (Qara Chai) in Tureh, 34° 02.118' N 49° 16.970' E, 04.III.2008, N. Alwan, K. Borkenhagen, M. Ghanbari Fardi & A. Kazemi, SMF 31003 (fin clip in 96 % alcohol). – (5) 2, 61.16-123.99 mm SL, Iran: Qareh Su (Qara Chai) in Tureh, 34° 02.118' N 49° 16.970' E, 04.III.2008, N. Alwan, K. Borkenhagen, M. Ghanbari Fardi & A. Kazemi, SMF uncatalogued (IR08/35). – (6) 1, 81.57 mm SL, Iran: Pol-e Doab, Arak-Markazi, 34° 02.607' N 49° 21.157' E, 15.XI.2007, A. Teimory, M. Ebrahimi, A. Gholami & A. Gholamhoseini, given by H. R. Esmaeili from Shiraz University, SMF 31004 (in 96 % alcohol).

3.2.1.1. Diagnosis

Capoeta buhsei is distinguished from all other *Capoeta* species by the following combination of characters: elongate and cylindrical body; 8 branched dorsal-fin rays; last unbranched dorsal-fin ray weakly ossified and serrated in 1/3-3/4 of its length; very small scales, 14-16 above the lateral line, 10-11.5 below the lateral line, 29-31 encircling least circumference of caudal peduncle, 82-95 scales in the lateral-line series; 7-10 gill rakers on lower limb of first gill arch; 44 total vertebrae; one posterior pair of barbels.

3.2.1.2. Description

The habitus of *C. buhsei* is shown in Figure 4. Morphometric measurements are given in Tables A2-A21 and meristic counts are given in Tables A22-A35.

Body usually elongate and cylindrical; greatest body depth at level of dorsal-fin origin; dorsal head profile convex; predorsal body profile smoothly convex to dorsal-fin origin; nuchal hump present in well-fed specimens; snout rounded; mouth ventral; lips a bit fleshy, being more pronounced at mouth corners; lower lip covered with a sharp-edged horny sheath (sometimes not very well developed), its anterior margin rounded to almost crescent in shape; rostral cap well developed, in most specimens partly overlapping upper lip.

Dorsal fin inserted anterior to pelvic-fin origin, its outer margin usually straight but sometimes concave or slightly concave; 4-5 unbranched and 8 branched dorsal-fin rays (Tables A22, A23); last unbranched dorsal-fin ray weakly ossified and serrated in 1/3-3/4 of its length, distal half thin and flexible; pectoral fins not extending to pelvic-fin base, their tips usually rounded but can be pointed; 18-20 pectoral-fin rays in total (Table A24); pelvic fins not extending to anal-fin base, outer margins straight or slightly rounded; 9-10 total pelvic-fin rays (Table A25); pelvic axillary scale present; anal fin with 3 unbranched and 5 branched rays (Tables A26, A27), outer margin convex or slightly convex; caudal fin forked with 17 branched fin rays (Table A28), its tips usually pointed and its lobes not always of equal size.

Fig. 4. *Capoeta buhsei* from Rud-e Qom in Qom (SMF uncatalogued IR08/36), photograph of live specimen (Photo by N. Alwan).

Scales small, 14-16 above the lateral line (Table A29), 10-11.5 below the lateral line (Table A30), 29-31 encircling least circumference of the caudal peduncle (Table A31), 82-95 scales in the lateral-line series (Table A32); ventral midline and pectoral region covered with deeply embedded scales of reduced size; gill rakers slightly hooked, 7-10 gill rakers on the lower limb of the first gill arch (Table A33); 44 total vertebrae (Table A34); one posterior pair of barbels (Table A35); pharyngeal teeth arranged in three rows: 2.3.5-5.3.2 (f1), teeth in the main row spatulate or spoon-shaped and crowns are flat, narrow and curved.

3.2.1.3. Coloration

Live specimens: dorsum, head and sides light silvery-golden, darker dorsally and lighter below the lateral line; fins opaque/white with or without grey tinge (pectoral fins sometimes golden) (Fig. 4).

Preserved specimens: dorsum, head and sides grey or brownish-grey dorsally and beige ventrally; fins beige with or without grey tinge.

3.2.1.4. Sexual Dimorphism

No comparison was made between sexes due to the lack of female specimens.

3.2.1.5. Habitat and Distribution

Capoeta buhsei inhabits small rivers with muddy or sandy bottoms containing stone and pebble substrates. It prefers turbid, medium-fast flowing water but can be found in clear water too. It is found in many rivers in the Daryacheh-ye Namak basin such as Jajrud and Rud-e Qom (Fig. A1). In addition to Daryacheh-ye Namak basin, COAD (2008) reported it from the Kavir basin in the Hableh Rud and the Shurab near Semnan.

3.2.1.6. Remarks

In their description of *C. buhsei* from Daryacheh-ye Namak, Esfahan, Hormuz and Kerman basins, BIANCO & BANARESCU (1982) gave a wider range of circumpendicular scale counts (26-36) than the one shown in Table A31 (29-31). The occurrence of this species in Esfahan, Hormuz and Kerman basins was considered by ABDOLI (2000) and COAD (2002) as questionable, which could explain the lower counts in the circumpendicular scale range of *C. buhsei*. If the higher counts were included in Table A31**,** then *C. buhsei* would no longer be distinct from *C. umbla* in terms of caudal peduncle scales. ABDOLI (2000) and COAD (2008) reported, from a wider sampling area, a wider range in lateral-line scale counts (78-99 and 72-99 respectively) than the one shown in Table A32. COAD (2008) used a different method of counting lateral-line scales than the one used in this study and that is why his range was slightly lower. If the range given in ABDOLI (2000) was compared with the one shown in Table A32, *C. bushei* would no longer differ in terms of lateral-line scale counts from *Capoeta* sp.1.

3.2.2. *Capoeta damascina* (Valenciennes in Cuv. & Val., 1842)

Gobio damascinus VALENCIENNES in CUVIER & VALENCIENNES, 1842: 314, plate 482 (p.240 in another edition), Damascus.

Scaphiodon capoeta (non sensu GÜLDENSTAEDT, 1773) HECKEL, 1843: 1057, plate 4, fig. 1, Aleppo.

Scaphiodon fratercula HECKEL, 1843: 1059, plate 5, fig. 2, rivers in Damascus ("Gewässern von Damascus").

Scaphiodon socialis HECKEL, 1843: 1061, around Damascus ("Um Damascus").

Scaphiodon peregrinorum HECKEL, 1843: 1061, around Aleppo ("Um Aleppo").

Chondrostoma syriacum VALENCIENNES in CUVIER & VALENCIENNES, 1844: 407, plate 314 (p.303 in another edition), Abraham's River at the foot of Mount Sinai (Rivière d'Abraham au pied du Sinai").

Scaphiodon capoeta (non sensu GÜLDENSTAEDT, 1773). – GÜNTHER 1864: 490, Lake of Galilee (Lake Tiberias), Jordan, streamlets by the Dead Sea, Nahr el Kelb, Wady el-Kurn.

Scaphiodon capoeta (non sensu GÜLDENSTAEDT, 1773). – STEINDACHNER 1864: 223, Kueik (Chalus) in Aleppo, Orontes, source of Jordan at Hesbayr, Seihun (Sarus) at Adana, Palestine without any locality, streams in the vicinity of Arsus and Amanus Mountains.

Capoeta damascina (partim). – GÜNTHER 1868: 77, Jordan, Lake of Galilee, Bahr el-Kelb, Wady el-Kurm, streamlets by the Dead Sea, Palestine.

Capoeta fratercula. – GÜNTHER 1868: 79, Damascus.

Capoeta syriaca. – GÜNTHER 1868: 81, Abraham's River at the foot of Mount Sinai.

Capoeta damascina. – GÜNTHER 1869: 411.

Capoeta syriaca. – LORTET 1883: 155, plate 14, Lake Tiberias, Jordan, Semak south of Tiberia.

Capoeta fratercula. – LORTET 1883: 156, plate 15, fig. 1, Nahr Bahsas, Nahr el-Minié, Nahr Kadischa, Nahr el-Bared, Ain Aslane, Nahr Raschein, Barada.

Capoeta socialis. – LORTET 1883: 159, plate 15, fig. 3, Lake Tiberia, Jordan, Lake Houleh, streamlets by the Dead Sea, Nahr Bahsas.

Capoeta damascina. – LORTET 1883: 160, plate 16, fig. 1, Lake Antioch, Orontes, Nahr Raschein, Nahr Kadischa, Barada, lakes situated east of Damascus, Nahr Hasbany, Lake Tiberias, Ain et-Tin, Ain el-Moundawara, Jordan from Lake Houleh till the Dead Sea, Qishon, Rabbat Ammon, Kulat el-Kurn.

Capoeta damascina. – TRISTAM 1884: 172, Jordan and all its affluents, streams flowing into the Mediterranean, all over Syria and Asia Minor.

Capoeta syriaca. – TRISTAM 1884: 173, Lake Tiberias, Jordan, Euphrates at Birajik (Birecik).

Capoeta fratercula. – TRISTAM 1884: 173, all mountain-streams of Lebanon, Deichûn village near Safed in Galilee, a spring near the Shrine at Sheikh el-Bedawi.

Capoeta socialis. – TRISTAM 1884: 173, whole course of Jordan.

Capoeta syriaca. – BARROIS 1894: 273, 287, Syria.

Capoeta socialis. – BARROIS 1894: 273, 287, 301, Syria.

Capoeta damascina. – BARROIS 1894: 253, 273, 287, 301, Syria.

Capoeta damascina. – MASTERMAN 1908: 50, Jordan, Damascus.

Capoeta syriaca. – MASTERMAN 1908: 51, Jordan system.

Capoeta socialis. – MASTERMAN 1908: 51.

Capoeta fratercula. – MASTERMAN 1908: 51, Deishûn.

Capoeta damascina. – PELLEGRIN 1911: 108, Lake Homs.

Capoeta fratercula. – PELLEGRIN 1911: 108, Lake Homs.

Capoeta syriaca. – PELLEGRIN 1911: 108, Damascus, Ararhta, Doummar (Dummar).

Varicorhinus damascinus. – ANNANDALE 1913: 31, Lake Tiberias and neighbouring fountains.

Varicorhinus damascinus. – ANNANDALE 1915: 441, Syria, Palestine.

Varicorhinus syriacus. – ANNANDALE 1915: 411, Lake Tiberias.

Varicorhinus socialis. – ANNANDALE 1915: 411, Jordan River system.

Varicorhinus damascinus. – HANKÓ 1924: 146, Bozanti, Kara-Su at Kara-Köi.

Varicorhinus capoeta angorae HANKÓ, 1924: 147, plate 3, fig. 3, Bozanti.

Varicorhinus damascinus. – VINCIGUERRA 1926: 224, Lake Tiberias.

Varicorhinus syriacus. – VINCIGUERRA 1926: 224, Palestine, Syria.

Varicorhinus damascinus. – GRUVEL 1931: 297, Damascus, Orontes, Lake Antioch.

Capoeta fratercula. – GRUVEL 1931: 298-299, fig. 52, all rivers descending from Lebanon, Lake Homs and Orontes basin.

Varicorhinus damascinus. – BODENHEIMER 1935: 426, Palestine.

Varicorhinus socialis. – BODENHEIMER 1935: 426, Jordan River, Lakes of Palestine.

Varicorhinus syriacus. – BODENHEIMER 1935: 426, Jordan River, Lakes of Palestine.

Varicorhinus fratercula. – BODENHEIMER 1935: 426, mountain rivers of Galilee and Lebanon, Deichun.

Varicorhinus damascinus. – TORTONESE 1937-1938: 21, 24, Ain-el-Douk, Ain-es-Sultan, Es-salt, Rabbat, Nahr-el-Lytani (Litani), Es-Sanamein, Lake Homs, Nahr-el-Asi, Nahr Hibrahim (Beirut).

Varicorhinus fratercula. – TORTONESE 1937-1938: 25, Syria.

Varicorhinus capoëta angorae. – BATTALGIL 1942: 304, Pozanti.

Varicorhinus fratercula. – BATTALGIL 1942: 306, Cakit in the vicinity of Adana, Lake Amik.

Varicorhinus damascinus. – KOSSWIG & BATTALGIL 1943: 23, Pozanti, Antakya, Urfa, Batman suyu.

Varicorhinus fratercula. – KOSSWIG & BATTALGIL 1943: 23, Antakya.

Varicorhinus syriacus. – KOSSWIG & BATTALGIL 1943: 24.

Varicorhinus peregrinorum. – KOSSWIG & BATTALGIL 1943: 24, Batman suyu.

Varicorhinus damascinus. – BERG 1949 (partim): 800, figs 12, 14 Palestine (both in coastal rivers as well as in the Dead Sea basin), Syria, upper Euphrates, Tigris, Seihun.

Varicorhinus fratercula. – BERG 1949: 804, Ayn-Mineya, Ayn-Aslan, Nahr el-Bared, Nahr Kadisha, Nahr Bakhsas.

Varicorhinus syriacus. – BERG 1949: 804.

Varicorhinus peregrinorum. – KOSSWIG 1952: 88, Anatolia south of Taurus Mountains.

Varicorhinus damascinus. – STEINITZ 1953: 209, Palestine.

Varicorhinus damascinus. – STEINITZ & BEN-TUVIA 1957: 176-188, fig. 2, Lakes Tiberias and Hulas (hybrid with *Barbus longiceps*).

Varicorhinus damascinus. – LADIGES 1960: 130 (listed).

Varicorhinus fratercula. – LADIGES 1960: 131 (listed).

? *Barbus belayewi* MENON, 1960: 144, fig. 2, Tigris (Baghdad).

Varicorhinus damascinus. – BECKMAN 1962: 146, fig. 78, Syria.

Varicorhinus syriaca. – BECKMAN 1962: 148, Jordan River, Syria.

Capoeta capoeta angorae. – KARAMAN 1969: 28, fig. 2, plate 2 (figs 2, 4), plate 5 (figs 2, 4), Ceyhan- and Seichan- River system.

Capoeta capoeta damascinus. – KARAMAN 1969: 29, fig. 2, plate 2 (figs 3, 5), plate 5 (figs 5, 6), Syria, Israel, Lebanon, Jordan and probably the Iraqi borders.

Capoeta damascina. – GOREN 1974: 88, figs 8a, 18, lakes and rivers in Israel.

? *Varicorhinus damascinus* (partim). – SAADATI 1977: 74, 192, 193, Tigris basin in Iran.

Capoeta damascina. – BEN-TUVIA 1978: 415, Lake Tiberias, Jordan River system, Syria (biology).

Capoeta capoeta damascinus. – BANISTER 1980: 103, Tigris, Euphrates.

Capoeta capoeta damascinus. – COAD 1980: 91, upper Euphrates River in Iraq.

Capoeta capoeta damascinus. – KURU 1980a: 38, Orontes and around Hatay.

Capoeta capoeta angorae. – KURU 1980a: 38, Seyhan, Ceyhan and parts of southern Turkey.

Capoeta damascina. – KRUPP 1985: 76, fig. 52, Ceyhan, Seyhan, Barada, Quwaiq, Orontes, Litani, Jordan River system, rivers by the Dead Sea, coastal rivers in Syria and Lebanon.

Capoeta damascina. – KHALAF 1985: 2631-2635, Nahr el-Kalb, Nahr Ibrahim (biology).

Capoeta damascina. – MOUBAYED 1987: 245, Orontes, Litani, Beirut.

Capoeta damascina. – KHALAF 1987: 395-401, Nahr Beirut, Nahr el-Kalb, Nahr Ibrahim (biology).

Capoeta damascina. – KRUPP 1987: 230, Orontes, Nahr al-Kabir (N), Nahr Marqiya, Nahr al-Kabir (S), Nahr al-Litani, Damascus basin, Jordan, coastal rivers in Lebanon and Palestine.

Capoeta damascina. – MIR et al. 1988: 931-936, fig. 1c, Ain al-Qunaiya (Jordan) (hybrid with *Barbus canis*).

Capoeta damascina. – KRUPP & SCHNEIDER 1989: 365-367, figs 17, 57, 58, entire Levant including the Jordan River drainage basin, Mesopotamia and parts of southern Turkey.

Capoeta damascina. – MIR 1990: 163, plate 2, fig. 3, Jordan River, Yarmuk River.

Capoeta damascina (partim). – COAD 1991: 15, Tigris-Euphrates basin (listed).

Capoeta capoeta angorae (partim). – BALIK 1995: 215, southern Anatolia.

Capoeta damascina. – FISHELSON et al. 1996: 80, fig. 1c, tributaries of the Jordan River system (biology).

Capoeta damascina. – GOREN & ORTAL 1999: 4, northern and central coastal system in Israel, Jordan Valley system.

Capoeta damascina. – MINA et al. 2001: 243, Lake Tiberias.

Capoeta damascina. – GORSHKOVA et al. 2002: Wadi Karak (biology).

Capoeta damascina. – HAMIDAN 2004: 387, Jordan River drainage basin, rivers and springs of the Dead Sea basin.

Capoeta capota angorae. – ALP et al. 2005: 665-676, Ceyhan River.

Capoeta angorae. – TURAN et al. 2006b: 151-155, Ceyhan River.

Capoeta umbla. – TURAN et al. 2006b: 151-155, Euphrates River.

Capoeta damascinus. – TURAN 2008: 3-14, Orontes.

Capoeta angorae. – TURAN 2008: 3-12, Seyhan River, Orontes.

Capoeta damascina. – KRUPP & SCHNEIDER 2008: 44, fig. 4: 13, Nahr al-Hābur (Khabur).

Capoeta angorae. – SCHÖTER et al. 2009: 232-235, Seyhan River.

Capoeta damascina. – SCHÖTER et al. 2009: 232-235, spring of Barada.

Capoeta umbla (partim). – SCHÖTER et al. 2009: 233-235, Tigris-Euphrates system.

Material examined: Types: Lectotype of *Gobio damascinus* (designated by Krupp & Schneider, 1989): 1, 177.23 mm SL, Syria: Damascus (most probably from Barada River, but the locality as written in the catalogue is: “du Jourdain” (most probably an error on geographical grounds), Bové, MNHN 4494. – Paralectotypes: 1, 168.02 mm SL, same data as lectotype, MNHN 1990-703. – 1, 260.52 mm SL, “Syria” (most probably same locality as lectotype), Bové, MNHN 3947 (dried specimen). – 1, ca. 290 mm SL, Syria: Nahr Barada, Damascus (most probably same locality as lectotype), Bové, MNHN 3948 (dried specimen). – Syntypes of *Scaphiodon peregrinorum*: 1, 189.99 mm SL, Syria: Nahr Quwayq in Aleppo, Th. Kotschy, NMW 51658. – 1, 187.47 mm SL, Syria: Nahr Quwayq in Aleppo, Th. Kotschy, NMW 51659. – 1, 187.16 mm SL, Syria: Nahr Quwayq in Aleppo, Th. Kotschy, NMW 51660. – 1, 190.00 mm SL, Syria: Nahr Quwayq in Aleppo, Th. Kotschy, NMW 51661. – 1, 108.65 mm SL, Syria: Nahr Quwayq in Aleppo, Th. Kotschy, NMW 51662. – 1, 238.87 mm SL, Syria: Nahr Quwayq in Aleppo, Th. Kotschy, NMW 51663. – 3, 136.18-169.59 mm SL, Syria: Nahr Quwayq in Aleppo, Th. Kotschy, NMW 51664. – 1, 172.69 mm SL, Syria: Nahr Quwayq in Aleppo, Th. Kotschy, NMW 51665. – Holotype of *Chondrostoma syriacum*: ca. 233 mm SL, Egypt: Abraham River at the foot of Mount Sinai, C. G. Ehrenberg, MNHN 1945 (in very poor condition).

– (1) Fin clip from FSJF 2494, Turkey: affluent canal below Cipköy damlake at picnic area, 38° 40.753' N 39° 03.962' E, 18.VI.2008, M. Özuluğ & J. Freyhof, FSJF 904 (in 96 % alcohol). – (2) 4, 122.51-162.64 mm SL, Turkey: affluent canal below Cipköy damlake at picnic area, 38° 40.753' N 39° 03.962' E, 18.VI.2008, M. Özuluğ & J. Freyhof, FSJF 2494. – (3) Fin clip from FSJF 2540, Turkey: Yenice İrmağı (Zamantı stream), south of Aşağıbeyçayırı, south of Pınarbaşı, 38° 39.354' N 36° 26.910' E, 22.VI.2008, M. Özuluğ & J. Freyhof, FSJF 954 (in 96 % alcohol). – (4) Fin clip from FSJF 2633, Turkey: upper Göksu Nehri, 5 km northeast of Gölbaşı, 37° 50.217' N 37° 41.088' E, 18.VI.2008, M. Özuluğ & J. Freyhof, FSJF 897 (in 96 % alcohol). – (5) 9, 57.04-164.44 mm SL, Turkey: upper Göksu Nehri, 5 km northeast of Gölbaşı, 37° 50.217' N 37° 41.088' E, 18.VI.2008, M. Özuluğ & J. Freyhof, FSJF 2633. – (6) Fin clip from FSJF 2571, Turkey: Nehir Çelik at road south of Gölbaşi, Adiyaman, 37° 37.433' N 37° 30.206' E, 20.VI.2008, M. Özuluğ & J. Freyhof, FSJF 935 (in 96 % alcohol). – (7) 9, 93.86-154.99 mm SL, Turkey: Nehir Çelik at road south of Gölbaşi, Adiyaman, 37° 37.433' N 37° 30.206' E, 20.VI.2008, M. Özuluğ & J. Freyhof, FSJF 2571. – (8) Fin clip from FSJF 2367, Turkey: Pozantı Nehir between Ulukışla and Pozantı, about 1 km east of Çiftehan, 37° 30.429' N 34° 47.422' E, 06.XI.2007, M. Özuluğ & J. Freyhof, FSJF 376 (in 96 % alcohol). – (9) 17, 75.42-167.22 mm SL, Turkey: Pozantı Nehir between Ulukışla and Pozantı, about 1 km east of Çiftehan, 37° 30.429' N 34° 47.422' E, 06.XI.2007, M. Özuluğ & J. Freyhof, FSJF 2367. – (10) 2, 132.58-142.54 mm SL, Turkey: upper reaches of Great Zab River (Zap suyu), southeastern Turkey, V. Pietschmann, NMW 90534. – (11) Fin clips, Turkey: a tributary to Ceyhan Nehri, between Tecirli and Kadirli north of Koçyurdu, 37° 13.290' N 36° 02.825' E, 29.IX.2009, M. Özuluğ & J. Freyhof, specimens identified by J. Freyhof, FSJF 1471 (in 96 % alcohol). – (12) 2, 135.33-139.15 mm SL, Turkey: Çatkıt Suyu (Çatkıt stream), south of Salbaş, the lower part of Pozantı Nehir, Adana, 37° 05.767' N 35° 07.019' E, 6.XI.2007, M. Özuluğ & J. Freyhof, FSJF 2330. – (13) 2, 67.29-75.29 mm SL, Turkey: Euphrates River (Firat), at Birecik, L. Lortet, SMF 38. – (14) 5, 100.01-146.25 mm SL, Turkey: Adana, Th. Kotschy, NMW 55846. – (15) 1, 38.49 mm SL, Turkey: northern slope of mountain, 4 km of Misis, 37° 00' N 35° 38' E, 15.IX.1982, R. Kinzelbach, station number 82/20 THD/SFB 19, SMF uncatalogued. – (16) 9, 87.93-158.66 mm SL, Turkey: Karasu Çayi below Tahtaköprü Dam, Gaziantep province, 36° 51.119' N 36° 41.165' E, 07.XI.2007, M. Özuluğ & J. Freyhof, FSJF 2352. – (17) 2, 270.56-282.32 mm SL, Turkey: 5 hours east of Urfa, wadi at Tektek Dağlari (Tektek Mountain), V. Pietschmann, NMW 91070. – (18) 2, bent specimen-144.50 mm SL, Iraq: Nahr Rawanduz, Razanok, Kurdistan, presented by W. Macfayden, BMNH 1934.9.5.1-2. – (19) 1, bent specimen, Syria: Jerablus at Euphrates, V. Pietschmann, NMW 91077. – (20) Fin clip from FSJF 2275, Turkey: İncesu spring at Hassa, 36° 47.593' N 36° 30.824' E, 07.XI.2007, M. Özuluğ & J. Freyhof, specimen identified by J. Freyhof, FSJF 355 (in 96 % alcohol). – (21) 4, 106.00-114.52 mm SL, Turkey: Hupnik Çayi, 31 km north-

northeast of Kirikhan, on the way to Islahiye, 36° 46' N 36° 30' E, 22.IX.1982, R. Kinzelbach, SMF 24479. – (22) 2, 49.81-53.40 mm SL, Turkey: Hupnik Çayi, 31 km north-northeast of Kirikhan, on the way to Islahiye, 36° 46' N 36° 30' E, 22.IX.1982, R. Kinzelbach, SMF uncatalogued (station number 82/42). – (23) 3, 85.30-111.43 mm SL, Syria: Nahr Afrin, 36° 31' N 36° 52' E, 19.III.1979, F. Krupp, SMF 17317. – (24) 4, 104.66-119.63 mm SL, Syria: Nahr Afrin, 36° 31' N 36° 52' E, 18.VIII.1980, F. Krupp & W. Schneider, SMF 17365. – (25) Fin clip from FSJF 2341, Turkey: Arsuz Nehri (Arsuz stream), east of Arsuz, 36° 23.950' N 35° 53.158' E 07.XI.2007, M. Özuluğ & J. Freyhof, FSJF292 (in 96 % alcohol). – (26) 10, 97.42-122.13 mm SL, Turkey: Arsuz Nehri (stream), east of Arsuz, 36° 23.950' N 35° 53.158' E, 07.XI.2007, M. Özuluğ & J. Freyhof, FSJF 2341. – (27) 4, 99.22-104.35 mm SL, Turkey: Arsuz, Th. Kotschy, NMW 51833. – (28) 3, 105.41-158.64 mm SL, Turkey: Arsuz, Th. Kotschy, NMW 51647. – (29) 1, 111.61 mm SL, Turkey: Arsuz, Th. Kotschy, NMW 51646. – (30) 1, 74.41 mm SL, Syria: Nahr al-Khabur at Nahab, 28.IX.1988, F. Krupp, D. Kock & G. Eppler, SMF 31335. – (31) 1, 119.48 mm SL, Turkey: Amik Gölü, 14.XI.1881, E. Chantre, MNHN 1881-999. – (32) 6, 112.80-144.68 mm SL, Turkey: Amik Gölü, 1930, W. Besnard, MNHN 1977-250. – (33) 5, 84.06-175.64 mm SL, Turkey: Amik Gölü, 1930, Gruvel, MNHN 1977-302. – (34) 1, 370.47 mm SL, Turkey: Amik Gölü, V. Pietschmann, NMW 91079. – (35) 1, 209.10 mm SL, Turkey: Amik Gölü, 36° 22' N 36° 17' E, L. Lortet, SMF 820. – (36) 2, 128.59-133.32 mm SL, Turkey: a canal at Orontes, Antioch, MNHN B-2897. – (37) Fin clip from FSJF 2436, Turkey: Nehir Yıldırım at Serinyol, 36° 21.971' N 36° 10.868' E, 08.XI.2007, M. Özuluğ & J. Freyhof, specimen identified by J. Freyhof, FSJF 299 (in 96 % alcohol).– (38) 7, 84.08-168.00 mm SL, Turkey: west of Antakya, 36° 14' N 36° 06' E, 17.III.1979, F. Krupp, SMF 17316. – (39) 3, 54.87-60.66 mm SL, Turkey: tributary of Orontes, 8 km southwest of Antakya, 36° 11' N 36° 03' E, 23.VIII.1978, F. Krupp, SMF 17312. – (40) Pharyngeal teeth of *V. damascinus*, Syria: Aleppo, E. Chantre, MNHN BD-52. – (41) 2, 125.21-163.42 mm SL, Syria: Nahr Quwayq, Aleppo, 36° 12' N 37° 10' E, ex NMW 1863 (an exchange specimen from NMW), MNHN 1629. – (42) 1, 135.36 mm SL, Syria: Aleppo, MNHN 1631. – (43) 1, 165.74 mm SL, Syria: Aleppo, Th. Kotschy, NMW 51650. – (44) 1, 169.73 mm SL, Syria: Aleppo, Th. Kotschy, NMW 51831. – (45) 1, 234.83 mm SL, Syria: Aleppo, 36° 12' N 37° 10' E, Th. Kotschy, NMW 55845. – (46) 1, 263.05 mm SL, Syria: Nahr Quwayq in Aleppo, 36° 12' N 37° 10' E, Th. Kotschy, NMW 55853. – (47) 2, 167.84-199.61 mm SL, Syria: Aleppo, Th. Kotschy, NMW 55855. – (48) 1, ca. 401 mm SL, Syria: Nahr Quwayq in Aleppo, 36° 08.400' N 37° 06.000' E, 1910, V. Pietschmann, NMW 91081. – (49) 1, 176.25 mm SL, Syria: Nahr Quereiz in Aleppo, 36° 08.400' N 37° 6.000' E, 1910, V. Pietschmann, NMW 91105. – (50) 7, 65.41-121.29 mm SL, Turkey: Büyük Karaçay at Karaçay, 36° 08.127' N 36° 02.533 'E, 08.XI.2007, M. Özuluğ & J. Freyhof, FSJF 2301. – (51) 1, 108.59 mm SL, Turkey: Orontes, southeast of Samandağ, 36° 06' N 35° 58' E, 23.VIII.1978, F. Krupp, SMF 17311. – (52) 1, 215.18 mm SL, Iraq: Mosul, Tigris, BMNH 1974.2.22.1356. – (53) 3, 128.23-145.78 mm SL, Syria: Orontes, Jisr ash-Shughur, 35° 48' N 36° 19' E, 21.III.1979, F. Krupp, SMF 17321. – (54) 2, ca. 224-ca. 300 mm SL (bent specimens), Syria: Orontes at Jisr ash-Shughur, main bridge, 35° 48' N 36° 19' E, 21.III.1979, R. Kinzelbach, SMF uncatalogued (station number 79/71). – (55) 1, 43.26 mm SL, Syria: an-Nahr al- Kabir (N) at al-Qastal village, 35° 44.267' N 36° 06.235' E, 08.X.2008, N. Alwan, K. Borkenhagen, J. Freyhof & F. Wicker, SMF 31034 (in 96 % alcohol). – (56) 43, 78.34-181.24 mm SL, Syria: an-Nahr al-Kabir (N) at al-Qastal village, 35° 44.267' N 36° 06.235' E, 08.X.2008, N. Alwan, K. Borkenhagen, J. Freyhof & F. Wicker, SMF uncatalogued (SYR08/06). – (57) 1, 139.74 mm SL, Syria: a tributary to an-Nahr al- Kabir (N), 35° 40' N 36° 01' E, 05.III.1979, F. Krupp, SMF 17313. – (58) 1, 50.80 mm SL, Syria: an-Nahr al-Kabir (N) at as-Safkun, 35° 39.360' N 35° 59.835' E, 08.X.2008, N. Alwan, K. Borkenhagen, J. Freyhof & F. Wicker, SMF 31044 (in 96 % alcohol). – (59) 6, 113.09-181.41 mm SL, Syria: an-Nahr al-Kabir (N) at as-Safkun, 35° 39.360' N 35° 59.835' E, 08.X.2008, N. Alwan, K. Borkenhagen, J. Freyhof & F. Wicker, SMF uncatalogued (SYR08/07). – (60) 1, 82.89 mm SL, Syria: an-Nahr al-Kabir, 35° 34' N 35° 53' E, 20.VIII.1978, F. Krupp, SMF 17310. – (61) 17, 66.06-177.90 mm SL, Syria: Nahr Sanawbar near Lattakia, 35° 28.167' N 35° 53.215' E, 09.X.2008, N. Alwan, K. Borkenhagen, J. Freyhof & F. Wicker, SMF uncatalogued (SYR08/09). – (62) 1, 249.40 mm SL, Syria: Nahr Sanawbar (upstream), 35° 28.272' N 35° 53.327' E, 09.X.2008, N. Alwan, K. Borkenhagen, J. Freyhof & F. Wicker, SMF uncatalogued (SYR08/10). – (63) 2, 59.88-63.43 mm SL, Syria: Nahr al-Fawwar, 35° 20' N 36° 18' E, 30.III.1979, F. Krupp, SMF 17319. – (64) 4, 50.03-97.42 mm SL, Syria: Wadi Abu Qubais, 35° 15' N 36° 21' E, 31.III.1979, F. Krupp, SMF 17320. – (65) 5, 61.60-74.28 mm SL, Syria: Nahr as-Sarout, 35° 12' N 36° 37' E, 25.III.1979, F. Krupp, SMF 17318. – (66) 1, 119.63 mm SL, Syria: Orontes, Hamah, MNHN A-3897. – (67) 4, 43.40-52.25 mm SL, Syria: Nahr Marqiyah at Nab Hassana, 35° 02' N 35° 55' E, 12.VIII.1980, F. Krupp & W. Schneider, SMF 17355. – (68) 1, 40.01 mm SL, Syria: Nahr Marqiyah, 35° 01.828' N 35° 54.298' E, 10.X.2008, N. Alwan, K. Borkenhagen, J. Freyhof & F. Wicker, SMF 31047 (in 96 % alcohol). – (69) 1, 38.58 mm SL, Syria: Nahr Marqiyah, 35° 01.828' N 35° 54.298' E, 10.X.2008, N. Alwan, K. Borkenhagen, J. Freyhof & F. Wicker, SMF 31049 (in 96 % alcohol). – (70) 17, 118.15-199.73 mm SL, Syria: Nahr Marqiyah, 35° 01.828' N 35° 54.298' E, 10.X.2008, N. Alwan, K. Borkenhagen, J. Freyhof & F. Wicker, SMF uncatalogued (SYR08/13). – (71) 1, 29.85 mm SL, Syria: Abu Noah headwater/Nahr Azak, 34° 57.617' N 35° 58.545' E, 10.X.2008, N. Alwan, K. Borkenhagen, J. Freyhof & F. Wicker, SMF 31050 (in 96 % alcohol). – (72) 1, 123.63 mm SL, Syria: Abu Noah spring, 34° 56.608' N 35° 53.047' E, 10.X.2008, N. Alwan, K. Borkenhagen, J. Freyhof & F. Wicker, SMF 31040 (fin clip in 96 % alcohol). – (73) 1, 66.35 mm SL, Lebanon: an-Nahr al-Kabir (S), 34° 40' N 36° 18' E, 11.VIII.1980, F. Krupp & W.

Schneider, SMF 17353.– (74) 5, 108.32-326.26 mm SL, Syria: Orontes, Homs, H. Gadeau de Kerville, MNHN 1910-27-MNHN 1910-31. – (75) 1, 194.48 mm SL, Syria: Bahrat Homs (Lake Qattinah), 34° 39.722' N 36° 37.10' E, 13.X.2008, N. Alwan, K. Borkenhagen, J. Freyhof & F. Wicker, SMF 31029 (fin clip in 96 % alcohol). – (76) Fin clip from SYR08/25, Syria: Bahrat Homs, 34° 39.722' N 36° 37.10' E, 13.X.2008, N. Alwan, K. Borkenhagen, J. Freyhof & F. Wicker, SMF 31031 (in 96 % alcohol). – (77) 1, 192.12 mm SL, Syria: Bahrat Homs, 34° 39.722' N 36° 37.100' E, 13.X.2008, N. Alwan, K. Borkenhagen, J. Freyhof & F. Wicker, SMF 31039 (fin clip in 96 % alcohol). – (78) 12, 94.27-200.78 mm SL, Syria: Bahrat Homs, 34° 39.722' N 36° 37.100' E, 13.X.2008, N. Alwan, K. Borkenhagen, J. Freyhof & F. Wicker, SMF uncatalogued (SYR08/25). – (79) 1, 50.40 mm SL, Syria: Orontes at al-Ghassaniyah village, 34° 35.978' N 36° 32.02' E, 13.X.2008, N. Alwan, K. Borkenhagen, J. Freyhof & F. Wicker, SMF 31037 (in 96 % alcohol). – (80) 2, 32.47-45.80 mm SL, Syria: Orontes at al-Qusayr village, 34° 30.515' N 36° 32.340' E, 13.X.2008, N. Alwan, K. Borkenhagen, J. Freyhof & F. Wicker, SMF 31032-31033 (in 96 % alcohol). – (81) 3, 34.43-142.80 mm SL, Syria: Orontes at al-Qusayr village, 34° 30.515' N 36° 32.340' E, 13.X.2008, N. Alwan, K. Borkenhagen, J. Freyhof & F. Wicker, SMF uncatalogued (SYR8/27). – (82) 1, 39.27 mm SL, Lebanon: Ain az-Zarqa, 34° 21' N 36° 21' E, 06.VIII.1980, F. Krupp & W. Schneider, SMF 17335. – (83) 9, 112.69-ca. 222 mm SL, Lebanon: Nahr Abu Ali at Sirʿil (Sera'al), 34° 16.982' N 35° 55.729' E, 19.VIII.2008, M. Abdel Sater, N. Alwan & M. Bariche, AUBM OS3666. – (84) 1, 55.68 mm SL, Lebanon: Nahr Abu Ali at Sirʿil (Sera'al), 34° 16.982' N 35° 55.729' E, 19.VIII.2008, M. Abdel Sater, N. Alwan & M. Bariche, SMF 30983 (in 96 % alcohol). – (85) 1, 28.35 mm SL, Lebanon: Nahr Abu Ali at Sirʿil (Sera'al), 34° 16.982' N 35° 55.729' E, 19.VIII.2008, M. Abdel Sater, N. Alwan & M. Bariche, SMF 30984 (in 96 % alcohol). – (86) 9, 102.33-115.39 mm SL, Lebanon: Nahr Ibrahim at Shwan (Showwan), 34° 04.916' N 35° 47.100' E, 20.VIII.2008, M. Abdel Sater, N. Alwan & M. Bariche, AUBM OS3668. – (87) 1, 63.27 mm SL, Lebanon: Nahr Ibrahim at Shwan, 34° 04.916' N 35° 47.100' E, 20.VIII.2008, M. Abdel Sater, N. Alwan & M. Bariche, SMF 31011 (in 96 % alcohol). – (88) 1, ca. 77 mm SL, Lebanon: Nahr Ibrahim at Shwan, 34° 04.916' N 35° 47.100' E, 20.VIII.2008, M. Abdel Sater, N. Alwan & M. Bariche, SMF 31012 (in 96 % alcohol). – (89) 1, ca. 226 mm SL (bent specimen), Lebanon: Nahr Ibrahim at Shwan Dam, 34° 04.819' N 35° 47.005' E, 20.X.2007, M. Bariche, AUBM OS3639. – (90) 1, 92.17 mm SL, Lebanon: Nahr Ibrahim at Jannet Qartaba, 20.VIII.2000, M. Bariche, AUBM OS3631. – (91) 12, 96.64-128.91 mm SL, Lebanon: irrigation pond in al-Hadath (Hadath Ba'labakk), Litani, 33° 58.627' N 36° 04.780' E, 28.X.2007, M. Bariche, AUBM OS3589. – (92) 1, 32.55 mm SL, Lebanon: Nahr al-Kalb estuary, 33° 57.303' N 35° 36.005' E, 11.VI.2008, M. Bariche, AUBM OS3720 (in 96 % alcohol). – (93) 5, 120.73-216.74 mm SL, Lebanon: Nahr al-Kalb at magharat Jeita (J'ita/Jeita Grotto) below the cave, 33° 56.340' N 35° 39.092' E, 16.VIII.2008, M.

Abdel Sater & N. Alwan, AUBM OS3651. – (94) 1, 36.06 mm SL, Lebanon: Nahr al-Kalb at magharat Jeita (J'ita/Jeita Grotto) below the cave, 33° 56.340' N 35° 39.092' E, 16.VIII.2008, M. Abdel Sater & N. Alwan, SMF 30991 (in 96 % alcohol). – (95) 2, 187.30-228.34 mm SL, Lebanon: Nahr al-Kalb, purchased by Rev. H. B. Tristam, BMNH 1864.8.23.56-57. – (96) 2, 179.77-132.21 mm SL, Lebanon: Nahr Antelias at Antelias, 18.X.1958, H. Kaladjian, AUBM OS3628. – (97) 27, 93.20-211.05 mm SL, Lebanon: Nahr Antelias at Antelias, 33° 54.748' N 35° 35.760' E, 16.VIII.2008, M. Abdel Sater & N. Alwan, AUBM OS3653. – (98) 1, 38.66 mm SL, Lebanon: Nahr Antelias River at Antelias, 33° 54.748' N 35° 35.760' E, 16.VIII.2008, M. Abdel Sater & N. Alwan, SMF 30987 (in 96 % alcohol). – (99) 8, 124.89-172.75 mm SL, Lebanon: about 1 km from the sea (freshwater), Beirut, 12.XI.1958, H. Kaladjian, AUBM OS3635. – (100) 6, 89.04-103.56 mm SL, Lebanon: river in Beirut, IX.1879, Plason 2, NMW 55856. – (101) 1, 48.91 mm SL, Lebanon: Nahr Beirut at Qanatir Zubaydah, al-Hazimiyah, 33° 50.781' N 35° 30.503' E, 19.VIII.2008, M. Abdel Sater, N. Alwan & M. Bariche, SMF 30981 (in 96 % alcohol). – (102) 1, 51.98 mm SL, Lebanon: Nahr Beirut at Qanatir Zubaydah, al-Hazimiyah, 33° 50.781' N 35° 30.503' E, 19.VIII.2008, M. Abdel Sater, N. Alwan & M. Bariche, SMF 30982 (in 96 % alcohol). – (103) 2, 111.41-117.49 mm SL, Lebanon: Anjar, Litani, 33° 44.156' N 35° 56.833' E, M. Bariche, 02.XI.2007, AUBM OS3564. – (104) Fin clip from AUBM OS3682, Lebanon: Ammiq marsh, 33° 43.913' N 35° 47.083' E, 27.VI.2008, M. Bariche, AUBM OS3682 (in 95 % alcohol). – (105) 11, 94.32-148.92 mm SL, Lebanon: Nahr Kafr Matta at Jisr al-Kadi, 33° 43.297' N 35° 33.474' E, 17.VIII.2008, M. Abdel Sater, N. Alwan & M. Bariche, AUBM OS3655. – (106) 1, 86.40 mm SL, Lebanon: Nahr Kafr Matta at Jisr al-Kadi, 33° 43.297' N 35° 33.474' E, 17.VIII.2008, M. Abdel Sater, N. Alwan & M. Bariche, SMF 30994 (in 96 % alcohol). – (107) 1, 83.91 mm SL, Lebanon: Nahr Kafr Matta at Jisr al-Kadi, 33° 43.297' N 35° 33.474' E, 17.VIII.2008, M. Abdel Sater, N. Alwan & M. Bariche, SMF 30995 (in 96 % alcohol). – (108) 2, 59.93-105.31 mm SL, Lebanon: mouth ad-Damur, Nahr ad-Damur, 18.VIII.1962, George et al., AUBM OS3647. – (109) 2, 65.74-126.81 mm SL, Lebanon: Ammiq, tall al-Ashkar, 33° 42.237' N 35° 48.708' E, M. Bariche, 08.VI.2008, AUBM OS3674. – (110) 38, 24.52-81.16 mm SL, Lebanon: Nahr ad-Damur at Bayt ad-Din, 07.VIII.1962, Lewis & George, AUBM OS3638. – (111) 19, 62.66-155.09 mm SL, Syria: spring of Nahr Barada/canal near Barada source, 33° 40.518' N 36° 03.330' E, 14.X.2008, N. Alwan, K. Borkenhagen, J. Freyhof & F. Wicker, SMF uncatalogued (SYR08/29). – (112) 2, 36.67-37.79 mm SL, Syria: spring of Nahr Barada/canal near Barada source, 33° 40.518' N 36° 03.330' E, 14.X.2008, N. Alwan, K. Borkenhagen, J. Freyhof & F. Wicker, SMF 31054-31056 (in 96 % alcohol). – (113) 1, 216.82 mm SL, Syria: at-Takiya, Barada Valley, 33° 37' N 36° 05' E, 13.V.1989, F. Krupp & H. Tayeb, SMF 23685. – (114) 1, 59.30 mm SL, Lebanon: Nahr al-Awwali below the bridge, 33° 35.288' N 35° 23.630' E, 18.VIII.2008, M. Abdel Sater, N. Alwan & M. Bariche, SMF 30992 (in

96 % alcohol). – (115) 1, 56.00 mm SL, Lebanon: Nahr Bisri leading to Nahr al-Awwali, 33° 34.823' N 35° 32.126' E, 21.VIII.2008, M. Abdel Sater, N. Alwan & M. Bariche, SMF 30985 (in 96 % alcohol). – (116) 1, 41.02 mm SL, Syria: Judaidat al-Wadi, Barada Valley, 33° 34' N 36° 11' E, 13.V.1989, F. Krupp & H. Tayeb, SMF 23693. – (117) 2, 236.25-279.80 mm SL, Syria: Dummar near Damascus, H. Gadeau de Kerville, MNHN 1910-81-MNHN 1910-82. – (118) 3, 108.22-117.88 mm SL, Syria: Damascus, NMW 55840. – (119) 3, 120.55-151.62 mm SL Syria: Damascus, NMW 55841. – (120) 5, 137.07-204.58 mm SL, Syria: Damascus, NMW 55842. – (121) 3, 81.30-91.39 mm SL, Syria: Damascus, 33° 30' N 36° 18' E, L. Lortet, SMF 542. – (122) 6, 89.15-135.12 mm SL, Syria: Nahr Barada at Damascus, 22.I.1985, W. C. Beckman, BMNH 1968.12.13.405-416. – (123) 1, 80.98 mm SL, Syria: Nahr Meissatoun, west of Damascus, 22.I.1985, W. C. Beckman, BMNH 1968.12.13.417-422. – (124) 3, 185.86-308.28 mm SL, Syria: Ararhta near Damascus, H. Gadeau de Kerville, MNHN 1910-83-MNHN 1910-85. – (125) 4, 132.74-135.83 mm SL, Syria: near Damascus, alt. 650-700 m (most probably Nahr Barada), H. Gadeau de Kerville, MNHN 1910-87-MNHN 1910-90. – (126) 5, 128.40-140.47 mm SL, Syria: near Damascus, alt. 650-700 m (most probably Nahr Barada), H. Gadeau de Kerville, MNHN 1910-91-MNHN 1910-95. – (127) 4, 118.92-245.60 mm SL, Syria: Bayt-ranies near Damascus at alt. 650-700 m, H. Gadeau de Kerville, MNHN 1910-96-MNHN 1910-99. – (128) 12, 96.81-154.41 mm SL, Lebanon: al-Hasbani, next to al-Hasbani spring, 33° 24.524' N 35° 40.293' E, 17.III.2008, M. Bariche, AUBM OS3534. – (129) 1, 30.88 mm SL, Lebanon: al-Hasbani, next to al-Hasbani spring, 33° 24.524' N 35° 40.293' E, 17.III.2008, M. Bariche, AUBM OS3724 (in 96 % alcohol). – (130) 1, 90.26 mm SL, Iraq: Baghdad, BMNH 1974.2.22.1360. – (131) 2, 69.69-92.66 mm SL, Iraq: Tigris-Euphrates with no exact locality, BMNH 1974.2.22.1354-1355. – (132) 11, 35.58-ca. 125 mm SL, Lebanon: Tayr Felsbeh, Litani, 33° 19.147' N 35° 20.667' E, 29.III.2008, M. Bariche, AUBM OS3591. – (133) 16, 34.65-96.85 mm SL, Lebanon: Nahr al- Qasimiyah, 33° 19.207' N 35° 17.291' E, 18.VIII.2008, M. Abdel Sater, N. Alwan & M. Bariche, AUBM OS3661. – (134) 1, 54.76 mm SL, Lebanon: Tayr Felsbeh, 33° 19.147' N 35° 20.667' E, 27.III.2008, M. Bariche, AUBM OS3721 (in 96 % alcohol). – (135) 1, 38.33 mm SL, Lebanon: Nahr al-Qasimiyah, 33° 19.207' N 35° 17.291' E, 18.VIII.2008, M. Abdel Sater, N. Alwan & M. Bariche, SMF 30990 (in 96 % alcohol). – (136) 1, 194.01 mm SL, Syria: Nahr al-Tammasiyyat near al-Maqsufa, 33° 17.611' N 35° 58.240' E, 15.X.2008, N. Alwan, K. Borkenhagen, Jörg Freyhof & F. Wicker, SMF 31038 (fin clip in 96 % alcohol). – (137) 2, 132.34-137.13 mm SL, sources of Jordan, Th. Kotschy, NMW 51668. – (138) 1, 189.48 mm SL, Palestine: Hula Emeq, presented by R. Washboum, BMNH 1936.4.6.17-19. – (139) 2, 182.55-206.15 mm SL, Palestine: Lake Tiberias, purchased from Rev. H. B. Tristam, BMNH 1864.8.20.22-24. – (140) 1, 207.55 mm SL, Palestine: Lake Tiberias, presented by A. Bennett, BMNH 1938.11.1.6. – (141) 1, 171.72 mm SL, Palestine: Lake Tiberias, presented by A. Bennett, BMNH

1938.11.1.7. – (142) 4, 182.69-214.65 mm SL, Palestine: Lake Tiberias, presented by R. Bertram, BMNH 1949.9.16.135-138. – (143) 1, 185.25 mm SL, Palestine: Lake Tiberias, NMW 55898. – (144) 1, 292.92 mm SL, Palestine: Lake Tiberias, NMW 78559. – (145) 2, 182.22-197.84 mm SL, Palestine: Lake Tiberias, NMW 79636. – (146) 1, 46.51 mm SL, Jordan: Nahr al-Yarmuk at Wadi Jallayn, 32° 44.347' N 35° 58.933' E, 16.X.2008, N. Alwan, K. Borkenhagen, J. Freyhof & F. Wicker, SMF 31059 (in 96 % alcohol). – (147) 10, 92.31-206.47 mm SL, Jordan: Nahr al-Yarmuk at Wadi Jallayn, 32° 44.347' N 35° 58.933' E, 16.X.2008, N. Alwan, K. Borkenhagen, J. Freyhof & F. Wicker, SMF uncatalogued (SYR08/33). – (148) 3, ca. 69-ca. 76 mm SL, Jordan: Wadi al-Arab, 32° 36' N 35° 37' E, 29.XI.1980, F. Krupp & W. Schneider, SMF 17370. – (149) 1, 105.62 mm SL, Jordan: Wadi al-Yabis, 32° 24' N 35° 36' E, 23.VII.1980, F. Krupp & W. Schneider, SMF 17346. – (150) 2, ca. 253-ca. 289 mm SL, Palestine: Jordan River, presented by R. Bertram, BMNH 1949.9.16.160-161. – (151) 1, ca. 204 mm SL, Jordan: Wadi Kufringa, 32° 18.288' N 35° 41.2.00' E, 25.X.2008, N. Alwan, K. Borkenhagen & F. Wicker, SMF 31043. – (152) 2, 98.30-137.87 mm SL, Jordan: Wadi Kufringa, 32° 18.288' N 35° 41.2.00' E, 25.X.2008, N. Alwan, K. Borkenhagen & F. Wicker, SMF uncatalogued (SYR08/45). – (153) 4, 55.99-70.07 mm SL, Jordan: Nahr az-Zarqa, Amman bridge-Garas road, 32° 13' N 35° 53' E, 22.VII.1980, F. Krupp & W. Schneider, SMF 17342. – (154) 1, 44.66 mm SL, Jordan: Nahr az-Zarqa, 32° 13' N 35° 53' E, 26.XI.1980, F. Krupp & W. Schneider, SMF 17368. – (155) 1, 48.29 mm SL, Jordan: Wadi at-Tawahin, 32° 13' N 35° 53' E, 22.VII.1980, F. Krupp & W. Schneider, SMF 17343. – (156) 1, 101.60 mm SL, Jordan: Wadi at-Tawahin, 32° 13' N 35° 53' E, 26.XI.1980, F. Krupp & W. Schneider, SMF 17369. – (157) 1, 46.00 mm SL, Jordan: Nahr az-Zarqa, 32° 12' N 35° 50' E, 22.VII.1980, F. Krupp & W. Schneider, SMF 17344. – (158) 1, 55.53 mm SL, Jordan: Nahr az-Zarqa (a tributary to Jordan River), 32° 11' N 35° 49' E, 13.III.1977, F. Krupp, SMF 14011. – (159) 20, 40.68-68.98 mm SL, Jordan: Nahr az-Zarqa, 32° 10' N 35° 37' E, 21.VII.1980, F. Krupp & W. Schneider, SMF 17339. – (160) 5, 57.88-107.28 mm SL, Jordan: Nahr az-Zarqa, 32° 10' N 35° 37' E, 21.VII.1980, F. Krupp & W. Schneider, SMF 24213. – (161) 1, 56.24 mm SL, Jordan: al-Yarmuk canal, 32° 10' N 35° 37' E, 23.VII.1980, F. Krupp & W. Schneider, SMF 17345. – (162) 1, 51.05 mm SL, Jordan: al-Yarmuk canal, 32° 08' N 35° 36' E, 21.VII.1980, F. Krupp & W. Schneider, SMF 17338. – (163) 1, 138.56 mm SL, Jordan: Ar-Rumaimin, 32° 07' N 35° 48' E, 11.III.1980, F. Krupp & W. Schneider, SMF 17324. – (164) 1, 37.70 mm SL, Jordan: small stream at Wadi Shuayb, 31° 56.205' N 35° 40.003' E, 18.X.2008, N. Alwan, K. Borkenhagen, J. Freyhof & F. Wicker, SMF 31028 (in 96 % alcohol). – (165) 4, 92.25-ca. 204 mm SL, Jordan: small stream at Wadi Shuayb, 31° 56.205' N 35° 40.003' E, 18.X.2008, N. Alwan, K. Borkenhagen, J. Freyhof & F. Wicker, SMF uncatalogued (SYR08/38). – (166) 8, 42.33-70.77 mm SL, Jordan: Wadi Shuayb, 31° 54' N 35° 39' E, 21.VII.1980, F. Krupp & W. Schneider, SMF 17340. – (167) 10, 50.07-74.74 mm SL, Jordan: Wadi

Shuayb, 31° 54' N 35° 39' E, 30.VII.1980, F. Krupp & W. Schneider, SMF 24214. – (168) 1, 145.17 mm SL, Israel (occupied areas): Vasi Auja, near Jericho, 30.XI.1972, NMW 91055. – (169) 4, 94.86-103.47 mm SL, Jordan: Dead Sea, purchased from Rev. H. B. Tristam, BMNH 1864.8.23.110-118. – (170) 1, 116.46 mm SL, Jordan: Dead Sea, E. Riebeck, NMW 55844. – (171) 10, 48.54-85.51 mm SL, Jordan: Wadi al-Kafrain, 31° 52' N 35° 47' E, 21.VII.1980, F. Krupp & W. Schneider, SMF 17337. – (172) 7, 50.65-70.94 mm SL, Jordan: Wadi al-Kafrain, 31° 52' N 35° 47' E, 21.VII.1980, F. Krupp & W. Schneider, SMF 24211. – (173) 2, 127.88-150.75 mm SL, Jordan: Wadi Zarqa, Mapar, east of Dead Sea, 31° 37' N 35° 38' E, W. Adams, BMNH 1909.7.17.1-2. – (174) 3, 49.19-64.53 mm SL, Jordan: Wadi al-Haidan, 31° 33' N 35° 46' E, 01.VIII.1980, F. Krupp & W. Schneider, SMF 24475. – (175) 16, 59.35-ca. 123 mm SL, Jordan: Wadi al-Mawjib, 31° 27' N 35° 49' E, 13.III.1977, F. Krupp, SMF 14026. – (176) 11, 43.15-64.42 mm SL, Jordan: Wadi al-Mawjib, 31° 27' N 35° 45' E, 02.VIII.1980, F. Krupp & W. Schneider, SMF 17349. – (177) 3, 38.63-58.35 mm SL, Jordan: Wadi al-Mawjib, 1 km from station 80/504, 31° 27' N 35° 49' E, 22.II.1980, F. Krupp & W. Schneider, SMF 24212. – (178) 3, 137.46-ca. 165 mm SL, Jordan: Wadi al-Mawjib, east of Dead Sea, W. Adams, BMNH 1909.7.17.3-5. – (179) 1, 62.03 mm SL, Jordan: Wadi al-Mawjib near the dam, 31° 26.79' N 35° 48.963' E, 24.X.2008, N. Alwan, K. Borkenhagen & F. Wicker, SMF 31061 (in 96 % alcohol). – (180) 10, 144.65-200.57 mm SL, Jordan: Wadi al-Mawjib near the dam, 31° 26.79' N 35° 48.963' E, 24.X.2008, N. Alwan, K. Borkenhagen & F. Wicker, SMF uncatalogued (SYR08/43). – (181) 5, 67.98-97.19 mm SL, Jordan: Wadi al-Karak, 31° 12' N 35° 40' E, 21.II.1980, F. Krupp & W. Schneider, SMF 17323. – (182) 5, 60.15-73.73 mm SL, Jordan: Wadi al-Karak, 31° 12' N 35° 40' E, 02.VIII.1980, F. Krupp & W. Schneider, SMF 24215. – (183) 2, 85.52-101.48 mm SL, Jordan: Wadi al-Karak, 3 km northwest Al-Karak, 31° 12' N 35° 40' E, 08.XII.1980, F. Krupp & W. Schneider, SMF 24476. – (184) 3, 112.76-123.86 mm SL, Jordan: Arava (a tributary to the Dead Sea), NMW 57151. – (185) 1, 30.94 mm SL, Jordan: tributary to Wadi al-Hasa, 30° 59' N 35° 34' E, 2.VIII.1980, F. Krupp & W. Schneider, SMF 17350. – (186) 1, ca. 48 mm SL, Jordan: Wadi Hasa, 30° 59.015' N 35° 40.228' E, 19.X.2008, N. Alwan, K. Borkenhagen, J. Freyhof & F. Wicker, SMF 31036 (in 96 % alcohol). – (187) 1, 109.75 mm SL, Jordan: Wadi Hasa, 30° 59.015' N 35° 40.228' E, 19.X.2008, N. Alwan, K. Borkenhagen, J. Freyhof & F. Wicker, SMF uncatalogued (SYR08/42). – (188) 2, 69.17-74.63 mm SL, Jordan: Dead Sea, Wadi al-Hasa, 06.III.1977, F. Krupp, SMF 14009. – (189) 6, 42.25-165.11 mm SL, Jordan: Wadi Araba drainage, Wadi al-Hasa, 2 km below its crossing with the King's highway, 03.VIII.1980, F. Krupp & W. Schneider, SMF uncatalogued (station number 601).

3.2.2.1. Diagnosis

Capoeta damascina is distinguished from all other *Capoeta* species by the following combination of characters: 7-11 branched dorsal-fin rays (modally 9); last unbranched dorsal-fin ray weakly to moderately ossified and serrated in 1/3-3/4 of its length; 6-11 total pelvic-fin rays (modally 10-11); small scales, 11-20 above the lateral line (modally 14-15), 7.5-14.5 below the lateral line (modally 9.5-10.5), 23-34 (modally 27) encircling least circumference of caudal peduncle, 61-91 scales in the lateral-line series (usually 68-82); 12-18 gill rakers on lower limb of first gill arch (modally 14-15); 43-48 total vertebrae; one posterior pair of barbels (rarely one posterior pair present with one/two anterior barbels); very dark grey-golden to greenish, olive-brown or silvery-grey body coloration in life; absence of black spots in adult specimens.

3.2.2.2. Description

The habitus of *C. damascina* is shown in Figures 5-6. Morphometric measurements are given in Tables A2-A21 and meristic counts are given in Tables A22-A35.

Capoeta damascina is extremely variable in body shape: body usually elongate and cylindrical, may be slightly compressed especially in juveniles; greatest body depth at level of dorsal-fin origin; dorsal head profile straight or convex; predorsal body profile smoothly convex to dorsal-fin origin but can be slightly convex or straight; nuchal hump present in large, well-fed specimens; snout usually rounded but can be pointed in some specimens; mouth ventral; lower lip covered with a sharp-edged horny sheath (sometimes not very well developed), its anterior margin straight in adult specimens and rounded to almost crescent-shaped in juveniles, with a considerable degree of individual variation; rostral cap well developed, in most specimens partly overlapping upper lip.

Dorsal fin inserted anterior to pelvic-fin origin, its outer margin concave or straight to slightly concave; 3-6 unbranched and 7-11 branched dorsal-fin rays (Tables A22, A23); last unbranched dorsal-fin ray weakly to moderately ossified, flexible and soft at the tip, usually serrated in 1/3-2/3 of its length in adults and subadults and 1/2-3/4 in juveniles (in some rare cases, no serrae present on the unbranched dorsal-fin ray); pectoral fins not extending to pelvic-fin base, their tips usually rounded but can be pointed; 16-22 pectoral-fin rays in total (Table A24); pelvic fins not extending to anal-fin base, outer margins straight or slightly rounded; 6-11 total pelvic-fin rays (Table A25); pelvic axillary scale present; anal fin with 3 unbranched and 5-6 branched rays (Tables A26, A27); caudal fin forked with 15-19 branched fin rays (Table A28), its tips usually pointed and its lobes not always of equal size.

Fig. 5. *Capoeta damascina* from Nahr Barada (SMF uncatalogued, SYR08/29), photograph of live specimen (Photo by N. Alwan).

Fig. 6. *Capoeta damascina* from Bahrat Homs (SMF uncatalogued SYR08/25), photograph of live specimen (Photo by N. Alwan).

Scales small, 11-20 above the lateral line (Table A29), 7.5-14.5 below the lateral line (Table A30), 23-34 encircling least circumference of the caudal peduncle (Table A31), 61-91 scales in the lateral-line series (Table A32); ventral midline and pectoral region covered with deeply embedded scales of reduced size; gill rakers slightly hooked, 12-18 gill rakers on the lower limb of the first gill arch (Table A33); 43-48 total vertebrae (Table A34); usually one posterior pair of barbels present but specimens with one or two anterior barbel(s) are occasionally found (Table A35); pharyngeal teeth arranged in three rows: 2.3.4-4.3.2 (f13) or 2.3.5-5.3.2 (f37), teeth in the main row spatulate or spoon-shaped and crowns flat, narrow and curved (Fig. 7).

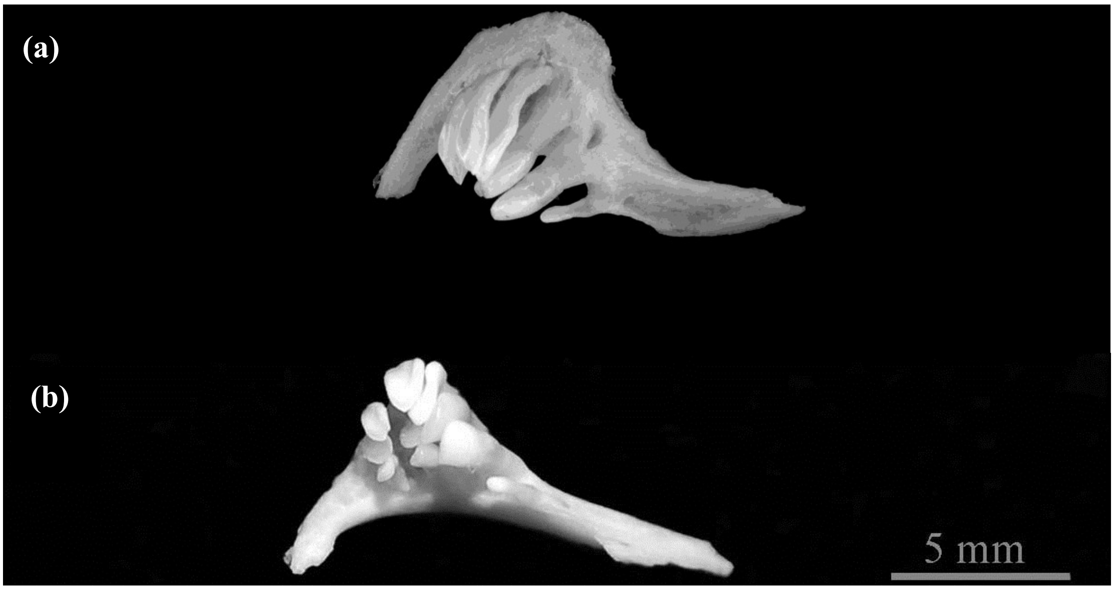

Fig. 7. Right pharyngeal bone and pharyngeal teeth of *Capoeta damascina* (specimen from Bahrat Homs [SMF uncatalogued SYR08/25], 170. 39 mm SL) (Photo by: (a) S. Tränkner, (b) N. Alwan).

3.2.2.3. Coloration

The coloration of live and preserved specimens is very variable.

Live specimens: uniformly silvery to silvery-grey, darker dorsally or golden on head and flanks, olive-brown dorsally and silvery to light silvery-golden ventrally (Figs 5, 6); fins opaque, white with or without grey tinge or yellow to light orange (pectoral and pelvic fins sometimes yellowish-grey; Figs 5, 6); diffuse dark spots present in juveniles (< 4 mm, on the body above the lateral line); dark lateral band present in few juveniles of some populations (e.g. from an-Nahr al-Kabir (N), Nahr Beirut and the Jordan River drainage basin); topotypical specimens with very dark grey-golden to greenish heads and bodies (in dorsal and lateral view), dorsal, pectoral, and caudal fins dark grey-green, pelvic and anal fins yellow-grey (Fig. 5).

Preserved specimens: variable coloration from olive-brown to grey dorsally and ochreous to whitish ventrally, dark spots being well discernible in juveniles; fins hyaline or white to yellowish with or without grey tinge.

3.2.2.4. Sexual Dimorphism

Well-developed breeding tubercles in males, covering entire dorsal surface of body from snout to caudal-fin origin, on the body above and below the lateral line especially in the area above the anal fin, on the lateral line with one, two or three tubercles per scale but not on each scale; present on branched anal-fin rays. In some cases, females may bear a small number of breeding tubercles on the sides of the snout (smaller than those in males).

Tip of anal fin reaching to or beyond the vertical of the caudal-fin base in females and to about 2/3 of the caudal peduncle in males; outer anal-fin margin usually more convex in females.

3.2.2.5. Habitat and Distribution

Capoeta damascina is found in a wide range of habitats from fast-running streams to stagnant lakes and even occurring in very shallow wadis. It inhabits clear and turbid waters with muddy, sandy or rocky bottoms. Its distributional range covers parts of southern Turkey, the entire Levant and Mesopotamia where it occurs in Seyhan Nehri drainage, Ceyhan Nehri drainage, Arsuz Nehri, the Orontes River drainage, Nahr Quwayq, the Litani River drainage, Nahr Barada (Damascus basin), Nahr al-Awaj (Damascus basin), the Jordan River drainage basin (including rivers discharging into the Dead Sea), in the Syrian and Lebanese coastal rivers and in the Tigris-Euphrates river system (mainly in its upper reaches) (Fig. A2 a-c). This species has also been reported from the coastal rivers (mainly northern and central ones) of Palestine and Israel (LORTET 1883, KRUPP 1987, GOREN & ORTAL 1999).

3.2.2.6. Remarks

The presence of one posterior pair of barbels in *C. damascina* clearly sets it apart from *C. antalyensis*, *C. baliki*, *C. banarescui* and *C. tinca* (which have one posterior and one anterior pairs of barbels [data from TURAN et al. 2006a]). *Capoeta damascina* is further distinguished from *C. antalyensis* by the presence of serrae on the last unbranched dorsal-fin ray (vs. absence), and by scale and gill-raker counts (ALL: 11-20 vs. 10-12 in *C. antalyensis*; BLL: 7.5-14.5 vs. 7; LL: 61-91 vs. $\mathrm{LL}_{\text{Caudal fin base}}$: 51-57; $\mathrm{GR}_{\text{Lower limb count}}$: 12-18 vs. $\mathrm{GR}_{\text{Total}}$: 15-17) and from *C. banarescui* by the number of gill rakers (12-18 vs. 9-11 in *C. banarescui*) [data from TURAN et al. 2006a]. *Capoeta damascina* is distinguished from *C. barroisi*, *C. erhani*, *C. mandica*, *C. trutta*, and *C. turani* by having a weaker, thinner and less ossified last unbranched dorsal-fin ray (vs. stronger, thicker and more ossified [data from ÖZULUĞ & FREYHOF 2008, TURAN et al. 2008]). While spots are absent on the body of *C. damascina* (except in juveniles), several to many irregular spots are present on the body and sometimes on the head of *C. barroisi*, *C. erhani*, *C. mandica*, *C. trutta* and *C. turani* [data from KRUPP 1985, ÖZULUĞ & FREYHOF 2008, TURAN et al. 2006b, 2008]. *Capoeta damascina* is further distinguished from *C. erhani* and *C. trutta* by having fewer gill rakers ($\mathrm{GR}_{\text{Lower limb count}}$: 12-18 vs. 20-22 in *C. erhani* and 18-25 in *C. trutta* [data from KRUPP 1985, TURAN et al. 2008]). Although only the number of gill rakers on the lower limb of the first gill arch was counted in *C. damascina* specimens, they clearly have fewer gill rakers than *C. barroisi* ($\mathrm{GR}_{\text{Total}}$: 28-30) and *C. turani* ($\mathrm{GR}_{\text{Total}}$: 25-30) [data from ÖZULUĞ & FREYHOF 2008, TURAN et al. 2006b]. Furthermore, the last unbranched dorsal-fin ray is shorter than the head length in *C. damascina* whereas it is longer in *C. trutta* (KRUPP 1985).

Capoeta damascina is distinguished from *C. bergamae* by having more branched pectoral fin rays (16-22, modally 19, vs. 15-18 in *C. bergamae*), longer barbels, a smaller and less horse-shoe shaped mouth, smaller scales and a stronger ossified unbranched dorsal-fin ray [data from KARAMAN 1969, TURAN et al. 2006b]. It is distinguished from *C. caelestis* by the presence of serrae on the last unbranched dorsal-fin ray (vs. absence) and by scale counts (BLL: 7.5-14.5, modally 9.5, vs. 7-8 in *C. caelestis*; CCP: 23-34, modally 27, vs. 23-24; LL: 61-91 usually 68-82 vs. 60-68 [data from KÜÇÜK et al. 2007, SCHÖTER et al. 2009]). *Capoeta damascina* differs from *C. capoeta* (including all subspecies) by having 11-20 scales above the lateral line (vs. 8-11 in *C. capoeta*) and 61-91 lateral-line scales, usually 68-82 (vs. 48-66) [data from BANARESCU 1999, ABDOLI 2000, TURAN et al. 2006b]. *Capoeta damascina* is clearly distinguished from *C. ekmekciae* by scale counts (ALL: 11-20 vs. 9-10 in *C. ekmekciae*; BLL: 7.5-14.5 vs. 6-7; LL: 61-91 vs. $LL_{\text{Caudal fin base}}$: 55-61 [data from TURAN et al. 2006b]).

No comparison was made with *C. kosswigi* regarding the number of gill rakers, since only the total number on the first gill arch has been reported in the literature (19-24: KARAMAN 1969, 22-24: TURAN et al. 2006b, 27-28: TURAN 2008). It seems that this species has higher gill-raker counts than *C. damascina* but probably with some overlap with several *C. damascina* populations (e.g. from the Tigris-Euphrates river system, Table A33). In addition, SCHÖTER et al. (2009) mentioned that *C. kosswigi* samples showed a wide range of lateral-line scale counts (73-88) and thus can be separated into two groups (73-79 and 80-88) raising the possibility that this nominal taxon consists of two species. It is quite difficult to resolve the problems related to *C. kosswigi* from Van Gölü because no specimens were available for comparison.

Capoeta damascina is distinguished from *C. mauricii* and *C. pestai* by having a weakly to moderately ossified last unbranched dorsal-fin ray in adults and juveniles (vs. a strongly ossified one in juveniles) and 12-18 gill rakers on the lower limb of the first gill arch (vs. 11-12) [data from KÜÇÜK et al. 2009]. It is further distinguished from *C. mauricii* by usually having 11-17 scales above the lateral line (vs.18-22) and from *C. pestai* by having no spots on the body except in juveniles (vs. many on the body) [data from ÖZULUĞ & FREYHOF 2008, KÜÇÜK et al. 2009].

In addition to the gill-raker number, *C. damascina* is distinguished from *C. sieboldii* by having more scales above the lateral line (ALL: 11-20 vs. 9-11 in *C. sieboldii*) and in the lateral-line series (LL: 61-91 vs. $LL_{\text{Caudal fin base}}$: 50-60 in *C. sieboldii*) [data from TURAN et al. 2006b]. It is distinguished from *C. umbla* by scale counts (ALL: 11-20, modally 14 and 15, vs. 18-24, modally 19 and 20 in *C. umbla*; BLL: 7.5-14.5, modally 9.5 and 10.5, vs. 11.5-15.5, modally 12.5; CCP: 23-34 vs. 32-39; LL: 61-91 vs. 86-104) (Tables A29-A32).

Compared to Iranian *Capoeta* species, *C. damascina* has more scales than *C. aculeata* (ALL: 11-20 vs. 6-10; CCP: 23-34 vs. 13-23; LL: 61-91 vs. 36-52 [data from COAD & KRUPP 1994]); more gill rakers on the lower limb of the first gill arch and more vertebrae than *C. buhsei* ($GR_{\text{Lower limb count}}$: 12-18 vs. 7-10 in *C. buhsei*; VC: 43-48, modally 45-46 vs. 44 in *C. buhsei*, Tables A33, A34); more branched dorsal-fin rays (7-11 vs. 7) and more lateral-line scales than *C. fusca* (LL: 61-91 vs. $LL_{\text{Caudal fin base}}$: 40-62) [data from COAD 2008, JOHARI et al. 2009]. It is distinguished from *C. saadii* by the number of gill rakers (12-18 (modally 14-15) vs. 9-15 (modally 10-11) in *C. saadii*, Table A33). It is important to mention that the slight overlap in gill-raker counts between *C. damascina* and *C. saadii* is mainly to be attributed to the *C. damascina* population from the Damascus basin, where specimens tend to have fewer gill rakers than in other *C. damascina* populations, resulting in a considerable overlap with the *C. saadii* population from the Rud-e Helleh drainage in Iran (Table A33). However, *C. damascina* from the Damascus basin is distinguished from *C. saadii* from the Rud-e Helleh drainage by the number of pelvic-fin rays (usually 9-10, modally 10, vs. 8-10, modally 9 in *C. saadii* from Helleh, Table A25) and by live body coloration (dark grey-golden to green vs. silvery-grey in *C. saadii* from Helleh).

3.2.3. *Capoeta saadii* (Heckel, 1849)

Scaphiodon saadii HECKEL, 1849: 260, sources of Saadi at Schiraz (Shiraz), near Persepolis ("Quellen des Saadi", possibly Kor River).

Scaphiodon amir HECKEL, 1849: 258, Araxes.

Scaphiodon niger HECKEL, 1849: 258, Araxes or Benth-Amir.

Scaphiodon chebisiensis KEYSERLING, 1861: 5, plate 2, canal in Chebis ("Wasserleitung in Chebis").

Scaphiodon rostratus KEYSERLING, 1861: 7, plate 3, canal in the vicinity of Jezd, Meibut ("Wasserleitungen in der Umgegend von Jezd").

Capoeta chebisiensis. – DE FILIPPI 1865: 359 (listed).

Capoeta saadi. – DE FILIPPI 1865: 359, Shiraz.

Capoeta amir. – GÜNTHER 1868: 79, Araxes River.

Scaphiodon niger. – GÜNTHER 1868: 79, Araxes.

Capoëta chebisiensis. – TORTONESE 1934: 6, Persia.

Capoëta saadii. – TORTONESE 1934: 6, Shiraz.

Varicorhinus damascinus (partim). – BERG 1949: 800-803, Shiraz, Kerman.

Varicorhinus damascinus (partim). – LADIGES 1960: 130, Persepolis.

Capoeta amir. – KÄHSBAUER 1963: 328, Araxes in Persepolis, Chun-i-Kaka (Sargado, possibly Sarhad region in eastern Kerman).

Capoeta chebisiensis. – KÄHSBAUER 1963: 328, canal in Chebis.

Capoeta niger. – KÄHSBAUER 1963: 329, Araxes in Persepolis.

Capoeta rostratus. – KÄHSBAUER 1963: 329, canal in Meibut near Jezd (Jazd).

Capoeta saadii. – KÄHSBAUER 1963: 329, Saadi River in Shiraz, Araxes River in Persepolis.

Varicorhinus damascinus (partim). – SAADATI 1977: 74, 192, 193, Jazd, Maharlu, Sirjan.

Capoeta saadi. – BIANCO & BANARESCU 1982: 88, Pulwar near Persepolis, Mand River near Akbar and near Dasht-e-Arzhan, springs of Kul River basin near Darab (Persepolis).

? *Capoeta buhsei* (partim). – BIANCO & BANARESCU 1982: 88, springs of Kul River basin near Darab, vicinity of Kerman.

Capoeta damascina (partim). – COAD 1995: 14, Gulf, Kor River, Lake Maharlu, Sirjan, Kerman-Na'in and Hormuz basins (listed, distribution).

Capoeta damascina (partim). – ABDOLI 2000: 128-129, Daryacheh-ye Maharlu, Rudkhaneh-ye Kor, and Gulf, Kerman (including Sirjan basin within) and Hormuz basins.

Capoeta saadi. – ABDOLI 2000: 132-133, Rudkhaneh-ye Kor, Shur Estan (Fars), Rudkhaneh-ye Mond (Gulf basin).

Material examined: Syntypes of *Scaphiodon saadii*: 18, 18.30-122.8 mm SL, Iran: sources of Saadi at Shiraz, Th. Kotschy, NMW 51666. – 4, 84.00-113.91 mm SL, Iran: Persepolis, 29° 37' N 52° 35' E, Th. Kotschy, NMW 55900. – Syntypes of *Scaphiodon amir*: 6, 138.83-272.72 mm SL, Iran: Araxes (Rud-e Kor) (village: Benth Amir (Band-e Amir)), Th. Kotschy, NMW 46081. – 1, ca. 384 mm SL, Iran: Araxes River or Benth Amir, Th. Kotschy, NMW 16508 (dried specimen). – Syntypes of *Scaphiodon niger*: 1, 227.84 mm SL, Iran: Araxes (village: Benth Amir), Th. Kotschy, NMW 51654. – 2, 140.24-181.83 mm SL, Iran: Araxes (village: Benth Amir), Th. Kotschy, NMW 51655. – 1, 221.70 mm SL, Iran: Araxes, Th. Kotschy, NMW 51656.

(1) 1, ca. 46 mm SL, Iran: small spring 55 km from Shahr-e Babak, Javazm village, 30° 30.882' N 55° 01.902' E, 20.II.2008, N. Alwan, K. Borkenhagen, M. Ghanbari Fardi & A. Kazemi , SMF 30861 (in 96 % alcohol). – (2) 4, 58.21-72.56 mm SL, Iran: small spring 55 km from Shahr-e Babak, Javazm village, 30° 30.882' N 55° 01.902' E, 20.II.2008, N. Alwan, K. Borkenhagen, M. Ghanbari Fardi & A. Kazemi, SMF 31144. – (3) 1, 89.92 mm SL, Iran: small spring 55 km from Shahr-e Babak, Javazm village, 30° 30.882' N 55° 01.902' E, 20.II.2008, N. Alwan, K. Borkenhagen, M. Ghanbari Fardi & A. Kazemi, SMF 33094 (fin clip in 96 % alcohol). – (4) Fin clip from FSJF 2250, Iran: Rud-e Kor about 73 km north of Shiraz, Fars, 30° 11.618' N 52° 27.945' E, 20.IV.2007, A. Abdoli & J. Freyhof, FSJF 22 (in 96 % alcohol). – (5) 9, 145.83-185.50 mm SL, Iran: Rud-e Kor about 73 km north of Shiraz, Fars, 30° 11.618' N 52° 27.945' E, 20.IV.2007, A. Abdoli & J. Freyhof, FSJF 2250. – (6) 1, 78.62 mm SL, Iran: Tang-e-Khiaran, Beyza city, Fars province, 29° 54.542' N 52° 25.943' E, 2007, H. R. Esmaeili, A. Teimory & A. Gholamhoseini, CBSU 7886. – (7) Fin clip, Iran: Sarab spring-stream system, Fars province, 29° 50.810' N 52° 25.211' E, A. Teimory, N. Nazari & A. Gholamhoseini, specimen (134.34 mm SL) identified and fin clip given by H. R. Esmaeili from Shiraz University, SMF 31010 (in 96 % alcohol). – (8) 4, 78.45-109.15 mm SL, Iran:

Rudkhaneh-ye Shapur, Kazerun city, Fars province, 29° 42.914' N 51° 30.538' E, 2005, A. Teimory, T. Ansari & A. Gholamhoseini, CBSU 6567 A-D. – (9) 2, 83.63-104.32 mm SL, Iran: Pol-e Qareh Aghaj, 29° 41.210' N 52° 06.000' E, 28.II.2008, N. Alwan, K. Borkenhagen, M. Ghanbari Fardi & A. Kazemi, SMF uncatalogued (IR08/22). – (10) 3, 144.15-251.83 mm SL, Iran: Shiraz, presented by Marquis G. Doria, BMNH 1869.3.4.22,24,37. – (11) 5, 109.55-148.73 mm SL, Iran: Arjan wetland, Fars, 20.XI.2003, H. R. Esmaeili, CBSU 4766-4770. – (12) Fin clip from FSJF 2251, Iran: Pirbanoo spring about 10 km south of Shiraz, 29° 31.135' N 52° 27.933' E, 21.IV.2007, A. Abdoli & J. Freyhof, specimen identified by J. Freyhof, FSJF 18 (in 96 % alcohol). – (13) 1, 73.49 mm SL, Iran: Kuhmareh Sorkhi, Fars, 04.XII.2003, H. R. Esmaeili, CBSU 3210. – (14) 2, 97.80-141.02 mm SL, Iran: Kuhmareh (Koohmareh) Sorkhi, Shiraz, Fars province, 29° 23.728' N 52° 09.650' E, 2006, H. R. Esmaeili, A. Teimory & M. Ebrahimi, CBSU 354 A-B. – (15) 1, 89.76 mm SL, Iran: Kuhmareh (Koohmareh) Sorkhi, Shiraz, Fars province, 29° 23.728' N 52° 09.650' E, 2006, H. R. Esmaeili, A. Teimory & M. Ebrahimi, CBSU 355. – (16) 1, 84.57 mm SL, Iran: Kuhmareh Sorkhi, Shiraz, Fars province, 29° 23.728' N 52° 09.650' E, 2006, H. R. Esmaeili, A. Teimory & M. Ebrahimi, CBSU 362. – (17) 1, ca. 135 mm SL, Iran: Kuhmareh Sorkhi, Fars, 04.XII.2003, H. R. Esmaeili, CBSU 3192. – (18) 1, 140.90 mm SL, Iran: Kuhmareh Sorkhi, Fars, 04.XII.2003, H. R. Esmaeili, CBSU 3195. – (19) 1, 14912 mm SL, Iran: Kuhmareh Sorkhi, Fars, 04.XII.2003, H. R. Esmaeili, CBSU 3197. – (20) 1, 115.70 mm SL, Iran: Kuhmareh Sorkhi, Fars, 04.XII.2003, H. R. Esmaeili, CBSU 3203. – (21) 1, 73.75 mm SL, Iran: Kuhmareh Sorkhi, Fars, 04.XII.2003, H. R. Esmaeili, CBSU 3211. – (22) Fin clip, Iran: Kuhmareh Sorkhi River, 27.XII.2008, H. R. Esmaeili, CBSU uncatalogued (# 1) (in 96 % alcohol). – (23) Fin clip, Iran: Kuhmareh Sorkhi, 27.XII.2008, H. R. Esmaeili, CBSU uncatalogued (# 2) (in 96 % alcohol). – (24) 2, 70.09-76.85 mm SL, Iran: Kohmareh Sorkhi Shiraz, Fars province, 29° 23.728' N 52° 09.650' E, 2006, H. R. Esmaeili, A. Teimory & M. Ebrahimi, given by H. R. Esmaeili from Shiraz University, SMF 31007-31008 (in 96 % alcohol). – (25) 1, 145.37 mm SL, Iran: Qareh Aghaj (Rud-e Mand), 29° 10.916' N 52° 40.120' E, 22.XI.2007, K. Borkenhagen & F. Wicker, SMF uncatalogued (IR07/03). – (26) 1, 108.30 mm SL, Iran: Ej, Estahban city, Fars province, 29° 00.743' N 54° 14.739' E, 2004, H. R. Esmaeili, A. Teimory, M. Ebrahimi & A. Gholamhoseini, CBSU 7117. – (27) 1, 85.10 mm SL, Iran: Ej, Estahban city, Fars province, 29° 00.743' N 54° 14.739' E, 2004, H. R. Esmaeili, A. Teimory, M. Ebrahimi & A. Gholamhoseini, CBSU 7121. – (28) Fin clip from FSJF 2242, Iran: Golabii spring, 35 km north of Darab, 28° 47.255' N 54° 22.321' E, 21.IV.2007, A. Abdoli & J. Freyhof, FSJF 15 (in 96 % alcohol). – (29) 13, 70.51-82.49 mm SL, Iran: Golabii spring, 35 km north of Darab, 28° 47.255' N 54° 22.321' E, 21.IV.2007, A. Abdoli & J. Freyhof, FSJF 2242. – (30) 10, 71.37-111.15 mm SL, Iran: Rudkhaneh-ye Rudbal near Firuzabad, 28° 42.590' N 52° 38.222' E, 22.XI.2007, K. Borkenhagen & F. Wicker, SMF uncatalogued (IR07/02). – (31) 1, ca. 86 mm SL, Iran: Rudkhaneh-ye Rudbal, Fars province, 28° 42.504' N 52° 36.631' E, 22.XI.2008, A. Teimory, A. Gholami & A. Gholamhoseini, SMF 31005 (in 96 % alcohol). – (32) Fin clip, Iran: Janatshahr, Fork road, Darab, 06.X.2009, H. R. Esmaeili, CBSU uncatalogued (# 21) (in 96 % alcohol).

3.2.3.1. Diagnosis

Capoeta saadii is distinguished from all other *Capoeta* species by the following combination of characters: elongate and usually cylindrical body; 8-9 branched dorsal-fin rays; last unbranched dorsal-fin ray weakly ossified and serrated in 1/3-3/4 of its length; 8-10 total pelvic-fin rays (modally 9); small scales, 11-16 above the lateral line (modally 14 and 15), 7-10 below the lateral line (modally 8 and 9), 23-28 encircling least circumference of caudal peduncle (modally 24 and 26), 63-79 scales in the lateral-line series; 9-15 gill rakers on lower limb of first gill arch (modally 10-11); 42-46 total vertebrae (modally 43-44); one posterior pair of barbels; light golden-yellowish or silvery-greyish body coloration in life; presence of few black blotches on the body of some specimens.

3.2.3.2. Description

The habitus of *C. saadii* is shown in Figure 8. Morphometric measurements are given in Tables A2-A21 and meristic counts are given in Tables A22-A35.

Body usually elongate and cylindrical; greatest body depth at level of dorsal-fin origin; dorsal head profile straight (very pronounced in specimens from the Rud-e Kor basin) or convex; predorsal body profile smoothly convex to dorsal-fin origin, slightly convex in some specimens, nuchal hump present in well-fed specimens; snout usually pointed; mouth ventral; lips a bit fleshy, being more pronounced at mouth corners; lower lip covered with a sharp-edged horny sheath (sometimes not very well developed), its anterior margin straight in adult specimens and rounded to almost crescent-shaped in juveniles, with a considerable degree of individual variation; rostral cap well developed, partly overlapping upper lip in most specimens.

Dorsal fin inserted anterior to pelvic-fin origin and its outer margin usually straight but occasionally concave; 3-6 unbranched and 8-9 branched dorsal-fin rays (Tables A22, A23); last unbranched dorsal-fin ray weakly ossified, flexible and soft at the tip, serrated in 1/3-2/3 of its length in adults and subadults and 1/2-3/4 in juveniles; pectoral fins, not extending to pelvic-fin base, outer margins usually slightly convex; 17-20 pectoral-fin rays in total (Table A24); pelvic fins not extending to anal-fin base, outer margins slightly rounded to straight; 8-10 total pelvic-fin rays (Table A25); pelvic axillary scale present; anal fin with 3 unbranched and 5 branched rays (Tables A26, A27); caudal fin forked, its tips pointed and its lobes not always of equal size; 16-18 branched caudal-fin rays (Table A28).

Fig. 8. *Capoeta saadii* from Rud-e Kor, about 73 km north of Shiraz, Iran (FSJF 2250), photograph of live specimen (Photo taken by J. Freyhof and edited by N. Alwan).

Scales small, 11-16 above the lateral line (Table A29); 7-10 below the lateral line (Table A30); 23-28 encircling least circumference of caudal peduncle (Table A31) and 63-79 scales in the lateral-line series (Table A32); ventral midline and pectoral region covered with deeply embedded scales of reduced size; gill rakers slightly hooked; 9-15 gill rakers on the lower limb of the first gill arch (Table A33); 42-46 total vertebrae (Table A34); one posterior pair of barbels present but very rarely, specimens with one additional anterior barbel can be found (Table A35); pharyngeal teeth arranged in three rows: 2.3.5-5.3.2 (f8) and very similar in shape to those of *C. damascina*.

3.2.3.3. Coloration

Live specimens: dorsum, head and sides of *C. saadii* from the Rud-e Kor basin golden-yellow, darker dorsally and lighter below the lateral line (Fig. 8); dorsal, anal and caudal fins light golden; pectoral and pelvic fins golden-yellow (Fig. 8); upper half of body of *C. saadii* from other river drainages light golden or silvery-grey and lower half white with or without grey tinge; fins white-yellowish or dusty grey. Few dark blotches (> 4 mm) are present on the body of some adult, subadult and juvenile specimens. In addition, juvenile specimens have a diffuse lateral band along the sides and small diffuse black spots above the lateral line.

Preserved specimens: dorsum, head and sides grey dorsally and beige or yellow ventrally; fins beige or dusty grey; dark lateral band (in juveniles), spots (in juveniles) and blotches well discernible

3.2.3.4. Sexual Dimorphism

Well-developed breeding tubercles in males, covering entire dorsal surface of body from snout to caudal-fin origin, on the body above and below the lateral line especially in the area above the anal fin, on the lateral line with one, two or three tubercles per scale but not on each scale and on the branched anal-fin rays. In some cases, females may bear a small number of breeding tubercles on the sides of the snout (smaller than those in males).

Tip of anal fin reaching to or beyond the vertical of the caudal-fin base in females and to about 2/3 of the caudal peduncle in males; outer anal-fin margin more convex in females.

3.2.3.5. Habitat and Distribution

Based on personal observations and field note recordings made at the time of capture in Iran, *C. saadii* can be found in slow to medium flowing rivers with muddy bottoms and gravel substrates. *Capoeta saadii* inhabits the western and south-western rivers flowing into the Persian Gulf and the Strait of Hormuz such as Rud-e Helleh, Rud-e Mand and Rud-e Kol. It is also found in watercourses present in the Rud-e Kor, Daryacheh-ye Maharlu and Kerman basins in Iran (Fig. A3).

3.2.3.6. Remarks

Although identified as *C. saadii*, specimens collected from Kerman basin (SMF 30861, 31144 and 33094: see material examined above) were very small in size making measurements and counts of many characters very difficult. Therefore, they were excluded from the morphological analyses.

In some cases, it was difficult to compare the number of gill rakers of *C. saadii* obtained in this study ($GR_{\text{Lower limb count}}$: 9-15, Table A33) with those of other species reported in the literature by various authors since they only counted the total number of gill rakers on the first gill arch. Therefore, their data were compared to those of BIANCO & BANARESCU (1982) who counted the total number of gill rakers in *C. saadii* (GR_{Total}: 13-17). Based on these counts, *C. saadii* has fewer gill rakers ($GR_{\text{Lower limb count}}$: 9-13 (14, 15), GR_{Total}: 13-17) than *C. aculeata* ($GR_{\text{Lower limb count}}$: 15-18), *C. barroisi* (GR_{Total}: 28-30), *C. bergamae* (GR_{Total}: 19-24), *C. caelestis* (GR_{Total}: 16-20), *C. capoeta* (GR_{Total}: 18-28), *C. ekmekciae* ($GR_{\text{Lower limb count}}$: 13-17), *C. erhani* ($GR_{\text{Lower limb count}}$: 20-22), *C. kosswigi* (GR_{Total}: 19-28 compiled from KARAMAN 1969, TURAN et al. 2006b and TURAN 2008), *C. mandica* (GR_{Total}: 21-24), *C. sieboldii* (GR_{Total}: 28-33), *C. tinca* (GR_{Total}: 19-23), *C. trutta* ($GR_{\text{Lower limb count}}$: 18-25), *C. turani* ($GR_{\text{Total}}$: 25-30) and *C. umbla* ($GR_{\text{Lower limb count}}$: 15-16) [data from Table A33, KARAMAN 1969, BIANCO & BANARESCU 1982, KRUPP 1985, BANARESCU 1999, TURAN et al. 2006b, KÜÇÜK et al. 2007, ÖZULUĞ & FREYHOF 2008, TURAN 2008, SCHÖTER et al. 2009]. In addition to gill-raker counts, *C. saadii* is further distinguished from *C. barroisi*, *C. erhani*, *C. mandica*, *C. trutta* and *C. turani* by having a weakly ossified last unbranched dorsal-fin ray (vs. strongly ossified [data from ÖZULUĞ & FREYHOF

2008, Turan et al. 2008]) and no spots on the body of all specimens except for some juveniles (vs. several to many irregular spots on the body and sometimes head of juvenile and adult specimens [data from Krupp 1985, Özuluğ & Freyhof 2008, Turan et al. 2008]). Few black blotches are present on the body of some *C. saadii* specimens whereas none are found in *C. barroisi*, *C. erhani*, *C. mandica*, *C. trutta*, and *C. turani* individuals [data from Krupp 1985, Özuluğ & Freyhof 2008, Turan et al. 2008]. Furthermore, the last unbranched dorsal-fin ray is shorter than the head length in *C. saadii* whereas it is longer in *C. trutta* (Krupp 1985). *Capoeta saadii* is further distinguished from *C. caelestis* by having serrae on the posterior margin of the last unbranched dorsal-fin ray [data from Schöter et al. 2009]. It is further distinguished from *C. capoeta* and *C. sieboldii* by having more scales above the lateral line (11-16 vs. 8-11 in *C. capoeta* and 9-11 in *C. sieboldii* [data from Abdoli 2000, Turan et al. 2006b]) and from *C. kosswigi* by having fewer scales (11-16 vs. 15-16 [data from Turan et al. 2006b]). *Capoeta saadii* also has more scales above and below the lateral line than *C. ekmekciae* (ALL: 11-16 vs. 9-10; BLL: 7-10 vs. 6-7 [data from Turan et al. 2006b]). *Capoeta saadii* is further distinguished from *C. umbla* by scale and vertebral counts (ALL: 11-16 vs. 18-24 in *C. umbla*; BLL: 7-10 vs. 11.5-15.5; CCP: 23-28 vs. 32-39; LL: 63-79 vs. 86-104; VC: 42-46 vs. 46-50, Tables A29-A32, A34).

Capoeta saadii has one posterior pair of barbels, which sets it apart from *C. antalyensis*, *C. banarescui*, *C. baliki* and *C. tinca* (two pairs of barbels [data from Turan et al. 2006a]). It is further distinguished from *C. antalyensis* by having serrae on the posterior margin of the last unbranched dorsal-fin ray [Turan et al. 2006a] *Capoeta saadii* is different from *C. mauricii* and *C. pestai* in having a weaker and less ossified last unbranched dorsal-fin ray in juveniles and adults (vs. stronger and more ossified in juveniles) and fewer scales above the lateral line (ALL: 11-16 vs.18-22 in *C. mauricii* and 16-18 in *C. pestai*) and in the lateral-line series (LL: 63-79 vs. $LL_{\text{Caudal fin base}}$: 80-87 in *C. mauricii* and $LL_{\text{Caudal fin base}}$: 78-91 in *C. pestai*) [data from Küçük et al. 2009]. It is further distinguished from *C. pestai* by the absence of spots on the body except in juveniles (vs. presence of many on the body [data from Özuluğ & Freyhof 2008, Küçük et al. 2009]).

Compared to other Iranian *Capoeta* species, *C. saadii* has more scales above the lateral line, around the least circumference of the caudal peduncle and in the lateral-line series than *C. aculeata* (ALL: 11-16 vs. 6-10; CCP: 23-28 vs. 13-23; LL: 63-79 vs. 36-52 [data from Coad & Krupp 1994]); fewer scales below the lateral line, around the least circumference of the caudal peduncle and in the lateral-line series than *C. buhsei* (BLL: 7-10 vs. 10-11; CCP: 23-28 vs. 29-31; LL: 63-79 vs. 82-95, Tables A30-A32) and more branched dorsal-fin rays and more lateral-line scales than *C. fusca* (branched D: 8-9 vs. 7-8; LL: 63-79 vs. $LL_{\text{Caudal fin base}}$: 40-62 [data from Coad 2008, Johari et al. 2009]).

3.2.4. *Capoeta* sp.1

? *Varicorhinus damascinus* (partim). – SAADATI 1977: 74, 192-193, Tigris basin in Iran.

? *Capoeta damascina* (partim). – COAD 1991: 15, Tigris-Euphrates basin (listed).

Capoeta damascina (partim). – COAD 1995: 14, Tigris River basin in Iran (listed, distribution).

Capoeta damascina (partim). – ABDOLI 2000: 128, Rudkhaneh-ye Dijlah, Karun.

Material examined: (1) 1, 48.86 mm SL, Iran: Rud-e Hadi between Zagheh and Polehoru, 33° 31.138' N 48° 46.340' E, 04.III.2008, N. Alwan, K. Borkenhagen, M. Ghanbari Fardi & A. Kazemi, SMF uncatalogued (IR08/34). – (2) 11, 107.92-143.94 mm SL, Iran: Rud-e Sangan (Sangan stream) at Sangan, 31° 15.692' N 51° 17.150' E, 19.IV.2007, A. Abdoli & J. Freyhof, FSJF 2213. – (3) Fin clips from FSJF 2213, Iran: Rud-e Sangan (Sangan stream) at Sangan, 31° 15.692' N 51° 17.150' E, 19.IV.2007, A. Abdoli & J. Freyhof, FSJF 7 (in 96 % alcohol). – (4) 2, 156.22-162.23 mm SL, Iran: Rud-e Beshar, 20 km northeast of Yasuj, 30° 44.152' N 51° 29.522' E, 19.IV.2007, A. Abdoli & J. Freyhof, FSJF 2233. – (5) 1, 26.94 mm SL, Iran: Tang-e Sorkh, 30° 27.680' N 51° 44.907' E, 28.XI.2007, K. Borkenhagen & F. Wicker, SMF 30865 (in 96 % alcohol). – (6) 1, 28.34 mm SL, Iran: Tang-e Sorkh, 30° 27.680' N 51° 44.907' E, 28.XI.2007, K. Borkenhagen & F. Wicker, SMF 30871 (in 96 % alcohol). – (7) 7, 35.22-165.72 mm SL, Iran: Tang-e Sorkh, 30° 27.680' N 51° 44.907' E, 28.XI.2007, K. Borkenhagen & F. Wicker, SMF uncatalogued (IR07/05). – (8) 1, 29.70 mm SL, Iran: Rud-e Tang-e Tizab, Sepidan, Fars, 30° 23.470' N 51° 46.710' E, 28.XI.2007, K. Borkenhagen & F. Wicker, SMF 30872 (in 96 % alcohol). – (9) 1, 96.69 mm SL, Iran: Rud-e Gorgu, Sepidan city, Fars province, 30° 21.283' N 51° 45.754' E, 2006, H. R. Esmaeili, A. Teimory, M. Ebrahimi & A. Gholamhoseini, CBSU 7880. – (10) 1, 158.12 mm SL, Iran: Rud-e Gorgu, Sepidan city, Fars province, 30° 21.283' N 51° 45.754' E, 2006, H. R. Esmaeili, A. Teimory, M. Ebrahimi & A. Gholamhoseini, CBSU 7881.

3.2.4.1. Diagnosis

Capoeta sp.1 is distinguished from all other *Capoeta* species by the combination of the following characters: elongate and usually cylindrical body; 8-9 branched dorsal-fin rays; last unbranched dorsal-fin ray weakly to moderately ossified and serrated in 1/3-2/3 of its length; small scales, 13-16 above the lateral line, 10-11 below the lateral line, 27-31 encircling least circumference of caudal peduncle (modally 27 and 29), 65-82 scales in the lateral-line series; 10-13 gill rakers on lower limb of first gill arch (modally 13); 45-47 total vertebrae; one posterior pair of barbels (rarely two); bright golden-greenish or silvery body coloration in life; presence of few black blotches on the body of some specimens; LD 17.30-21.74 % SL; HL 22.34-28.86 % SL; WM 7.31-10.25 % SL; PrOL 7.39-9.13 % SL.

3.2.4.2. Description

The habitus of *Capoeta* sp.1 is shown in Figure 9. Morphometric measurements are given in Tables A2-A21 and meristic counts are given in Tables A22-A35.

Body usually elongate and cylindrical; predorsal body profile smoothly convex with no marked discontinuity between head and body except when a nuchal hump is present; greatest body depth at level of dorsal-fin origin; snout usually pointed but may be rounded; mouth ventral; lips slightly fleshy, especially at the mouth corners; lower lip covered with a sharp-edged horny sheath, its anterior margin straight in adult specimens and rounded to almost crescent-shaped in juveniles, with a considerable degree of individual variation.

Dorsal fin inserted anterior to pelvic-fin origin, its outer margin usually straight to slightly concave; 4-5 unbranched and 8-9 branched dorsal-fin rays (Tables A22, A23); last unbranched dorsal-fin ray weakly to moderately ossified, flexible and soft at the tip, serrated in 1/2-2/3 of its length; pectoral fins not extending to pelvic-fin base; their outer margins usually slightly convex; 18-22 pectoral-fin rays in total (Table A24); pelvic fins not extending to anal fin base, their outer margin straight or slightly convex and blunt; 9-11 pelvic-fin rays in total (Table A25); pelvic axillary scale present; anal fin with 3 unbranched and 5 branched rays, outer margin straight or slightly convex (Tables A26, A27); caudal fin forked with 17-19 branched rays (Table A28), its tips pointed and its upper lobe often longer than lower one.

Fig. 9. *Capoeta* sp.1 from Rud-e Sangan at Sangan (FSJF 2213), photograph of live specimen (143.94 mm SL) (Photo taken by J. Freyhof and edited by N. Alwan).

Scales small, 13-16 above the lateral line (Table A29), 10-11 below the lateral line (Table A30), 27-31 encircling least circumference of caudal peduncle (Table A31), 65-82 scales in the lateral-line series (Table A32); ventral midline and pectoral region covered with deeply embedded scales of reduced size; gill rakers slightly hooked, 10-13 gill rakers on the lower limb of the first gill arch (Table A33); 45-47 total vertebrae (Table A34); usually one posterior pair of barbels present (very rarely two) (Table A35); pharyngeal teeth arranged in 3 rows in the following manner: 2.3.5-5.3.2 (f2) and very similar in shape to those of *C. damascina*.

3.2.4.3. Coloration

Live specimens: dorsum and sides bright golden-green (Fig. 9) or silvery, darker dorsally and lighter below the lateral line; dorsal head bright golden-green or light pink-brown; dorsal, anal and caudal fins beige to light brown with light pink to red tinge; pectoral and pelvic-fins beige to light brown or golden with brown tinge on the first few rays (Fig. 9); few large black blotches present on the body of some specimens whereas small diffuse black spots are present only on the body of some juveniles (above the lateral line).

Preserved specimens: dorsum, head and sides grey or brownish-grey dorsally and beige or yellow ventrally; dorsal and caudal fins dusty grey; pectoral, pelvic and anal fins white or beige with or without grey tinge; blotches and spots well discernible.

3.2.4.4. Sexual Dimorphism

Breeding tubercles present in both sexes, being bigger and more pronounced in males. Tubercles present on the sides of the snout but may also cover the entire body surface, on and above the lateral line with one or two tubercles per scale but not on each scale, below the lateral line especially in the area above the anal fin and on the branched anal-fin rays; tip of anal fin reaching to or beyond the vertical of the caudal-fin base in females and to about 2/3 of the caudal peduncle in males.

3.2.4.5. Habitat and Distribution

The habitat of *Capoeta* sp.1 is known only from field notes made at the time of capture in Iran. *Capoeta* sp.1 occurs in medium-fast flowing rivers with muddy bottoms and gravel substrates and is found in cloudy waters. It occurs in the Rud-e Karun and possibly in the Rudkhaneh-ye Karkheh, which constitute the southeastern part of the Tigris-Euphrates river system (Fig. A4).

3.2.4.6. Remarks

The presence of one pair of barbels in *Capoeta* sp.1 clearly sets it apart from *C. antalyensis*, *C. baliki*, *C. banarescui* and *C. tinca* (two pairs of barbels [data from TURAN et al. 2006a]). It is further distinguished from *C. antalyensis* by the presence of serrae on the last unbranched dorsal-fin ray (vs. absence), and by scale counts (ALL: 13-16 vs. 10-12 in *C. antalyensis*; BLL: 10-11 vs. 7; LL: 65-82 vs.

$LL_{Caudal\ fin\ base}$: 51-57) and from *C. banarescui* by the number of scales below the lateral line (10-11 vs. 8-9 in *C. banarescui*) [data from TURAN et al. 2006a].

Capoeta sp.1 is distinguished from *C. barroisi*, *C. erhani*, *C. mandica*, *C. trutta* and *C. turani* by having a weaker, thinner and less ossified last unbranched dorsal-fin ray (vs. stronger, thicker and more ossified) and by the presence of few black blotches on the body of some specimens (vs. absence) [data from KRUPP 1985, ÖZULUĞ & FREYHOF 2008, TURAN et al. 2008]. While spots are absent on the body of the former species (except in some juveniles), several to many irregular spots are present on the body and sometimes on the head of the latter species [data from KRUPP 1985, ÖZULUĞ & FREYHOF 2008, TURAN et al. 2008]. *Capoeta* sp.1 is further distinguished from *C. erhani* and *C. trutta* and by having 10-13 (modally 13) gill rakers on the lower limb of the first gill arch (vs. 20-22 in *C. erhani* and 18-25 in *C. trutta* [data from KRUPP 1985, TURAN et al. 2008]). Although the total number of gill rakers was not counted in *Capoeta* sp.1 specimens, it is evident that they have a lower number of gill-rakers than *C. barroisi* (GR_{Total}: 28-30), *C. mandica* (GR_{Total}: 21-24) or *C. turani* (GR_{Total}: 25-30) [data from TURAN et al. 2006b, ÖZULUĞ & FREYHOF 2008]. Furthermore, the last unbranched dorsal-fin ray is shorter than the head length in *Capoeta* sp.1 whereas it is longer in *C. trutta* (KRUPP 1985).

Besides the gill-raker number, *Capoeta* sp.1 is distinguished from *C. bergamae*, *C. capoeta* and *C. sieboldii* by scale counts (ALL: 13-16 vs. 8-11 in *C. capoeta* and 9-11 in *C. sieboldii*; BLL: 10-11 vs. 7-9 in *C. bergamae*, 6-10 in *C. capoeta* and 8-10 in *C. sieboldii*; LL: 65-82 vs. 48-66 in *C. capoeta* and 52-60 in *C. sieboldii*) [data from BANARESCU 1999, ABDOLI 2000, TURAN et al. 2006b]. In addition to the presence of serrae on the unbranched dorsal-fin ray, *Capoeta* sp.1 is set apart from *C. caelestis* by scale counts (ALL: 13-16 vs. 10-13.5 in *C. caelestis*; BLL: 10-11 vs. 7-8; CCP: 27-31 vs. 23-24) and probably vertebral counts (45-47 vs. 44 in *C. caelestis*) [data from SCHÖTER et al. 2009].

It is distinguished from *C. damascina* by having 10-13, modally 13, gill rakers on the lower limb of the first gill arch (vs. 12-18, modally 14-15; Table A33), by the presence of black blotches on the body of some specimens (vs. absence in *C. damascina*) and by live coloration (see sections 3.2.2.3 and 3.2.4.3 above). It is important to note that there are some characters, which are not unique to the species but distinguish it from several *C. damascina* populations: LD: 17.30-21.74 % SL; HL: 22.34-28.86 % SL; WM: 7.31-10.25 % SL; PrOL: 7.39-9.13 % SL; BLL: 10-11; CCP: 27-31. *Capoeta* sp.1 is clearly distinguished from *C. ekmekciae* by scale counts (ALL: 13-16 vs. 9-10; BLL: 10-11 vs. 6-7; LL: 65-82 vs. 55-61 in *C. ekmekciae* [data from TURAN et al. 2006b]). Although only the total number of gill rakers of *C. kosswigi* was reported in the literature (19-24: KARAMAN 1969, 22-24: TURAN et al. 2006b, 27-28: TURAN 2008), it is obvious that it has a higher number than *Capoeta* sp.1.

It is distinguished from *C. mauricii* and *C. pestai* by having a weaker, thinner and less ossified last unbranched dorsal-fin ray in juveniles and adults and fewer scales above the lateral line (13-16 vs. 18-22 in *C. mauricii* and 16-19 in *C. pestai* [data from ÖZULUĞ & FREYHOF 2008, KÜÇÜK et al. 2009]). It is further distinguished from *C. pestai* by the absence of spots on the body except in juveniles (vs. presence of many on the body [data from ÖZULUĞ & FREYHOF 2008, KÜÇÜK et al. 2009]). It is distinguished from *C. umbla* by scale and gill-raker counts (ALL: 13-16 vs. 18-24; BLL: 10-11 vs. 11.5-15.5; CCP: 27-31 vs. 32-39; LL: 65-82 vs. 86-104; $\text{GR}_{\text{Lower limb count}}$: 10-13 vs. 15-16, Tables A29-A33).

Compared to other Iranian *Capoeta* species, *Capoeta* sp.1 has more scales and fewer gill rakers than *C. aculeata* (ALL: 13-16 vs. 6-10; BLL: 10-11 vs. 5-9; CCP: 27-31 vs. 13-23; LL: 65-82 vs. 36-52; $\text{GR}_{\text{Lower limb count}}$: 10-13 vs. 15-18 [data from COAD & KRUPP 1994]); more gill rakers on the lower limb of the first gill arch and more vertebrae than *C. buhsei* ($\text{GR}_{\text{Lower limb count}}$: 10-13 vs. 7-10; VC: 45-47 vs. 44, Tables A33, A34) and more branched dorsal-fin rays (8-9 vs. 7) and more lateral-line scales (LL: 65-82 vs. $\text{LL}_{\text{Caudal fin base}}$: 40-62) than *C. fusca* [data from COAD 2008, JOHARI et al. 2009]. It is distinguished from *C. saadii* by having more scales below the lateral line (10-11 vs. 7-10, modally 9), more circumpendicular scales (27-31, modally 27 and 29, vs. 23-28, modally 25-26) and more vertebrae (45-47 vs. 42-46, this might prove incorrect once a larger sample has been studied) (Tables A30, A31, A34).

3.2.5. *Capoeta umbla* (Heckel, 1843)

Scaphiodon umbla HECKEL, 1843: 1060, plate 5, fig. 3, Tigris River in Mossul ("Tigris bei Mossul").

Capoeta umbla. – GÜNTHER 1868: 79, Tigris River.

Capoeta umbla. – SAUVAGE 1884: 5, 16, Tigris, Biredjik (Euphrates).

Varicorhinus umbla. – KOSSWIG & BATTALGIL 1943: 24, Mossul, Şitak, Batman suyu, Hazer (Hazar) Gölü.

Varicorhinus umbla. – BERG 1949: 379, fig. 17, Tigris basin from Mosul to the lower reaches.

Varicorhinus umbla. – LADIGES 1960: 132 (listed).

Varicorhinus damascinus umbla. – KHALAF 1961: 34, Iraqi waters.

Varicorhinus umbla. – BECKMAN 1962: 149, Tigris River.

Capoeta capoeta umbla. – KARAMAN 1969: 32, upper reaches of the Tigris-Euphrates system.

Capoeta capoeta umbla. – KURU 1971: 139, Euphrates, Murat suyu (Murat Nehri), Kara su.

? *Varicorhinus damascinus* (partim). – SAADATI 1977: 74, 192-193, Tigris basin in Iran.

Varicorhinus umbla. – SAADATI 1977: 76, 194, Tigris River system.

Capoeta capoeta umbla. – COAD 1980: 91, upper Tigris-Euphrates system.

Varicorhinus umbla. – BANISTER 1980: 103, Tigris and Euphrates.

Capoeta capoeta umbla. – KURU 1980b: 494, Tigris and Euphrates.

Capoeta capoeta umbla. – BIANCO & BANARESCU 1982: 87, Tigris-Euphrates drainage.

Capoeta damascina (partim). – COAD 1991: 15, Tigris-Euphrates basin (listed).

Capoeta umbla. – BANARESCU 1999: 386, Tigris, Euphrates.

Capoeta capoeta umbla. – KILIÇ DEMIROK & ÜNLÜ 2001: 389-393, Tigris River (biology).

Capoeta capoeta umbla. – TÜRKMEN et al. 2002: 317-328, Aşkale region of the Karasu River (biology).

C. umbla (partim). – SCHÖTER et al. 2009: 234, Tigris-Euphrates system.

Material examined: Syntypes of *Scaphiodon umbla*: 1, 177.45 mm SL, Iraq: Tigris at Mosul, 29.10.1984, Th. Kotschy, NMW 55933. – 1, 183.55 mm SL, same data as NMW 55933, 29.10.1984, NMW 55932. – 1, ca. 263 mm SL, Iraq: Mosul, Th. Kotschy, NMW 79373.

– (1) 1, 175.81 mm SL, Turkey: Palu/Murat (source of Euphrates), ca. 38° 43' N 39° 56' E, V. Pietschmann, NMW 90541. – (2) 1, 42.43 mm SL, Turkey: outflow of Hazar Gölü at Plajköy, 38° 30.187' N 39° 30.423' E, 24.IX.2008, M. Özuluğ & J. Freyhof, FSJF 1494 (in 96 % alcohol). – (3) 1, bent specimen, Turkey: Hazar Gölü, ca. 38° 30' N 39° 30' E, 22/23.VII.1914, V. Pietschmann, NMW 90543. – (4) 2, 212.22-220.14 mm SL, Turkey: Kürk at Hazar Gölü, draining to Tigris, ca. 38° 30' N 39° 30' E, V. Pietschmann, 1914, NMW 91066. – (5) 6, 156.73-216.18 mm SL, Turkey: Kürk at Hazar Gölü, draining to Tigris, ca. 38° 30' N 39° 30' E, V. Pietschmann, NMW 91067. – (6) 3, 153.47-228.75 mm SL, Turkey: Kürk at Hazar Gölü, draining to Tigris, ca. 38° 30' N 39° 30' E, V. Pietschmann, NMW 91069. – (7) 3, bent specimen with damaged snout-ca. 227.28 mm SL, Turkey: Wadi Mahmedian Çay, (source of Tigris), ca. 38° 20' N 40° 45' E, 1914, V. Pietschmann, NMW 90543. – (8) 2, bent specimen with damaged snout-224.04 mm SL, Turkey: Wadi Mahmedian Çay, (source of Tigris), ca. 38° 20' N 40° 45' E, 1914, V. Pietschmann, NMW 91062. – (9) Fin clip, Turkey: Tigris River, 5 km east of Bismil, 37° 50.314' N 40° 41.620' E, 25.IX.2008, M. Özuluğ & J. Freyhof, specimen identified by J. Freyhof, FSJF 1425 (in 96 % alcohol). – (10) 2, 123.26-141.95 mm SL, Turkey: Batman (a tributary to Tigris), ca. 37° 50' N 41° 00' E, V. Pietschmann, NMW 90536. – (11) 2, 132.67-152.50 mm SL, Syria: Jerablus at Euphrates, ca. 36° 49' N 38° 02' E, V. Pietschmann, NMW 91078. – (12) 1, bent specimen (ca. 100 mm SL), Iraq: Nahr Rawanduz (Great Zab), N. Sarsam, BMNH 1974.2.22.1390. – (13) 2, bent specimens (ca. 178-ca. 201 mm SL), Iraq: Nahr Rawanduz and Serokani stream (Rawanduz), N. Sarsam, BMNH 1974.2.22.1392-1393. – (14) 2, 173.15-197.74 mm SL, Iraq: Great Zab near Aski Kalak (Eski Kelek) and near Bekhme Dam, N. Sarsam, BMNH 1974.2.22.1394-1395. – (15) 1, bent specimen (ca. 197 mm SL), Iraq: Siwel River, Little Zab, N. Sarsam, BMNH 1974.2.22.1391. – (16) 1, bent specimen, Iraq: Nahr Qiziljah, Little Zab, N. Sarsam, BMNH 1974.2.22.1396. – (17) Fin clip, Iran: Rud-e Garan, Marivan, Kurdestan, 26.VI.2009, H. R. Esmaeili, CBSU uncatalogued (# 11) (in 96 % alcohol).

3.2.5.1. Diagnosis

Capoeta umbla is distinguished from all other *Capoeta* species by the combination of the following characters: very elongate and slightly compressed body; 8-10 branched dorsal-fin rays; last unbranched dorsal-fin ray weakly to moderately ossified and serrated in 1/2-3/4 of its length; very small scales, 18-24 above the lateral line, 11.5-15.5 below the lateral line, 32-39 encircling least circumference of the caudal peduncle, 86-104 scales in the lateral-line series; 15-16 gill rakers on lower limb of first gill arch; 46-50 total vertebrae; one posterior pair of barbels.

3.2.5.2. Description

The habitus of *C. umbla* is shown in Figure 10. Morphometric measurements are given in Tables A2-A21 and meristic counts are given in Tables A22-A35.

Body elongate and slightly compressed; greatest body depth at level of dorsal-fin origin; predorsal body profile smoothly convex to dorsal-fin origin; nuchal hump present in well-fed specimens; snout pointed; mouth ventral; lower lip covered with a sharp-edged horny sheath and its anterior margin straight or rounded to almost crescent-shaped; rostral cap well developed, partly overlapping upper lip.

Dorsal fin inserted anterior to pelvic-fin origin and its outer margin usually concave; 4-6 unbranched and 8-10 branched dorsal-fin rays (Tables A22, A23); last unbranched dorsal-fin ray weakly to moderately ossified, soft and flexible at the tip, serrated in 1/2-3/4 of its length; pectoral fins not extending to pelvic-fin base, outer margins usually slightly convex; 19-21 pectoral-fin rays in total (Table A24); pelvic fins not extending to anal-fin base, outer margins straight or slightly rounded; 10-11 total pelvic-fin rays (Table A25); pelvic axillary scale present; anal fin with 3 unbranched and 5 branched rays (Tables A26, A27), outer margin straight or slightly convex; caudal fin forked and its tips pointed; 17 branched caudal-fin rays (Table A28).

Fig. 10. *Capoeta umbla* from Tigris River, 5 km east of Bismil, photograph of live specimen (Photo taken by J. Freyhof and edited by N. Alwan).

Scales very small, 18-24 above the lateral line (Table A29); 11.5-15.5 below the lateral line (Table A30); 32-39 encircling least circumference of caudal peduncle (Table A31), 86-104 scales in the lateral-line series (Table A32); ventral midline and pectoral region covered with deeply embedded scales of reduced size; gill rakers slightly hooked; 15-16 gill rakers on the lower limb of the first gill arch (Table A33); 46-50 total vertebrae (Table A34); one posterior pair of barbels (Table A35); pharyngeal teeth arranged in three rows in the following manner: 2.3.5-5.3.2 (f1) and very similar in shape to those of *C. damascina*.

3.2.5.3. Coloration

Live specimens: dorsum, head and body shiny golden-brown (Fig. 10) or yellow, darker dorsally and lighter below the lateral line; fins yellowish-golden (Fig. 10); several to many small diffuse black spots present on the body above the lateral line in some juveniles.

Preserved specimens: dorsum, head and upper half of the body brown or brownish-grey; lower half yellow or whitish-yellow; fins yellow or brownish-yellow; black spots in juveniles well discernible.

3.2.5.4. Sexual Dimorphism

Well-developed breeding tubercles in males present on the sides of the snout from eye to eye below the nostril, on the back, on the body above the lateral line to caudal-fin origin, on the lateral line with one tubercle per scale but not on every scale, on the area above the anal fin and on anal-fin rays; unculi present on the snout of some males. In very rare cases, females bear a small number of breeding tubercles on the sides of the snout and in the area above the anal fin.

Tip of anal fin reaching to or beyond the vertical of the caudal-fin base in females and to about 2/3 of the caudal peduncle in males.

3.2.5.5. Habitat and Distribution

Nothing is known regarding the habitat of this species. *Capoeta umbla* is found in the Tigris-Euphrates river system (Fig. A5). It inhabits the upper reaches of the Tigris and Euphrates Rivers and their tributaries.

3.3. Statistical Analyses

3.3.1. Morphometrics

Based on a comparative analysis of the relative morphometric measurements of the different species and populations within the *C. damascina* complex (Figs A6-A24; Tables A2-A21, A36-A73), it must be concluded that these characters are of little or no relevance in diagnosing species and separating them from each other, because of considerable overlaps in the ranges of these characters. Although the p-values obtained from pairwise comparisons of regression line slopes and intercepts for morphometric measurements indicate statistically significant differences in these characters among many populations across species or within a species (Tables A36-A73), considerable overlaps in the ranges of these characters existed among them. These characters can only be useful in distinguishing one population of a certain species from one or few populations of the other remaining species but do not allow distinguishing among species.

3.3.2. Meristics

3.3.2.1. Allometric Growth

The p-values obtained from the non-parametric Mann-Whitney tests showed that all meristic characters studied (except the number of gill rakers) in the *C. damascina* population from the Jordan River drainage basin stay constant and no significant differences were found when comparing between two different size groups (Table A74, $P \geq 0.05$). Thus, it is assumed that the meristic characters of all populations examined stay stable during growth.

3.3.2.2. Comparisons among Species and Populations

Statistical analyses using the non-parametric Kruskal-Wallis test revealed significant differences in meristic characters tested ($P < 0.05$) among species and populations, with the exception of unbranched anal- ($P = 1.00$) and branched caudal- ($P = 0.602$) fin ray counts. To investigate which populations differed, they were tested against each other in a pairwise manner using the Mann-Whitney test or ANCOVA (Tables A75-A87).

As can be seen from Figures A25-A29 and Tables A29-A34, six meristic characters (ALL, BLL, CCP, LL, $GR_{\text{Lower limb count}}$ and VC) prove to be useful in diagnosing and separating species within the *C. damascina* complex. Comparisons of these meristic characters, using Mann-Whitney tests or ANCOVA, indicate significant differences among species (Tables A80-A86). All statistically tested *C.*

damascina populations have significantly higher $\mathrm{GR}_{\mathrm{Lower\ limb\ count}}$ than those of *C. saadii* (Fig. A29; Tables A33, A85). Specimens of *C. saadii* have significantly lower BLL and CCP than *Capoeta* sp.1 (Figs 26, 27; Tables A30-A31, A81-A82). *Capoeta saadii* has a lower VC than *C. umbla* (Tables A34, A86). *Capoeta* sp.1 has a significantly lower $\mathrm{GR}_{\mathrm{Lower\ limb\ count}}$ than all *C. damascina* populations except that from the Damascus basin (Fig. A29; Tables A33, A85). Specimens of *C. umbla* have significantly higher ALL, BLL, CCP and LL counts than those of *C. damascina*, *C. saadii* and *Capoeta* sp.1 populations (Figs A25-A28; Tables A29-A32, A80-A83).

The remaining populations of the above-mentioned species, which were not tested statistically, showed the same patterns of differences in meristic characters as stated in the previous paragraph (Figs A25-A29, Tables A29-A34).

Though not statistically-tested, *C. buhsei* ($n < 15$) has a lower $\mathrm{GR}_{\mathrm{Lower\ limb\ count}}$ and a lower VC than *C. damascina* and *Capoeta* sp.1 (Fig. A29; Tables A33, A34). It has a higher BLL, CCP and LL than *C. saadii* (Figs A26-A28, Tables A30-A32) and a lower ALL, BLL, $\mathrm{GR}_{\mathrm{Lower\ limb\ count}}$ and VC than *C. umbla* (Figs A25, A26, A29; Tables A29, A30, A33, A34). Specimens of *C. umbla* have higher $\mathrm{GR}_{\mathrm{Lower\ limb\ count}}$ than *C. saadii* and *Capoeta* sp.1 specimens (Fig. A29, Table A33). According to the present results, *C. saadii* has a lower VC than *Capoeta* sp.1 but this might prove incorrect once a larger sample has been studied (Table A34).

As far as populations within the same species, above all those of *C. damascina*, are concerned, statistically significant differences in meristic characters existed among some of them, despite considerable overlaps in ranges (e.g. ALL: the population from the Damascus basin differs from the ones from Nahr Quwayq, the Litani River drainage, the Jordan River drainage basin, rivers in the Dead Sea Valley, Arsuz Nehri and Nahr Antelias). In few cases, a slight or no overlap in the meristic count ranges exists among some of these populations (e.g. ALL: the population from the Damascus basin differs from the one from the Tigris-Euphrates river system; CCP: the population from Nahr Marqiyah and the ones from the Jordan River drainage basin, rivers in the Dead Sea Valley and the Tigris-Euphrates river system; LL: the population from the Seyhan Nehri drainage and the one from the Tigris-Euphrates river system). A similar situation applies to populations represented by sample sizes of less than 15 specimens. Such differences (slight/no overlap in ranges) among populations within the same species are of no relevance in taxonomy as they can be useful in distinguishing one population from several ones but not from all the populations. This also applies to the other remaining meristic characters (unbranched D, branched D, Pc, P, branched A and total number of barbels), which despite the statistical significant differences among the species and populations are not useful in taxonomy because they do not allow distinguishing among species (Tables A22-A25, A27, A35, A75-A79, A87).

3.4. Principal Component Analysis

3.4.1. Morphometrics

Seven PCAs, performed on the correlation matrix, were carried out on 17 log-transformed measurements of the 614 fully examined specimens of the *C. damascina* species complex (*C. buhsei*, *C. damascina*, *C. saadii*, *Capoeta* sp.1 and *C. umbla*). However, only the first PCA was shown (Fig. A30) since none of the others has revealed any new information.

The most important factor loadings on the second Principal Component (PCII) are for the eye diameter followed by the postorbital length and anal-fin base length (Table A88). The PCIII is defined mainly by the length of the longest dorsal-fin ray and the length of the longest anal-fin ray (Table A88).

As shown in Figure A30, the PCA did not result in any reasonable discrimination among the different species as the clusters of *C. buhsei*, *C. saadii*, *Capoeta* sp.1 and *C. umbla* specimens are almost entirely situated within the cluster of *C. damascina* specimens. Concerning the *C. damascina* populations, the results obtained from PCA were not different from those obtained from statistical analyses and that is why no PCA plots are shown. The same applies to *C. saadii* populations, which show considerable overlaps among their clusters.

3.4.2. Meristics

A PCA, performed on the correlation matrix, was carried out on 12 meristic characters of all fully examined specimens (n = 446) (Fig. A31). *Capoeta buhsei* was not included due to a lack of fully examined specimens. The factor loadings of this PCA are given in Table A89. The highest factor loadings on PCI are for the counts of circumpendicular scales, scales above the lateral-line and lateral-line scales. The PCII is defined mainly by the number of total pelvic-fin rays, total pectoral-fin rays and gill rakers on the lower limb of the first gill arch. As shown in Figure A31, a clear separation was found between *C. umbla* and the other remaining species (*C. damascina*, *C. saadii* and *Capoeta* sp.1). Another PCA using the same meristic data but excluding those of *C. umbla* specimens (n = 7) revealed a slight overlap between *C. damascina* and *C. saadii* clusters (Fig. A32). A clear separation was found between *C. saadii* and *Capoeta* sp.1 clusters (Fig. A32). As shown in Figure A32, the cluster of *Capoeta* sp.1 specimens is entirely situated within that of the *C. damascina* populations. The factor loadings of this PCA are given in Table A90.

Concerning the *C. damascina* populations, no new results were revealed from PCA and for this reason no PCA plots are shown. The same applies to *C. saadii* populations, which show considerable overlaps among their clusters. This also confirms the results obtained from statistical analyses.

3.5. Identification Key

This identification key works only with the *Capoeta* species pointed out in this PhD project and will be subject to changes if more species are added.

1. More than 18 scales above the lateral line; more than 11.5 scales below the lateral line

C. umbla

- Less than 18 scales above the lateral line; less than or equal to 11.5 scales below the lateral line

2

2. Absence of serrae on the last unbranched dorsal fin-ray

C. caelestis

- Presence of serrae on the last unbranched dorsal fin-ray

3

3. Fish from the Damascus basin

C. damascina from the Damascus basin

- Fish from other river drainages and basins

4

4. More than 13 gill rakers on the lower limb of the first gill arch

C. damascina from all remaining river drainages and basins

- Less than or equal to 13 gill rakers on the lower limb of the first gill arch

5

5. 7-10 scales below the lateral line; less than 27 circumpendicular scales (modally 25-26)

C. saadii

- 10-11.5 scales below the lateral line; more than or equal to 27 circumpendicular scales

6

6. More than 10 gill rakers on the lower limb of the first gill arch

***Capoeta* sp.1**

- Less than or equal to 10 gill rakers on the lower limb of the first gill arch

C. buhsei

3.6. Phylogenetic Analyses

The major result of the molecular phylogenetic analyses is that *C. damascina* is a complex of six closely related species: *C. buhsei*, *C. caelestis*, *C. damascina*, *C. saadii*, *Capoeta* sp.1 and *C. umbla*.

3.6.1. Phylogenetic Trees

3.6.1.1. COI

Sequence Characteristics

COI sequences of 581 nucleotides were obtained for each of the 105 specimens (including two sequences from Genbank) after editing and were unambiguously aligned. Among the 581 nucleotide sites, 126 were variable and 83 were parsimony informative. The nucleotide composition of the COI sequences was **G**-deficient (16.9 %) whereas similar frequencies were observed for the other three nucleotides (**A**: 27.1 %, **C**: 28.7 %, **T**: 27.3 %).

Phylogenetic Inference

The Hasegawa-Kishono-Yano model of molecular evolution (HASEGAWA et al. 1985) with invariant sites and gamma distribution (HKY+I+G) was the best-fitting model for the data set using the Akaike Information Criterion (AIC). The resulting phylogenetic trees using the MP and the BA methods were congruent. They produced a tree where 11 major clades (A-K, Fig. 11) were tentatively identified. The first clade (A), supported by a bootstrap value of 54 % and a posterior probability (PP) value of 70 %, included *C. damascina* and *C. umbla*. Within this clade, *C. umbla* is nested within *C. damascina* where *C. umbla* specimens from the Tigris river system cluster in one group with one sample of *C. damascina* from the Seyhan Nehri drainage (FSJF 376) and two from the Euphrates river system (FSJF 897 and FSJF 904). Regarding the different geographically defined *C. damascina* populations, the relationships among them are not well resolved though most of the samples from the Lebanese coastal rivers tend to cluster with each other, supported by a PP value of 86 %. A larger clade with a PP value of 60 % contains samples from the Lebanese coastal rivers as well as four additional ones from the Jordan River drainage basin (two samples) and from the Syrian coastal river, an-Nahr al-Kabir (N) (two samples). Similarly, *C. damascina* samples from the Damascus basin tend to cluster together along with one sample from Nahr Yarmuk from the Jordan River drainage basin (PP value = 75 %). The well-supported clade B (bootstrap value = 98 %, PP value = 100 %) comprises *C. caelestis* from the Göksu Nehri drainage, which forms the sister group to clade A.

Capoeta saadii samples (clade C) are grouped together, showing a tendency to cluster by sampling locality (i.e. those from the same basin clustered together), and forms the sister group to *C. buhsei* and *Capoeta* sp.1 (clade D+E). Concerning *C. buhsei* (clade D), it is obvious that the relationship among its individuals is not very well resolved and there is no significant support. They seem to be very closely related to members of the *Capoeta* sp.1 (clade E), which form a well-supported monophyletic group (PP value = 100 %). *Capoeta saadii* (clade C), *C. buhsei* (clade D) and *Capoeta* sp.1 (clade E) are clearly separated from *C. damascina*, *C. umbla* and *C. caelestis* (clades A and B). Clade A+B (bootstrap value = 89 %, PP value = 100 %) and clade C+D+E (bootstrap value = 83 %, PP value = 100 %) are well supported and form a larger clade (A-E), which constitutes the *C. damascina* species complex (bootstrap value = 67 %, PP value = 72 %).

Capoeta turani and *C. erhani* samples cluster together in one clade (G). The tree topology supports the monophyly of *C. pestai/mauricii* (clade F), *C. barroisi* (clade H), *C. trutta* (clade I) and *C. mandica* (clade J) though the relationships among these clades are not resolved. As far as *C. aculeata* (clade K) is concerned, a clear separation is observed between this species and between all the other remaining species (bootstrap value = 91 %, PP value = 100 %), where it forms a well-supported clade (bootstrap value = 99 %, PP value = 100 %).

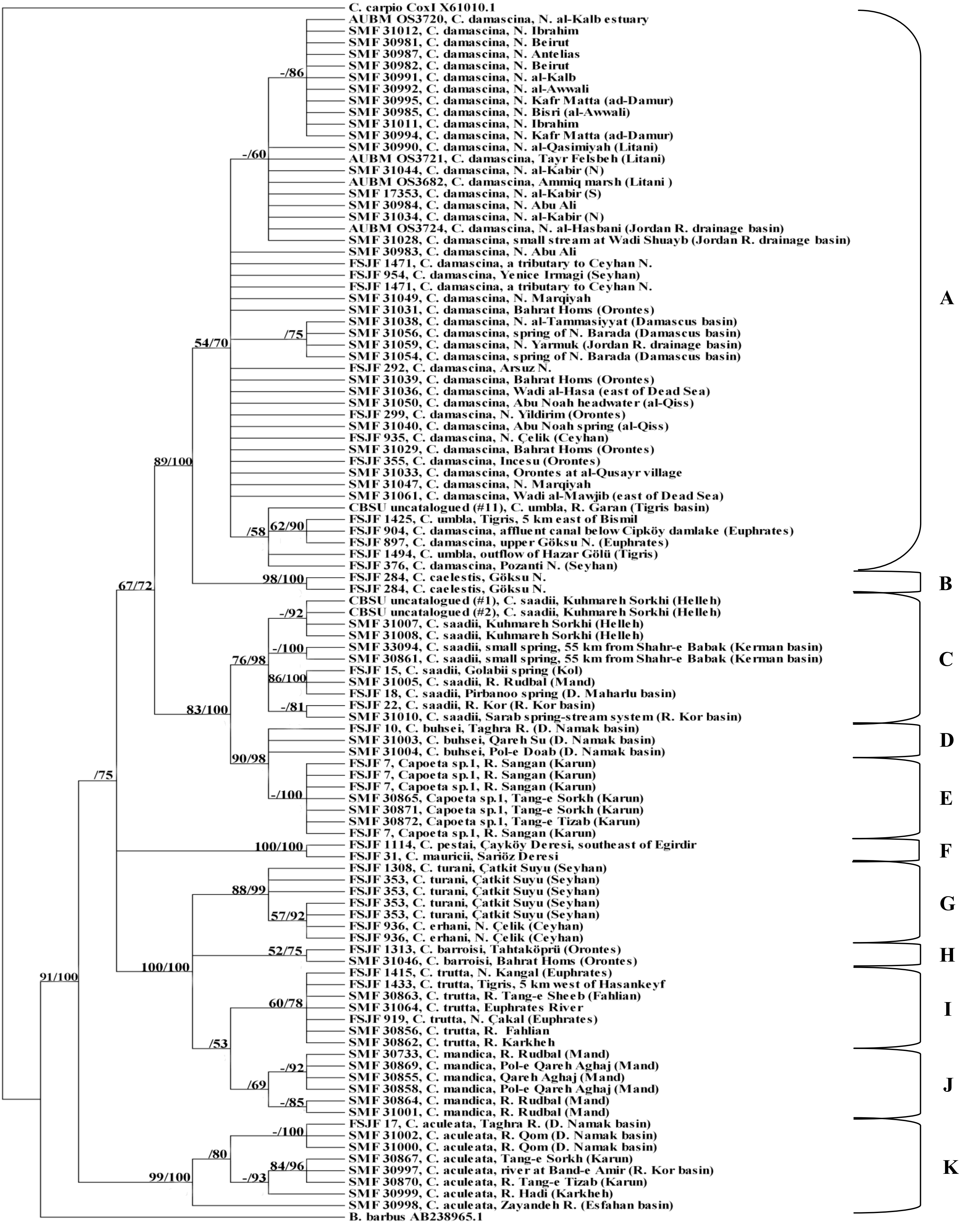

Fig. 11. Condensed cladogram obtained from COI sequences using Maximum Parsimony/Bayesian analysis. Numbers above branches refer to bootstrap/posterior probability percentages; only values ≥ 50 % are shown. "-" indicates that no bootstrap value was obtained from MP analysis as only a single sequence was included in the analysis.

3.6.1.2. LSU

Sequence Characteristics

Since the target taxon in this study is the *C. damascina* species complex, not all the specimens used in COI analysis were sequenced with the LSU marker. Therefore, a total of 65 sequences (with a length of 528 sites or positions including nucleotides and gaps) were obtained from all the *C. buhsei*, *C. caelestis* and *C. pestai* individuals and most of the *C. damascina* (43 out of 45), *C. saadii* (7 out of 11), *Capoeta* sp.1 (5 out of 7) and *C. umbla* (2 out of 3) samples. It is important to note that one specimen from the Rud-e Kol drainage (FSJF 15) yielded a very short sequence due to an amplification artifact; therefore, it was replaced by another specimen from the same river drainage but from a different locality (CBSU uncatalogued, # 21), thus raising the number of *C. saadii* sequences obtained from seven to eight. Among the 528 nucleotide sites, 84 were variable and 44 were parsimony informative. Visual inspection revealed that there was no need for manually improving the alignment. The nucleotide composition of the LSU sequences was as follows: **A**: 15.8 %, **C**: 30.8 %, **G**: 35.6 % and **T**: 17.8 %.

Phylogenetic Inference

The generalized time reversible model (TAVARÉ, 1986) with invariant sites (GTR+I) was the best-fitting model of sequence evolution for the data set using the Akaike Information Criterion (AIC).

The MP and the BA trees show the same topology. The phylogenetic relationships among the different clades are not very well resolved but the tree topology using the LSU marker (Fig. 12) supports the monophyly of *C. umbla* (clad A), *C. caelestis* (clade B), *C. saadii* (clade C), *C. buhsei* (clade D), *Capoeta* sp.1 (clade E) and *C. pestai*/*mauricii* (clade F) with high bootstrap values ranging between 88 % and 97 % and PP values ranging between 83 % and 100 %. Concerning *C. damascina* (clade A), the phylogenetic relationships among its individual populations are not well resolved. *Capoeta umbla* members, which clustered in one group with few members of *C. damascina* from the Euphrates river system and the Seyhan Nehri drainage in the previous tree using the COI marker (Fig. 11), form a monophyletic group without the *C. damascina* specimens in the tree using the LSU marker (Fig. 12). However, the phylogenetic relationship between *C. damascina* and *C. umbla* is not resolved. *Capoeta caelestis* (clade B), which formed the sister group to clade A using the COI marker, formed a separate branch which is basal to all the other *Capoeta* clades using the LSU marker but is not very strongly supported (clade A+C+D+E: bootstrap value = 62 %, PP value = 54 %; clade A+C+D+E+F: bootstrap value = 72 %, PP value = 61 %).

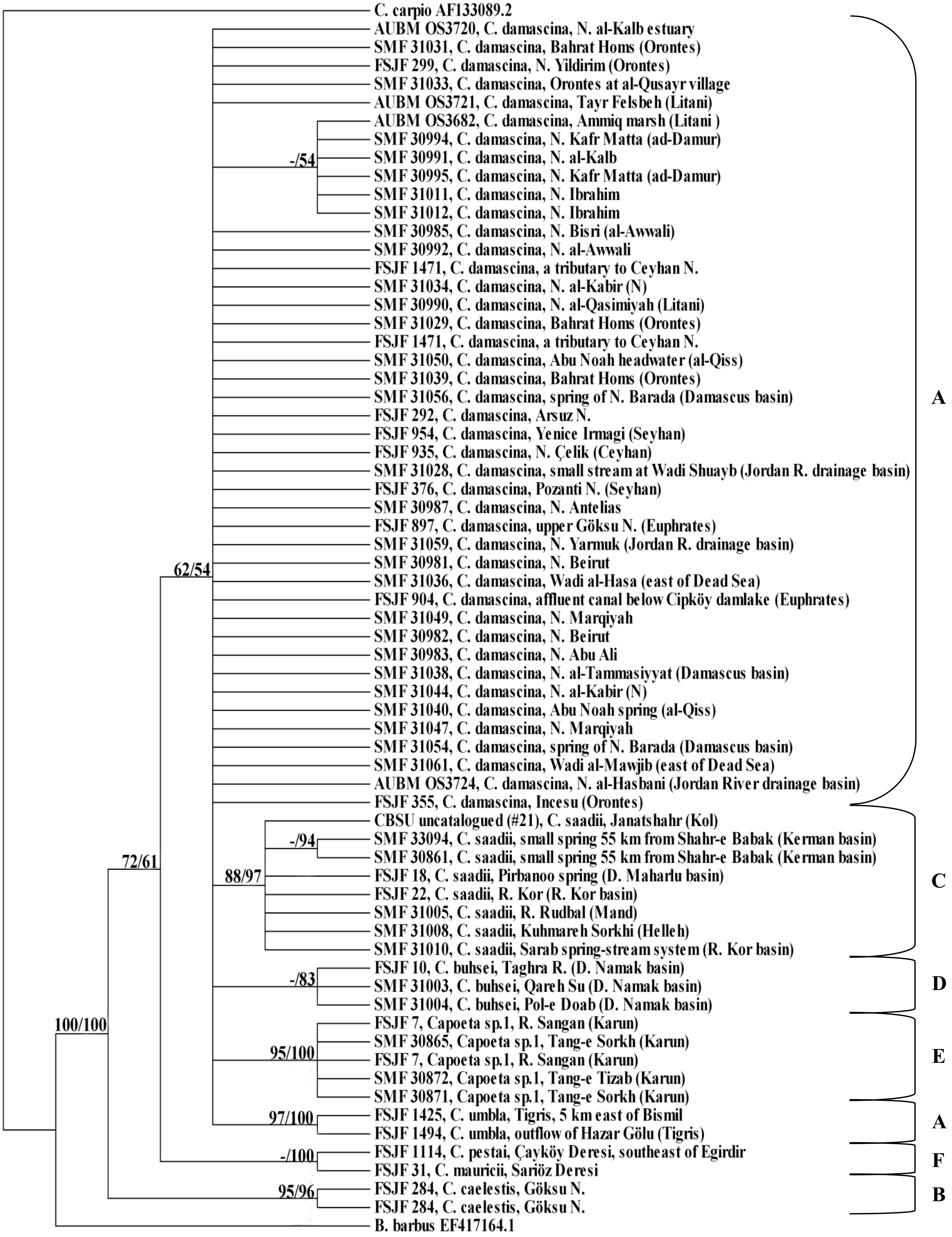

Fig. 12. Condensed cladogram obtained from LSU sequences using Maximum Parsimony/Bayesian analysis. Numbers above branches refer to bootstrap/posterior probability percentages; only values ≥ 50 % are shown. "-" indicates that no bootstrap value was obtained from MP analysis as only a single sequence was included in the analysis.

3.6.1.3. COI + LSU

The total evidence tree (Fig. 13) had a very similar topology to the condensed cladogram obtained from COI sequences except for very few changes. Although the phylogenetic relationship between *C. damascina* and *C. umbla* is still not well resolved, specimens of *C. umbla* cluster together with each other and form a well-supported monophyletic group (bootstrap value = 94 %, PP value = 100 %). Similarly, *C. buhsei* samples form a well-supported monophyletic group (bootstrap value = 81 %, PP value = 96 %), which is the sister group to *Capoeta* sp.1. The phylogenetic relationship between clade F and clade A+B+C+D+E is very well resolved as clade F forms a separate group from clade A+B+C+D+E.

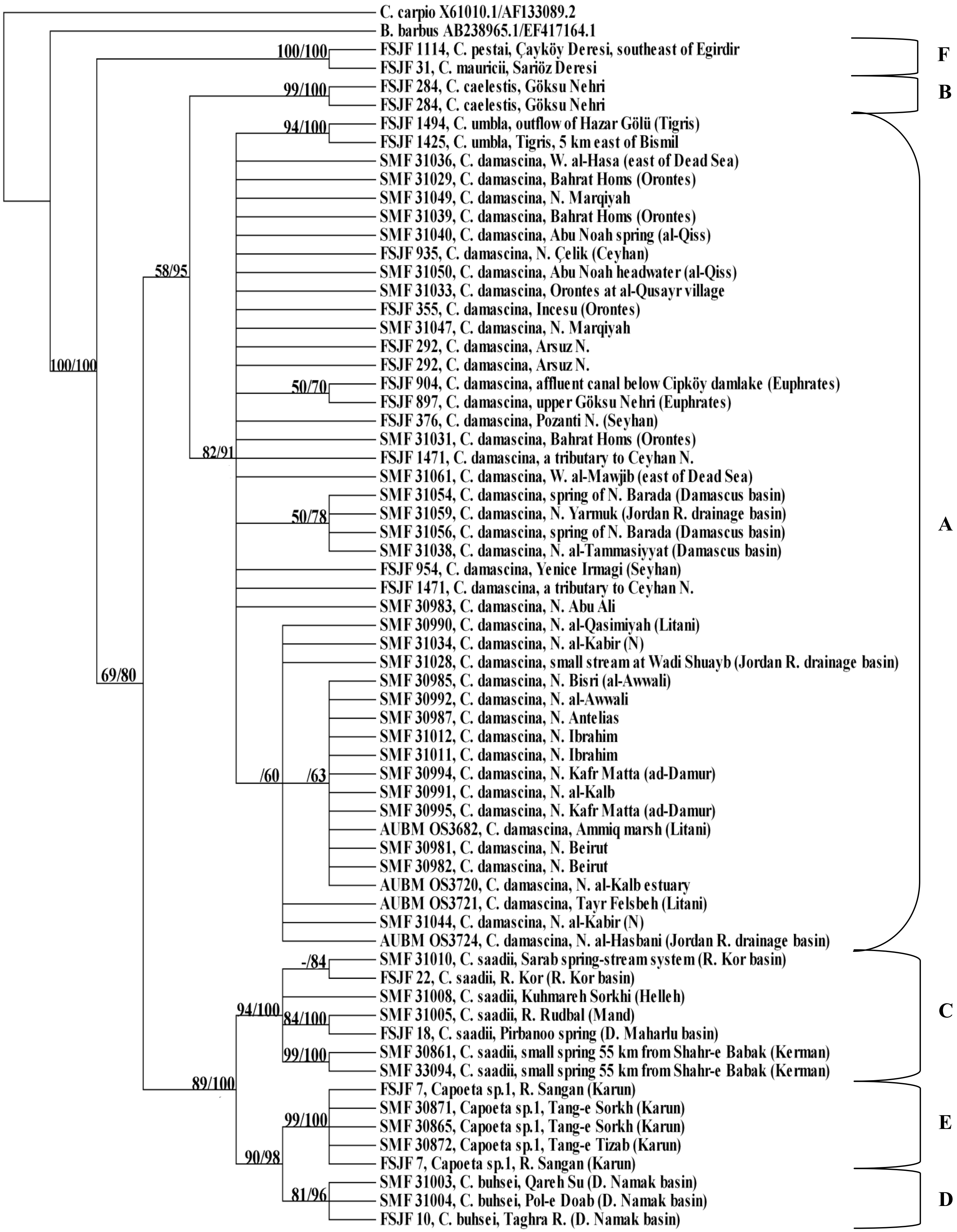

Fig. 13. Condensed cladogram obtained from COI+LSU sequences using Maximum Parsimony/Bayesian analysis. Numbers above branches refer to bootstrap/posterior probability percentages; only values ≥ 50 % are shown. "-" indicates that no bootstrap value was obtained from MP analysis as only a single sequence was included in the analysis.

3.6.2. Haplotype Networks

Only clades (A-E) are presented in this section since they include the species of interest in this study i.e. the members of the *C. damascina* species complex.

Like the tree obtained from COI sequences using MP/BA methods, the haplotype network separates clades A+B (Fig. 14) and clades C+D+E (Fig. 15) from each other. As these clades are not linked in the haplotype network, the number of nucleotide differences exceeds the chosen connection limit (10 mutation steps). The number of nucleotide differences between even the most similar haplotypes of clade A and clades C, D and E is 12, 18 and 21 respectively. As shown in Figure 14, most specimens from the different *C. damascina* populations (clade A) share one of the two most common haplotypes or possess very similar ones. These haplotypes are much more similar to *C. umbla* haplotypes (clade A) than to the two *C. damascina* haplotypes from the Seyhan Nehri drainage and the Euphrates river system (FSJF 376 and FSJF 897). Interestingly, the two haplotypes obtained for the Seyhan Nehri drainage are very distinct from each other (separated by 5 mutation steps) and do not form part of the samples that share the two most common haplotypes. One specimen of *C. umbla* from the Tigris river system (FSJF 1425) shares the same haplotype with a *C. damascina* sample from the Euphrates (FSJF 904). Although linked to clade A, *C. caelestis* (clade B) forms a separate group (7 steps).

Regarding clades C, D, and E (Fig. 15), the haplotype network has revealed that *Capoeta* sp.1 is closely related to *C. buhsei* (3 steps). Interestingly, the *C. saadii* haplotypes were quite divergent from the haplotypes of *C. buhsei* and *Capoeta* sp.1 (maximum 8 steps) and displayed a pattern without an obvious central haplotype. Additionally, the *C. saadii* samples from each separate basin shared the same haplotype except those from Rud-e Mand drainage and Daryacheh-ye Maharlu basin (two specimens) which clustered together and shared the same haplotype.

Fig. 14. Haplotype network for the *Capoeta caelestis*, *Capoeta damascina* and *C. umbla* sequences showing the number of nucleotide differences between haplotypes. Clades labeled A and B correspond to clades A and B in the phylogenetic tree.

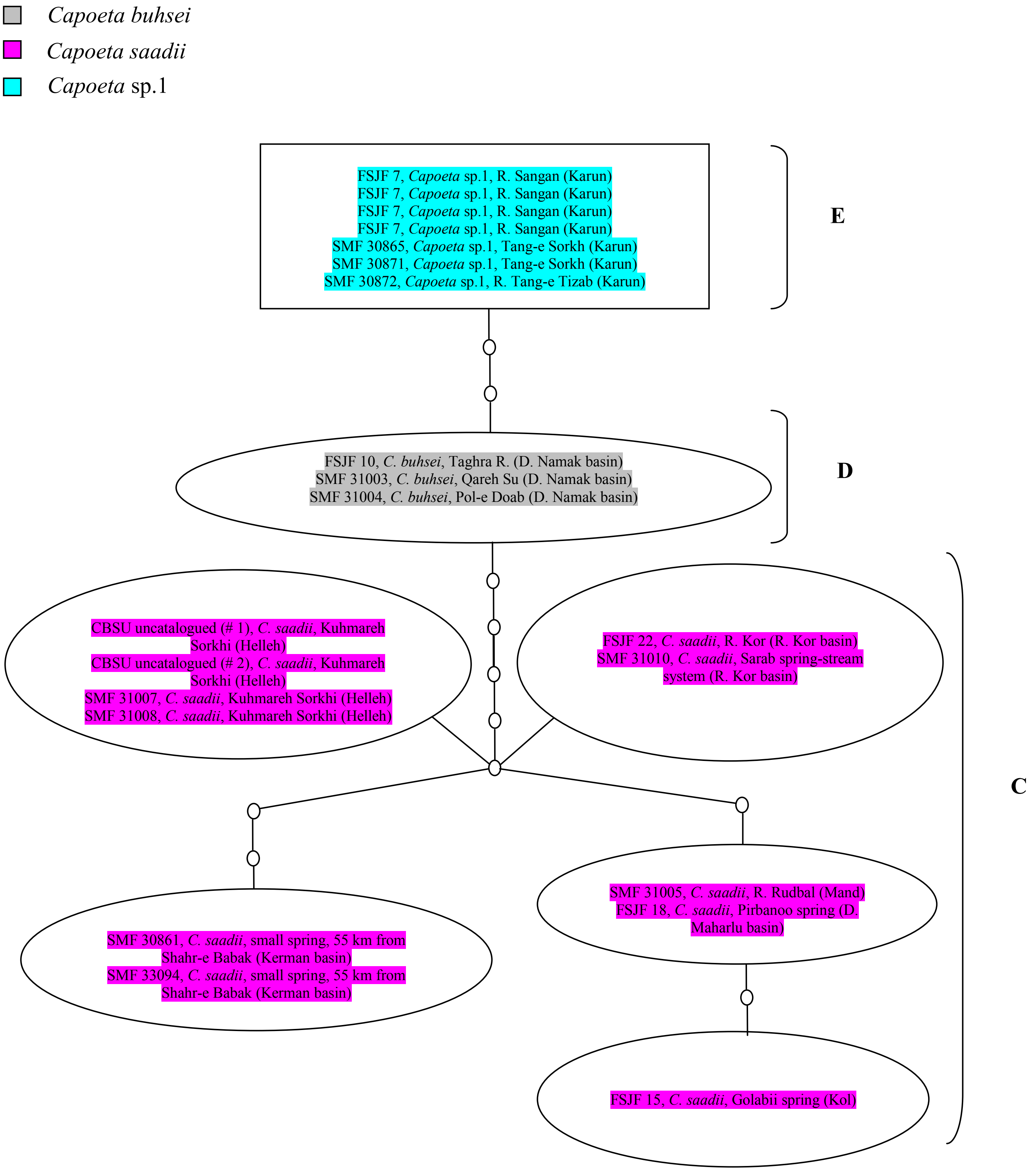

Fig. 15. Haplotype network for the *Capoeta buhsei*, *Capoeta saadii* and *Capoeta* sp.1 sequences. Clades labeled C, D and E correspond to clades C, D and E in the phylogenetic tree.

IV. Discussion

4.1. Material Examined

4.1.1. Measurements and Counts

This part deals with the difficulties encountered in measuring and counting some museum specimens, which were in very poor conditions and with the contradictions existing in the literature due to discrepancies in methods used in measuring and counting morphological characters.

Some of the museum specimens examined (types and non-types) were in very bad condition due to the way they were collected, fixed, preserved and handled. For example, the holotype of *Chondrostoma syriacum* is in a very poor condition and it was almost impossible to take counts and measurements. It was also difficult to count the scale numbers in other specimens (e.g. types of *Scaphiodon amir* and *Scaphiodon niger*), as scales were missing. Counting scale beds was an option to solve this problem in some cases, but did not always prove to be successful because beds were not always clearly visible.

When comparing the data obtained in this study with those present in the literature, discrepancies sometimes occurred. This is because different authors used different methods in measuring and counting morphological characters. For example, measurements were done by SCHÖTER et al. (2009) from point to point and not as projections along the longitudinal axis as in this study. The latter method was followed in order to compare the data obtained with those of KRUPP (1985), whose study was the first comprehensive one on the Levantine *C. damascina*. Various authors such as KRUPP (1985), TURAN et al. (2006a, b) and COAD (2008) used different methods in counting the lateral-line scales (from the first complete scale to the last scale at the level of the hypural plate or to the last scale terminating at the beginning of the caudal-fin base, $LL_{\text{Caudal fin base}}$). In this study, scales were counted from the first pore-bearing scale to the last scale on the caudal fin, as this method was much easier than the other stated ones. This may account for differences of about 3-4 scales. These differences were taken into consideration when comparing lateral-line scale counts between species of the *C. damascina* complex and the other *Capoeta* species reported by the aforementioned authors. In most of their species' descriptions, COAD (2008) and others (e.g. SAADATI 1977, BIANCO & BANARESCU 1982) counted the total number of gill rakers on the first gill arch whereas only the number of gill rakers on the lower limb of the first gill arch was counted in this study. Counting the number of gill rakers on the lower limb seems to be much more accurate than counting the total number on the first gill arch due to the presence of many rudimentary rakers on the upper limb, which increases the chance of missing them while counting. Others (e.g. HECKEL 1849) did not specify the method used, thus making it nearly impossible to decide, if differences were due to the method used in measuring and counting or to other factors such as morphological differences among samples. Also, sample size certainly played a role.

4.1.2. Type Specimens

Twenty four nominal species (*Capoeta aculeata*, *C. angorae*, *C. barroisi*, *C. buhsei*, *C. caelestis*, *C. erhani*, *C. mandica*, *C. mauricii*, *C. pestai*, *C. trutta*, *C. turani*, *Chondrostoma syriacum*, *Gobio damascinus*, *Scaphiodon amir*, *S. capoeta*, *S. chebisiensis*, *S. rostratus*, *S. fratercula*, *S. niger*, *S. peregrinorum*, *S. saadii*, *S. socialis*, *S. umbla* and *Varicorhinus nikolskii*) have been included in this study. Out of them, one holotype of *Chondrostoma syriacum*, one lectotype and three paralectotypes of *Gobio damascinus*, seven syntypes of *Scaphiodon amir*, four syntypes of *S. niger*, 10 syntypes of *S. peregrinorum*, 22 syntypes of *S. saadii* and three syntypes of *S. umbla* have been examined.

A search for the types of *S. fratercula* and *S. socialis*, which were described from Damascus, in the NMW did not produce fruitful results. This was in agreement with what has been mentioned earlier by KRUPP & SCHNEIDER (1989). The original descriptions and locality data provided by HECKEL (1843) leave no doubt that both are synonyms of *C. damascina*.

There are three specimens of *Scaphiodon capoeta* from Aleppo (NMW 51650, 51831, 55845), which look very similar to what has been mentioned in HECKEL's description. However, HECKEL (1843) described only two specimens in his manuscript, which measure 279 mm (11 inches) and 305 mm (12 inches) in length and these measurements are different from those of NMW 51650, 51831 and 55845. Thus, they can not be the types of *S. capoeta* but they certainly belong to *C. damascina* based on HECKEL's description.

Currently, there are 10 syntypes of *S. peregrinorum* (considered a synonym of *C. damascina*) in the NMW catalogued as NMW 51658 (1 specimen), NMW 51659 (1), NMW 51660 (1), NMW 51661 (1), NMW 51662 (1), NMW 51663 (1) NMW 51664 (3) and NMW 51665 (1) but only six specimens are listed in HECKEL's acquisition catalogue. One possibility is that two copies of HECKEL's acquisition catalogue existed and he possibly adjusted changes in one copy but not in the other. Another possibility could be that HECKEL was not aware of the presence of additional specimens. ESCHMEYER (1998) considered NMW 51658 and NMW 51660-51665 as valid type specimens of this species and noted that specimens catalogued as RMNH 2681 (3) (ex NMW) in the Rijksmuseum van Natuurlijke Historie (Leiden) might possibly belong to the syntype series of *S. peregrinorum*. Unfortunately, HECKEL (1843) in his original description did not specify the number of specimens examined, but based on the locality data it seems that they all belong to the type series of *S. peregrinorum*.

Eighteen syntypes of *S. saadii* were deposited under NMW 51666 with a further four syntypes under NMW 55900. The 1840-1844 catalogue of the NMW lists 10 fish in one column and 10 in an adjacent column for *S. saadii*. There is also an additional syntype catalogued as RMNH 3166 (ex NMW) (ESCHMEYER 1998). ESCHMEYER (1998) considered only "NMW 52666" (should read 51666) and RMNH 3166 as syntypes of *S. saadii*. Specimens catalogued as NMW 55900 were difficult to examine since they were in bad condition. Many scales were missing making it nearly impossible to take all the counts. However, the locality data and number of gill rakers on the lower limb of the first gill arch leave no doubt that they belong to *C. saadii* and that is why they were considered types in this study.

4.2. Comparative Morphological and Molecular Assessments of the *C. damascina* Species Complex

4.2.1. Causes and Significance of Morphological Variability

Analyses of the morphometric and meristic data obtained in this study revealed phenotypic variability among the various populations within a species and among the different species. Some of the differences proved to be statistically significant.

4.2.1.1. Morphometric Characters

Morphometric data, which were subjected to ANCOVA, indicated significant differences in the slopes and intercepts among populations of the same as well as different species. Although such differences did not prove to be useful in taxonomy, because they did not allow distinguishing among species due to the considerable overlap in ranges; they reflect, to some extent, intra- and interspecific variability which could be attributed to several factors. Differences in slopes among populations of the same species as well as different species (e.g. SD in *C. damascina* from the Damascus basin and the same species from the Jordan River drainage basin or rivers discharging into the Dead Sea; SA in *C. damascina* from the Jordan River drainage basin and the same species from the Damascus basin and the Orontes River drainage) reveal different growth patterns. These differences in slopes indicate that some populations within *C. damascina* or among species change body proportions faster/slower and/or earlier/later during their development than others. This may be related to heterochronies. Heterochronies are changes in the development rate or the beginning time of development, which are directly caused by genetic changes and indirectly by environmental changes (MOTTELY 1934, GOULD 1977, SMIRNOV et al. 2006).

Differences in intercepts of the morphometric characters among several populations of the same as well as different species indicate different relative body proportions (e.g. SP in *C. damascina* from the Damascus basin and the same species from the Orontes River drainage, Jordan River drainage basin, rivers discharging into the Dead Sea, Nahr Marqiyah, Nahr Antelias, and the Tigris-Euphrates river system with considerable overlap in ranges; SA in *C. damascina* from the Damascus basin and the same species from the Orontes River drainage, Nahr Marqiyah and Nahr Antelias with considerable overlap in ranges; LPC in *C. damascina* from Arsuz Nehri and the same species from Nahr Quwayq and the Tigris-Euphrates river system with slight-no overlap in ranges). This is also the case for populations with sample sizes of less than 15 individuals. An evaluation of the morphometric data using PCA did not result in any new information. Such differences in morphometric characters, as stated above, could be, in large part, attributed to ecological conditions (e.g. water temperature, dissolved oxygen, availability and type of food supply and water flow) and habitat structure and characteristics (e.g. width/depth of the habitat, substrate, vegetation and competition), but also can be determined genetically (BONE & MARSHALL 1985, VAN EEDEN et al. 1996, VIDAL 2009). Genetic changes can be induced by random and non-random factors such as genetic drift and selective environmental pressures. Many of the populations studied within the *C. damascina* species complex occur in small isolated water bodies and thus are expected to develop different degrees of genetic diversion due to isolation. As a consequence, some populations might turn out to be more susceptible to genetic drift than other, more conservative ones. In addition, ecological conditions may vary considerably in watercourses, where these populations occur leading to intra-as well as interspecific variability. Since information on the ecological conditions in the river systems, where members of the *C. damascina* species complex occur and studies dealing with the effects of these factors in inducing morphometric variability within *C. damascina* or among the various species in this complex are lacking, it is quite difficult to assess if the differences shown in this study are determined by genes, ecological conditions or (more likely) both.

4.2.1.2. Meristic Characters

Six meristic characters (ALL, BLL, CCP, LL, $GR_{\text{Lower limb count}}$ and VC) prove to be useful in diagnosing and separating species within the *C. damascina* complex as can be seen from Figures A25-A29 and Tables A29-A34. Comparisons of these meristic characters, using Mann-Whitney tests or ANCOVA, indicate significant differences among species (e.g. ALL in *C. umbla* and *C. damascina*, *C. saadii*, and *Capoeta* sp.1; VC in *C. saadii* and *C. umbla*). These differences in meristic counts reflect genetic differences, environmentally induced phenotypic variation or both, as the meristic phenotype of fish is sometimes a consequence of environmental parameters acting on the genotype (LINDSEY1988).

Differences in the lateral-line scale counts between *C. buhsei* and *C. saadii*; *C. caelestis* and *C. damascina*; *C. umbla* and *C. caelestis*, *C. damascina*, *C. saadii* and *Capoeta* sp.1, and to a lesser extent among several *C. damascina* populations may be attributed to heterochronies caused by genetic and environmental changes. As mentioned earlier, many populations in the *C. damascina* species complex inhabit small isolated water bodies. These small, isolated gene pools are expected to develop different degrees of genetic diversion within short periods of time, accompanied (though not always) by changes in phenotype and with time, some of these populations might evolve into new species. Ecological conditions (e.g. water temperature, food availability, etc.) may also have an effect and play a significant role in inducing phenotypic variations since most of these populations occur in river systems, where environmental conditions vary considerably from each other.

In an experimental study on the relationship between numbers of scales in the lateral line and the rate of ontogeny, specimens of the African barbel '*Barbus*' *intermedius* (Rüppell, 1835), developing under different hormonal regimes, demonstrated significant differences in the number of lateral-line scales. Low LL values (1st group: 21-26, 2nd group: 17-24) were recorded in fish, which demonstrated an acceleration of development due to increased hormonal (Thyroid) levels. Higher LL values (35-42) were observed in fish characterized by a decelerated rate of ontogeny under hormonal deficiency conditions (SMIRNOV et al. 2006). A similar effect was observed in *Platygobio gracilis* (Richardson, 1836), when ontogeny was slowed down by parasite infestation (HUBBS 1927). As stated by MOTTELY (1934), ecological factors and in particular temperature can also affect hormonal activity in fish, which in turn, causes changes in the rate of development. This indicates that changes in the rate of ontogeny, regardless of which factor causes them, can result in changes in scale number (SMIRNOV et al. 2006).

Some of the results obtained in my study showed that water temperature may have an effect on the developmental rate of scale number, and such an effect should not be disregarded especially in explaining differences in scale number among several populations within *C. damascina* despite the considerable overlaps in ranges existing among most of them. As shown earlier by KHALAF (1987), the spawning period of *C. damascina* populations from Nahr Ibrahim, Nahr al-Kalb and Nahr Antelias begins in May and ends in June. However, according to BEN-TUVIA (1978), KRUPP & SCHNEIDER (1989) and STOUMBOUDI et al. (1993), *C. damascina* from the southern Levant spawns between January and March. This reflects changes in water temperature at different latitudes and altitudes. Therefore, the development of larvae and juveniles in these rivers is subject to a wide range of temperatures and thus it would be expected, as shown in the results of this study, that differences in scale numbers occur among populations within *C. damascina*. Other internal and external factors (e.g. genetic differences and environmental factors) are likely to play an important role in inducing phenotypic differences within and among species but as no data on such factors are available, it is quite difficult to relate them to such differences.

As shown in this study, the number of gill-rakers is a reliable character in distinguishing most of the species of the *C. damascina* complex and differences in this character might be correlated with food type and size, habitat choice and feeding ecology (WOOTTON 1984, HESSEN et al. 1988, AMUNDSEN et al. 2004). Differences in the number of gill-rakers among several *C. damascina* populations, despite the considerable overlap in ranges, could be also attributed to food type. For example, the population from the Damascus basin tends to have a lower gill-raker number than all other *C. damascina* populations. It shares the low gill-raker counts with *C. saadii* from Rud-e Helleh drainage and *Capoeta* sp.1. This similarity might indicate similar ecological conditions (e.g. consumption of similar diets). However, *C. damascina* from the Damascus basin is distinguished from *C. saadii* from the Rud-e Helleh drainage and *Capoeta* sp.1 based on other meristic and/or descriptive characters (see Results, sections 3.2.2.6 and 3.2.4.6). It is quite difficult to relate with certainty the differences in gill-raker counts observed in this study to diet and feeding habits because no detailed studies on the feeding ecology and diets of species in this complex are available.

As demonstrated by LØKEN & PEDERSEN (1996), the vertebral number in juvenile cods was controlled, in large part, by genes but also affected by changes in water temperature during the embryonic period. Marked differences in offspring vertebral counts were found in groups from different broodstocks exposed to the same temperature at the egg stage. The coastal cod (CC) parent produced offsprings with lower vertebral counts than the Northeast Arctic cod (NAC) parents and such results are more likely due to genetic differences between them. An inverse relationship was also found between vertebral counts and water temperature in the broodstock cod groups.

Based on my results, it is likely that differences in the vertebral counts among some species in the *C. damascina* complex are largely determined by genes and to a lesser extent, are affected by changes in water temperature during embryonic development. However, it is quite difficult to determine whether the latter factor has an impact, as information on the spawning periods of many populations and on the water temperatures of the rivers, where these populations occur are lacking. Regarding populations within the same species, no comparison or assessment was made among them due to the low number of specimens x-rayed.

Changes in the rate of ontogeny can also affect other meristic features in fish. SMIRNOV & LEVIN (2007), using the same experimental method applied in SMIRNOV et al. (2006), studied the effect of accelerated ontogeny on other meristic features such as the number of pharyngeal teeth and fin-ray counts. As was the case with the lateral-line scale number, the results revealed that accelerated development led to a reduction in the number of pharyngeal teeth and fin-ray counts in specimens of '*Barbus*' *intermedius*. This phenomenon might explain some of the differences in fin-ray counts within and among species of the *C. damascina* complex though accelerated development might not necessarily or always have an effect on these meristic characters. Such differences are not of much relevance to taxonomy as they are at best useful in distinguishing one population from others but not from all the populations (e.g. unbranched D in *C. damascina* from Nahr Quwayq and the same species from Nahr Marqiyah and Nahr Sanawbar). This reflects a relatively low interspecific and a high intraspecific variability. The differences in fin-ray counts among and within species of the *C. damascina* complex were not huge as compared to those in '*Barbus'* *intermedius*. This is most probably related to the rate of development. The greater the rate of accelerated development is, the greater is the numeric reduction in the counts of these characters.

Similar to the conclusions deducted from comparative meristic analyses, the evaluation of the meristic data using PCA supported the cluster separation of *C. umbla* specimens from those of *C. damascina*, *C. saadii*, and *Capoeta* sp.1 and those of *C. saadii* from *C. damascina* and *Capoeta* sp.1 specimens. However, the PCA plots showed that the cluster of *Capoeta* sp.1 specimens was entirely situated within that of *C. damascina* (Figs A31, A32) and this may be attributed to the overlap in most of the meristic characters between the two species and the way these clusters are transformed from a multi-dimensional hypervolume to a two-dimensional figure.

4.2.2. Phylogenetic Relationships

Although the mitochondrial marker (COI) had a better resolution than the nuclear one (LSU) because it was less conservative, both of them proved to be suitable for discriminating closely related species and for inferring evolutionary relationships among them. Generally, the COI marker is more useful for the differentiation among closely related species or among phylogeographic groups within a single species whereas the LSU marker is more useful in analyzing deeper phylogenies (HEBERT et al. 2003, WYATT et al. 2006, SONNENBERG et al. 2007). Detection of hybridizations or introgressions is best investigated using a nuclear marker in combination with a mitochondrial marker. When nuclear and mitochondrial data are contradictory, this indicates the possible presence of hybrids because the mitochondrial DNA is maternally inherited whereas the nuclear DNA is biparentally inherited (WYATT et al. 2006). Recently introgressed populations therefore can be identified by the presence of hybrids or their offsprings carrying mitochondrial haplotypes of the introgressing population but nuclear genotypes of the introgressed population. This was in one way or another reflected in the results obtained from molecular-based phylogeny in this study.

As described in the results section, two main lineages were identified within the *C. damascina* species complex: a western lineage represented by clade A (*C. damascina* and *C. umbla*) and clade B (*C. caelestis*) and an eastern lineage represented by clade C (*C. saadii*), clade D (*C. buhsei*) and clade E (*Capoeta* sp.1). The phylogenetic tree obtained from COI sequences showed that within clade A, *C. umbla* was nested within *C. damascina* where *C. umbla* specimens from the Tigris river system clustered in one group with one sample of *C. damascina* from the Seyhan Nehri drainage (FSJF 376) and two from the Euphrates river system (FSJF 897 and FSJF 904) (Fig. 11). In the LSU and total evidence trees, the same *C. umbla* members formed a monophyletic group without *C. damascina* specimens but the phylogenetic relationship between the two species was not resolved (Figs 12, 13). The haplotype network (Fig. 14) showed that most of the *C. damascina* haplotypes were much more similar to *C. umbla* haplotypes than to the two *C. damascina* haplotypes from the Seyhan Nehri drainage and the Euphrates river system (FSJF 376 and FSJF 897). In addition, one specimen of *C. umbla* from the Tigris river system (FSJF 1425) shared the same haplotype with a *C. damascina* sample from the Euphrates (FSJF 904) (Fig. 14). Such results raise several possibilities. The first one considers the likelihood of an incomplete lineage sorting due to a very recent speciation. The second one points to a possible mitochondrial transfer in the recent past where the mitochondrial DNA of *C. umbla* was introgressed by *C. damascina* from the Tigris-Euphrates river system and the third one considers a combination of both processes. Such findings are quite interesting but more ample population sampling of *C. damascina* and *C. umbla* is needed in order to gain deeper insights into the causative processes. As these two species occur sympatrically in the Tigris-Euphrates river system, it is likely that introgressions would take place especially that *C. damascina* is known to hybridize with species in other genera (e.g. *Barbus*). A hybrid of *C. damascina* and *Barbus longiceps* Valenciennes in Cuv. & Val., 1842 was described from Lakes Tiberias and Hula by STEINITZ & BEN-TUVIA (1957). Additionally, a hybrid of *C. damascina* and *Barbus canis* Valenciennes in Cuv. & Val., 1842 was described and illustrated by MIR et al. (1988) from Ain al-Qunaiya, an isolated source within the Jordan River drainage basin.

Regarding the different geographically defined *C. damascina* populations, the relationships among them using both markers were not well resolved and no pronounced genetic differences were observed among them (Figs 11-13). The haplotype network (Fig. 14) showed that most specimens from the different *C. damascina* populations (clade A) share one of the two most common haplotypes or possess very similar ones. It is important to note that the haplotypes of *C. damascina* from the Seyhan Nehri drainage appeared to be more similar to the haplotypes of other *C. damascina* populations than to each other (Fig. 14). Such results reflect either very recent geographic separation or ongoing gene flow among these populations. It is important to note that most of the samples from the Lebanese coastal rivers tend to cluster with each other along with or without some specimens from the Jordan River drainage basin as well as from an-Nahr al-Kabir (N) as evident in the COI and total evidence trees. Similarly, *C. damascina* samples from the Damascus basin have a tendency to cluster together along with one sample from Nahr Yarmuk from the Jordan River drainage basin (Figs 11, 13).

The COI and total evidence trees (Figs 11, 13) supports the close relationship between *C. caelestis* (clade B) and *C. damascina* as well as *C. umbla* (clade A) where clade B is the sister group to clade A. This was not the case in the tree obtained from LSU sequences (Fig. 12) since *C. caelestis* formed a separate branch which was basal to all the other clades within *Capoeta*. However, not so much significance should be attached to this as the supports for clade A+C+D+E (bootstrap value = 62 %, PP value = 54 %) and clade A+C+D+E+F (bootstrap value = 72 %, PP value = 61 %) were not particularly high. Although linked to clade A in the haplotype network (Fig. 14), *C. caelestis* (clade B) forms a separate group (7 steps) and this confirms the results obtained in the phylogenetic trees.

Concerning the eastern lineage, it was shown based on the COI and total evidence trees (Figs 11, 13) as well as the haplotype networks (Figs 14, 15) that *C. saadii*, *C. buhsei* and *Capoeta* sp.1 were clearly separated from *C. damascina*, *C. umbla* and *C. caelestis* (clades A and B). They also revealed the existence of three major groups (*Capoeta* sp.1, *C. buhsei* and *C. saadii*) within the eastern lineage, where *Capoeta* sp.1 is very closely related to *C. buhsei*. Although the phylogenetic relationships among the clades within the *C. damascina* species complex were generally not well resolved using the LSU marker, the tree topology supported the monophyly of *C. saadii*, *C. buhsei*, *Capoeta* sp.1, *C. umbla* and *C. caelestis* (Fig. 12). Interestingly, the *C. saadii* haplotypes were quite divergent from the haplotypes of *C. buhsei* and *Capoeta* sp.1 (maximum 8 steps) and displayed a pattern without an obvious central haplotype. Thus, it can be concluded that the well-supported mitochondrial lineages of *C. saadii* and *C. buhsei*/*Capoeta* sp.1 evolved probably under complete genetic isolation. However, the divergence of these evolutionary units was not strong enough to result in a clearly resolved pattern from the less variable ribosomal marker. The split, therefore, might have been relatively recent. Contrary to what has been observed in the *C. damascina* haplotypes, most of the *C. saadii* haplotypes showed differences among the populations (Fig. 15). The divergence in mitochondrial sequences among *C. saadii* specimens from most of the isolated basins can be interpreted as indication of restricted gene flow among basins. However, with the small number of specimens at hand, it is not possible to assess the significance of the differentiation among putative populations and subpopulations.

Apart from the *C. damascina* species complex, *C. turani* and *C. erhani* samples clustered together in one clade (G) (Fig. 11) thus raising two interesting possibilities. The first scenario questions the validity of *C. turani* and it is possible that *C. turani* is a synonym of *C. erhani*, rather than a valid species. The second scenario considers the likelihood of an incomplete lineage sorting due to a very recent speciation. It is beyond the aim of this study to resolve the questions related to these two species as this requires examinations and further analyses of additional specimens. Future studies are expected to shed more light on the validity of one of the above-mentioned possibilities. Although the relationships among these clades were not resolved as revealed from the COI marker, the tree topology supported the monophyly of *C. pestai/mauricii* (clade F), *C. barroisi* (clade H), *C. trutta* (clade I) and *C. mandica* (clade J) (Fig. 11). Contrary to the COI tree and as shown in the total evidence tree (Fig. 13), clade F formed a separate, well-supported group from clade A+B+C+D+E. Concerning *C. aculeata* (clade K), a clear separation was observed between this species and between all the other remaining species, thus setting apart this large-scaled species from the small-scaled ones (Fig. 11).

4.2.3. Correspondence of Morphological and Molecular Relationships

Based on the combination of one or more meristic characters (ALL, BLL, CCP, LL, $GR_{\text{Lower limb count}}$, VC), six closely related species were recognized within the *C. damascina* complex. In addition to meristic counts, descriptive morphological characters (e.g. absence of serrae on the last unbranched dorsal-fin ray in *C. caelestis* vs. presence of serrae in all other species in the *C. damascina* complex) sometimes helped in distinguishing taxa from each other. The molecular genetic analyses supported, with stronger evidence, the presence of these six species within the *C. damascina* complex. It is important to note that the degree of genetic differences among the species studied was not always linked to the degree of morphological variations. For example, *C. damascina* and *C. umbla*, which occur sympatrically in the Tigris-Euphrates river system, are genetically very closely related, presumably due to recent speciation, but are morphologically very different. This morphological differentiation most likely reflects adaption to ecological conditions (e.g. competition, food availability and other environmental factors) the diverging lineages are subjected to. Besides an evolutionary explanation that invokes sympatric speciation, in this case, an alternative scenario of allopatric speciation and secondary contact seems more likely, as there is not enough complexity in the reproductive behaviour of *Capoeta* to assume sympatric speciation. Such a scenario could explain the high degree of morphological (and unobserved functional genetic) differentiation as a result of adaptation to ecological conditions in combination with the low levels of presumably neutral (with respect to morphological variation) genetic differentiation as displayed in the mitochondrial COI and ribosomal LSU genes. A different situation is observed in the relationship between *C. damascina* and *Capoeta* sp.1, which are morphologically very similar to each other and the population of *C. damascina* from the Damascus basin shows considerable overlap in all meristic characters with *Capoeta* sp.1, which may indicate that they are subjected to broadly similar ecological conditions (e.g. consumption of similar diets). Based on the molecular markers used in this study, these two species are genetically very different and have no close phylogenetic relationship, when compared with other species from the *C. damascina* species complex.

An attempt to evaluate the usefulness of morphological characters to determine relationships among species in this complex based on morphological phylogeny was not successful. This is because apart from molecular characters based on the markers used in this study, no other synapomorphic characters were found.

4.2.4. Taxonomic Appraisals and Implications

Based on comparative morphology, *C. damascina* is here defined as a complex of closely related species which include the following: *C. buhsei* from Daryacheh-ye Namak basin, *C. damascina* from rivers in the Levant, Mesopotamia and parts of southern Turkey, *C. saadii* from rivers flowing into the Persian Gulf as well as the Strait of Hormuz and from watercourses in the Rud-e Kor, Daryacheh-ye Maharlu and Kerman basins in Iran, *Capoeta* sp.1 from Rud-e Karun and possibly Rudkhaneh-ye Karkheh and *C. umbla* from the Tigris-Euphrates river system. No specimens were available for morphological examination, but it was shown, based on molecular data, that *Capoeta caelestis* from Göksu Nehri (Turkey) belongs to this complex as well. The original description of *C. caelestis* as illustrated by SCHÖTER et al. (2009) supports this assumption. It might well be possible that *C. kosswigi* is a member of this complex but no specimens were available for study.

4.2.4.1. *Capoeta buhsei*

Descriptions of *C. buhsei* published by previous authors agree with the one in this study, except for the description in BIANCO & BANARESCU (1982). These authors considered *C. buhsei* a valid species and reported it, based on very few specimens, from Hormuz (Darab), Kerman (Jupa), Esfahan and Daryacheh-ye Namak (Djodje and Tehran) basins. ABDOLI (2000) and COAD (2002) agreed with BIANCO & BANARESCU (1982) on the occurrence of *C. buhsei* in Daryacheh-ye Namak basin but considered its presence in Hormuz, Kerman and Esfahan as questionable. Specimens at my disposal from Hormuz (FSJF 2242) and Kerman (SMF 30861, SMF 31144 and SMF 33094) basins belong to *C. saadii*. However, it is difficult to decide, based on the data provided by BIANCO & BANARESCU (1982), whether the specimens from Darab (Hormuz) and Jupa (Kerman) belong to *C. buhsei*. This is because they did not specify the method used in counting the lateral-line scales nor did they provide the frequency distribution of circumpendicular scale counts. More samples will have to be collected from the aforementioned basins for morphological and molecular analyses to decide whether only *C. saadii* occurs there or whether more than one species is present. It seems that specimens regarded by BIANCO & BANARESCU (1982) as *C. buhsei* from Esfahan were misidentified as can be concluded from the lateral-line scale and gill-raker counts (LL: 76-77; GR_{Total}: 15-19). They most probably belong to *Capoeta* sp.1. Unfortunately, these specimens were not available for examination. Aside from this, the meristic counts of *C. buhsei* given by BIANCO & BANARESCU (1982) for specimens from the Daryacheh-ye Namak basin are congruent with the meristic counts of *C. buhsei* specimens given in my study.

4.2.4.2. *Capoeta caelestis*

The description of *C. caelestis* by SCHÖTER et al. (2009) leaves no doubt that this species is a member of the *C. damascina* species complex. However, no specimens were available for study.

4.2.4.3. *Capoeta damascina*

Prior to this study, the taxonomic status of this species was largely unsettled due to its wide distributional range and tremendous intraspecific variability. Previous authors such as BERG (1949), KARAMAN (1969), KRUPP (1985, 1989, 2008) and COAD (1991, 2008) did not study this species over its whole distributional range. Most of them noted that this species is far from being a well-defined taxon and mentioned that analyses based on comparative morphology and molecular markers should be carried out in order to clarify its status and to better understand its phylogenetic relationships with other species in the genus *Capoeta*. Based on the detailed morphological analyses of the different populations of *C. damascina* that were carried out in this study, it can be concluded that *C. damascina* is very variable with respect to body shape, meristic characters and color patterns.

The descriptions provided by the authors whose names are listed in the synonymy of *C. damascina* (see Results, section 3.2.2) are congruent with the results of this study. For example, KRUPP (1985) studied various populations of *C. damascina* from the Levant and parts of southern Turkey (Ceyhan Nehri drainage, Orontes River drainage, Nahr Quwayq, north Syrian coastal rivers, an-Nahr al-Kabir (S) drainage, Jordan River drainage basin and rivers discharging into the Dead Sea) and reported differences among populations in body shape and scale counts. He reported that populations from the Jordan River drainage basin and rivers in the Dead Sea Valley had the highest numbers of lateral-line scale counts (68-91 with a mean of 76.7, from the first complete scale to the last scale at the level of the hypural plate), while those from the Orontes River drainage, north Syrian coastal rivers and an-Nahr al-Kabir (S) had much lower counts (Orontes: 59-73 with a mean of 66.6, north Syrian coastal rivers: 59-74 with a mean of 67.5 and al-Kabir (S): 54-65 with a mean of 59.5).

KRUPP's morphometric and meristic data are largely supported by the results of this study.

The variability in the morphology of *C. damascina* has led researchers to describe a large number of new species, which were later considered synonyms of this highly variable species (see Results, section 3.2.2). For example, *C. angorae*, which was first described by HANKÓ (1924) as *Varicorhinus capoeta angorae* from Bozanti based on one specimen having 65 scales in the lateral-line series, is considered in this study as a synonym of *C. damascina* since it could not be distinguished based on morphology and molecular-based phylogeny from *C. damascina*. Although he reported *Varicorhinus damascinus* from Bozanti and Karasu based on four specimens having a range of 72-77 scales in the lateral-line series, HANKÓ (1924) did not notice that these two taxa were actually the same (total lateral-line scale range for *C. damascina* in my study: 61-91). KOSSWIG (1952), who conducted an extensive survey of Anatolian freshwater fishes, suggested synonymizing *V. capoeta* Heckel [sic.], *V. peregrinorum* Heckel, aff. *peregrinorum* sensu Battalgil, *V. umbla* sensu Battalgil and *V. capoeta* sensu Hankó (including *V. c. angorae*) with *V. damascinus*. Later, KARAMAN (1969) in his revision of the genus *Capoeta* published a description of *C. c. angorae* from Ceyhan Nehri and Seyhan Nehri. According to him, the thin, weakly ossified last unbranched dorsal-fin ray sets apart *C. c. angorae* from other subspecies. Although some of the specimens from Seyhan Nehri and Ceyhan Nehri drainages examined in this study were characterized by having a thin and a weakly ossified last unbranched dorsal-fin ray, this character was similar to *C. damascina* from other drainages. Thus, this feature has little significance, as it may be affected by ecological conditions. In his study, KRUPP (1985) examined specimens from the Ceyhan Nehri drainage and included them in the description of *C. damascina* without mentioning *C. c. angorae*. TURAN et al. (2006b) considered *C. angorae* a valid species, but did not have any *C. damascina* specimen for comparison. The meristic counts reported by TURAN et al. (2006b) are very similar to those reported in this study.

Recently, a study on the molecular systematics of the Anatolian *Capoeta* species (*C. angorae*, *C. antalyensis*, *C. barroisi*, *C. bergamae*, *C. capoeta*, *C. damascina*, *C. kosswigi*, *C. pestai*, *C. sieboldii*, *C. tinca*, *C. trutta* and *C. umbla*) was carried out by TURAN (2008) using mitochondrial 16S rDNA sequence data. TURAN's results and conclusions did not reveal much significant information that would form a basis for comparison and discussion because most of the phylogenetic relationships among the different species were not very well supported and this led to incorrect conclusions regarding the status of some taxa. Although TURAN (2008) regarded *C. barroisi* and *C. damascina* as valid species, he stated that the genetic difference detected was not sufficient to consider them as such and that additional genetic markers should be used for a more reliable assessment. It is worthwhile mentioning that specimens identified by TURAN (2008) as *C. barroisi* most probably belong to *C. damascina* as the number of the total gill rakers on the first gill arch of *C. barroisi* specimens (17-24) was much lower than that reported by TURAN et al. (2006b) (28-30). TURAN (2008) also considered *C. angorae* a valid species. Based on the morphological and molecular differences highlighted in my study, *C. angorae* is a synonym of *C. damascina*.

4.2.4.4. *Capoeta saadii*

Capoeta saadii was one of the least known taxa in the genus *Capoeta* until BIANCO & BANARESCU (1982) re-evaluated this species based on comparative morphology. Prior to their study, it was considered by several authors such as BERG (1949) and SAADATI (1977) as a synonym of *C. damascina*. The latter author reported the occurrence of *C. damascina* from almost all Iranian basins except very few such as the Gulf drainage, Daryacheh-ye Urmia and the Caspian Sea basins. He also regarded *C. buhsei* from Daryacheh-ye Namak basin as a synonym of *C. damascina*. BIANCO & BANARESCU (1982) had many specimens of *C. saadii* at their disposal from the Rud-e Kor basin, the type locality, and this allowed them to determine its position within the genus. They reported it from the Rud-e Mand, Rud-e Kol and the Rud-e Kor basin and stated that it is close to *C. buhsei*. They referred to this species from Iran as *C. saadi* [with one "i" contrary to HECKEL's (1849) original spelling]. According to the International Code of Zoological Nomenclature (1999), BIANCO & BANARESCU's (1982) spelling (*C. saadi*) is an "unjustified emendation" under Art. 33.2.3 and the original spelling (*saadii*) must be maintained under Art. 32.2 and Art. 33.4. In his book on the inland water fishes of Iran, ABDOLI (2000) considered *C. saadii* as a valid species and he reported it from the Rud-e Mand drainage and the Rud-e Kor basin. He also reported *C. damascina* from Daryacheh-ye Namak, Tigris, Kavir, Kerman, Gulf, Esfahan, Rud-e Kor, Hormuz and Hamun-e Jaz Murian basins. Based on material from the various Iranian basins examined in this study, I conclude that specimens recorded as *C. damascina* from the Rud-e Kor, Gulf, Daryacheh-ye Maharlu, Hormuz and Kerman basins by SAADATI (1977) and ABDOLI (2000) belong to *C. saadii*. Unfortunately, no specimens were available for examination from the other Iranian basins (Esfahan, Kavir, Lut and Hamun-e Jaz Murian). Based on data provided by SAADATI (1977) and ABDOLI (2000), it was quite difficult to relate these populations to any of the closely related species known to occur in Iran (*C. buhsei*, *C. saadii* and *Capoeta* sp.1), because other important characters (e.g. CCP) were missing in the publications by these authors and no frequency distributions of the meristic counts in the different populations were given by ABDOLI (2000).

4.2.4.5. *Capoeta* sp.1

It remains questionable whether *V. damascinus* (from the Tigris basin) reported by SAADATI (1977) belongs to *Capoeta* sp.1. Meristic data provided by SAADATI (1977) (e.g. ALL: 12-20; LL: 69-87; GR_{Total}: 16-22) indicate the possible presence of more than one species (*Capoeta* sp.1, *C. umbla* and probably *C. damascina*). He collected samples from the Tigris basin including a small part of Nahr Diyala (Rud-e Sivan) near Marivan in Iran where *C. umbla* and possibly *C. damascina* are found. These specimens will need to be examined in order to verify identifications. Since no additional data and/or specimens are available, it remains difficult to decide upon this issue.

4.2.4.6. ***Capoeta umbla***

The results obtained in this study agree with those published earlier except for TURAN et al. (2006b) and SCHÖTER et al. (2009). Specimens identified by TURAN et al. (2006b) as *C. umbla* from the Euphrates in Turkey are likely to be *C. damascina* according to meristic counts (branched D: 8-10; Pc: 17-20; P: 10-12; ALL: 13-16; BLL: 8-10; $LL_{Caudal\ fin\ base}$: 81-93; GR_{Total}: 18-23). In 2009, SCHÖTER et al. noted that *Capoeta* samples preliminary identified as *C. umbla* including the data given by TURAN et al. (2006b) showed a very wide range of lateral-line scale counts (72-93) and can be separated into two groups: one group including specimens with 72-78 lateral-line scales and another including specimens with 80-93 scales. They concluded that there may be two species involved, the one with the higher lateral-line scale count (80-93) probably being *C. umbla*. As reported in this study, a closer look at specimens catalogued as FSJF 2494 (4), NMW 55932 (1), NMW 55933 (1), which were listed as comparative materials in SCHÖTER et al. (2009), showed that the samples catalogued as FSJF 2494 (ALL: 16-17; BLL: 10-11; CCP: 28-31; LL: 82-88; $GR_{Lower\ limb\ count}$: 16-18) belong indeed to *C. damascina* and those catalogued as NMW 55932-33 (ALL: 20; BLL: 12.5-15.5; CCP: 37-38; LL: 90-91; $GR_{Lower\ limb\ count}$: 15-17) belong to *C. umbla*.

In 2008, a study by TURAN on the molecular systematics of the Anatolian *Capoeta* species was carried out using mitochondrial 16S rDNA sequence data. TURAN's results showed that *C. kosswigi* and *C. umbla* are genetically contiguous and belong to *C. trutta*. Based on the morphological and molecular differences highlighted in my study, *C. umbla* proved to be different from *C. trutta*. Regarding *C. kosswigi*, no specimens were available for morphological and molecular analyses and thus it is quite difficult to clarify the issues highlighted in TURAN's study.

4.3. Biogeographical Analyses

Since members of the genus *Capoeta* are primary freshwater fishes, their dispersal and distribution depend on freshwater connections. Therefore, their distribution has a major biogeographic significance, being determined by the paleogeography of an area and the geological history of hydrographic systems. Since the target taxa in this study are the species of the *C. damascina* complex, a possible biogeographical scenario for their evolution and dispersal is discussed in detail here below based on the results of this study.

After *C. aculeata* (clade K) split from its common ancestral stock with clade A-J, the latter clade diverged into three major groups (Fig. 11). The first group comprised clade F and gave rise to *C. pestai* and *C. mauricii*. The second group was represented by clade G+H+I+J and gave rise to *C. barroisi*, *C. erhani*, *C. mandica*, *C. trutta* and *C. turani*. The third group was represented by clade A+B+C+D+E and constituted the ancestral stock of the *C. damascina* species complex. This ancestral population separated into two lineages: an eastern one comprising the species restricted to Iran and a western one comprising the species found in the Levant, Mesopotamia and parts of southern Turkey.

4.3.1. The Eastern Lineage of the *C. damascina* Species Complex

A plausible biogeographical scenario for the separation between the eastern and western lineages presents itself based on the following assumption: During the Pleistocene glacials, when the global sea level dropped by at least 100 m, the Persian Gulf dried up completely and a river valley connected the waters of Mesopotamia to the rivers of the Gulf and Hormuz basins (BUTZER 1961, KASSLER 1973, KRUPP 1983). It may be assumed that during that period (probably during one of the first glacials), the ancestor of the *C. damascina* species complex reached the rivers of the Gulf and Hormuz basins and differentiated there, giving rise to the eastern lineage which consisted of the ancestor of *C. buhsei*, *C. saadii* and *Capoeta* sp.1. As the Rud-e Kor basin was part of the Rud-e Mand drainage during that time, the ancestor of *C. buhsei*, *C. saadii* and *Capoeta* sp.1 reached the Rud-e Kor basin through this connection. It may have reinvaded the Tigris basin and from there reached the Daryacheh-ye Namak basin through headwater capture during wetter periods of the Pleistocene. The populations in the Gulf, Rud-e Kor and Hormuz basins then evolved into *C. saadii* and later the populations from the Iranian Tigris basin and Daryacheh-ye Namak basin split into *Capoeta* sp.1 and *C. buhsei*. Based on the results shown in Figures 11, 12 and 13, it can be concluded that *C. buhsei* from Daryacheh-ye Namak basin is very closely related to *Capoeta* sp.1 and that the split between these two species might have been relatively recent. Concerning populations of *C. saadii*, it is probable that they made their way into those basins (Gulf, Rud-e Kor, Hormuz, Maharlu and Kerman) via headwater capture and/or via more extensive watercourses during wet periods of the Pleistocene. Rivers in these basins have headwaters which arise in close vicinity of each other on a high plain and transfer of species is to be expected over time.

4.3.2. The Western Lineage of the *C. damascina* Species Complex

The ancestor of *C. damascina*, *C. umbla* and *C. caelestis* most likely got into the Levant and parts of southern Turkey from the Tigris-Euphrates system during the Pleistocene glacials and after the separation from the eastern lineage. A connection existed, possibly via headwater capture, in the regions of the upper courses of Ceyhan Nehri and western affluents to the Euphrates. It is unlikely that it reached the Orontes from a connection to the Tigris-Euphrates because these connections were already interrupted by that time (DE VAUMAS 1957, KINZELBACH 1980, POR 1989). From Ceyhan Nehri, it dispersed into Seyhan Nehri via headwater capture or via the confluence of these two rivers during Pleistocene periods of low sea levels. It reached the Göksu Nehri following possibly the same routes and evolved into *C. caelestis*. The sister population differentiated, most probably in the Tigris-Euphrates river system, into *C. damascina* and *C. umbla*. Based on the results obtained in this study, it is likely that *C. damascina* colonized the Levant and southern Turkey during the Pleistocene glacials. This is well supported by the low genetic differences among the *C. damascina* populations. As connections existed between Tigris-Euphrates and Ceyhan Nehri as well as between Tigris-Euphrates and Nahr Quwayq, it is very probable that *C. damascina* reached Nahr Quwayq and parts of southern Turkey via these routes. Subsequently, it dispersed from Ceyhan Nehri to Seyhan Nehri, as mentioned earlier, either via headwater capture and/or via connections of the lower courses during the Pleistocene periods of low sea levels. It moved from the rivers of southern Turkey southward to the lower Orontes. These rivers were connected to each other as a result of low sea levels in the eastern Mediterranean. The species reached an-Nahr al-Kabir (N) via the confluence of Ceyhan Nehri and the lower Orontes. It might have colonized the central Orontes, which was represented by the isolated al-Ghab basin at that time, using two possible routes: via Nahr al-Abyad whose upper reaches were a source of an-Nahr al-Kabir (N) and/or via the coastal rivers in the Nahr Marqiyah area, which were connected to the central Orontes. It got into the upper Orontes via an-Nahr al-Kabir (S), as the former was an upper affluent of the latter. Taking advantage of the low sea levels, it dispersed into the Syrian, Lebanese and Palestenian/Israeli coastal rivers. Another possibility, which should not be excluded here, is that *C. damascina* may have dispersed into these rivers via headwater capture or more extensive watersheds during wet periods of the Pleistocene. It colonized the Jordan-Dead Sea drainage basin via the coastal river Nahal Qishon and using the Yizre'el Valley as a pathway. The flooding of this valley provided swampy connections between the headwaters of Nahal Qishon and streams of Beit She'an in the Jordan Valley (KINZELBACH 1987, POR 1989). During that time, the Damascus basin was still connected to the Jordan River drainage basin thus allowing the dispersal of this species into the Damascus basin.

The low genetic variability among the *C. damascina* populations may also be related to the fact that connections between some of the coastal rivers existed until very recently or occasionally still exist allowing for a continuous gene flow between the *C. damascina* populations. For example, it is highly possible that Ceyhan Nehri and Seyhan Nehri were frequently connected as a result of flooding. Today, they are connected by a channel. In addition, part of the water of the Litani River drainage was and is still being diverted to Nahr al-Awwali via Markaba tunnel for the generation of hydroelectric power (AMERY 1993), thus allowing a gene flow between the *C. damascina* populations from these two rivers.

4.4. Future Perspectives

This study is the first comprehensive taxonomic revision, molecular phylogenetic and zoogeographic analysis of the *C. damascina* species complex inferred from comparative morphology and molecular-based phylogeny. Although the goals of this PhD project were achieved, more studies need to be conducted in the future using additional samples and molecular markers in order to check whether the close relationship between *C. damascina* and *C. umbla* is due to recent speciation, mitochondrial introgressions or a combination of both. Since no *C. kosswigi* specimens from the Van Gölü basin were available for morphological or molecular analyses, future studies should shed light on this poorly known species in order to check whether *C. kosswigi* belongs to this complex and investigate its phylogenetic relationships with the other members of this group. Very little is known about the biology and the ecology of the various members of the *C. damascina* species complex and research in these areas will definitely be useful to better understand and explain the observed morphological variations within and among species.

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VI. Annex

Field Data Sheet

Comparative Material

Figures A1-A32

Tables A1-A90

FIELD DATA SHEET-FRESHWATER

Field #:	**Locality:**		**Date:**
Lat.:	**Long.:**	**Alt.:**	**Gear:**
Researchers:			

PROFILE					
PICS					
ENVIRONMENT	**Geomorph. & Soil**				
	Water Body		Size: Depth:		
	Weather	☐ Calm Wind ☐ Breezy Wind ☐ Windy ☐ Rainy ☐ Clear ☐ Partly Cloudy Sky ☐ Cloudy			
WATER	**Color**				
	Clarity	☐ Clear ☐ Cloudy ☐ Turbid			
	Physical Measurements	Temp:	pH:	Conductivity:	Speed:
FAUNA	**Aquatic**				
	Terrestrial				
FLORA	**Aquatic**				
	Terrestrial				

Comparative Material

Capoeta aculeata

(1) Fin clip from FSJF 2205, Iran: Taghra Rud between Ja'fari and Dolatabad, 34° 42.954' N 50° 27.286' E, 17.IV.2007, A. Abdoli & J. Freyhof, FSJF 17 (in 96 % alcohol). – (2) 1, 42.82 mm SL, Iran: Rud-e Qom in Qom, 34° 22.623' N 50° 36.105' E, 05.III.2008, N. Alwan, K. Borkenhagen, M. Ghanbari Fardi & A. Kazemi, SMF 31000 (in 96 % alcohol). – (3) 1, ca. 94 mm SL, Iran: Rud-e Qom in Qom, 34° 22.623' N 50° 36.105' E, 05.III.2008, N. Alwan, K. Borkenhagen, M. Ghanbari Fardi & A. Kazemi, SMF 31002 (fin clip in 96 % alcohol). – (4) 1, 113.12 mm SL, Iran: Rud-e Hadi between Zagheh and Polehoru, 33° 31.133' N 48° 46.340' E, 04.III.2008, N. Alwan, K. Borkenhagen, M. Ghanbari Fardi & A. Kazemi, SMF 30999 (fin clip in 96 % alcohol). – (5) Fin clip, Iran: Zayandeh Rud in Esfahan, 32° 38.327' N 51° 36.738' E, 19.II.2008, N. Alwan, K. Borkenhagen, M. Ghanbari Fardi & A. Kazemi, whole specimen present at the University of Tehran, SMF 30998 (in 96 % alcohol). – (6) 1, 45.90 mm SL, Iran: Tang-e Sorkh, 30° 27.680' N 51° 44.907' E, 28.XI.2007, K. Borkenhagen & F. Wicker, SMF 30867 (in 96 % alcohol). – (7) 1, 29.95 mm SL, Iran: Rud-e Tang-e Tizab, Sepidan, Fars, 30° 23.470' N 51° 46.710' E, 28.XI.2007, K. Borkenhagen & F. Wicker, SMF 30870 (in 96 % alcohol). – (8) 1, 162.60 mm SL, Iran: river at Band-e Amir, 29° 46.500' N 52° 50.612' E, 28.II.2008, N. Alwan, K. Borkenhagen, M. Ghanbari Fardi & A. Kazemi, SMF 30997 (fin clip in 96 % alcohol).

Capoeta barroisi

(1) Fin clip, Turkey: Tahtaköprü east of Islahiye, 36° 59.185' N 36° 42.276' E, 29.IX.2009, M. Özuluğ & J. Freyhof, specimen identified by J. Freyhof, FSJF 1313 (in 96 % alcohol). – (2) 1, 163.6 mm SL, Syria: Bahrat Homs, 34° 39.722' N 36° 37.100' E, 13.X.2008, N. Alwan, K. Borkenhagen, J. Freyhof & F. Wicker, SMF 31046 (fin clip in 96 % alcohol).

Capoeta caelestis

(1) Fin clips from FSJF 2304, Turkey: Göksu Nehri at Göksu, below Göksu power station, 37° 02.740' N 32° 44.562' E, 05.XI.2007, M. Özuluğ & J. Freyhof, specimens identified by J. Freyhof, FSJF 284 (in 96 % alcohol).

Capoeta erhani

(1) Fin clips, Turkey: Nehir Çelik at road south of Gölbaşı, 37° 37.433' N 37° 30.206' E, 20.VI.2008, M. Özuluğ & J. Freyhof, specimens identified by J. Freyhof, FSJF 936 (in 96 % alcohol).

Capoeta mandica

(1) 1, 45.02 mm SL, Iran: Pol-e Qareh Aghaj, 29° 41.217' N 52° 06.003' E, 28.II.2008, N. Alwan, K. Borkenhagen, M. Ghanbari Fardi & A. Kazemi, SMF 30858 (in 96 % alcohol). – (2) 1, 26.13 mm SL, Iran: Pol-e Qareh Aghaj, 29° 41.217' N 52° 06.003' E, 28.II.2008, N. Alwan, K. Borkenhagen, M. Ghanbari Fardi & A. Kazemi, SMF 30869 (in 96 % alcohol). – (3) 1, 55.85 mm SL, Iran: Qareh Aghaj, 28° 49.978' N 53° 20.005' E, 26.II.2008, N. Alwan, K. Borkenhagen, M. Ghanbari Fardi & A. Kazemi, SMF 30855 (in 96 % alcohol). – (4) 1, ca. 71 mm SL, Iran: Rudkhaneh-ye Rudbal near Firuzabad, 28° 42.590' N 52° 38.222' E, 22.XI.2007, K. Borkenhagen & F. Wicker, SMF 30733 (in 96 % alcohol). – (5) 1, ca. 77 mm SL, Iran: Rudkhaneh-ye Rudbal near Firuzabad, 28° 42.590' N, 52° 38.222' E, 22.XI.2007, K. Borkenhagen & F. Wicker, SMF 30864 (in 96 % alcohol). – (6) 1, 47.90 mm SL, Iran: Rudkhaneh-ye Rudbal near Firuzabad, 28° 42.590' N 52° 38.222' E, 22.XI.2007, K. Borkenhagen & F. Wicker, SMF 31001 (in 96 % alcohol).

Capoeta mauricii

(1) Fin clip from FSJF 1950, Turkey: Sarıöz Deresi at İsaköy about 4 km south of Sariköy, 37° 44.908' N 31° 46.818' E, 14.VI.2006, M. Özuluğ & J. Freyhof, specimen identified by J. Freyhof, FSJF 31 (in 96 % alcohol).

Capoeta pestai

(1) Fin clip from FSJF 2515, Turkey: Çayköy Deresi above Kemerköprü water regulator, southeast of Eğirdir, 37° 50.253' N 30° 54.046' E, 27.VI.2008, M. Özuluğ & J. Freyhof , specimen identified by J. Freyhof, FSJF 1114 (in 96 % alcohol).

Capoeta trutta

(1) Fin clip, Turkey: Nehir Kangal under railway bridge at Çetinkaya, 39° 15.095' N 37° 37.136' E, 23.IX.2009, M. Özuluğ & J. Freyhof, specimen identified by J. Freyhof, FSJF 1415 (in 96 % alcohol). – (2) Fin clip, Turkey: Tigris River, 5 km west of Hasankeyf, 37° 43.429' N 41° 21.630' E, 25.IX.2009, M. Özuluğ & J. Freyhof, specimen identified by J. Freyhof, FSJF 1433 (in 96 % alcohol). – (3) Fin clip from

FSJF 2589, Turkey: Nehir Çakal, 13 km west of Adıyaman, tributary to Atatürk damlake, 37° 43.342' N 38° 09.920' E, 20.VI.2008, M. Özuluğ & J. Freyhof, identified by J. Freyhof, FSJF 919 (in 96 % alcohol). – (4) Fin clip, Syria: Euphrates River with no exact locality (fin clip taken from a specimen found at fish market), 28.X.2008, SMF 31064 (in 96 % alcohol). – (5) 1, 29.04 mm SL, Iran: Rudkhaneh-ye Karkheh near Pol-e Dokhtar, 33° 09.602' N 47° 43.195' E, 03.III.2008, N. Alwan, K. Borkenhagen, M. Ghanbari Fardi & A. Kazemi, SMF 30862 (in 96 % alcohol). – (6) 1, 40.83 mm SL, Iran: Rud-e Tang-e Sheeb in Kupan, 30° 19.343' N 51° 14.535' E, 29.II.2008, N. Alwan, K. Borkenhagen, M. Ghanbari Fardi & A. Kazemi, SMF 30863 (in 96 % alcohol). – (7) 1, 29.42 mm SL, Iran: Rud-e Fahlian, 30° 11.143' N 51° 31.247' E, 29.II.2008, N. Alwan, K. Borkenhagen, M. Ghanbari Fardi & A. Kazemi, SMF 30856 (in 96 % alcohol).

Capoeta turani

(1) Fin clip, Turkey: Çatkıt Suyu south of Salbaş, the lower part of Pozantı Nehir, 37° 06.155' N 35° 06.572' E, 30.IX.2009, M. Özuluğ & J. Freyhof, specimen identified by J. Freyhof, FSJF 1308 (in 96 % alcohol). – (2) Fin clips from FSJF 2356, Turkey: Çatkıt Suyu south of Salbaş, the lower part of Pozantı Nehir, 37° 05.767' N 35° 07.019' E, 06.XI.2007, M. Özuluğ & J. Freyhof, specimen identified by J. Freyhof, FSJF 353 (in 96 % alcohol).

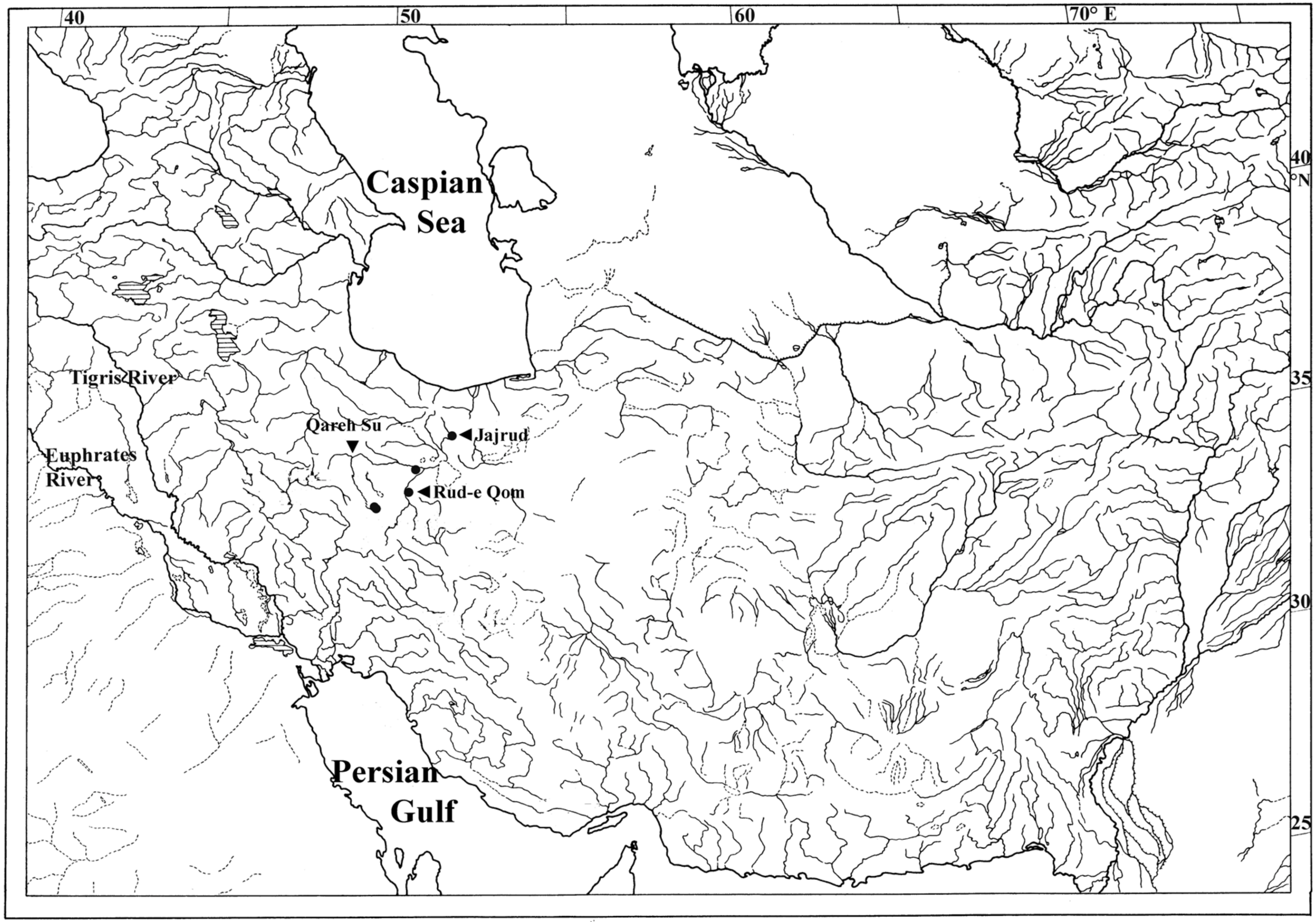

Fig. A1. Occurrence of *Capoeta buhsei*. Only localities of specimens examined are included in the map.

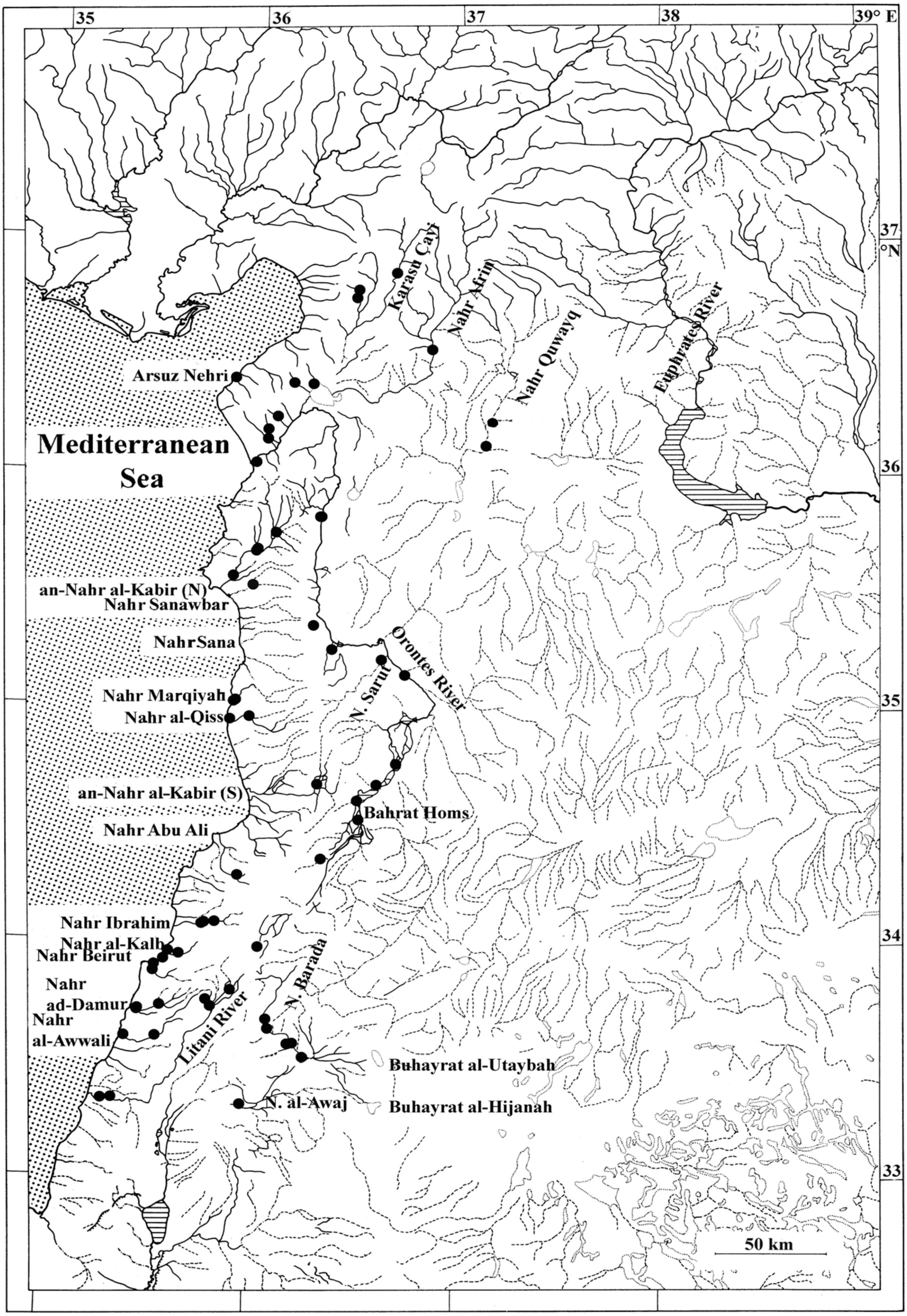

Fig. A2 a. Occurrence of *Capoeta damascina* (northern Levant). Only localities of specimens examined are included in the map.

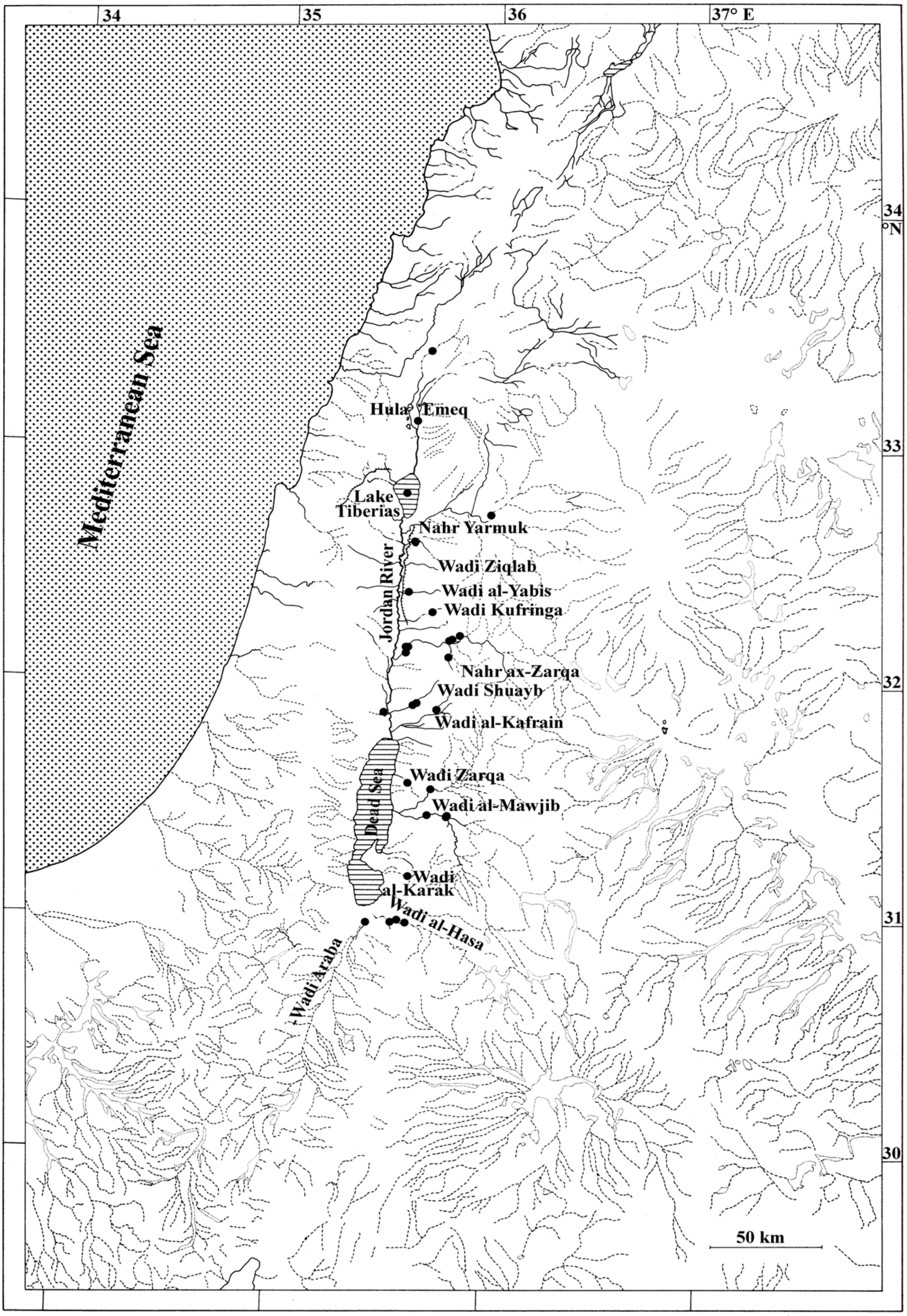

Fig. A2 b. Occurrence of *Capoeta damascina* (southern Levant). Only localities of specimens examined are included in the map.

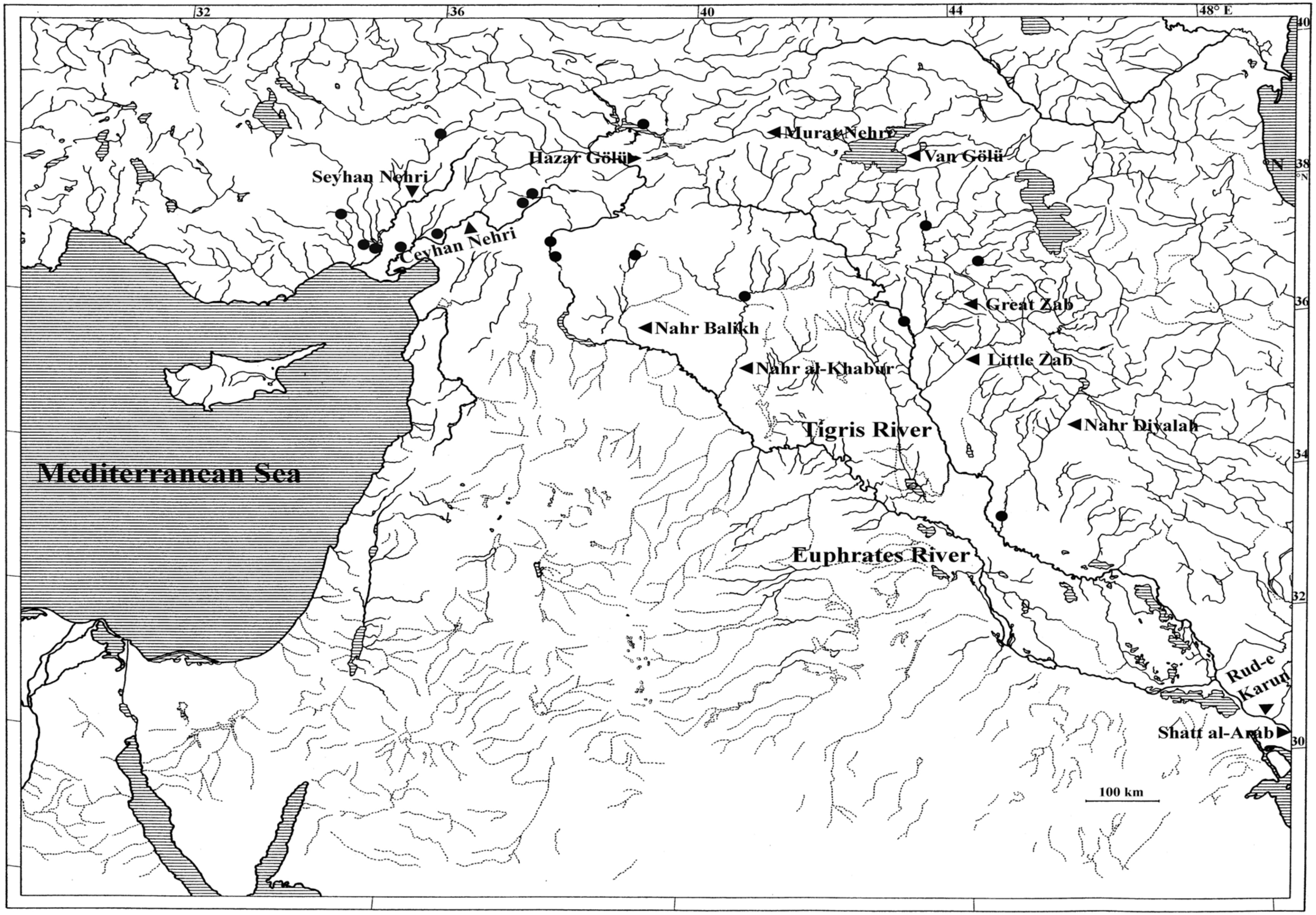

Fig. A2 c. Occurrence of *Capoeta damascina* (Mesopotamia and parts of southern Turkey). Only localities of specimens examined are included in the map.

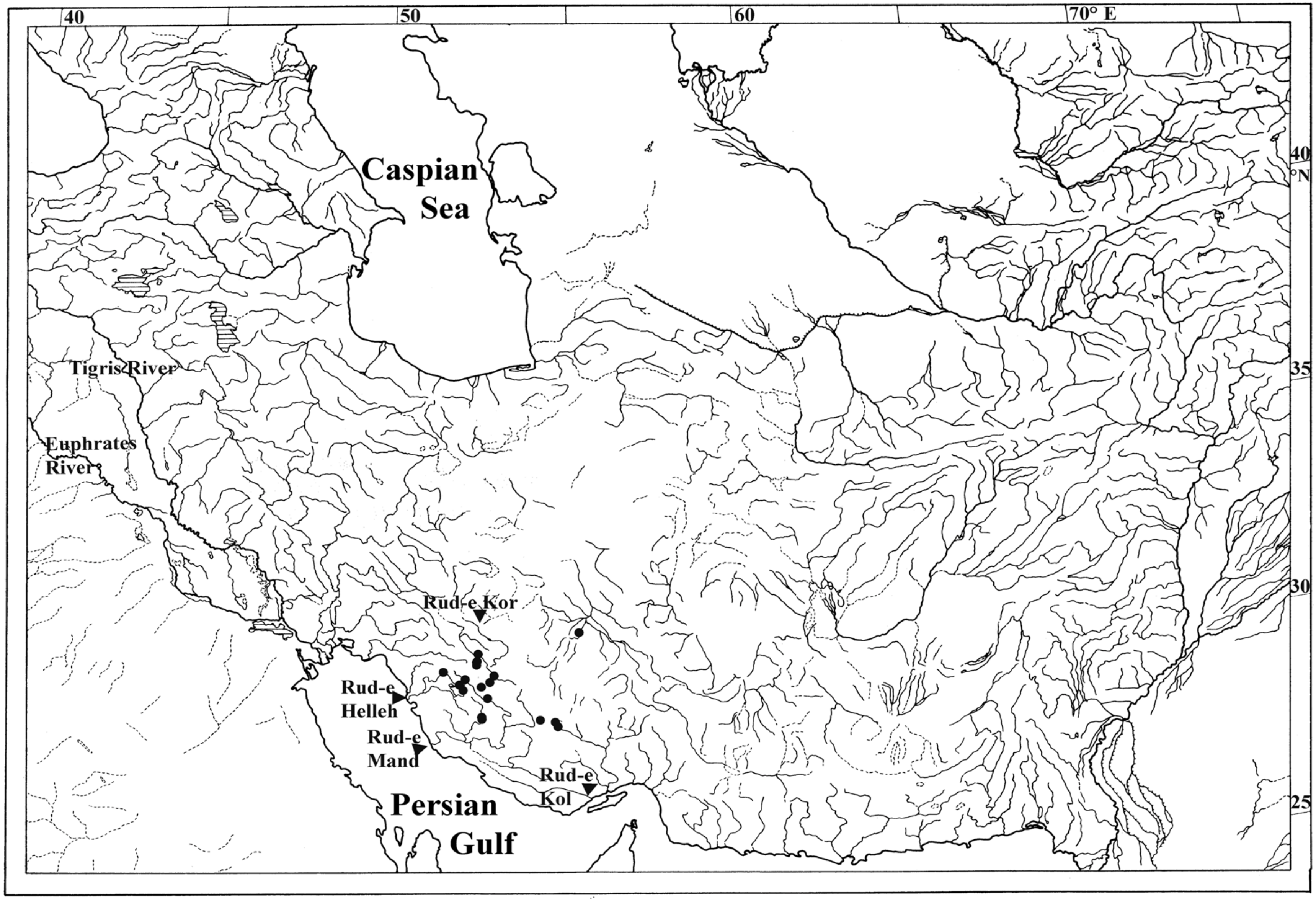

Fig. A3. Occurrence of *Capoeta saadii*. Only localities of specimens examined are included in the map.

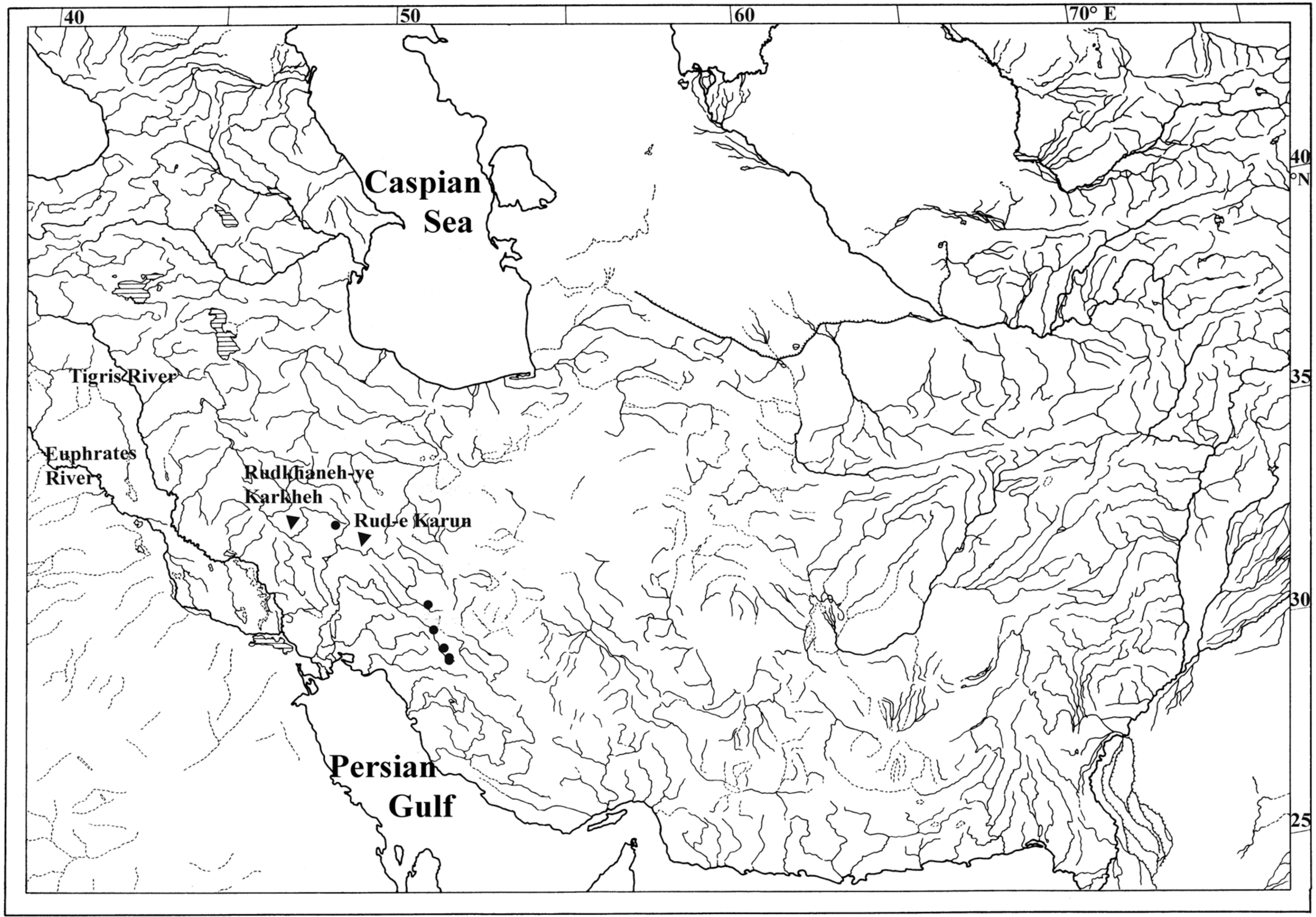

Fig. A4. Occurrence of *Capoeta* sp.1. Only localities of specimens examined are included in the map.

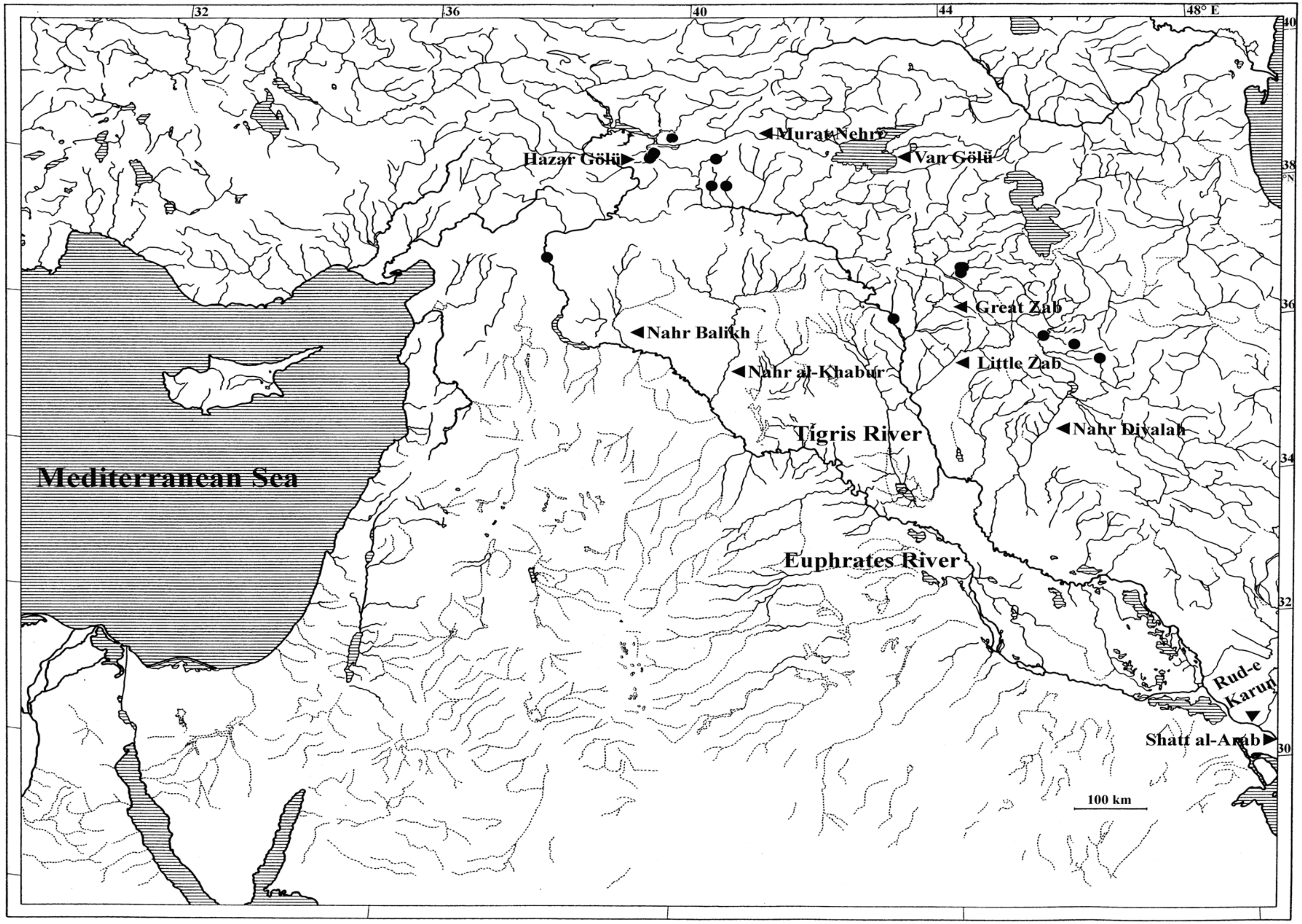

Fig. A5. Occurrence of *Capoeta umbla*. Only localities of specimens examined are included in the map.

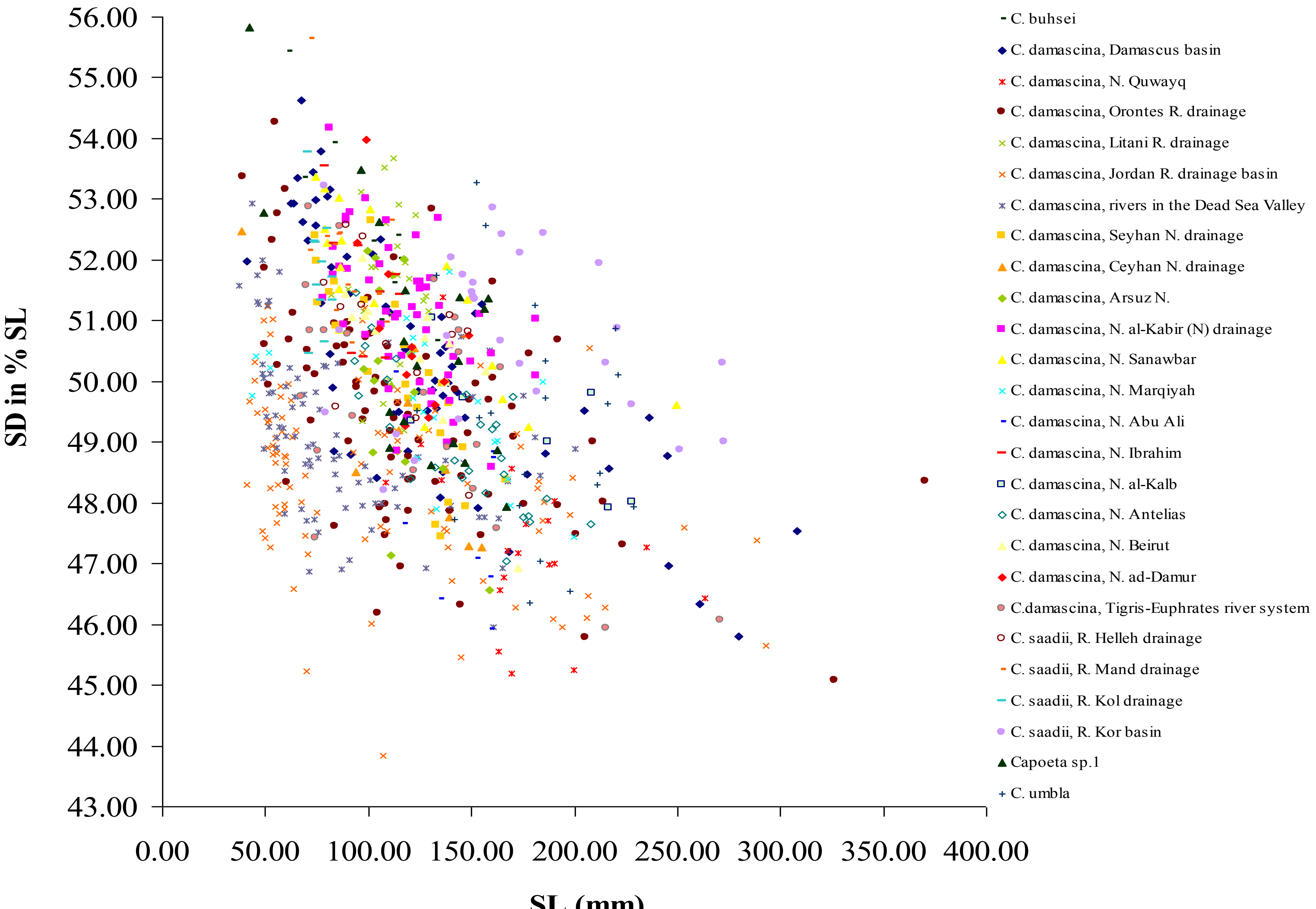

Fig. A6. Predorsal length in relation to standard length.

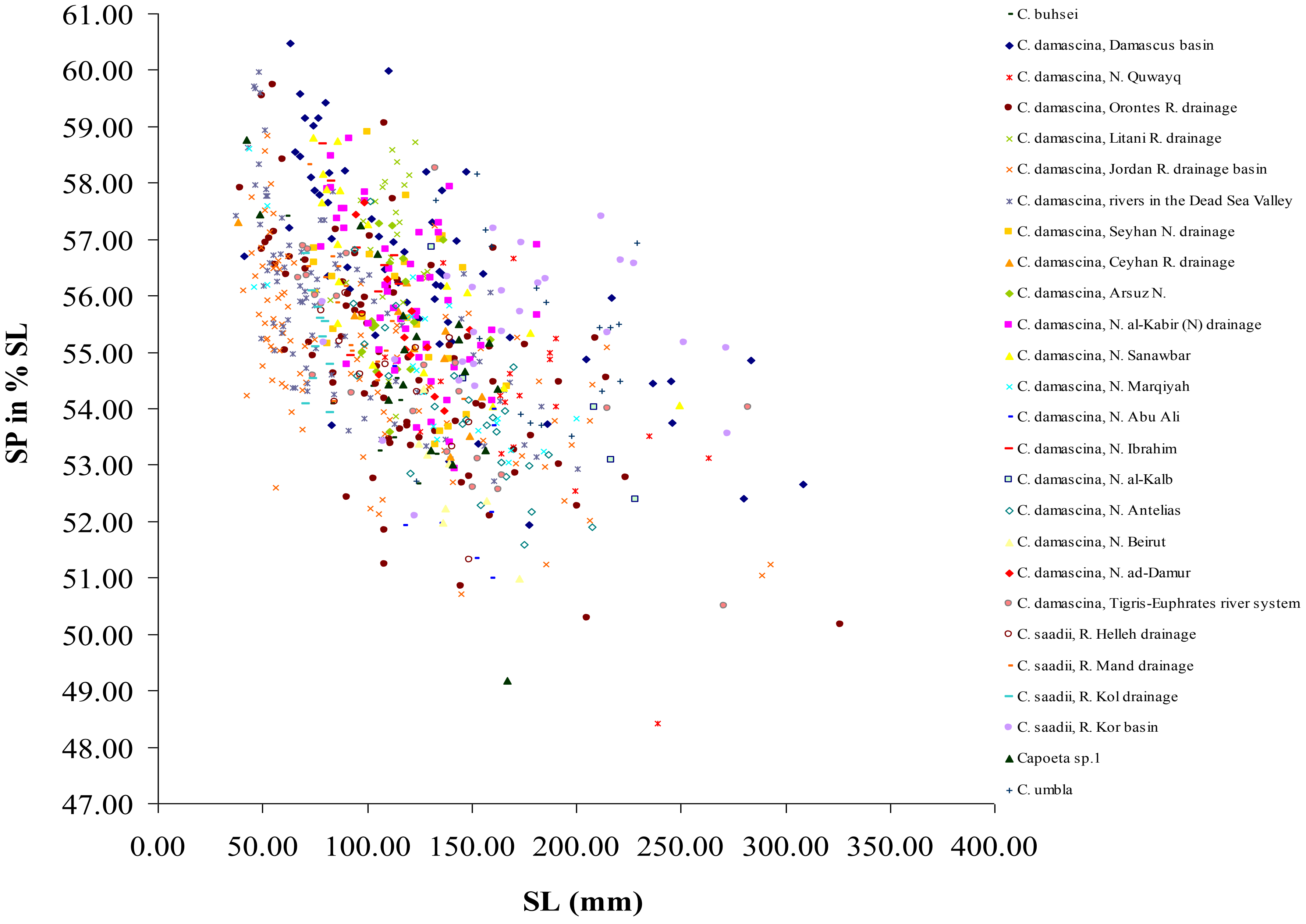

Fig. A7. Preplevic length in relation to standard length.

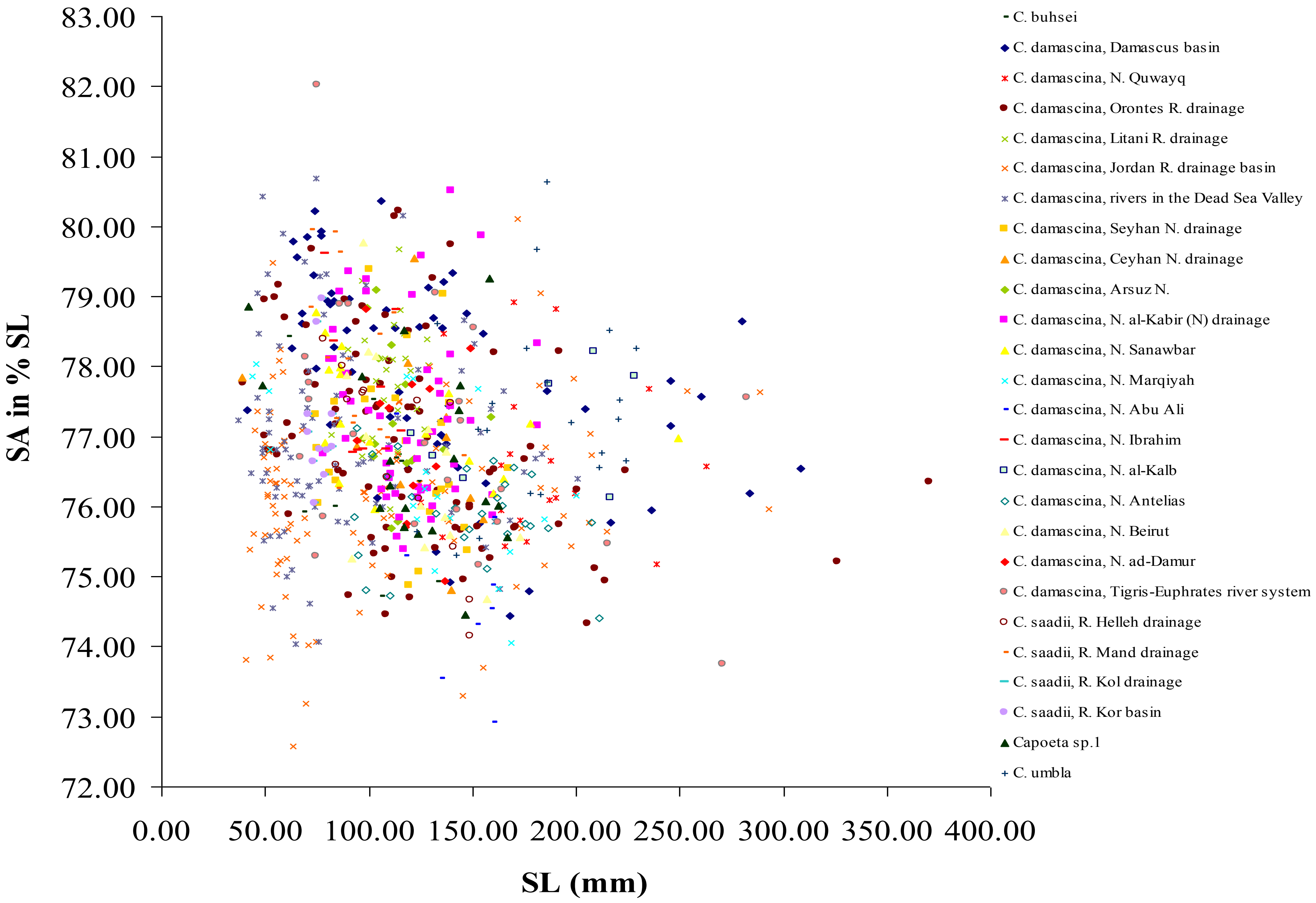

Fig. A8. Preanal length in relation to standard length.

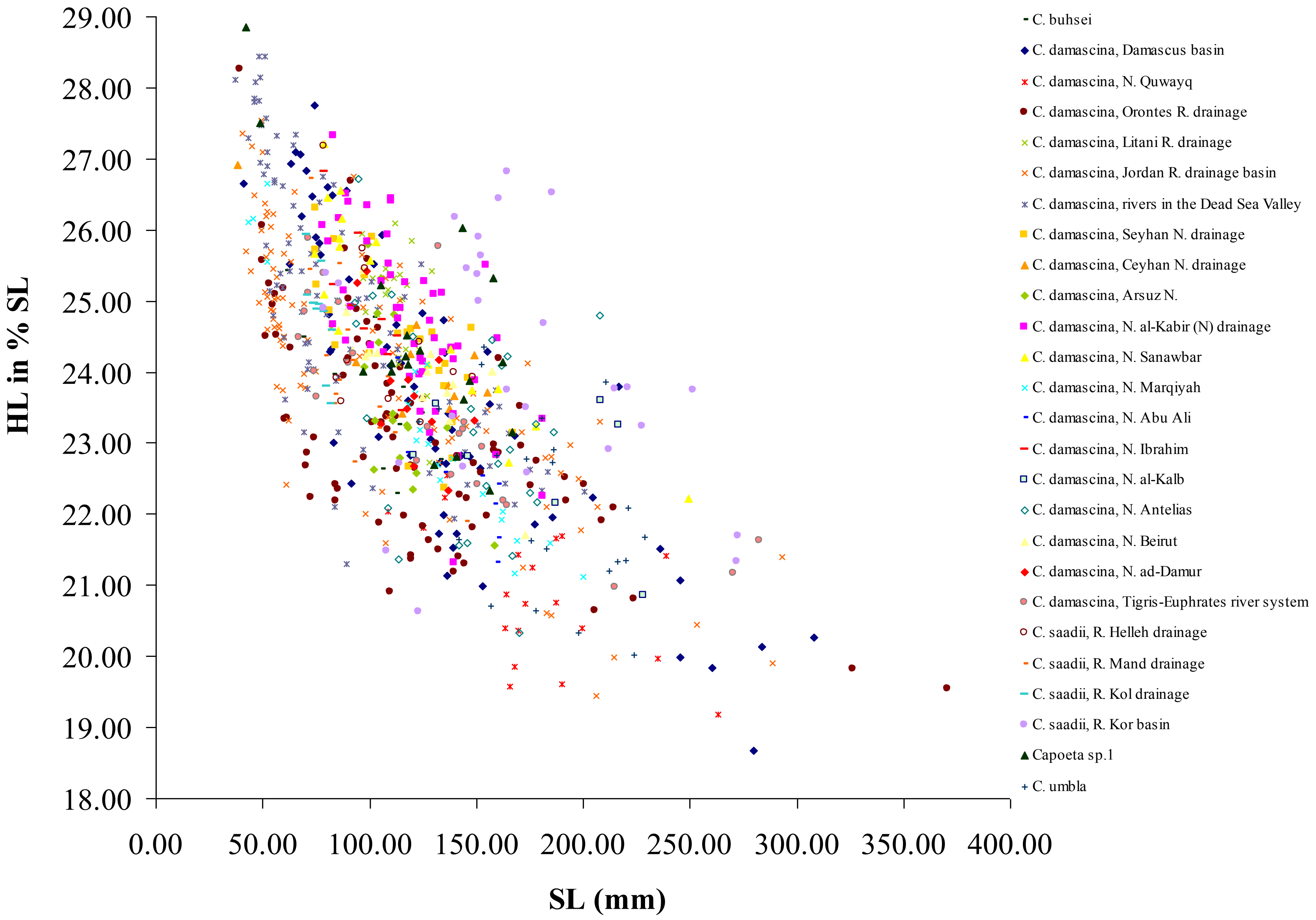

Fig. A9. Head length in relation to standard length.

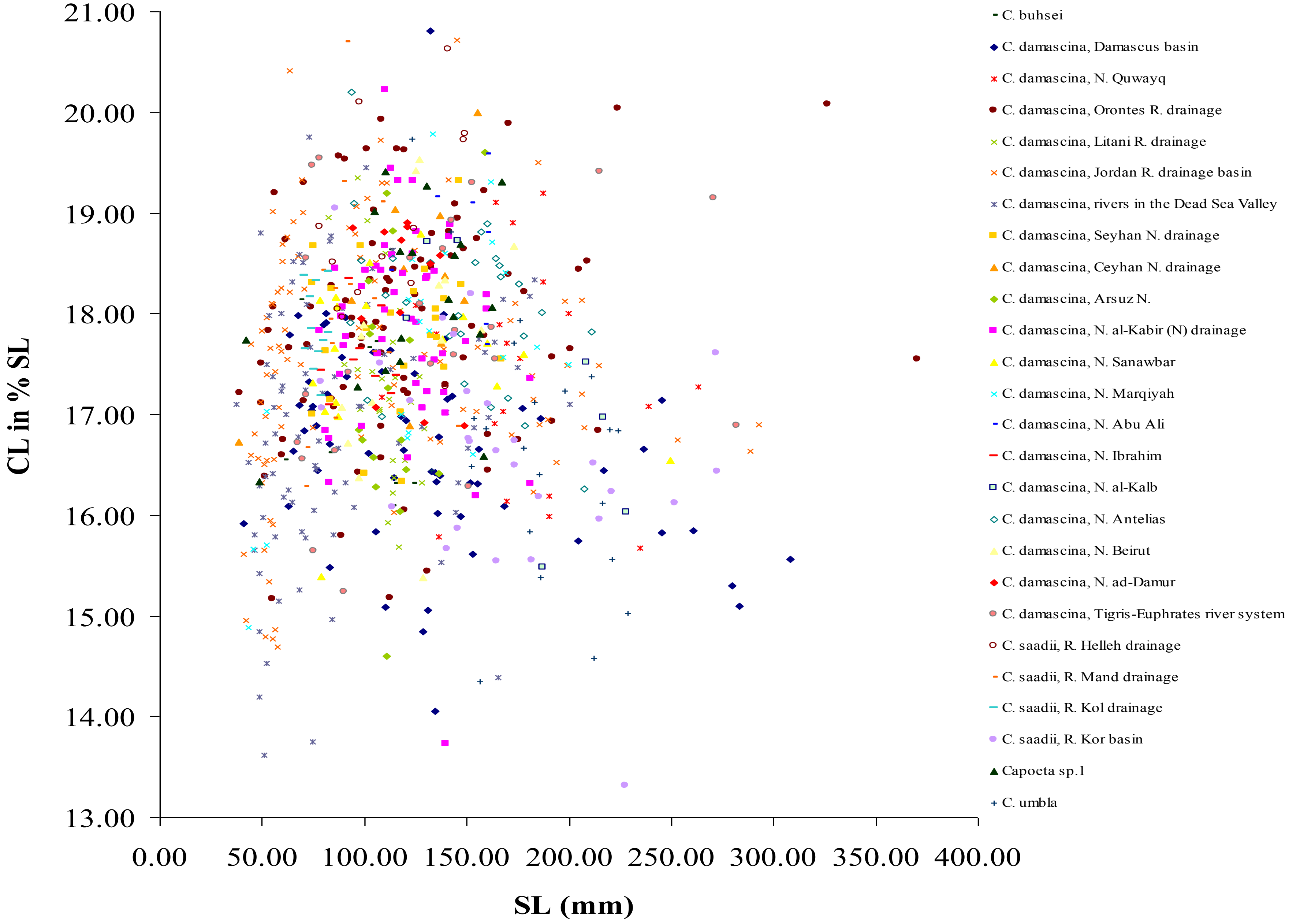

Fig. A10. Caudal peduncle length in relation to standard length.

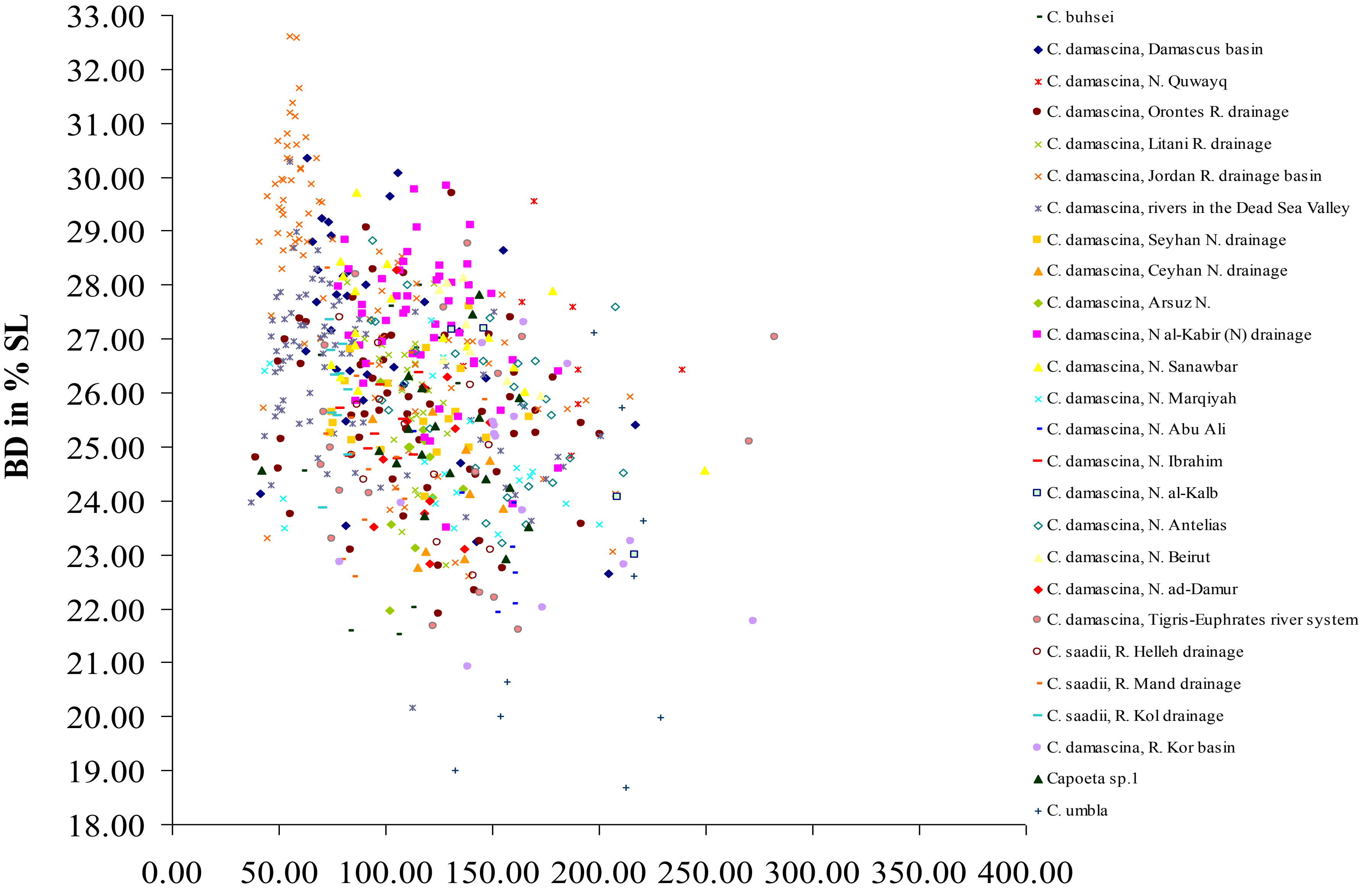

Fig. A11. Body depth in relation to standard length.

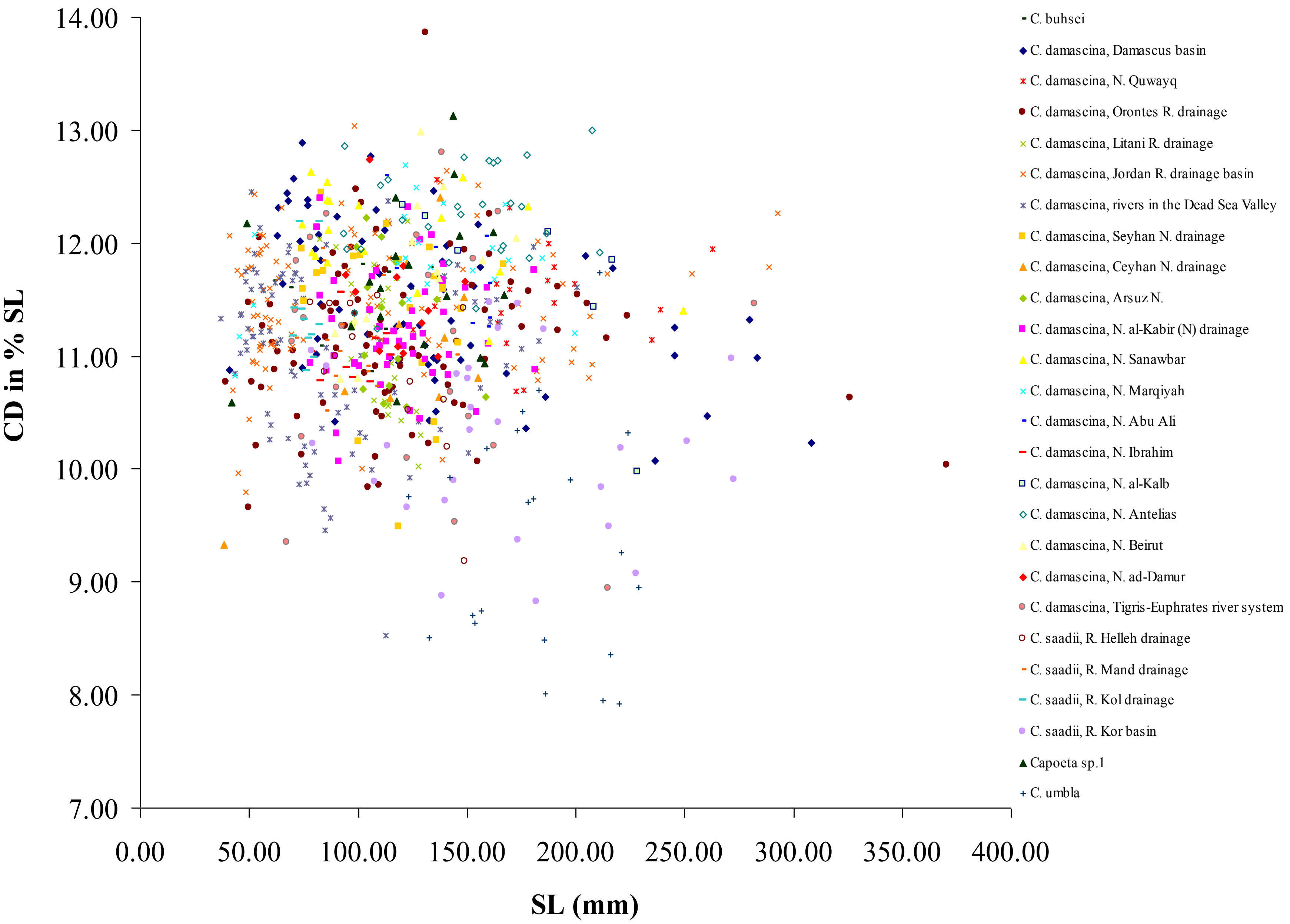

Fig. A12. Caudal peduncle depth in relation to standard length.

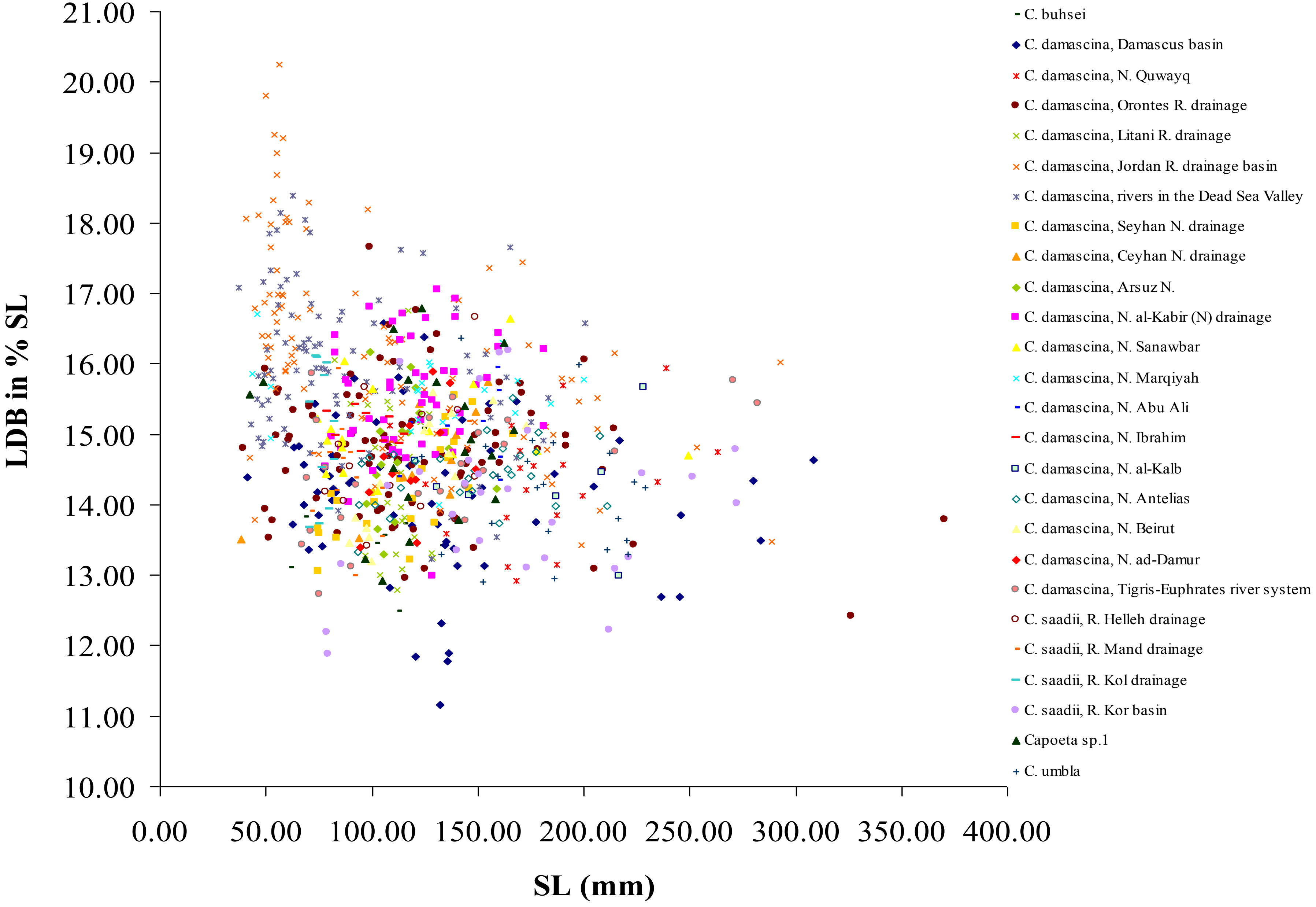

Fig. A13. Length of the dorsal-fin base in relation to standard length.

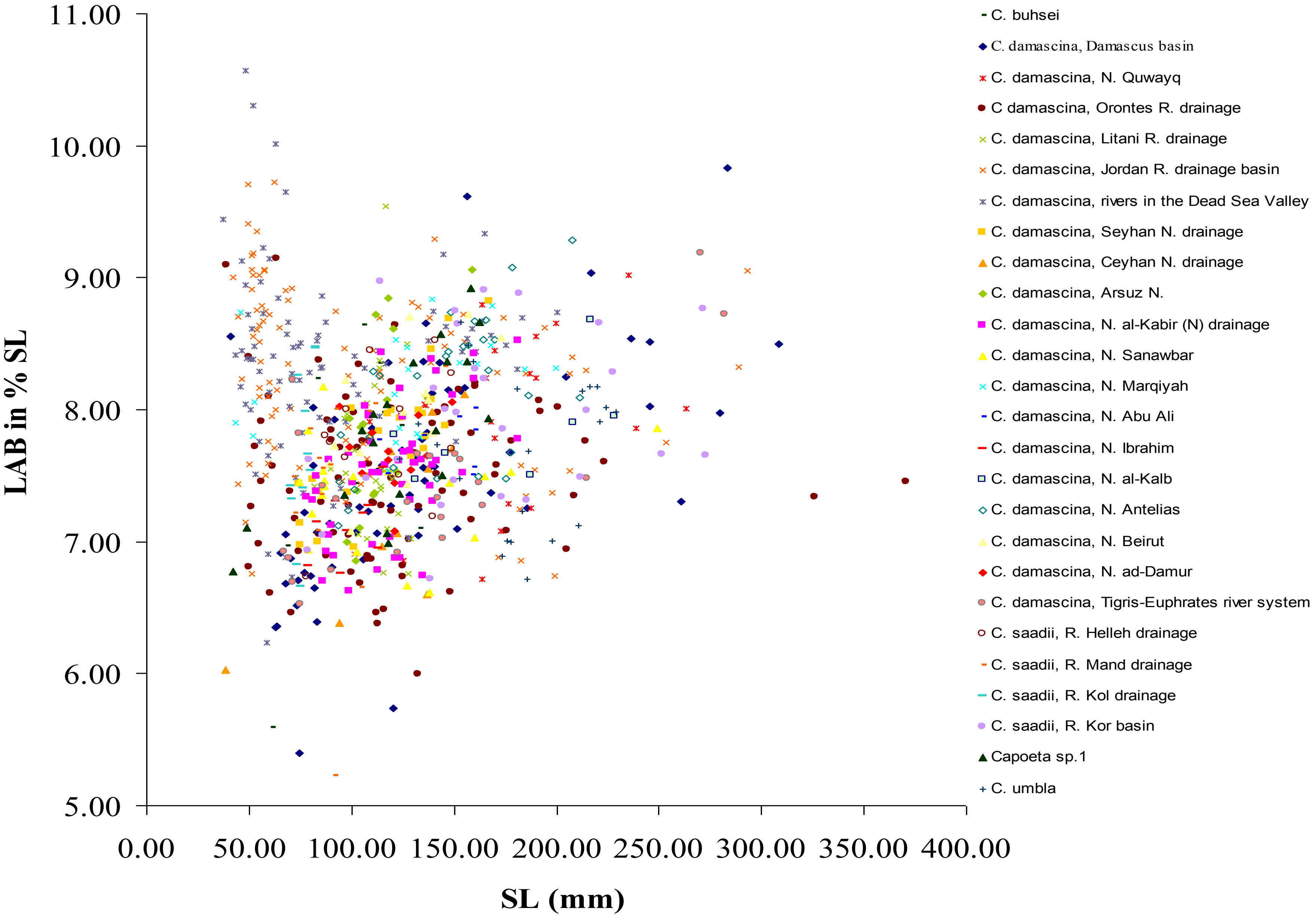

Fig. A14. Length of the anal-fin base in relation to standard length.

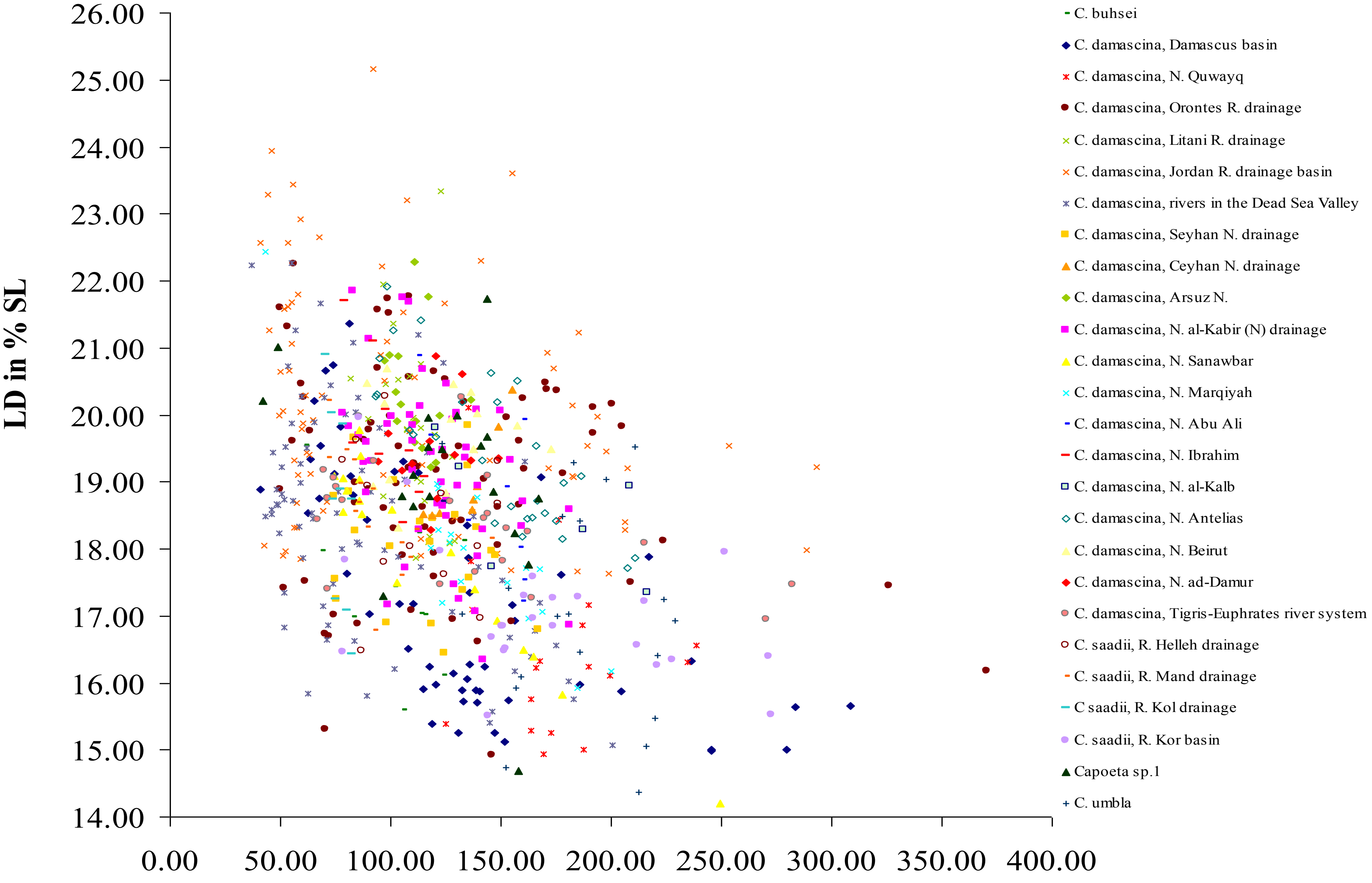

Fig. A15. Length of the longest dorsal-fin ray in relation to standard length.

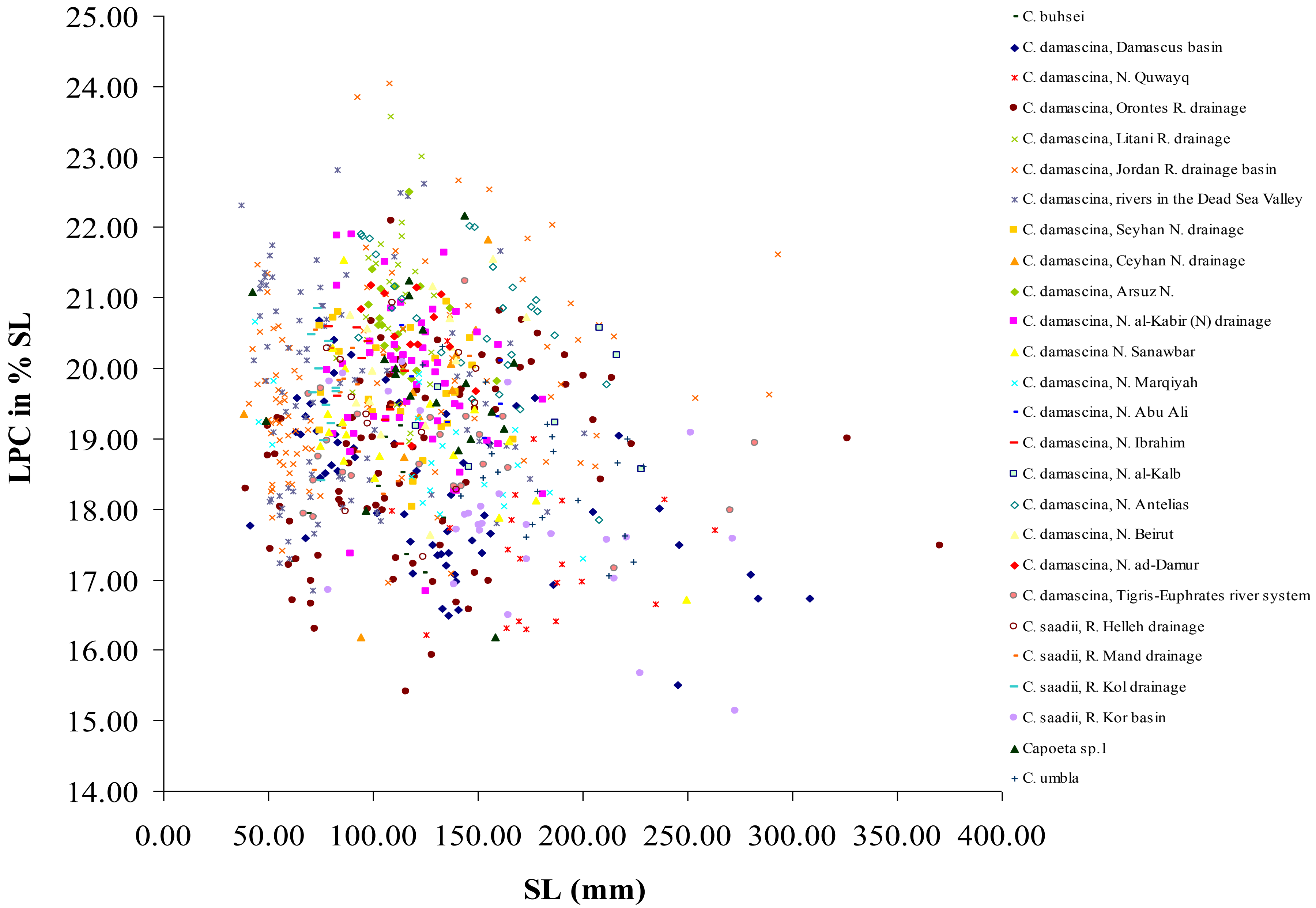

Fig. A16. Length of the pectoral fin in relation to standard length.

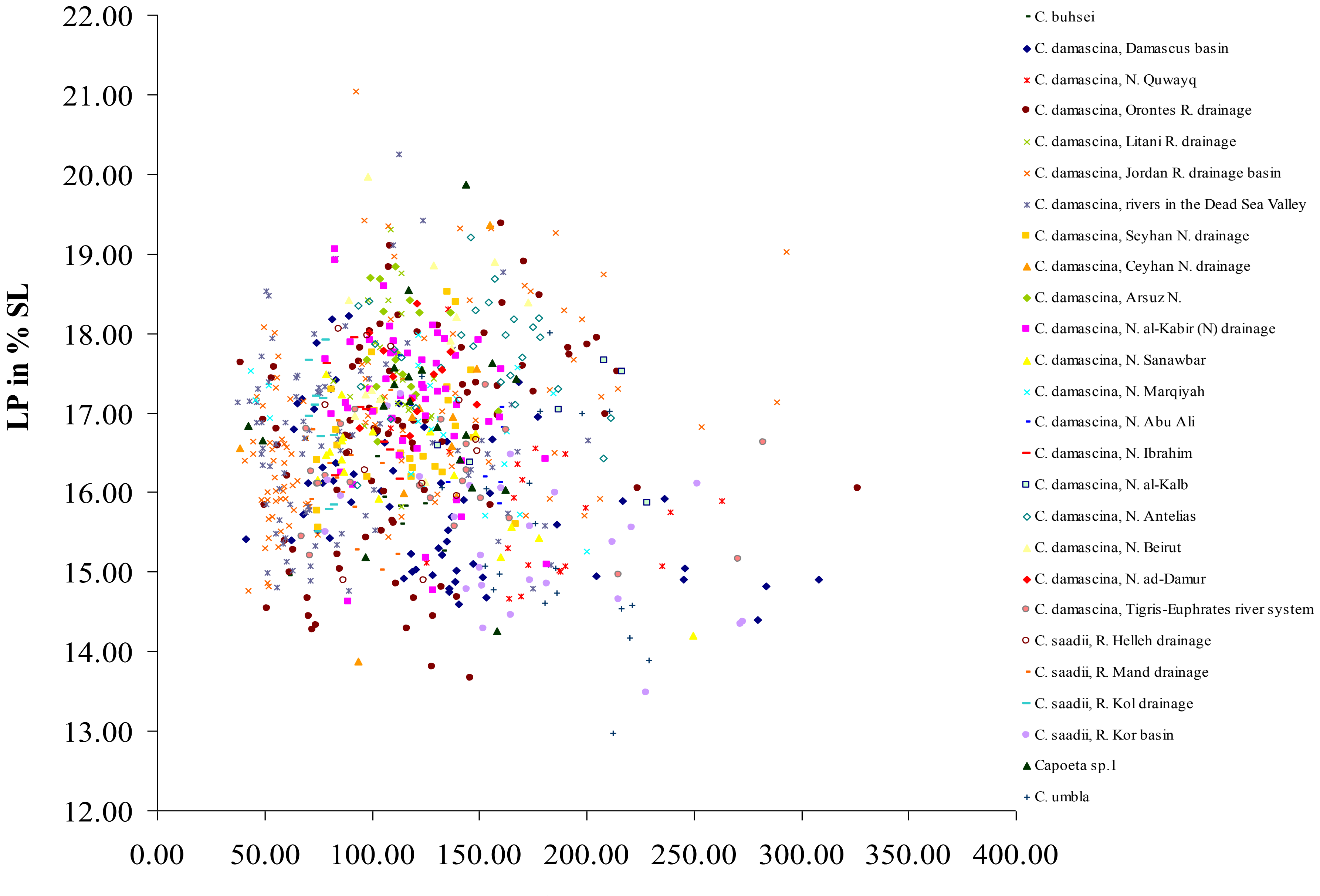

Fig. A17. Length of the pelvic fin in relation to standard length.

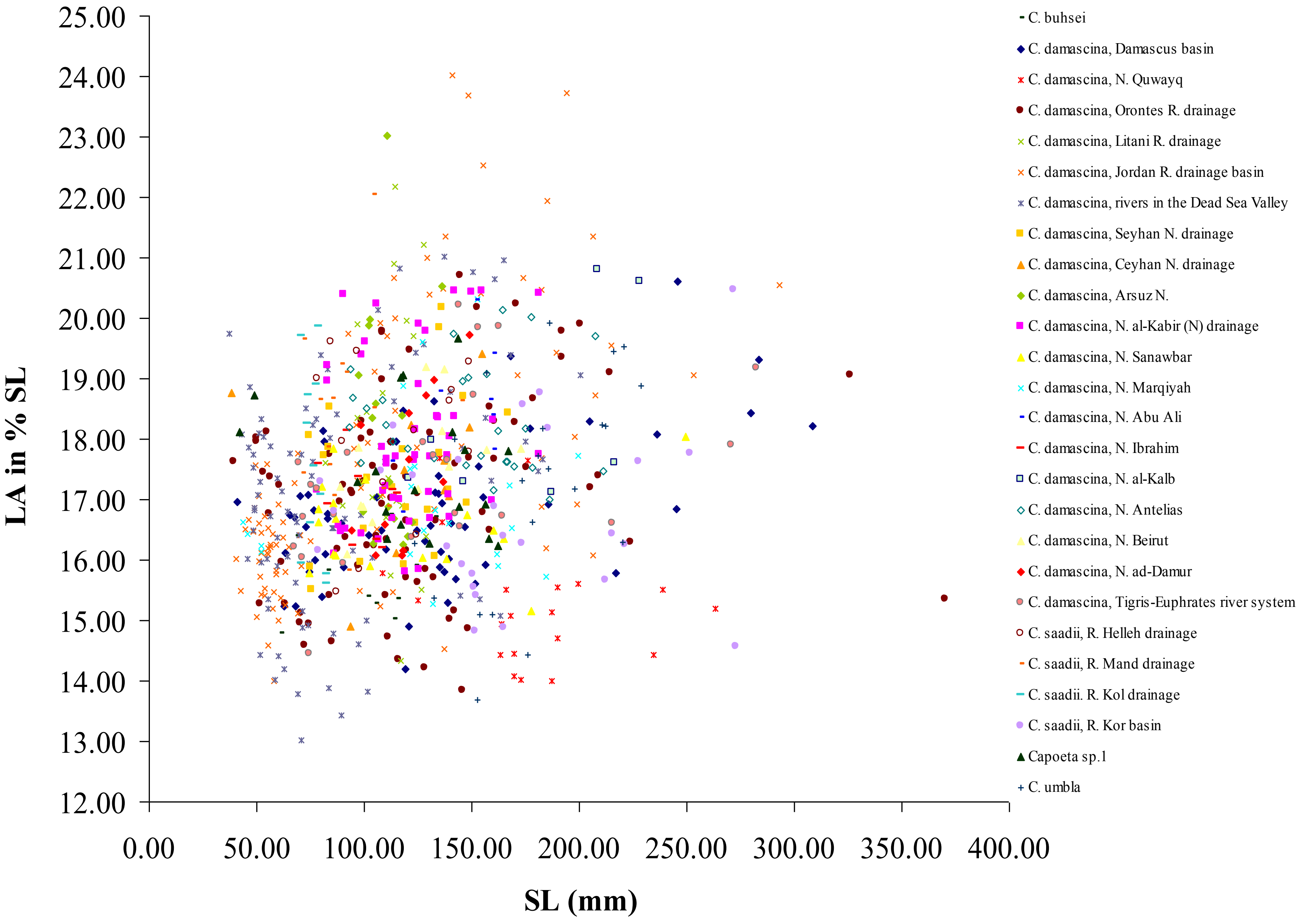

Fig. A18. Length of the longest anal-fin ray in relation to standard length.

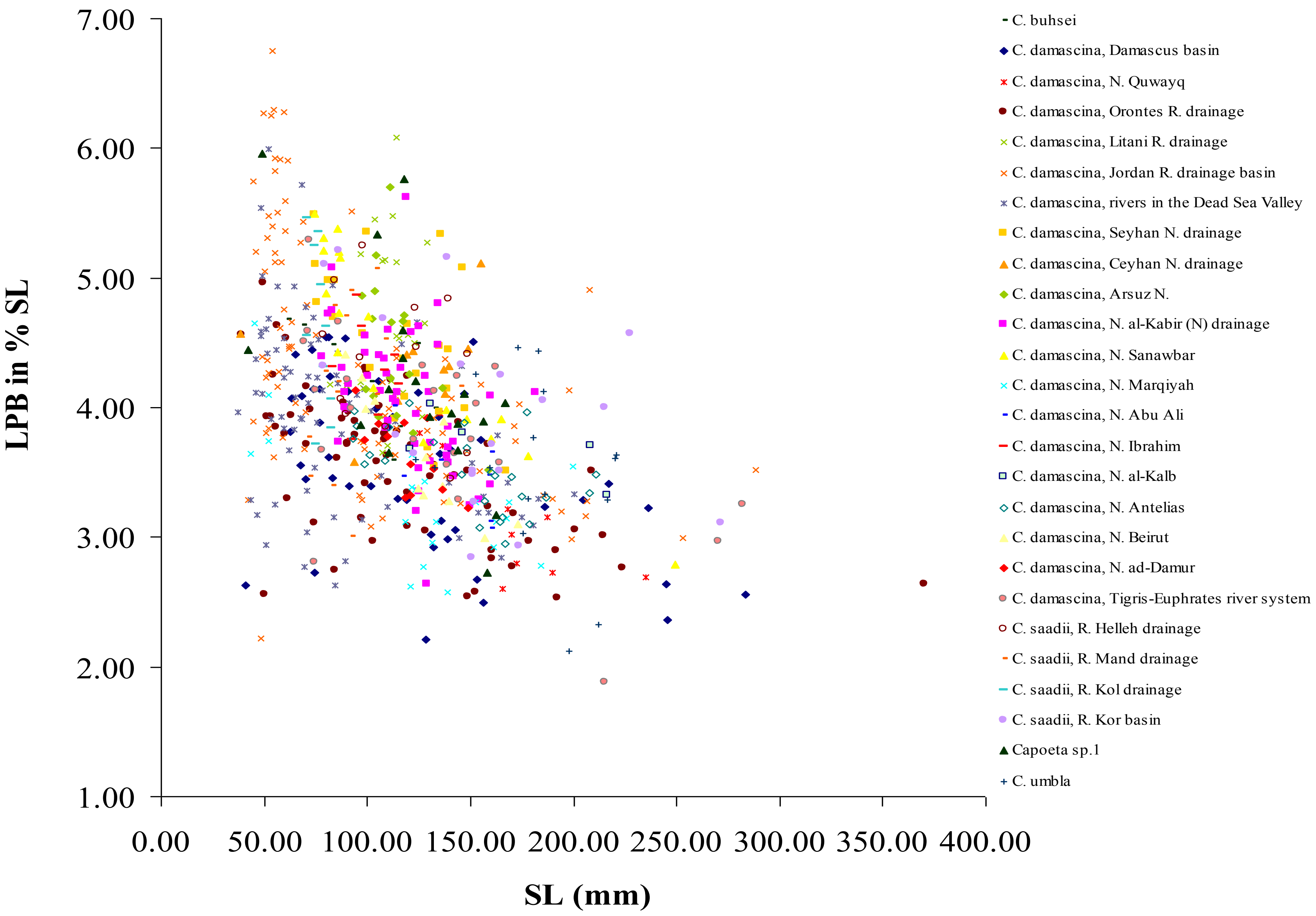

Fig. A19. Length of the posterior barbel in relation to standard length.

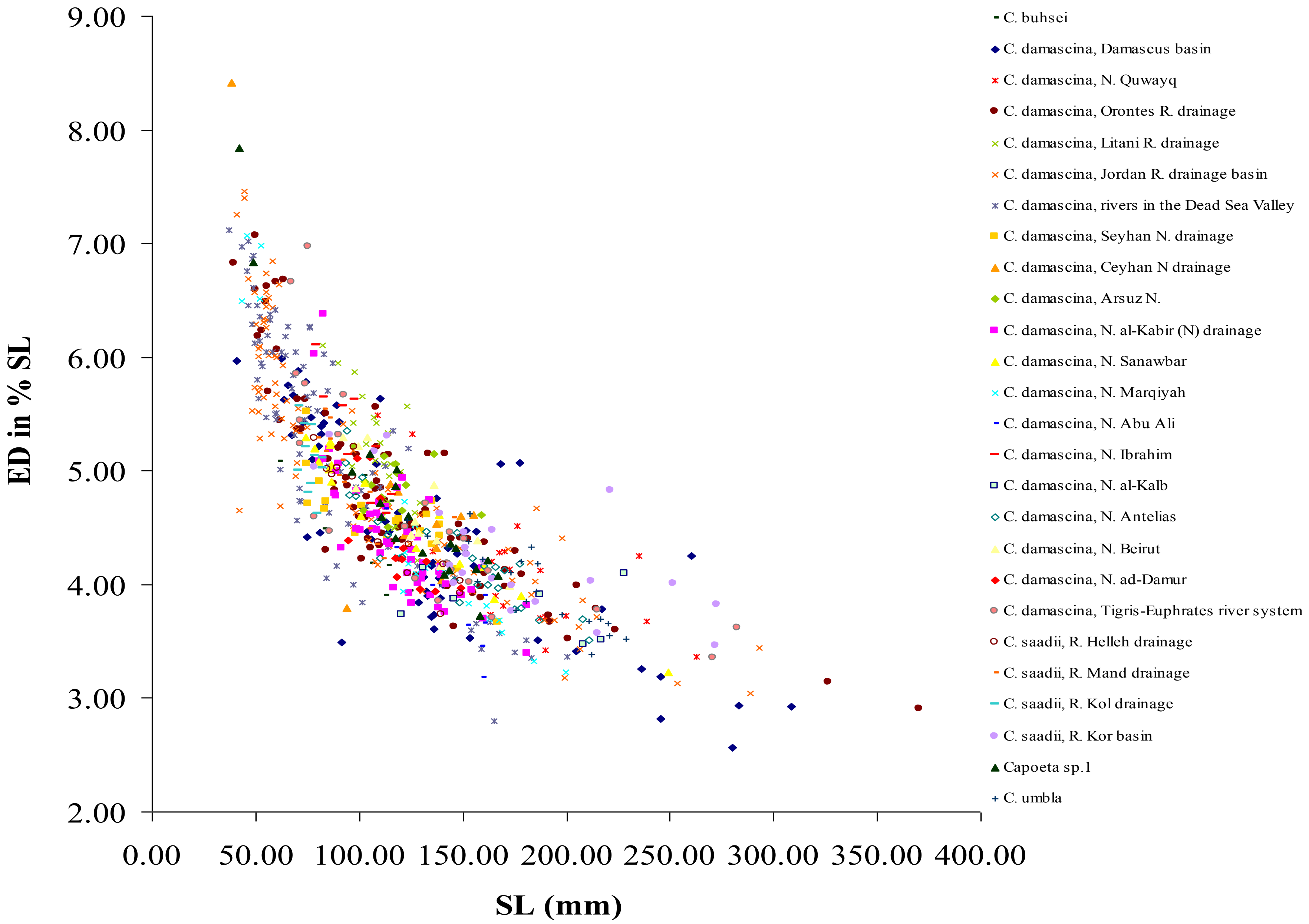

Fig. A20. Eye diameter in relation to standard length.

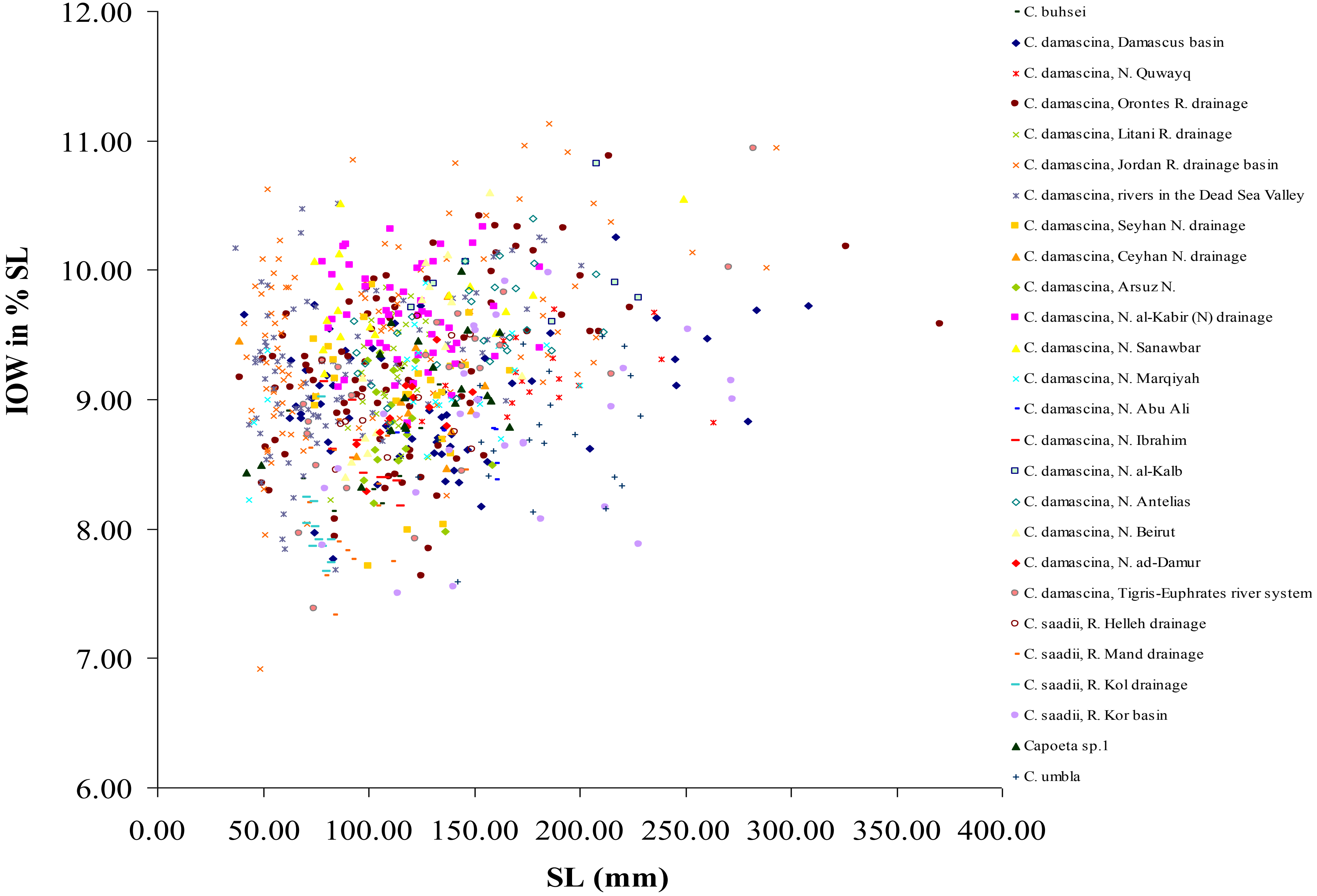

Fig. A21. Interorbital width in relation to standard length.

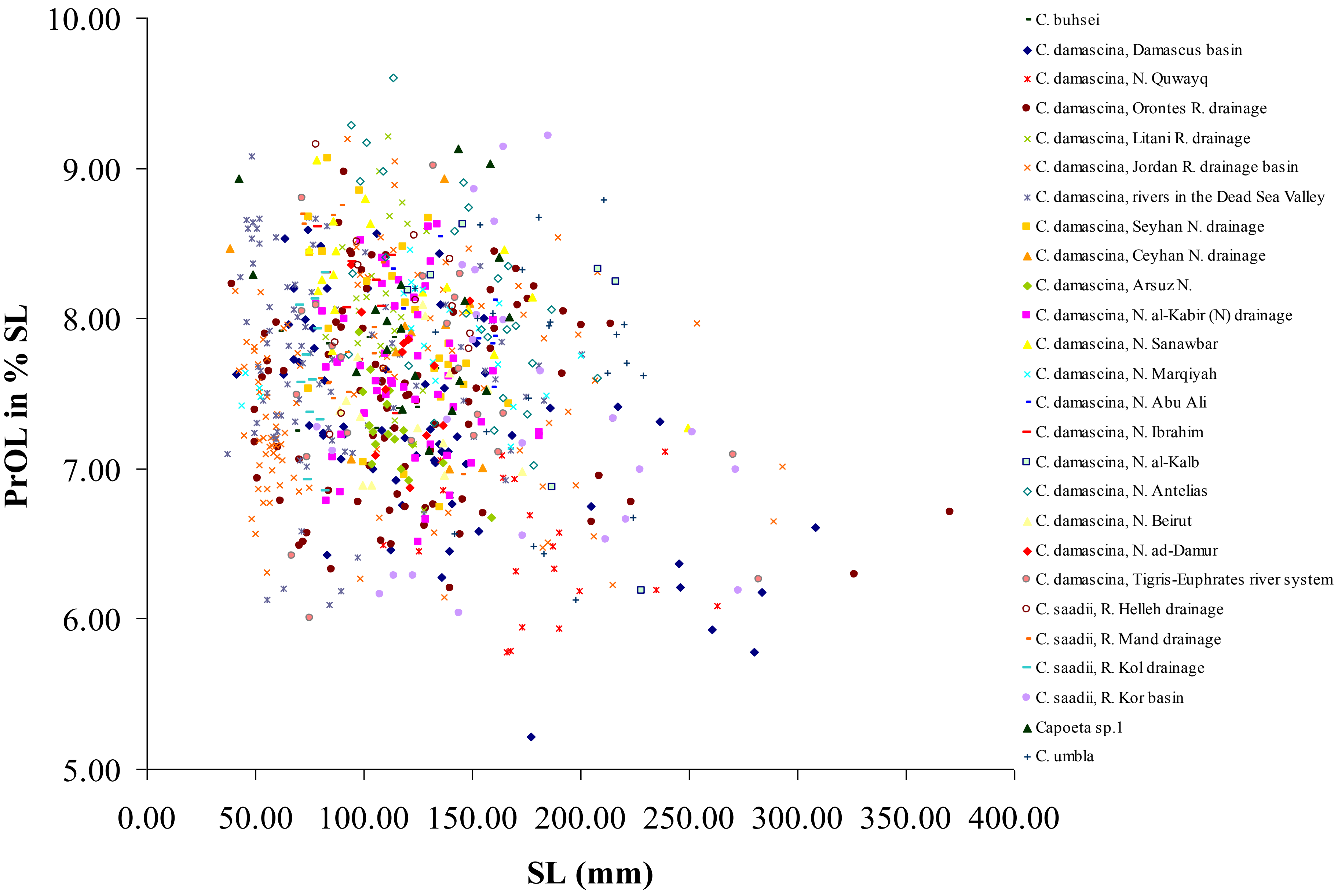

Fig. A22. Preorbital length in relation to standard length.

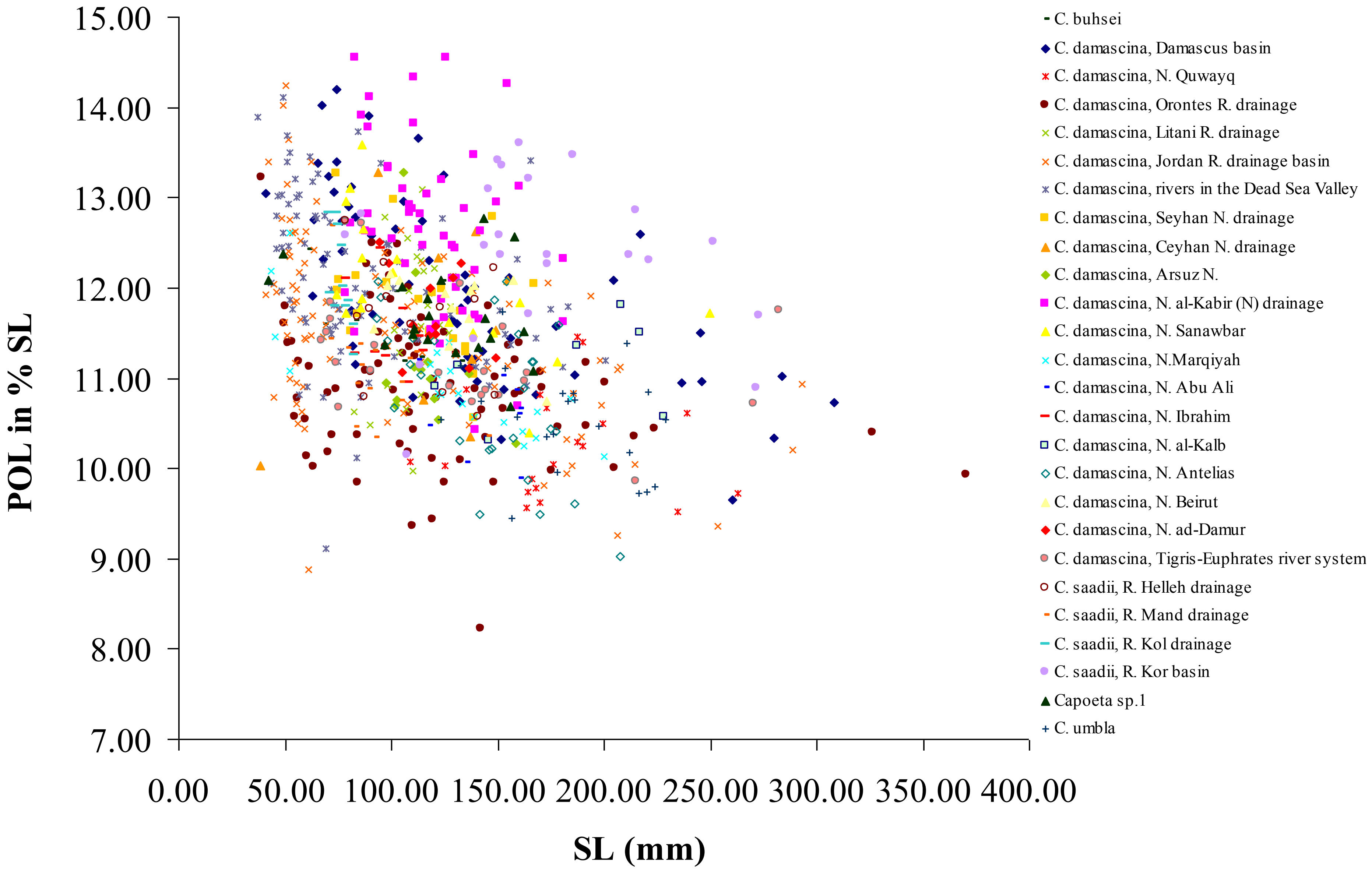

Fig. A23. Postorbital length in relation to standard length.

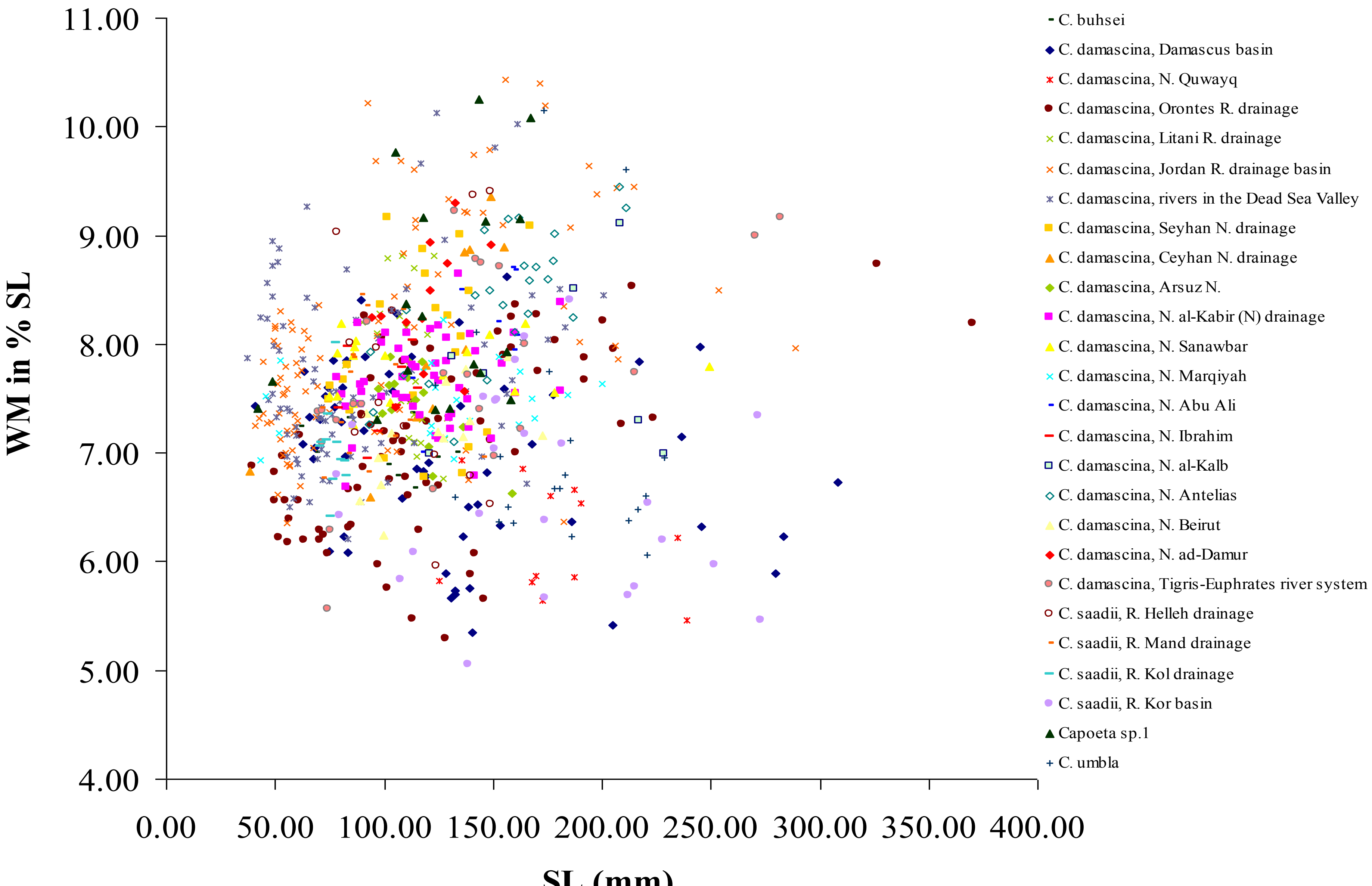

Fig. A24. Width of the mouth in relation to standard length.

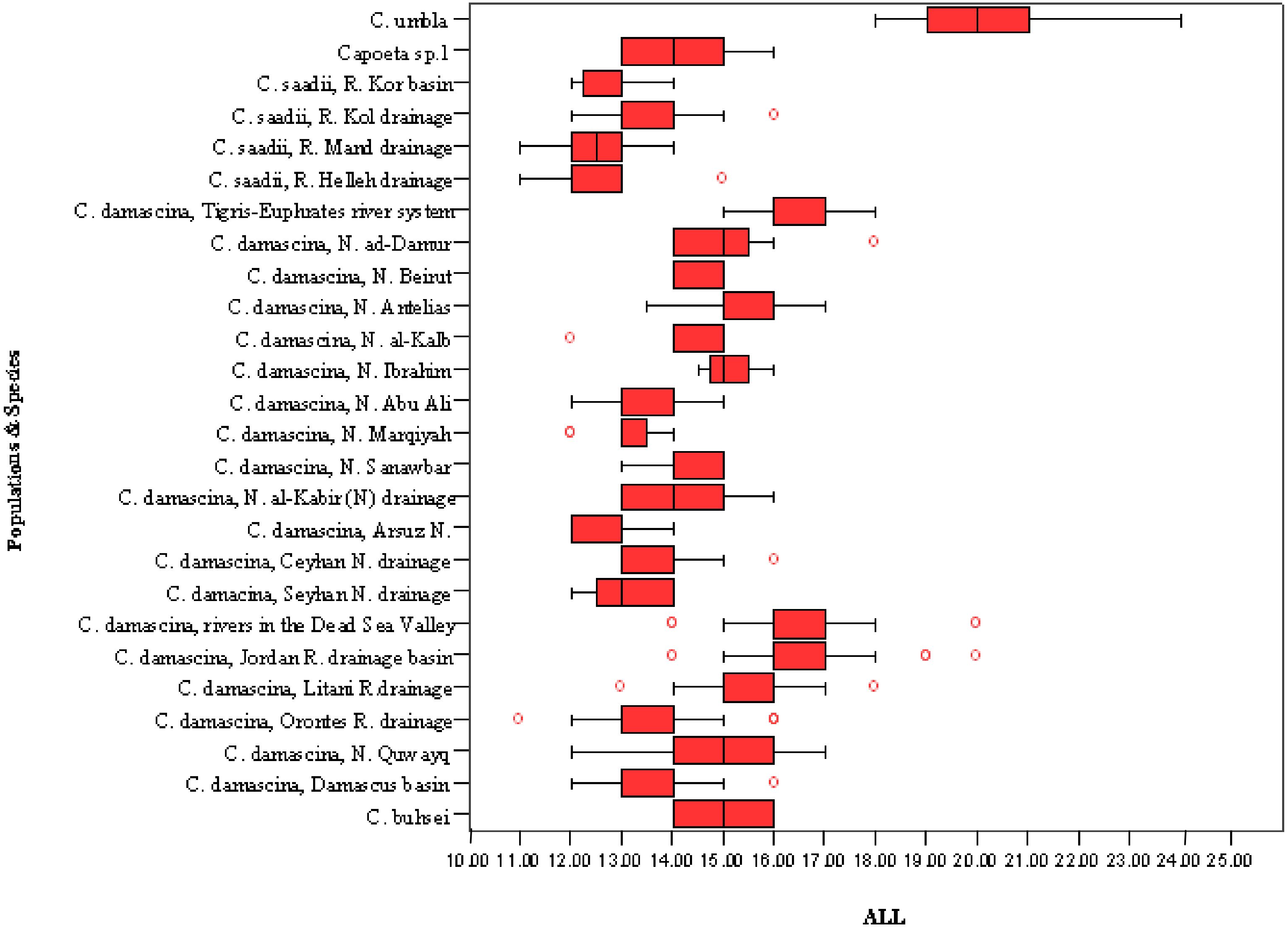

Fig. A25. Counts of the scales above the lateral line (ALL): box plots show the 25th to 75th percentile range of the data within the box, with the median indicated with a line in the box; whiskers represent the remaining quartile ranges, with outliers indicated as circles.

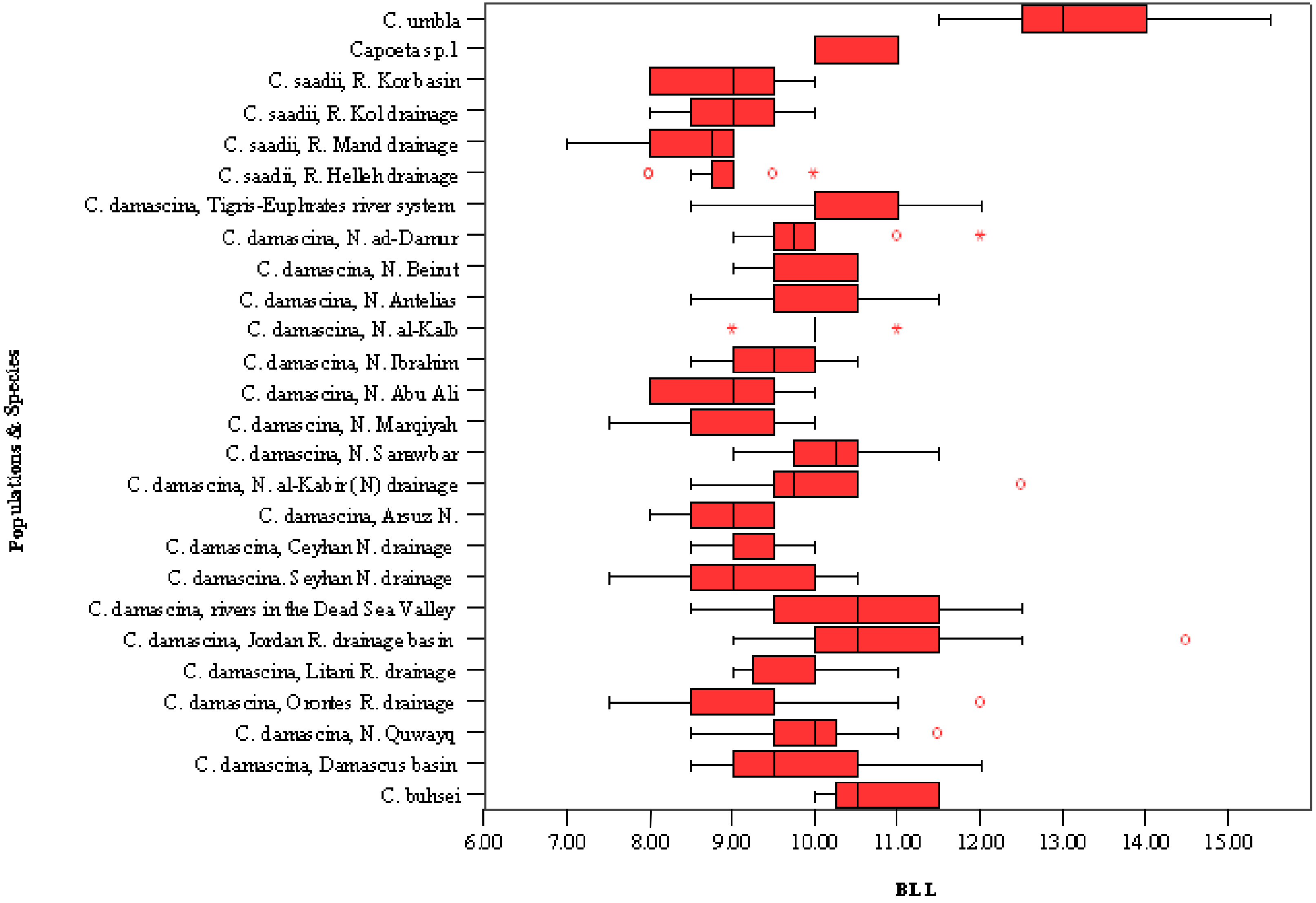

Fig. A26. Counts of the scales below the lateral line (BLL): box plots show the 25th to 75th percentile range of the data within the box, with the median indicated with a line in the box; whiskers represent the remaining quartile ranges, with outliers indicated as circles/asterisks.

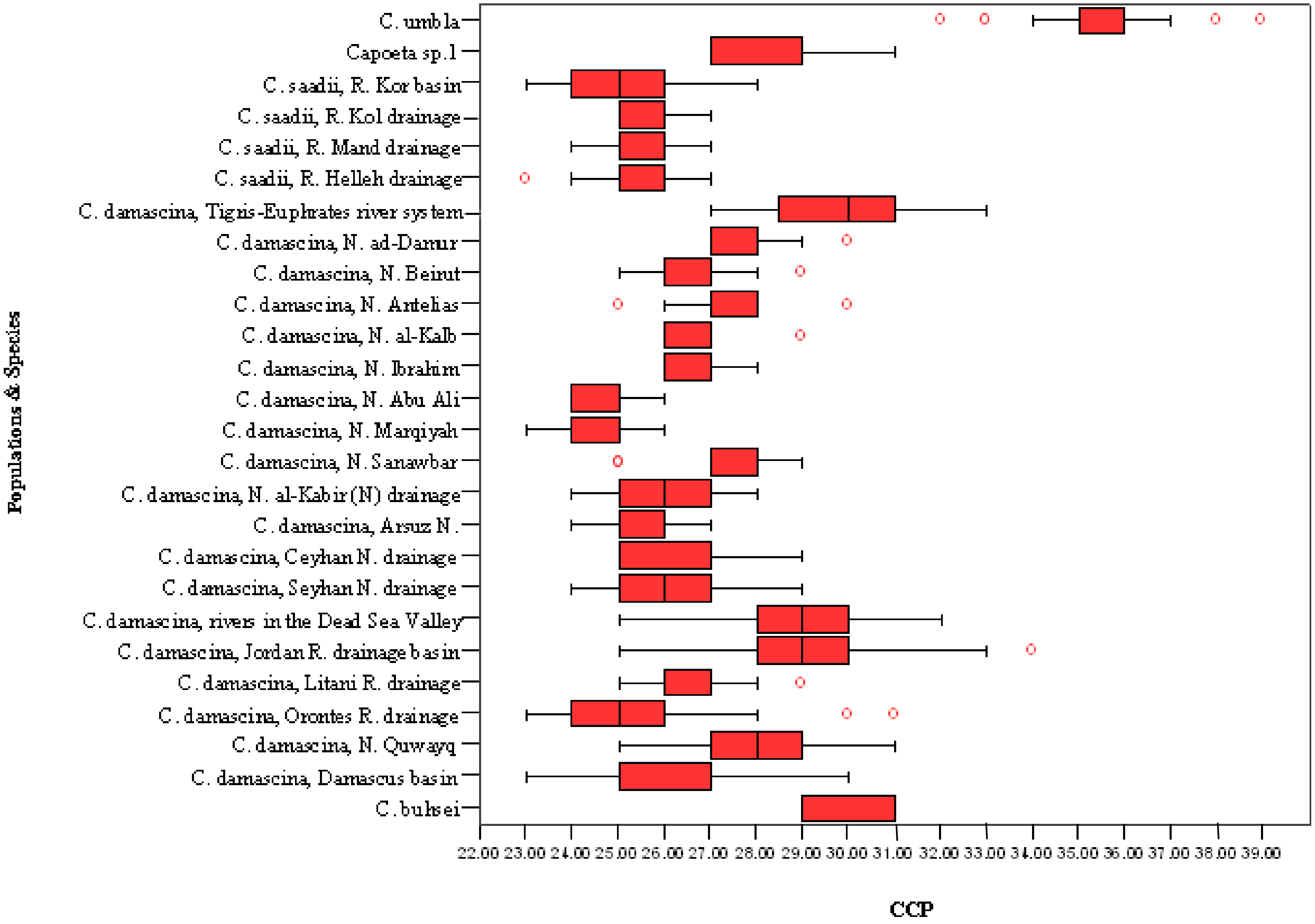

Fig. A27. Circumpendicular scale counts (CCP): box plots show the 25th to 75th percentile range of the data within the box, with the median indicated with a line in the box; whiskers represent the remaining quartile ranges, with outliers indicated as circles.

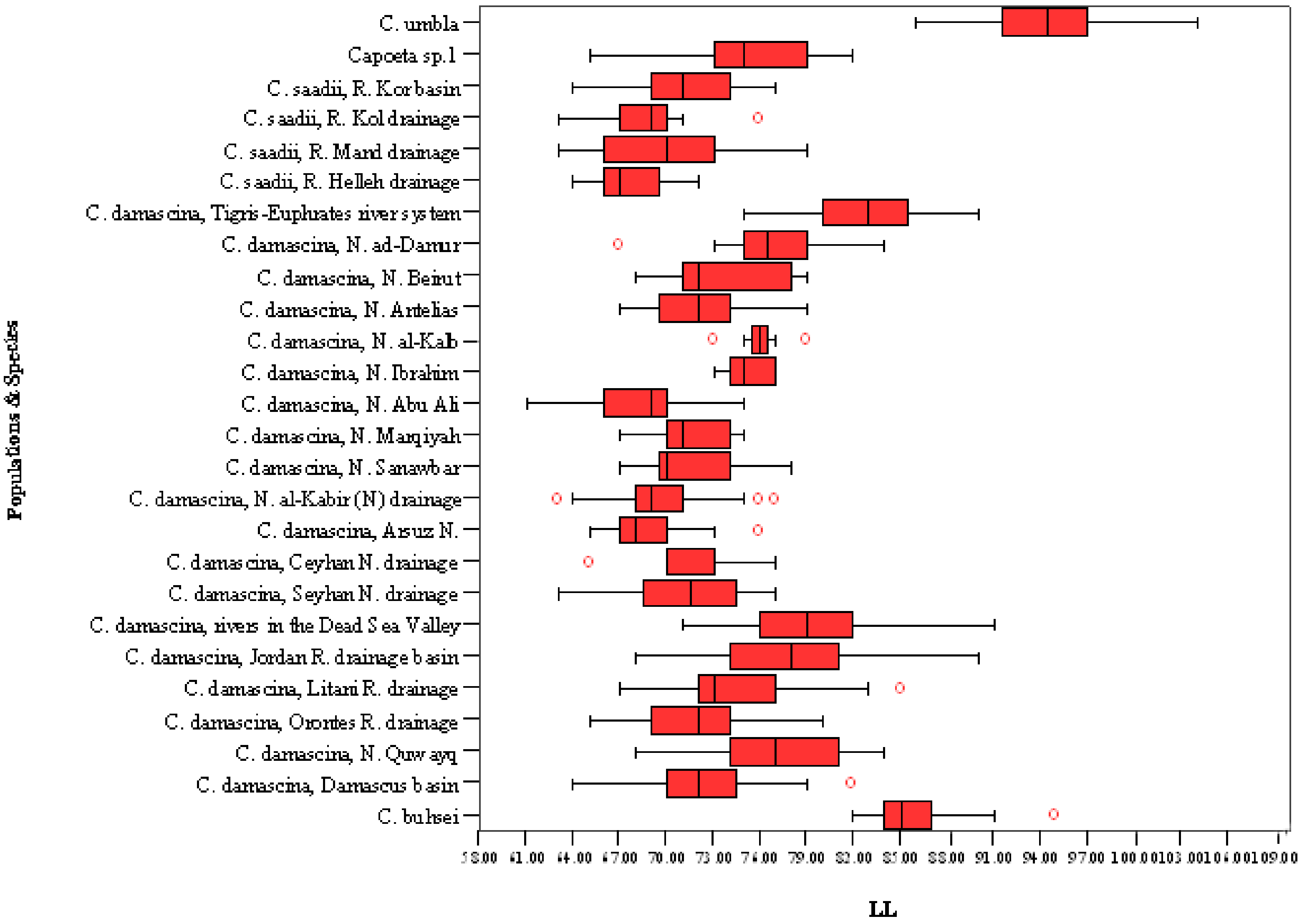

Fig. A28. Lateral-line scale counts (LL): box plots show the 25th to 75th percentile range of the data within the box, with the median indicated with a line in the box; whiskers represent the remaining quartile ranges, with outliers indicated as circles.

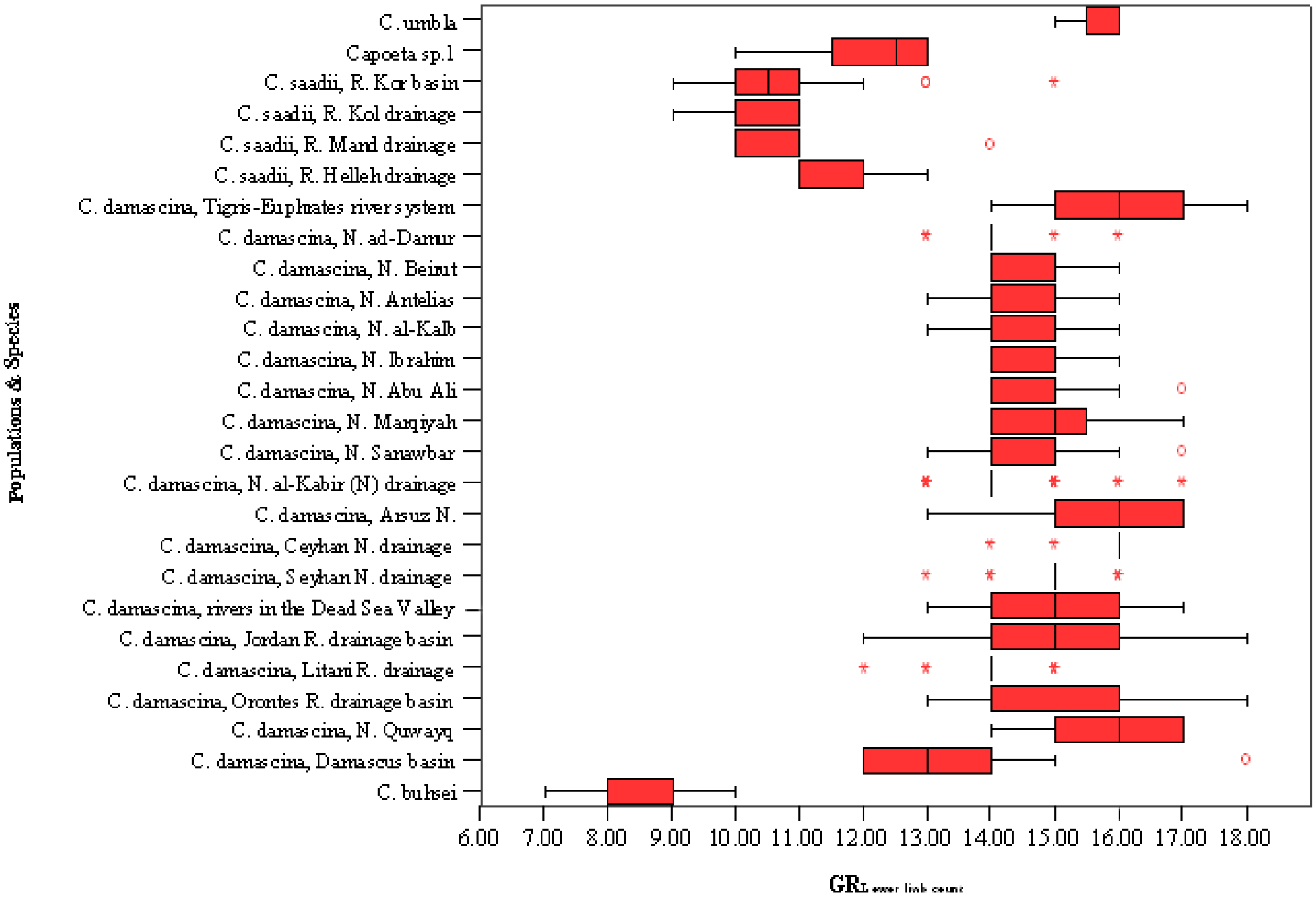

Fig. A29. Number of gill rakers on the lower limb of the first gill arch ($GR_{\text{Lower limb count}}$): box plots show the 25th to 75th percentile range of the data within the box, with the median indicated with a line in the box; whiskers represent the remaining quartile ranges, with outliers indicated as circles/asterisks.

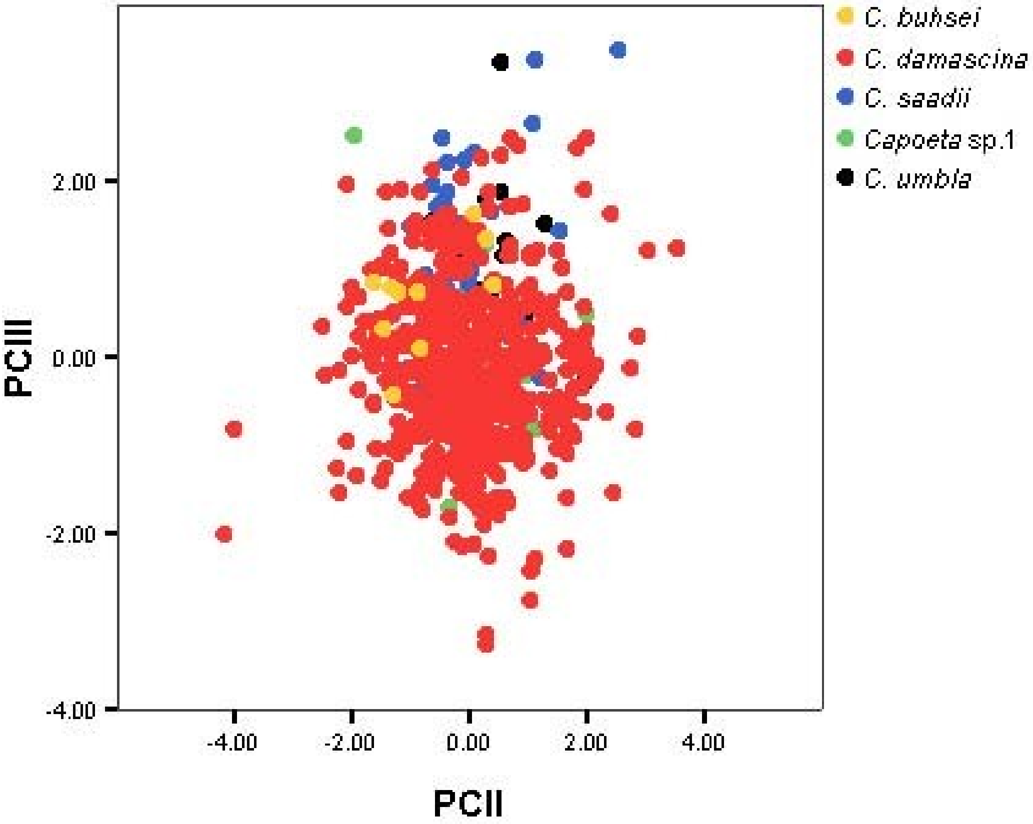

Fig. A30. Plot of a PCA carried out on 17 log-transformed morphometric measurements of all specimens fully examined (n = 614).

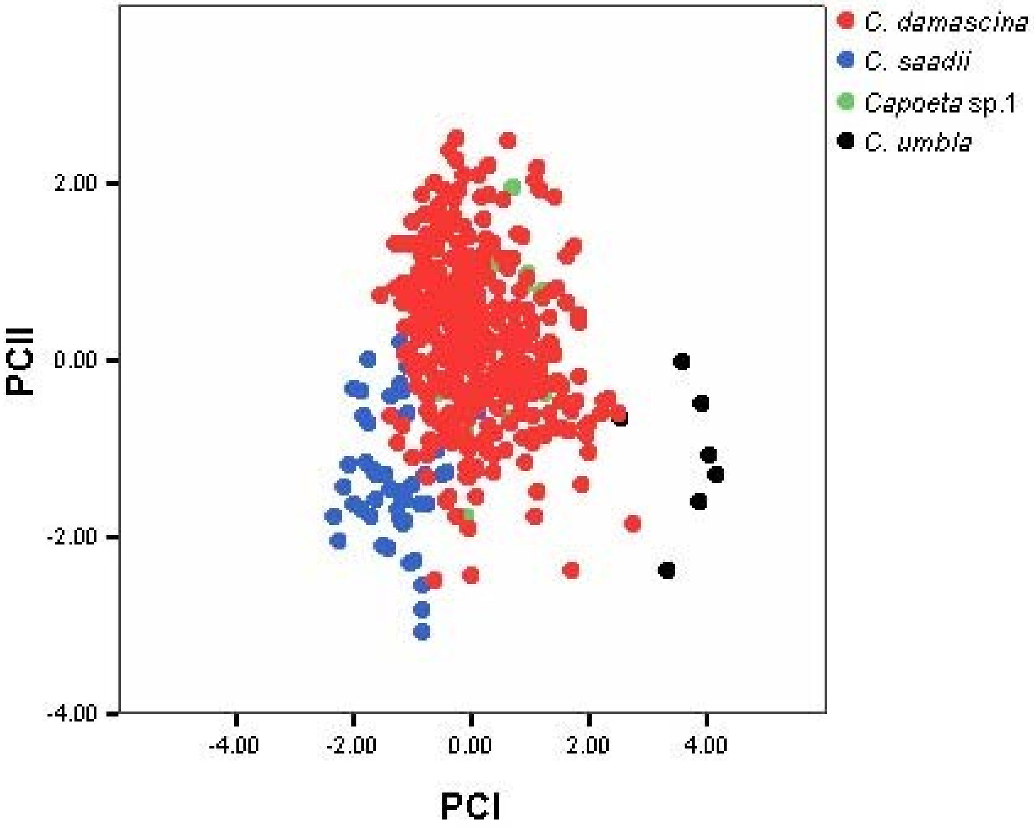

Fig. A31. Plot of a PCA carried out on 12 meristic characters of all specimens fully examined (n = 446).

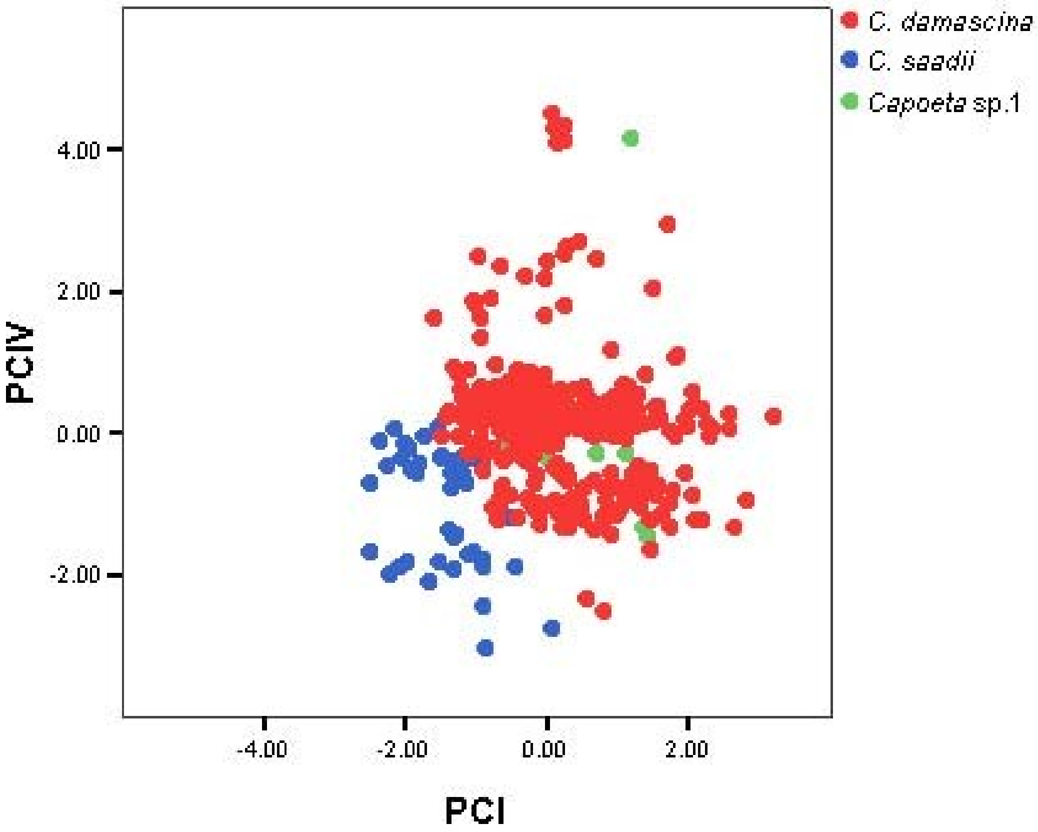

Fig. A32. Plot of a PCA carried out on 12 meristic characters of all specimens fully examined excluding *Capoeta umbla* (n = 439).

Table A1. Standard official names, alternative names and coordinates of rivers and lakes discussed in detail in section 1.3. Standard official names and coordinates were taken from the "Official Standard Names Gazetteers" of Iran (1956), Iraq (1957), Israel (1970), Jordan (1971), Lebanon (1970), Syria (1967) and Turkey (1960). Alternative names were taken from various literature sources (taxonomic publications, gazetteers, etc.).

Standard official names	**Alternative names used in literature**	**Coordinates**
an-Nahr al-Kabir (N) (Arabic)	an-Nahr al-Kabir al-Shemali (Arabic), al-Kabir (N) River, northern great river	35° 30' N 35° 48' E
an-Nahr al-Kabir (S) (Arabic)	an-Nahr al-Kabir (Arabic), an-Nahr al-Kabir al-Janoubi (Arabic), al-Kabir (S) River, southern great river	34° 38' N 35° 58' E
Ceyhan Nehri (Turkish)	Ceyhan River	36° 45' N 35° 42' E
Dead Sea (Conventional)	al-Bahr al-Mayyit (Arabic),Yam Hamelah (Hebrew)	31° 30' N 35° 30' E
Euphrates River (Conventional)	Nahr al-Furat (Arabic), Firat Nehri (Turkish)	31° 00' N 47° 25' E
Göksu Nehri (Turkish)	Göksu Çayi (Turkish), Göksu River	36° 20' N 35° 05' E
Jordan River (Conventional)	Nahr al-Urdun (Arabic), Hayarden (Hebrew)	31° 46' N 35° 33' E
Litani River (Conventional)	Nahr al-Litani (Arabic), Nahr el-Lytani (Arabic)	33° 20' N 35° 14' E
Nahal Qishon (Hebrew)	Qishon River, Kishon River	32° 49' N 35° 02' E
Nahal Tanninim (Hebrew)	Tanninim River	32° 32' N 34° 54 E
Nahr Abu Ali (Arabic)	Nahr Abou Ali (Arabic), Abu Ali/Abou Ali River	34° 27' N 35° 50' E
Nahr ad-Damur (Arabic)	Nahr ad-Damour/ed-Damour (Arabic), ad-Damur River	33° 42' N 35° 26' E
Nahr al-Awaj (Arabic)	al-Awaj River	33° 20' N 36° 34' E
Nahr al-Awwali (Arabic)	Nahr el-Aowali, al-Awwali River	33° 35' N 35° 23' E
Nahr al-Kalb (Arabic)	Nahr el-Kalb/el-Kelb (Arabic), al-Kalb River	33° 57' N 35° 35' E
Nahr al-Qiss (Arabic)	al-Qiss River	34° 53' N 35° 53' E
Nahr Barada (Arabic)	Barada River	33° 30' N 36° 28' E
Nahr Beirut (Arabic)	Nahr Bayrut (Arabic), Beirut River	33° 54' N 35° 32' E
Nahr Ibrahim (Arabic)	Ibrahim River	34° 04' N 35° 38' E
Nahr Marqiyah (Arabic)	Nahr Marqiye (Arabic), Mariqyah River	35° 01' N 35° 53' E
Nahr Quwayq	Nahr Kueik/Kweik/Qwaiq/Quweiq (Arabic), Haleparki Deresi (Turkish), Quwayq/Quwaiq River	35° 59' N 37° 02' E
Nahr Sana (Arabic)	Sana River	35° 20' N 35° 55' E

Nahr Sanawbar (Arabic)	Nahr Sanaubar (Arabic), Sanawbar/Sanaubar River	35° 26' N 35° 54' E
Orontes River (Conventional)	Asi Nehri (Turkish), Nehir Oronte (Turkish), Nahr al-Asi/el-Asi (Arabic)	36° 02' N 35° 58' E
Rud-e Helleh (Persian)	Helleh Rud (Persian), Rudkhaneh-ye Helleh (Persian), Helleh River	29° 10' N 50° 40' E
Rud-e Kol (Persian)	Rudkhaneh-ye Kol (Persian), Rud-i-Kul (Persian), Rud Kul (Persian), Kol/Kul River	26° 59' N 55° 47' E
Rud-e Mand (Persian)	Mand Rud (Persian), Rud-e Mond (Persian), Mand/Mond River	28° 11' N 51° 17' E
Rud-e Zohreh (Persian)	Rudkhaneh-ye Zohreh (Persian), Zohreh River	30° 04' N 49° 34' E
Seyhan Nehri (Turkish)	Seyhan/Seihun/Seihan/Sihun/Seichun River	36° 43' N 34° 53' E
Tigris River (Conventional)	Nahr Dijlah (Arabic), Dicle Nehri (Turkish)	31° 00' N 47° 25' E
Van Gölü (Turkish)	Lake Van	38° 33' N 42° 46' E

Table A2. Total length measurements of the *Capoeta damascina* species complex in % of standard length (SD = standard deviation).

	SL (mm)		**TL in % SL**			
	Mean	Range	Mean	SD	Range	n
C. buhsei	**101.85**	**61.16-132.99**	**124.07**	**1.94**	**122.09-127.22**	**10**
C. damascina from Damascus basin	126.92	41.02-308.28	124.48	2.64	116.46-129.41	47
N. Quwayq	177.68	108.65-263.05	123.94	2.30	120.70-127.95	19
Orontes R. drainage	117.44	34.43-370.47	125.08	2.57	117.40-130.18	83
Litani R. drainage	102.21	34.65-128.91	127.59	2.37	122.44-131.02	30
Jordan R. drainage basin	94.87	26.71-292.92	126.81	2.23	122.15-134.38	99
Rivers in the Dead Sea Valley	87.52	37.07-200.57	126.42	2.92	119.30-133.78	88
Seyhan N. drainage	115.67	74.52-167.22	125.81	1.43	122.60-128.95	24
Ceyhan N. drainage	120.60	38.49-154.99	126.39	2.32	122.86-129.59	10
Arsuz N.	114.51	97.42-158.64	127.16	1.66	124.45-130.42	15
N. al-Kabir (N) drainage	114.47	40.41-181.41	126.80	1.69	122.76-131.39	55
N. Sanawbar	107.13	66.06-177.90	124.82	1.28	121.68-126.98	18
N. Marqiyah	125.40	30.29-199.73	125.26	2.60	120.08-128.83	21
N. Abu Ali	144.48	112.69-160.28	124.90	1.60	122.37-127.76	8
N. Ibrahim	98.78	78.90-115.39	127.04	1.41	124.92-129.70	9
N. al-Kalb	176.96	120.73-228.34	124.95	1.42	122.40-127.00	7
N. Antelias	141.70	23.53-211.05	125.98	2.24	120.70-133.36	29
N. Beirut	121.36	89.04-172.75	125.38	1.86	123.61-129.10	13
N. ad-Damur	119.36	94.32-148.92	126.06	1.56	123.64-129.77	12
Tigris-Euphrates river system	123.31	69.69-215.18	125.65	1.18	124.36-128.96	19
***C. damascina* (compiled)**	**113.12**	**23.53-370.47**	**125.97**	**2.44**	**116.46-134.38**	**606**
C. saadii from R. Helleh drainage	114.36	78.45-149.12	125.54	2.89	119.73-128.73	12
R. Mand drainage	93.79	71.37-145.37	125.95	1.49	122.97-128.85	15
R. Kol drainage	76.51	70.51-82.49	125.38	1.09	123.88-127.13	11
R. Kor basin	130.76	65.93-215.22	124.50	2.51	119.94-130.80	23
***C. saadii* (compiled)**	**108.66**	**65.93-215.22**	**125.22**	**2.22**	**119.73-130.80**	**61**
***Capoeta* sp.1**	**116.17**	**35.22-166.87**	**126.14**	**2.61**	**122.15-132.57**	**20**
C. umbla	**178.90**	**123.26-228.75**	**125.26**	**1.56**	**121.81-127.60**	**17**

Table A3. Predorsal length measurements of the *Capoeta damascina* species complex in % of standard length (SD = standard deviation).

	SL (mm)		**SD in % SL**			
	Mean	Range	Mean	SD	Range	n
C. buhsei	**101.85**	**61.16-132.99**	**52.30**	**1.57**	**50.34-55.43**	**10**
C. damascina from Damascus basin	131.53	41.02-308.28	50.35	1.98	45.80-54.63	61
N. Quwayq	174.04	108.65-263.05	47.39	1.44	45.20-51.39	19
Orontes R. drainage	121.97	39.27-370.47	49.54	1.73	45.08-54.27	82
Litani R. drainage	110.25	82.10-128.91	51.46	1.32	48.89-53.67	25
Jordan R. drainage basin	104.88	40.68-292.92	48.42	1.43	43.83-51.23	98
Rivers in the Dead Sea Valley	88.71	37.07-200.57	49.11	1.32	45.95-52.93	87
Seyhan N. drainage	115.67	74.52-167.22	50.08	1.52	47.44-52.64	24
Ceyhan N. drainage	120.60	38.49-154.99	49.13	1.63	47.27-52.48	10
Arsuz N.	113.82	97.42-158.64	49.93	1.68	46.56-52.16	17
N. al-Kabir (N) drainage	119.86	78.34-181.41	51.08	1.18	48.58-54.17	51
N. Sanawbar	117.32	74.47-249.40	51.47	1.37	49.25-53.38	18
N. Marqiyah	126.42	43.40-199.73	49.63	1.12	47.44-51.81	21
N. Abu Ali	144.48	112.69-160.28	47.70	1.44	45.91-50.15	8
N. Ibrahim	98.78	78.90-115.39	51.54	1.05	50.38-53.54	9
N. al-Kalb	176.96	120.73-228.34	49.27	1.09	47.91-51.05	7
N. Antelias	143.51	93.20-207.64	49.04	1.11	47.05-51.45	27
N. Beirut	121.61	89.04-172.75	50.49	1.22	46.92-52.03	14
N. ad-Damur	119.36	94.32-148.92	50.75	1.36	49.28-53.98	12
Tigris-Euphrates river system	123.76	67.29-270.56	49.70	1.86	45.94-52.88	23
***C. damascina* (compiled)**	**117.20**	**37.07-370.47**	**49.64**	**1.80**	**43.83-54.63**	**613**
C. saadii from R. Helleh drainage	113.09	78.45-149.12	50.73	1.22	48.10-52.56	13
R. Mand drainage	93.79	71.37-145.37	51.95	1.22	50.62-55.65	15
R. Kol drainage	76.51	70.51-82.49	51.81	0.92	50.44-53.77	11
R. Kor basin	165.71	78.62-272.72	50.74	1.37	48.21-53.22	28
***C. saadii* (compiled)**	**124.75**	**70.51-272.72**	**51.18**	**1.34**	**48.10-55.65**	**67**
***Capoeta* sp.1**	**123.04**	**42.10-166.87**	**52.02**	**5.66**	**48.63-74.02**	**19**
C. umbla	**180.43**	**123.26-228.75**	**49.37**	**1.88**	**46.35-53.28**	**21**

Table A4. Prepelvic length measurements of the *Capoeta damascina* species complex in % of standard length (SD = standard deviation).

	SL (mm)		**SP in % SL**			
	Mean	Range	Mean	SD	Range	n
C. buhsei	**101.85**	**61.16-132.99**	**54.37**	**1.52**	**52.66-57.41**	**10**
C. damascina from Damascus basin	128.63	41.02-308.28	56.48	1.96	51.94-60.47	58
N. Quwayq	177.33	108.65-263.05	54.04	1.73	48.43-56.66	19
Orontes R. drainage	118.90	39.27-326.60	54.90	1.98	50.17-59.74	80
Litani R. drainage	110.25	82.10-128.91	56.90	1.26	53.87-58.72	25
Jordan R. drainage basin	100.65	40.68-292.92	54.84	1.65	50.71-58.83	94
Rivers in the Dead Sea Valley	88.71	37.07-200.57	55.79	1.67	52.71-59.97	87
Seyhan N. drainage	115.67	74.52-167.22	55.77	1.39	53.36-58.90	24
Ceyhan N. drainage	120.60	38.49-154.99	55.11	1.25	53.14-57.31	10
Arsuz N.	114.73	97.42-158.64	55.68	1.07	53.59-57.29	16
N. al-Kabir (N) drainage	119.86	78.34-181.41	55.96	1.39	52.94-58.79	51
N. Sanawbar	117.32	74.47-249.40	56.36	1.61	54.03-58.80	18
N. Marqiyah	126.42	43.40-199.73	54.91	1.53	53.04-58.62	21
N. Abu Ali	144.48	112.69-160.28	52.60	1.36	50.99-54.73	8
N. Ibrahim	98.78	78.90-115.39	56.63	1.15	54.93-58.68	9
N. al-Kalb	186.14	131.15-228.34	54.17	1.71	52.39-56.85	5
N. Antelias	143.51	93.20-207.64	54.03	1.46	51.58-57.68	27
N. Beirut	140.39	124.89-172.75	52.69	1.02	50.99-54.35	8
N. ad-Damur	119.36	94.32-148.92	55.47	1.16	53.96-57.65	12
Tigris-Euphrates river system	129.75	67.29-282.32	54.73	1.82	50.50-58.27	23
***C. damascina* (compiled)**	**116.58**	**37.07-326.26**	**55.35**	**1.85**	**48.43-60.47**	**595**
C. saadii from R. Helleh drainage	113.09	78.45-149.12	54.55	1.26	51.31-56.04	13
R. Mand drainage	93.79	71.37-145.37	55.64	1.14	54.11-58.32	15
R. Kol drainage	76.51	70.51-82.49	55.22	0.86	53.92-56.74	11
R. Kor basin	169.76	78.62-272.72	55.43	1.23	52.09-57.41	26
***C. saadii* (compiled)**	**125.11**	**70.51-272.72**	**55.27**	**1.20**	**51.31-58.32**	**65**
***Capoeta* sp.1**	**123.04**	**42.10-166.87**	**54.88**	**2.04**	**49.18-58.76**	**19**
C. umbla	**182.51**	**123.26-228.75**	**55.38**	**1.57**	**52.71-58.16**	**18**

Table A5. Preanal length measurements of the *Capoeta damascina* species complex in % of standard length (SD = standard deviation).

	SL (mm)		SA in % SL			
	Mean	Range	Mean	SD	Range	n
C. buhsei	**101.85**	**61.16-132.99**	**76.39**	**1.11**	**74.72-78.42**	**10**
C. damascina from Damascus basin	131.38	41.02-308.28	77.86	1.41	74.44-80.36	61
N. Quwayq	177.28	108.65-263.05	76.61	1.11	75.18-78.91	20
Orontes R. drainage	122.19	39.27-370.47	76.97	1.42	74.34-80.22	84
Litani R. drainage	110.25	82.10-128.91	77.86	0.83	75.97-79.68	25
Jordan R. drainage basin	104.88	40.68-292.92	76.17	1.30	72.58-80.11	98
Rivers in the Dead Sea Valley	88.71	37.07-200.57	76.96	1.39	74.04-80.69	87
Seyhan N. drainage	115.67	74.52-167.22	76.83	1.15	74.88-79.39	24
Ceyhan N. drainage	120.60	38.49-154.99	76.97	1.32	74.82-79.55	10
Arsuz N.	113.82	97.42-158.64	77.23	0.95	75.69-79.10	17
N. al-Kabir (N) drainage	119.86	78.34-181.41	77.28	1.22	75.39-80.51	51
N. Sanawbar	117.32	74.47-249.40	77.27	0.82	75.97-78.78	18
N. Marqiyah	126.42	43.40-199.73	76.36	1.12	74.06-78.03	21
N. Abu Ali	144.48	112.69-160.28	74.83	1.37	72.91-77.32	8
N. Ibrahim	98.78	78.90-115.39	77.64	1.05	76.77-79.61	9
N. al-Kalb	176.96	120.73-228.34	77.16	0.80	76.13-78.21	7
N. Antelias	145.92	93.20-211.05	75.92	0.65	74.41-77.12	28
N. Beirut	121.61	89.04-172.75	76.67	1.44	74.68-79.78	14
N. ad-Damur	119.36	94.32-148.92	76.97	1.15	74.93-78.83	12
Tigris-Euphrates river system	130.36	67.29-282.32	77.06	1.71	73.75-82.02	24
***C. damascina* (compiled)**	**118.13**	**37.07-370.47**	**76.90**	**1.39**	**72.58-82.02**	**618**
C. saadii from R. Helleh drainage	113.09	78.45-149.12	76.73	1.32	74.15-78.39	13
R. Mand drainage	93.79	71.37-145.37	78.04	1.19	76.26-79.95	15
R. Kol drainage	76.51	70.51-82.49	77.17	0.89	76.05-78.97	11
R. Kor basin	165.71	78.62-272.72	77.24	1.22	74.85-79.30	28
***C. saadii* (compiled)**	**124.75**	**70.51-272.72**	**77.31**	**1.24**	**74.15-79.95**	**67**
***Capoeta* sp.1**	**123.04**	**42.10-166.87**	**76.74**	**1.29**	**74.45-79.26**	**19**
C. umbla	**182.85**	**123.26-228.75**	**77.35**	**1.34**	**75.31-80.64**	**21**

Table A6. Head length measurements of the *Capoeta damascina* species complex in % of standard length (SD = standard deviation).

	SL (mm)		**HL in % SL**			
	Mean	Range	Mean	SD	Range	n
C. buhsei	**101.85**	**61.16-132.99**	**23.68**	**1.01**	**22.29-25.43**	**10**
C. damascina from Damascus basin	131.53	41.02-308.28	23.73	2.12	18.68-27.76	63
N. Quwayq	177.28	108.65-263.05	20.89	0.96	19.18-22.54	20
Orontes R. drainage	121.97	39.27-370.47	23.15	1.53	19.54-28.27	82
Litani R. drainage	110.25	82.10-128.91	24.86	0.80	22.72-26.09	25
Jordan R. drainage basin	104.88	40.68-292.92	24.14	1.74	19.44-27.55	98
Rivers in the Dead Sea Valley	88.71	37.07-200.57	25.00	1.83	21.30-28.45	87
Seyhan N. drainage	115.67	74.52-167.22	24.39	1.05	22.37-26.32	24
Ceyhan N. drainage	120.60	38.49-154.99	24.23	1.02	23.43-26.92	10
Arsuz N.	113.82	97.42-158.64	23.59	1.13	21.56-25.79	17
N. al-Kabir (N) drainage	119.86	78.34-181.41	24.69	1.19	21.31-27.32	51
N. Sanawbar	117.32	74.47-249.40	24.94	1.42	22.22-27.21	18
N. Marqiyah	126.42	43.40-199.73	23.28	1.65	21.12-26.65	21
N. Abu Ali	144.48	112.69-160.28	22.46	0.86	21.31-24.18	8
N. Ibrahim	98.78	78.90-115.39	24.94	0.98	23.45-26.82	9
N. al-Kalb	176.96	120.73-228.34	22.72	0.96	20.85-23.60	7
N. Antelias	143.51	93.20-207.64	23.26	1.49	20.32-26.72	27
N. Beirut	121.61	89.04-172.75	23.99	0.83	21.71-25.44	14
N. ad-Damur	119.36	94.32-148.92	23.73	0.91	22.34-25.3	12
Tigris-Euphrates river system	130.36	67.29-282.32	23.50	1.41	20.97-25.88	24
C. damascina **(compiled)**	**118.00**	**37.07-370.47**	**23.95**	**1.76**	**18.68-28.45**	**617**
C. saadii from R. Helleh drainage	113.09	78.45-149.12	24.22	1.25	22.72-27.18	13
R. Mand drainage	93.79	71.37-145.37	24.01	1.20	21.89-26.72	15
R. Kol drainage	76.51	70.51-82.49	24.82	0.68	23.55-25.93	11
R. Kor basin	165.71	78.62-272.72	24.10	1.71	20.63-26.82	28
C. saadii **(compiled)**	**124.75**	**70.51-272.72**	**24.22**	**1.39**	**20.63-27.18**	**67**
Capoeta **sp.1**	**123.04**	**42.10-166.87**	**24.47**	**1.60**	**22.34-28.86**	**19**
C. umbla	**182.41**	**123.26-228.75**	**22.18**	**1.26**	**20.02-24.35**	**22**

Table A7. Caudal peduncle length measurements of the *Capoeta damascina* species complex in % of standard length (SD = standard deviation).

	SL (mm)		**CL in % SL**			
	Mean	Range	Mean	SD	Range	n
C. buhsei	**101.85**	**61.16-132.99**	**17.25**	**0.97**	**16.09-18.63**	**10**
C. damascina from Damascus basin	131.53	41.02-308.28	16.69	1.03	14.06-20.80	63
N. Quwayq	177.28	108.65-263.05	17.39	1.07	15.68-19.20	20
Orontes R. drainage	122.19	39.27-370.47	17.92	1.10	15.16-20.08	84
Litani R. drainage	110.25	82.10-128.91	17.28	0.94	15.69-19.35	25
Jordan R. drainage basin	104.88	40.68-292.92	17.53	1.22	14.69-20.71	98
Rivers in the Dead Sea Valley	89.20	37.07-200.57	16.89	1.24	13.61-19.76	86
Seyhan N. drainage	115.67	74.52-167.22	17.82	0.71	16.33-19.32	24
Ceyhan N. drainage	120.60	38.49-154.99	18.24	0.99	16.73-20.00	10
Arsuz N.	113.82	97.42-158.64	17.25	1.27	14.60-19.60	17
N. al-Kabir (N) drainage	119.86	78.34-181.41	17.84	1.03	13.72-20.22	51
N. Sanawbar	117.32	74.47-249.40	17.56	0.79	15.39-18.79	18
N. Marqiyah	126.42	43.40-199.73	17.55	1.22	14.88-19.79	21
N. Abu Ali	144.48	112.69-160.28	18.58	0.68	17.69-19.58	8
N. Ibrahim	98.78	78.90-115.39	17.57	0.41	17.09-18.35	9
N. al-Kalb	176.96	120.73-228.34	17.34	1.26	15.48-18.73	7
N. Antelias	145.92	93.20-211.05	18.03	0.81	16.26-20.20	28
N. Beirut	121.61	89.04-172.75	17.73	1.14	15.37-19.53	14
N. ad-Damur	119.36	94.32-148.92	18.17	0.80	16.89-18.90	12
Tigris-Euphrates river system	130.36	67.29-282.32	17.77	1.23	15.23-19.54	24
***C. damascina* (compiled)**	**118.31**	**37.07-370.47**	**17.50**	**1.17**	**13.61-20.80**	**619**
C. saadii from R. Helleh drainage	113.09	78.45-149.12	18.83	0.97	17.27-20.62	13
R. Mand drainage	93.79	71.37-145.37	17.99	1.13	16.28-20.70	15
R. Kol drainage	76.51	70.51-82.49	17.87	0.41	17.18-18.41	11
R. Kor basin	165.71	78.62-272.72	16.67	1.07	13.32-19.04	28
***C. saadii* (compiled)**	**124.75**	**70.51-272.72**	**17.58**	**1.28**	**13.32-20.70**	**67**
***Capoeta* sp.1**	**123.04**	**42.10-166.87**	**18.11**	**0.87**	**16.33-19.42**	**19**
C. umbla	**182.41**	**123.26-228.75**	**16.65**	**1.28**	**14.34-19.74**	**22**

Table A8. Body depth measurements of the *Capoeta damascina* species complex in % of standard length (SD = standard deviation).

	SL (mm)		**BD in % SL**			
	Mean	Range	Mean	SD	Range	n
C. buhsei	**101.85**	**61.16-132.99**	**25.19**	**2.58**	**21.50-27.99**	**10**
C. damascina from Damascus basin	98.44	41.02-216.82	27.05	1.95	22.64-30.35	33
N. Quwayq	182.90	136.18-238.87	26.86	1.43	24.83-29.57	8
Orontes R. drainage	114.54	39.27-200.78	25.66	1.63	21.90-29.69	57
Litani R. drainage	110.25	82.10-128.91	25.88	1.28	22.80-28.06	25
Jordan R. drainage basin	88.29	40.68-214.65	28.06	2.41	22.61-33.12	83
Rivers in the Dead Sea Valley	87.17	37.07-200.57	26.28	1.56	20.17-30.29	80
Seyhan N. drainage	112.93	74.52-167.22	25.72	0.85	24.06-27.60	20
Ceyhan N. drainage	129.72	93.86-154.99	24.18	1.11	22.76-26.65	9
Arsuz N.	113.83	97.42-136.27	24.40	1.18	21.96-26.22	11
N. al-Kabir (N) drainage	119.86	78.34-181.41	27.21	1.35	23.50-29.82	51
N. Sanawbar	117.32	74.47-249.40	27.17	1.17	24.56-29.71	18
N. Marqiyah	126.42	43.40-199.73	24.76	1.20	23.38-27.35	21
N. Abu Ali	144.48	112.69-160.28	23.35	1.13	21.92-25.28	8
N. Ibrahim	98.78	78.90-115.39	25.37	0.60	24.76-26.37	9
N. al-Kalb	175.60	131.15-216.74	25.35	2.15	22.99-27.19	4
N. Antelias	145.92	93.20-211.05	25.83	1.45	23.23-28.83	28
N. Beirut	140.39	124.89-172.75	27.12	0.85	25.96-28.13	8
N. ad-Damur	119.36	94.32-148.92	24.92	1.58	22.82-28.28	12
Tigris-Euphrates river system	130.47	69.69-282.32	25.05	2.20	21.61-28.75	19
***C. damascina* (compiled)**	**110.56**	**37.07-282.32**	**26.34**	**2.00**	**20.17-33.12**	**504**
C. saadii from R. Helleh drainage	113.09	78.45-149.12	25.01	1.46	22.61-27.39	13
R. Mand drainage	93.79	71.37-145.37	25.07	1.54	22.57-28.31	15
R. Kol drainage	77.07	70.51-82.49	25.96	1.04	23.85-27.35	10
R. Kor basin	164.08	78.62-272.72	24.31	1.92	20.92-27.29	16
***C. saadii* (compiled)**	**116.16**	**70.51-272.72**	**24.99**	**1.63**	**20.92-28.31**	**54**
***Capoeta* sp.1**	**127.16**	**42.10-166.87**	**25.13**	**1.28**	**22.92-27.82**	**18**
C. umbla	**192.17**	**132.67-228.75**	**21.94**	**3.02**	**18.68-27.12**	**9**

Table A9. Caudal peduncle depth measurements of the *Capoeta damascina* species complex in % of standard length (SD = standard deviation).

	SL (mm)		**CD in % SL**			
	Mean	Range	Mean	SD	Range	n
C. buhsei	**101.85**	**61.16-132.99**	**11.52**	**0.34**	**10.86-11.85**	**10**
C. damascina from Damascus basin	131.53	41.02-308.28	11.48	0.68	10.07-12.89	63
N. Quwayq	177.28	108.65-263.05	11.54	0.47	10.68-12.56	20
Orontes R. drainage	120.93	39.27-370.47	11.14	0.69	9.66-13.86	79
Litani R. drainage	110.25	82.10-128.91	11.15	0.64	10.03-12.19	25
Jordan R. drainage basin	104.88	40.68-292.92	11.48	0.59	9.79-13.04	98
Rivers in the Dead Sea Valley	88.71	37.07-200.57	11.03	0.74	8.53-12.45	87
Seyhan N. drainage	115.67	74.52-167.22	11.44	0.70	9.49-12.44	24
Ceyhan N. drainage	120.60	38.49-154.99	11.03	0.83	9.33-12.40	10
Arsuz N.	113.82	97.42-158.64	11.29	0.54	10.55-12.23	17
N. al-Kabir (N) drainage	119.86	78.34-181.41	11.23	0.50	10.06-12.39	51
N. Sanawbar	117.32	74.47-249.40	12.06	0.42	11.14-12.64	18
N. Marqiyah	126.42	43.40-199.73	11.84	0.46	10.83-12.70	21
N. Abu Ali	144.48	112.69-160.28	11.74	0.46	11.25-12.59	8
N. Ibrahim	98.78	78.90-115.39	11.02	0.26	10.77-11.57	9
N. al-Kalb	176.96	120.73-228.34	11.69	0.81	9.97-12.33	7
N. Antelias	145.92	93.20-211.05	12.22	0.46	11.24-12.99	28
N. Beirut	121.61	89.04-172.75	11.71	0.64	10.80-12.99	14
N. ad-Damur	119.36	94.32-148.92	11.50	0.49	11.00-12.74	12
Tigris-Euphrates river system	124.27	67.29-282.32	11.08	1.01	8.95-12.80	23
***C. damascina* (compiled)**	**117.75**	**37.07-370.47**	**11.38**	**0.71**	**8.53-13.86**	**614**
C. saadii from R. Helleh drainage	113.09	78.45-149.12	10.90	0.67	9.18-11.53	13
R. Mand drainage	93.79	71.37-145.37	11.21	0.49	10.50-12.18	15
R. Kol drainage	76.51	70.51-82.49	11.38	0.43	10.87-12.19	11
R. Kor basin	165.71	78.62-272.72	10.27	0.76	8.82-11.47	28
***C. saadii* (compiled)**	**124.75**	**70.51-272.72**	**10.78**	**0.78**	**8.82-12.19**	**67**
***Capoeta* sp.1**	**123.04**	**42.10-166.87**	**11.65**	**0.67**	**10.59-13.13**	**19**
C. umbla	**182.41**	**123.26-228.75**	**9.38**	**1.03**	**7.93-11.74**	**22**

Table A10. Measurements of the dorsal-fin base length of the *Capoeta damascina* species complex in % of standard length (SD = standard deviation).

	SL (mm)		**LDB in % SL**			
	Mean	Range	Mean	SD	Range	n
C. buhsei	**101.85**	**61.16-132.99**	**13.68**	**0.74**	**12.49-15.08**	**10**
C. damascina from Damascus basin	129.45	41.02-308.28	14.13	1.08	11.15-16.58	62
N. Quwayq	177.28	108.65-263.05	14.39	0.83	12.92-15.95	20
Orontes R. drainage	122.11	39.27-370.47	14.77	0.92	12.41-17.66	83
Litani R. drainage	110.25	82.10-128.91	14.40	1.08	12.79-16.76	25
Jordan R. drainage basin	104.88	40.68-292.92	16.25	1.40	13.43-20.24	98
Rivers in the Dead Sea Valley	88.71	37.07-200.57	15.96	1.07	13.24-18.39	87
Seyhan N. drainage	115.67	74.52-167.22	14.27	0.69	13.06-15.55	24
Ceyhan N. drainage	120.60	38.49-154.99	14.61	0.77	13.51-15.74	10
Arsuz N.	113.82	97.42-158.64	14.73	0.80	13.29-16.18	17
N. al-Kabir (N) drainage	119.86	78.34-181.41	15.52	0.82	12.98-17.06	51
N. Sanawbar	114.80	74.47-249.40	15.07	0.62	14.19-16.64	17
N. Marqiyah	124.62	43.40-199.73	15.55	0.56	14.00-16.70	20
N. Abu Ali	144.48	112.69-160.28	15.05	0.56	14.34-15.95	8
N. Ibrahim	98.78	78.90-115.39	15.08	0.24	14.75-15.42	9
N. al-Kalb	176.96	120.73-228.34	14.31	0.79	12.98-15.66	7
N. Antelias	145.92	93.20-211.05	14.44	0.46	13.34-15.52	28
N. Beirut	121.61	89.04-172.75	14.49	0.82	13.19-15.59	14
N. ad-Damur	119.36	94.32-148.92	14.60	0.77	13.40-15.90	12
Tigris-Euphrates river system	130.36	67.29-282.32	14.50	0.82	12.72-15.86	24
***C. damascina* (compiled)**	**117.80**	**37.07-370.47**	**15.12**	**1.23**	**11.15-20.24**	**616**
C. saadii from R. Helleh drainage	113.09	78.45-149.12	14.64	0.89	13.41-16.66	13
R. Mand drainage	93.79	71.37-145.37	14.50	0.70	12.98-15.93	15
R. Kol drainage	76.51	70.51-82.49	15.01	0.96	13.67-16.10	11
R. Kor basin	165.71	78.62-272.72	14.06	1.14	11.88-16.18	28
***C. saadii* (compiled)**	**124.75**	**70.51-272.72**	**14.43**	**1.02**	**11.88-16.66**	**67**
***Capoeta* sp.1**	**123.04**	**42.10-166.87**	**14.91**	**1.12**	**12.92-16.78**	**19**
C. umbla	**182.41**	**123.26-228.75**	**14.22**	**0.89**	**12.91-16.36**	**22**

Table A11. Measurements of the anal-fin base length of the *Capoeta damascina* species complex in % of standard length (SD = standard deviation).

	SL (mm)		**LAB in % SL**			
	Mean	Range	Mean	SD	Range	n
C. buhsei	**101.85**	**61.16-132.99**	**7.57**	**0.88**	**5.59-8.64**	**10**
C. damascina from Damascus basin	131.53	41.02-308.28	7.52	0.83	5.39-9.83	63
N. Quwayq	177.28	108.65-263.05	7.95	0.64	6.72-9.02	20
Orontes R. drainage	122.57	39.27-370.47	7.48	0.61	6.00-9.14	82
Litani R. drainage	110.25	82.10-128.91	7.64	0.63	6.76-9.54	25
Jordan R. drainage basin	105.54	42.33-292.92	8.25	0.67	6.74-9.73	97
Rivers in the Dead Sea Valley	88.71	37.07-200.57	8.33	0.71	6.24-10.57	87
Seyhan N. drainage	115.67	74.52-167.22	7.75	0.50	6.96-8.82	24
Ceyhan N. drainage	120.60	38.49-154.99	7.21	0.71	6.03-8.12	10
Arsuz N.	113.82	97.42-158.64	7.84	0.67	6.86-9.06	17
N. al-Kabir (N) drainage	119.86	78.34-181.41	7.54	0.48	6.62-8.52	51
N. Sanawbar	117.32	74.47-249.40	7.36	0.41	6.61-8.17	18
N. Marqiyah	124.62	43.40-199.73	8.21	0.38	7.53-8.84	20
N. Abu Ali	144.48	112.69-160.28	7.74	0.20	7.50-8.01	8
N. Ibrahim	98.78	78.90-115.39	7.12	0.25	6.76-7.56	9
N. al-Kalb	176.96	120.73-228.34	7.86	0.41	7.47-8.68	7
N. Antelias	145.92	93.20-211.05	8.11	0.57	7.12-9.28	28
N. Beirut	121.61	89.04-172.75	7.96	0.48	7.08-8.72	14
N. ad-Damur	119.36	94.32-148.92	7.68	0.27	7.08-8.06	12
Tigris-Euphrates river system	132.62	67.29-282.32	7.43	0.63	6.52-9.18	23
C. damascina **(compiled)**	**118.35**	**37.07-370.47**	**7.83**	**0.72**	**5.39-10.57**	**615**
C. saadii from R. Helleh drainage	113.09	78.45-149.12	7.74	0.53	6.73-8.52	13
R. Mand drainage	93.79	71.37-145.37	7.43	0.74	5.22-8.32	15
R. Kol drainage	76.51	70.51-82.49	7.64	0.61	6.65-8.47	11
R. Kor basin	165.71	78.62-272.72	7.93	0.64	6.71-8.97	28
C. saadii **(compiled)**	**124.75**	**70.51-272.72**	**7.73**	**0.66**	**5.22-8.97**	**67**
Capoeta **sp.1**	**123.04**	**42.10-166.87**	**7.83**	**0.62**	**6.77-8.92**	**19**
C. umbla	**182.41**	**123.26-228.75**	**7.70**	**0.57**	**6.71-8.67**	**22**

Table A12. Measurements of the length of the longest dorsal-fin ray of the *Capoeta damascina* species complex in % of standard length (SD = standard deviation).

	SL (mm)		**LD in % SL**			
	Mean	Range	Mean	SD	Range	n
C. buhsei	**101.85**	**61.16-132.99**	**17.40**	**1.13**	**15.59-19.54**	**10**
C. damascina from Damascus basin	133.64	41.02-308.28	17.33	1.73	15.00-21.36	56
N. Quwayq	172.93	108.65-238.87	16.61	1.46	14.93-20.11	18
Orontes R. drainage	123.61	49.81-370.47	19.04	1.56	14.93-22.25	73
Litani R. drainage	110.25	82.10-128.91	19.73	1.31	17.87-23.33	25
Jordan R. drainage basin	109.43	40.68-292.92	20.03	1.75	17.09-25.17	81
Rivers in the Dead Sea Valley	90.06	37.07-200.57	18.48	1.65	15.07-22.26	78
Seyhan N. drainage	115.67	74.52-167.22	18.48	2.12	16.44-27.51	24
Ceyhan N. drainage	134.20	114.96-154.99	19.00	0.71	18.49-20.37	8
Arsuz N.	111.39	97.42-136.27	20.32	0.88	19.22-22.28	15
N. al-Kabir (N) drainage	120.68	78.34-181.41	19.21	1.23	16.34-21.85	49
N. Sanawbar	117.32	74.47-249.40	17.90	1.46	14.19-19.77	18
N. Marqiyah	139.18	43.40-199.73	17.97	1.39	15.92-22.44	18
N. Abu Ali	144.48	112.69-160.28	18.82	1.27	17.21-20.88	8
N. Ibrahim	98.78	78.90-115.39	19.73	1.07	18.38-21.70	9
N. al-Kalb	168.40	120.73-216.74	18.55	0.94	17.35-19.80	6
N. Antelias	145.92	93.20-211.05	19.47	1.15	17.71-21.92	28
N. Beirut	121.61	89.04-172.75	19.72	0.72	18.32-20.69	14
N. ad-Damur	119.36	94.32-148.92	19.47	0.71	18.29-20.88	12
Tigris-Euphrates river system	132.11	67.29-282.32	18.44	0.85	16.95-20.26	23
***C. damascina* (compiled)**	**120.12**	**37.07-370.47**	**18.87**	**1.74**	**14.19-27.51**	**563**
C. saadii from R. Helleh drainage	113.09	78.45-149.12	18.45	1.09	16.47-20.28	13
R. Mand drainage	93.79	71.37-145.37	18.57	0.85	16.78-20.21	15
R. Kol drainage	77.13	70.51-82.49	18.65	1.50	16.42-20.89	9
R. Kor basin	169.38	78.62-272.72	17.06	0.99	15.50-19.95	24
***C. saadii* (compiled)**	**125.18**	**70.51-272.72**	**17.96**	**1.27**	**15.50-20.89**	**61**
***Capoeta* sp.1**	**123.04**	**42.10-166.87**	**19.06**	**1.49**	**14.68-21.74**	**19**
C. umbla	**184.90**	**123.26-228.75**	**17.07**	**1.58**	**14.37-19.57**	**20**

Table A13. Pectoral-fin length measurements of the *Capoeta damascina* species complex in % of standard length (SD = standard deviation).

	SL (mm)		**LPC in % SL**			
	Mean	Range	Mean	SD	Range	n
C. buhsei	**101.85**	**61.16-132.99**	**18.17**	**0.80**	**17.08-19.17**	**10**
C. damascina from Damascus basin	137.13	41.02-308.28	18.30	1.16	15.50-20.68	60
N. Quwayq	177.28	108.65-263.05	17.47	1.04	16.22-20.38	20
Orontes R. drainage	122.19	39.27-370.47	18.69	1.30	15.41-22.08	84
Litani R. drainage	110.25	82.10-128.91	20.90	1.11	18.97-23.58	25
Jordan R. drainage basin	104.08	40.68-292.92	19.79	1.31	16.96-24.05	97
Rivers in the Dead Sea Valley	88.71	37.07-200.57	19.68	1.45	16.85-22.82	87
Seyhan N. drainage	115.67	74.52-167.22	19.71	0.78	18.03-20.93	24
Ceyhan N. drainage	120.60	38.49-154.99	19.56	1.45	16.18-21.83	10
Arsuz N.	113.82	97.42-158.64	20.70	0.68	19.83-22.51	17
N. al-Kabir (N) drainage	119.86	78.34-181.41	19.79	1.05	16.83-21.89	51
N. Sanawbar	117.32	74.47-249.40	19.04	1.01	16.71-21.54	18
N. Marqiyah	126.42	43.40-199.73	18.81	0.80	17.30-20.67	21
N. Abu Ali	144.48	112.69-160.28	19.47	0.73	18.21-20.60	8
N. Ibrahim	98.78	78.90-115.39	19.86	0.60	18.92-20.58	9
N. al-Kalb	176.96	120.73-228.34	19.43	0.76	18.56-20.57	7
N. Antelias	145.92	93.20-211.05	20.69	0.95	17.84-22.02	28
N. Beirut	121.61	89.04-172.75	20.06	1.01	17.64-21.55	14
N. ad-Damur	119.36	94.32-148.92	20.50	0.67	18.91-21.18	12
Tigris-Euphrates river system	130.36	67.29-282.32	18.81	0.80	17.15-21.23	24
***C. damascina* (compiled)**	**117.89**	**37.07-370.47**	**19.43**	**1.40**	**15.41-24.05**	**616**
C. saadii from R. Helleh drainage	113.09	78.45-149.12	19.37	1.02	17.32-20.93	13
R. Mand drainage	93.79	71.37-145.37	19.54	0.75	18.21-20.54	15
R. Kol drainage	76.51	70.51-82.49	19.70	0.71	18.39-20.85	11
R. Kor basin	165.12	78.62-272.72	17.93	1.26	15.13-20.08	27
***C. saadii* (compiled)**	**123.89**	**70.51-272.72**	**18.87**	**1.29**	**15.13-20.93**	**66**
***Capoeta* sp.1**	**123.04**	**42.10-166.87**	**19.74**	**1.30**	**16.19-22.16**	**19**
C. umbla	**181.06**	**123.26-228.75**	**18.53**	**0.87**	**17.06-20.31**	**21**

Table A14. Pelvic-fin length measurements of the *Capoeta damascina* species complex in % of standard length (SD = standard deviation).

	SL (mm)		**LP in % SL**			
	Mean	Range	Mean	SD	Range	n
C. buhsei	**101.85**	**61.16-132.99**	**15.87**	**0.53**	**14.94-16.66**	**10**
C. damascina from Damascus basin	129.45	41.02-308.28	15.91	0.95	14.40-18.22	62
N. Quwayq	177.28	108.65-263.05	15.78	0.90	14.67-18.30	20
Orontes R. drainage	119.20	39.27-326.26	16.60	1.33	13.67-19.38	83
Litani R. drainage	110.25	82.10-128.91	17.49	0.72	15.83-19.30	25
Jordan R. drainage basin	104.08	40.68-292.92	16.86	1.20	14.76-21.04	97
Rivers in the Dead Sea Valley	88.71	37.07-200.57	16.64	1.12	14.77-20.25	87
Seyhan N. drainage	115.67	74.52-167.22	16.74	0.77	15.56-18.51	24
Ceyhan N. drainage	120.60	38.49-154.99	16.68	1.38	13.87-19.37	10
Arsuz N.	113.82	97.42-158.64	17.81	0.66	16.64-18.84	17
N. al-Kabir (N) drainage	119.86	78.34-181.41	17.11	0.95	14.62-19.05	51
N. Sanawbar	117.32	74.47-249.40	16.26	0.78	14.21-17.49	18
N. Marqiyah	126.42	43.40-199.73	16.83	0.71	15.26-17.98	21
N. Abu Ali	144.48	112.69-160.28	16.62	0.65	15.85-17.71	8
N. Ibrahim	98.78	78.90-115.39	16.87	0.60	16.16-17.93	9
N. al-Kalb	186.34	131.15-228.34	16.84	0.69	15.86-17.65	6
N. Antelias	145.92	93.20-211.05	17.72	0.68	16.08-19.21	28
N. Beirut	121.20	89.04-172.75	17.94	1.00	16.13-19.97	13
N. ad-Damur	119.36	94.32-148.92	17.44	0.50	16.71-18.37	12
Tigris-Euphrates river system	130.36	67.29-282.32	16.17	0.63	14.96-17.35	24
***C. damascina* (compiled)**	**117.43**	**37.07-326.26**	**16.75**	**1.13**	**13.67-21.04**	**615**
C. saadii from R. Helleh drainage	113.09	78.45-149.12	16.60	1.03	14.89-18.04	13
R. Mand drainage	93.79	71.37-145.37	16.10	0.63	15.01-17.28	15
R. Kol drainage	76.51	70.51-82.49	16.77	0.78	15.49-17.91	11
R. Kor basin	166.66	78.62-272.72	15.41	0.89	13.48-17.23	27
***C. saadii* (compiled)**	**124.52**	**70.51-272.72**	**16.03**	**1.00**	**13.48-18.04**	**66**
***Capoeta* sp.1**	**123.04**	**42.10-166.87**	**16.98**	**1.19**	**14.26-19.87**	**19**
C. umbla	**182.35**	**123.26-228.75**	**15.49**	**1.32**	**12.97-18.01**	**20**

Table A15. Measurements of the length of the longest anal-fin ray of the *Capoeta damascina* species complex in % of standard length (SD = standard deviation).

	SL (mm)		**LA in % SL**			
	Mean	Range	Mean	SD	Range	n
C. buhsei	**101.85**	**61.16-132.99**	**15.74**	**0.69**	**14.78-16.75**	**10**
C. damascina from Damascus basin	130.51	41.02-308.28	16.84	1.18	14.20-20.60	60
N. Quwayq	177.28	108.65-263.05	15.29	1.05	14.00-17.69	20
Orontes R. drainage	123.34	39.27-370.47	17.05	1.59	13.83-20.71	82
Litani R. drainage	110.25	82.10-128.91	17.89	1.87	14.33-22.17	25
Jordan R. drainage basin	102.50	40.68-292.92	17.53	2.22	14.00-24.02	94
Rivers in the Dead Sea Valley	88.71	37.07-200.57	17.07	1.88	13.02-21.02	87
Seyhan N. drainage	115.67	74.52-167.22	17.39	1.20	15.50-20.17	24
Ceyhan N. drainage	120.60	38.49-154.99	17.50	1.30	14.91-19.41	10
Arsuz N.	111.02	97.42-136.27	18.19	1.92	16.26-23.01	16
N. al-Kabir (N) drainage	120.47	78.34-181.41	17.90	1.38	15.80-20.45	49
N. Sanawbar	117.32	74.47-249.40	16.57	0.74	15.16-18.04	18
N. Marqiyah	126.42	43.40-199.73	17.00	1.27	15.27-20.31	21
N. Abu Ali	144.48	112.69-160.28	18.47	1.09	16.77-20.29	8
N. Ibrahim	98.78	78.90-115.39	17.01	0.66	16.20-18.13	9
N. al-Kalb	176.96	120.73-228.34	18.39	1.60	17.12-20.80	7
N. Antelias	145.92	93.20-211.05	18.31	0.88	17.00-20.14	28
N. Beirut	121.20	89.04-172.75	17.58	0.91	16.10-19.20	13
N. ad-Damur	119.36	94.32-148.92	17.54	1.27	16.08-19.72	12
Tigris-Euphrates river system	130.36	67.29-282.32	17.41	1.39	14.46-20.22	24
***C. damascina* (compiled)**	**117.85**	**37.07-370.47**	**17.31**	**1.68**	**13.02-24.02**	**607**
C. saadii from R. Helleh drainage	113.09	78.45-149.12	17.98	1.37	15.48-19.62	13
R. Mand drainage	93.79	71.37-145.37	18.28	1.47	15.83-22.03	15
R. Kol drainage	76.51	70.51-82.49	17.64	1.56	15.60-19.87	11
R. Kor basin	166.66	78.62-272.72	16.79	1.37	14.57-20.47	27
***C. saadii* (compiled)**	**124.52**	**70.51-272.72**	**17.51**	**1.53**	**14.58-22.03**	**66**
***Capoeta* sp.1**	**123.04**	**42.10-166.87**	**17.51**	**1.05**	**16.23-19.67**	**19**
C. umbla	**180.43**	**123.26-228.75**	**17.24**	**1.77**	**13.68-19.92**	**21**

Table A16. Measurements of the length of the posterior barbel of the *Capoeta damascina* species complex in % of standard length (SD = standard deviation).

	SL (mm)		**LPB in % SL**			
	Mean	Range	Mean	SD	Range	n
C. buhsei	**101.85**	**61.16-132.99**	**4.21**	**0.36**	**3.59-4.68**	**10**
C. damascina from Damascus basin	122.12	41.02-283.44	3.56	0.64	2.21-4.54	49
N. Quwayq	163.06	108.65-234.83	3.22	0.51	2.60-3.95	11
Orontes R. drainage	116.90	39.27-370.47	3.56	0.57	2.53-4.96	65
Litani R. drainage	110.62	82.10-128.91	4.61	0.62	3.66-6.08	24
Jordan R. drainage basin	98.88	42.33-288.56	4.33	0.95	2.22-6.75	91
Rivers in the Dead Sea Valley	88.07	37.07-200.57	3.96	0.70	2.62-5.99	78
Seyhan N. drainage	115.67	74.52-167.22	4.49	0.57	3.51-5.49	24
Ceyhan N. drainage	120.60	38.49-154.99	4.33	0.39	3.58-5.11	10
Arsuz N.	113.82	97.42-158.64	4.44	0.55	3.52-5.70	17
N. al-Kabir (N) drainage	118.63	78.34-181.41	4.05	0.53	2.64-5.62	50
N. Sanawbar	117.32	74.47-249.40	4.46	0.77	2.79-5.49	18
N. Marqiyah	126.42	43.40-199.73	3.29	0.49	2.58-4.65	21
N. Abu Ali	143.39	112.69-160.28	3.48	0.32	3.06-4.01	7
N. Ibrahim	101.27	83.02-115.39	4.29	0.35	3.75-4.86	8
N. al-Kalb	164.62	120.73-216.74	3.71	0.26	3.32-4.03	5
N. Antelias	147.33	93.20-211.05	3.52	0.31	2.95-4.04	26
N. Beirut	126.03	89.04-172.75	3.64	0.46	2.99-4.41	12
N. ad-Damur	119.36	94.32-148.92	3.64	0.29	3.23-4.13	12
Tigris-Euphrates river system	133.10	69.69-282.32	3.85	0.72	1.88-5.29	23
***C. damascina* (compiled)**	**114.31**	**37.07-370.47**	**3.95**	**0.76**	**1.88-6.75**	**551**
C. saadii from R. Helleh drainage	113.09	78.45-149.12	4.35	0.54	3.45-5.25	13
R. Mand drainage	93.79	71.37-145.37	4.14	0.60	3.00-5.07	15
R. Kol drainage	76.81	70.51-82.49	4.61	0.63	3.71-5.46	10
R. Kor basin	152.13	78.62-271.83	3.97	0.72	2.84-5.21	20
***C. saadii* (compiled)**	**115.31**	**70.51-271.83**	**4.21**	**0.66**	**2.84-5.46**	**58**
***Capoeta* sp.1**	**123.04**	**42.10-166.87**	**4.20**	**0.79**	**2.73-5.96**	**19**
C. umbla	**181.08**	**123.26-220.93**	**3.52**	**0.66**	**2.12-4.46**	**16**

Table A17. Measurements of the horizontal eye diameter of the *Capoeta damascina* species complex in % of standard length (SD = standard deviation).

	SL (mm)		**ED in % SL**			
	Mean	Range	Mean	SD	Range	n
C. buhsei	**101.85**	**61.16-132.99**	**4.50**	**0.59**	**3.90-5.66**	**10**
C. damascina from Damascus basin	131.71	41.02-308.28	4.50	0.88	2.56-5.98	62
N. Quwayq	179.44	108.65-263.05	4.10	0.56	3.36-5.49	19
Orontes R. drainage	121.14	39.27-370.47	4.79	0.87	2.91-7.07	83
Litani R. drainage	110.25	82.10-128.91	5.12	0.49	4.21-6.10	25
Jordan R. drainage basin	103.79	40.68-292.92	5.12	1.05	3.04-7.46	96
Rivers in the Dead Sea Valley	87.87	37.07-200.57	5.26	1.05	2.80-7.12	86
Seyhan N. drainage	113.76	74.52-167.22	4.58	0.36	3.67-5.52	20
Ceyhan N. drainage	120.60	38.49-154.99	4.85	1.30	3.79-8.42	10
Arsuz N.	116.27	97.42-158.64	4.87	0.22	4.51-5.21	14
N. al-Kabir (N) drainage	119.86	78.34-181.41	4.42	0.56	3.39-6.38	51
N. Sanawbar	117.32	74.47-249.40	4.67	0.60	3.22-5.29	18
N. Marqiyah	126.42	43.40-199.73	4.51	1.18	3.23-7.07	21
N. Abu Ali	144.48	112.69-160.28	3.85	0.48	3.18-4.66	8
N. Ibrahim	98.78	78.90-115.39	5.27	0.51	4.62-6.11	9
N. al-Kalb	176.96	120.73-228.34	3.82	0.26	3.47-4.14	7
N. Antelias	145.92	93.20-211.05	4.24	0.44	3.52-5.36	28
N. Beirut	126.37	91.89-172.75	4.66	0.44	3.99-5.30	12
N. ad-Damur	119.36	94.32-148.92	4.36	0.42	3.94-5.12	12
Tigris-Euphrates river system	130.36	67.29-282.32	4.70	0.96	3.35-6.97	24
***C. damascina* (compiled)**	**117.92**	**37.07-370.47**	**4.77**	**0.91**	**2.56-8.42**	**605**
C. saadii from R. Helleh drainage	113.09	78.45-149.12	4.55	0.54	3.73-5.29	13
R. Mand drainage	93.79	71.37-145.37	4.99	0.42	4.22-5.54	15
R. Kol drainage	76.51	70.51-82.49	5.11	0.28	4.62-5.57	11
R. Kor basin	169.03	78.62-272.72	4.29	0.53	3.46-5.31	23
***C. saadii* (compiled)**	**122.68**	**70.51-272.72**	**4.66**	**0.57**	**3.46-5.57**	**62**
***Capoeta* sp.1**	**123.04**	**42.10-166.87**	**4.75**	**1.00**	**3.73-7.84**	**19**
C. umbla	**180.43**	**123.26-228.75**	**4.01**	**0.36**	**3.38-4.62**	**21**

Table A18. Interorbital width measurements of the *Capoeta damascina* species complex in % of standard length (SD = standard deviation).

	SL (mm)		**IOW in % SL**			
	Mean	Range	Mean	SD	Range	n
C. buhsei	**101.85**	**61.16-132.99**	**8.60**	**0.39**	**8.13-9.23**	**10**
C. damascina from Damascus basin	131.53	41.02-308.28	8.98	0.47	7.77-10.26	63
N. Quwayq	177.28	108.65-263.05	9.16	0.29	8.69-9.70	20
Orontes R. drainage	122.19	39.27-370.47	9.24	0.66	7.63-10.88	84
Litani R. drainage	110.25	82.10-128.91	9.18	0.42	8.22-9.87	25
Jordan R. drainage basin	104.88	40.68-292.92	9.49	0.72	6.92-11.13	98
Rivers in the Dead Sea Valley	88.71	37.07-200.57	9.23	0.59	7.68-10.51	87
Seyhan N. drainage	115.67	74.52-167.22	9.03	0.52	7.71-9.88	24
Ceyhan N. drainage	120.60	38.49-154.99	9.04	0.42	8.47-9.80	10
Arsuz N.	113.82	97.42-158.64	8.76	0.40	7.98-9.36	17
N. al-Kabir (N) drainage	119.86	78.34-181.41	9.64	0.37	8.82-10.34	51
N. Sanawbar	117.32	74.47-249.40	9.76	0.37	9.20-10.55	18
N. Marqiyah	126.42	43.40-199.73	9.13	0.38	8.23-9.90	21
N. Abu Ali	144.48	112.69-160.28	8.71	0.19	8.37-9.01	8
N. Ibrahim	98.78	78.90-115.39	8.58	0.32	8.17-9.14	9
N. al-Kalb	176.96	120.73-228.34	9.97	0.40	9.59-10.82	7
N. Antelias	145.92	93.20-211.05	9.54	0.38	8.83-10.40	28
N. Beirut	121.61	89.04-172.75	9.35	0.70	8.40-10.60	14
N. ad-Damur	119.36	94.32-148.92	8.90	0.29	8.29-9.46	12
Tigris-Euphrates river system	130.36	67.29-282.32	9.07	0.75	7.38-10.93	24
***C. damascina* (compiled)**	**118.19**	**37.07-370.47**	**9.26**	**0.61**	**6.92-11.13**	**620**
C. saadii from R. Helleh drainage	113.09	78.45-149.12	8.98	0.39	8.45-9.64	13
R. Mand drainage	93.79	71.37-145.37	8.18	0.46	7.33-8.84	15
R. Kol drainage	76.51	70.51-82.49	8.04	0.37	7.67-9.01	11
R. Kor basin	165.71	78.62-272.72	8.78	0.67	7.50-9.98	28
***C. saadii* (compiled)**	**124.75**	**70.51-272.72**	**8.57**	**0.64**	**7.33-9.98**	**67**
***Capoeta* sp.1**	**123.04**	**42.10-166.87**	**9.06**	**0.44**	**8.33-9.99**	**19**
C. umbla	**182.41**	**123.26-228.75**	**8.73**	**0.47**	**7.59-9.49**	**22**

Table A19. Preorbital length measurements of the *Capoeta damascina* species complex in % of standard length (SD = standard deviation).

	SL (mm)		PrOL in % SL			
	Mean	Range	Mean	SD	Range	n
C. buhsei	**101.85**	**61.16-132.99**	**7.57**	**0.28**	**7.25-7.91**	**10**
C. damascina from Damascus basin	131.71	41.02-308.28	7.28	0.72	5.21-8.59	62
N. Quwayq	177.28	108.65-263.05	6.46	0.44	5.78-7.11	20
Orontes R. drainage	122.19	39.27-370.47	7.44	0.65	6.21-8.97	84
Litani R. drainage	110.25	82.10-128.91	8.07	0.57	6.73-9.21	25
Jordan R. drainage basin	104.88	40.68-292.92	7.49	0.66	6.14-9.20	98
Rivers in the Dead Sea Valley	88.71	37.07-200.57	7.68	0.64	6.09-9.08	87
Seyhan N. drainage	115.67	74.52-167.22	7.94	0.61	6.74-9.07	24
Ceyhan N. drainage	120.60	38.49-154.99	7.82	0.64	7.00-8.93	10
Arsuz N.	113.82	97.42-158.64	7.25	0.30	6.67-7.91	17
N. al-Kabir (N) drainage	119.86	78.34-181.41	7.64	0.52	6.51-8.62	51
N. Sanawbar	117.32	74.47-249.40	8.26	0.41	7.27-9.06	18
N. Marqiyah	126.42	43.40-199.73	7.81	0.34	7.15-8.46	21
N. Abu Ali	144.48	112.69-160.28	8.02	0.31	7.53-8.54	8
N. Ibrahim	98.78	78.90-115.39	8.13	0.38	7.37-8.61	9
N. al-Kalb	176.96	120.73-228.34	7.82	0.91	6.18-8.62	7
N. Antelias	143.51	93.20-207.64	8.17	0.68	7.03-9.60	27
N. Beirut	121.61	89.04-172.75	7.38	0.39	6.89-8.10	14
N. ad-Damur	119.36	94.32-148.92	7.64	0.45	6.87-8.35	12
Tigris-Euphrates river system	130.36	67.29-282.32	7.54	0.73	6.00-9.01	24
***C. damascina* (compiled)**	**118.04**	**37.07-370.47**	**7.59**	**0.69**	**5.21-9.60**	**618**
C. saadii from R. Helleh drainage	113.09	78.45-149.12	8.07	0.53	7.22-9.15	13
R. Mand drainage	93.79	71.37-145.37	7.92	0.56	6.95-8.74	15
R. Kol drainage	76.51	70.51-82.49	7.62	0.48	6.85-8.30	11
R. Kor basin	170.01	78.62-272.72	7.39	0.95	6.03-9.21	26
***C. saadii* (compiled)**	**125.21**	**70.51-272.72**	**7.69**	**0.77**	**6.04-9.21**	**65**
***Capoeta* sp.1**	**123.04**	**42.10-166.87**	**8.01**	**0.57**	**7.12-9.13**	**19**
C. umbla	**182.41**	**123.26-228.75**	**7.65**	**0.76**	**6.13-8.79**	**22**

Table A20. Postorbital length measurements of the *Capoeta damascina* species complex in % of standard length (SD = standard deviation).

	SL (mm)		**POL in % SL**			
	Mean	Range	Mean	SD	Range	n
C. buhsei	**101.85**	**61.16-132.99**	**11.60**	**0.44**	**11.12-12.43**	**10**
C. damascina from Damascus basin	131.71	41.02-308.28	11.95	1.01	9.66-14.20	62
N. Quwayq	179.44	108.65-263.05	10.26	0.59	9.53-11.47	19
Orontes R. drainage	120.90	39.27-370.47	10.92	0.79	8.22-13.22	81
Litani R. drainage	110.25	82.10-128.91	11.67	0.76	9.98-13.09	25
Jordan R. drainage basin	103.79	40.68-292.92	11.54	0.98	8.89-14.24	96
Rivers in the Dead Sea Valley	87.87	37.07-200.57	12.08	0.90	9.11-14.11	86
Seyhan N. drainage	113.76	74.52-167.22	11.86	0.64	10.55-13.27	20
Ceyhan N. drainage	120.60	38.49-154.99	11.57	1.03	10.03-13.29	10
Arsuz N.	116.27	97.42-158.64	11.17	0.75	10.27-13.28	14
N. al-Kabir (N) drainage	119.86	78.34-181.41	12.62	0.93	10.43-14.56	51
N. Sanawbar	117.32	74.47-249.40	12.01	0.74	10.40-13.58	18
N. Marqiyah	126.42	43.40-199.73	10.96	0.60	10.14-12.60	21
N. Abu Ali	144.48	112.69-160.28	10.59	0.45	9.88-11.20	8
N. Ibrahim	98.78	78.90-115.39	11.54	0.48	10.95-12.44	9
N. al-Kalb	176.96	120.73-228.34	11.09	0.53	10.31-11.81	7
N. Antelias	143.51	93.20-207.64	10.83	0.86	9.02-12.07	27
N. Beirut	126.37	91.89-172.75	11.78	0.41	10.74-12.16	12
N. ad-Damur	119.36	94.32-148.92	11.73	0.49	11.06-12.51	12
Tigris-Euphrates river system	130.36	67.29-282.32	11.26	0.65	9.86-12.72	24
***C. damascina* (compiled)**	**117.72**	**37.07-370.47**	**11.58**	**1.01**	**8.22-14.56**	**602**
C. saadii from R. Helleh drainage	113.09	78.45-149.12	11.60	0.67	10.57-12.73	13
R. Mand drainage	93.79	71.37-145.37	11.09	0.57	10.34-12.69	15
R. Kol drainage	76.51	70.51-82.49	12.10	0.53	11.26-12.84	11
R. Kor basin	169.03	78.62-272.72	12.37	0.88	10.15-13.61	23
***C. saadii* (compiled)**	**122.68**	**70.51-272.72**	**11.85**	**0.87**	**10.15-13.61**	**62**
***Capoeta* sp.1**	**123.04**	**42.10-166.87**	**11.70**	**0.52**	**10.69-12.76**	**19**
C. umbla	**182.41**	**123.26-228.75**	**10.54**	**0.57**	**9.44-11.73**	**22**

Table A21. Mouth width measurements of the *Capoeta damascina* species complex in % of standard length (SD = standard deviation).

	SL (mm)		**WM in % SL**			
	Mean	Range	Mean	SD	Range	n
C. buhsei	**101.85**	**61.16-132.99**	**7.06**	**0.25**	**6.67-7.36**	**10**
C. damascina from Damascus basin	129.15	41.02-308.28	6.99	0.81	5.35-8.63	56
N. Quwayq	179.06	125.21-238.87	6.19	0.51	5.46-6.94	12
Orontes R. drainage	122.28	39.27-370.47	7.10	0.81	5.30-8.73	74
Litani R. drainage	110.25	82.10-128.91	7.74	0.63	6.77-8.82	25
Jordan R. drainage basin	99.08	40.68-288.56	8.05	0.99	6.35-10.43	92
Rivers in the Dead Sea Valley	89.14	37.07-200.57	7.74	0.83	6.20-10.12	86
Seyhan N. drainage	114.34	74.52-167.22	7.91	0.74	6.77-9.16	23
Ceyhan N. drainage	120.60	38.49-154.99	7.99	0.96	6.59-9.36	10
Arsuz N.	114.53	97.42-158.64	7.44	0.37	6.63-7.88	15
N. al-Kabir (N) drainage	119.47	78.34-181.41	7.65	0.40	6.68-8.65	49
N. Sanawbar	117.32	74.47-249.40	7.78	0.28	7.26-8.19	18
N. Marqiyah	126.42	43.40-199.73	7.48	0.33	6.93-8.23	21
N. Abu Ali	144.48	112.69-160.28	8.10	0.57	7.00-8.70	8
N. Ibrahim	99.27	78.90-115.39	7.54	0.38	6.94-8.03	8
N. al-Kalb	176.96	120.73-228.34	7.79	0.79	6.99-9.11	7
N. Antelias	150.90	93.20-211.05	8.38	0.65	7.10-9.44	25
N. Beirut	121.61	89.04-172.75	7.16	0.45	6.24-7.88	14
N. ad-Damur	119.36	94.32-148.92	8.34	0.58	7.43-9.30	12
Tigris-Euphrates river system	133.10	69.69-282.32	7.70	0.93	5.56-9.22	23
***C. damascina* (compiled)**	**116.44**	**37.07-370.47**	**7.62**	**0.87**	**5.30-10.43**	**578**
C. saadii from R. Helleh drainage	113.09	78.45-149.12	7.63	1.08	5.96-9.40	13
R. Mand drainage	93.79	71.37-145.37	7.54	0.57	6.77-8.45	15
R. Kol drainage	76.51	70.51-82.49	7.05	0.40	6.41-8.01	11
R. Kor basin	168.34	78.62-272.72	6.71	0.88	5.05-8.41	26
***C. saadii* (compiled)**	**124.55**	**70.51-272.72**	**7.14**	**0.88**	**5.05-9.40**	**65**
***Capoeta* sp.1**	**123.37**	**42.10-166.87**	**8.34**	**0.99**	**7.31-10.25**	**18**
C. umbla	**179.56**	**123.26-228.75**	**7.10**	**1.09**	**6.06-10.15**	**20**

Table A22. Frequency distribution of unbranched dorsal-fin ray counts (unbranched D).

Unbranched D	**III**	**IV**	**V**	**VI**	**n**
C. buhsei		**8**	**2**		**10**
C. damascina from Damascus basin		50	11		61
N. Quwayq		5	15	1	21
Orontes R. drainage	1	53	38		92
Litani R. drainage		21	5		26
Jordan R. drainage basin		71	26		97
Rivers in the Dead Sea Valley		46	32	4	82
Seyhan N. drainage	5	12	4		21
Ceyhan N. drainage		8	1		9
Arsuz N.		16	2		18
N. al-Kabir (N) drainage		51			51
N. Sanawbar	2	16			18
N. Marqiyah		18	1		19
N. Abu Ali		8	1		9
N. Ibrahim		11			11
N. al-Kalb		5	2		7
N. Antelias		29			29
N. Beirut		14			14
N. ad-Damur		11	1		12
Tigris-Euphrates river system		16	12		28
***C. damascina* (compiled)**	**8**	**461**	**151**	**5**	**625**
C. saadii from R. Helleh drainage		12	2		14
R. Mand drainage		11	4		15
R. Kol drainage	1	6	3		10
R. Kor basin		10	15	7	32
***C. saadii* (compiled)**	**1**	**39**	**24**	**7**	**71**
***Capoeta* sp.1**		**13**	**4**		**17**
C. umbla		**3**	**23**	**1**	**27**

Table A23. Frequency distribution of branched dorsal-fin ray counts (branched D).

Branched D	**7**	**8**	**9**	**10**	**11**	**n**
C. buhsei		**10**				**10**
C. damascina from Damascus basin		13	46	2		61
N. Quwayq		1	17	2		20
Orontes R. drainage	1	16	76	2		95
Litani R. drainage		11	15			26
Jordan R. drainage basin		23	70	3	1	97
Rivers in the Dead Sea Valley	1	26	55			82
Seyhan N. drainage		2	18	1		21
Ceyhan N. drainage			9			9
Arsuz N.		4	14			18
N. al-Kabir (N) drainage		8	43			51
N. Sanawbar		1	12	5		18
N. Marqiyah		3	15	1		19
N. Abu Ali		1	8			9
N. Ibrahim			11			11
N. al-Kalb		3	4			7
N. Antelias		17	12			29
N. Beirut		4	10			14
N. ad-Damur		6	6			12
Tigris-Euphrates river system		2	24	1		27
C. damascina **(compiled)**	**2**	**141**	**465**	**17**	**1**	**626**
C. saadii from R. Helleh drainage		5	11			16
R. Mand drainage		10	6			16
R. Kol drainage		8	3			11
R. Kor basin		15	18			33
C. saadii **(compiled)**		**38**	**38**			**76**
Capoeta **sp.1**		**5**	**13**			**18**
C. umbla		**10**	**15**	**5**		**30**

Table A24. Frequency distribution of pectoral-fin ray counts (Pc).

Pc	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**n**
C. buhsei			**4**		**2**			**6**
C. damascina from Damascus basin		1	13	33	11	1		59
N. Quwayq			2	11	4	2		19
Orontes R. drainage	1		5	39	32	10	1	88
Litani R. drainage			6	8	12			26
Jordan R. drainage basin		3	11	44	25	4		87
Rivers in the Dead Sea Valley	1	1	4	37	28	2	1	74
Seyhan N. drainage		1	2	4	8	4	1	20
Ceyhan N. drainage				5	3	1		9
Arsuz N.			1	7	9	1		18
N. al-Kabir (N) drainage		3	14	22	5	2		46
N. Sanawbar			1	8	5	3		17
N. Marqiyah		1	4	5	8			18
N. Abu Ali				3	6			9
N. Ibrahim			1	4	6			11
N. al-Kalb			1	2	3	1		7
N. Antelias		1	6	17	4	1		29
N. Beirut			4	8	2			14
N. ad-Damur			4	7	1			12
Tigris-Euphrates river system			2	8	9	3	1	23
***C. damascina* (compiled)**	**2**	**11**	**81**	**272**	**181**	**35**	**4**	**586**
C. saadii from R. Helleh drainage		1	6	5	4			16
R. Mand drainage			10	3	2			15
R. Kol drainage		4	3	2	1			10
R. Kor basin			10	13	7			30
***C. saadii* (compiled)**		**5**	**29**	**23**	**14**			**71**
***Capoeta* sp.1**			**2**	**4**	**6**	**1**	**3**	**16**
C. umbla				**5**	**6**	**5**		**16**

Table A25. Frequency distribution of pelvic-fin ray counts (P).

P	**6**	**7**	**8**	**9**	**10**	**11**	**n**
C. buhsei				**1**	**8**		**9**
C. damascina from Damascus basin				8	54		62
N. Quwayq					16	4	20
Orontes R. drainage			1	2	77	15	95
Litani R. drainage				2	23	1	26
Jordan R. drainage basin				2	82	8	92
Rivers in the Dead Sea Valley					68	13	81
Seyhan N. drainage					19	2	21
Ceyhan N. drainage					9		9
Arsuz N.				1	14	3	18
N. al-Kabir (N) drainage	1	2		4	41	3	51
N. Sanawbar				3	15		18
N. Marqiyah				1	18		19
N. Abu Ali					9		9
N. Ibrahim					11		11
N. al-Kalb					6		6
N. Antelias			2	2	25		29
N. Beirut				2	11		13
N. ad-Damur					12		12
Tigris-Euphrates river system					25	2	27
***C. damascina* (compiled)**	**1**	**2**	**3**	**27**	**535**	**51**	**619**
C. saadii from R. Helleh drainage			2	13	1		16
R. Mand drainage			2	14			16
R. Kol drainage			3	8			11
R. Kor basin			2	18	12		32
***C. saadii* (compiled)**			**9**	**53**	**13**		**75**
***Capoeta* sp.1**				**3**	**8**	**7**	**18**
C. umbla					**26**	**3**	**29**

Table A26. Frequency distribution of unbranched anal-fin ray counts (unbranched A).

Unbranched A		**III**
C. buhsei		**10**
C. damascina from	Damascus basin	61
	N. Quwayq	20
	Orontes R. drainage	96
	Litani R. drainage	26
	Jordan R. drainage basin	97
	Rivers in the Dead Sea Valley	82
	Seyhan N. drainage	21
	Ceyhan N. drainage	9
	Arsuz N.	18
	N. al-Kabir (N) drainage	50
	N. Sanawbar	18
	N. Marqiyah	19
	N. Abu Ali	9
	N. Ibrahim	11
	N. al-Kalb	7
	N. Antelias	29
	N. Beirut	13
	N. ad-Damur	12
	Tigris-Euphrates river system	27
***C. damascina* (compiled)**		**625**
C. saadii from	R. Helleh drainage	16
	R. Mand drainage	15
	R. Kol drainage	11
	R. Kor basin	32
***C. saadii* (compiled)**		**74**
***Capoeta* sp.1**		**18**
C. umbla		**30**

Table A27. Frequency distribution of branched anal-fin ray counts (branched A).

Branched A	**5**	**6**	**n**
C. buhsei	**7**		**7**
C. damascina from Damascus basin	53	8	61
N. Quwayq	20		20
Orontes R. drainage	96		96
Litani R. drainage	26		26
Jordan R. drainage basin	93	4	97
Rivers in the Dead Sea Valley	70	12	82
Seyhan N. drainage	21		21
Ceyhan N. drainage	9		9
Arsuz N.	18		18
N. al-Kabir (N) drainage	49		49
N. Sanawbar	18		18
N. Marqiyah	19		19
N. Abu Ali	9		9
N. Ibrahim	11		11
N. al-Kalb	7		7
N. Antelias	29		29
N. Beirut	13		13
N. ad-Damur	12		12
Tigris-Euphrates river system	26	1	27
***C. damascina* (compiled)**	**599**	**25**	**624**
C. saadii from R. Helleh drainage	16		16
R. Mand drainage	16		16
R. Kol drainage	11		11
R. Kor basin	33		33
***C. saadii* (compiled)**	**76**		**76**
***Capoeta* sp.1**	**18**		**18**
C. umbla	**30**		**30**

Table A28. Frequency distribution of branched caudal-fin ray counts (branched C).

Branched C	**15**	**16**	**17**	**18**	**19**	**n**
C. buhsei			**10**			**10**
C. damascina from Damascus basin	1	2	59			62
N. Quwayq			20			20
Orontes R. drainage		2	90	2		94
Litani R. drainage			26			26
Jordan R. drainage basin		3	90	2	1	96
Rivers in the Dead Sea Valley	1	1	71	7	1	81
Seyhan N. drainage			21			21
Ceyhan N. drainage			9			9
Arsuz N.			18			18
N. al-Kabir (N) drainage		1	47	3		51
N. Sanawbar		1	17			18
N. Marqiyah			19			19
N. Abu Ali			9			9
N. Ibrahim			10	1		11
N. al-Kalb			7			7
N. Antelias		1	28			29
N. Beirut		1	13			14
N. ad-Damur			12			12
Tigris-Euphrates river system	1		25	1		27
***C. damascina* (compiled)**	**3**	**12**	**591**	**16**	**2**	**624**
C. saadii from R. Helleh drainage			16			16
R. Mand drainage			15			15
R. Kol drainage		1	9	1		11
R. Kor basin		1	29	1		31
***C. saadii* (compiled)**		**2**	**69**	**2**		**73**
***Capoeta* sp.1**			**17**		**1**	**18**
C. umbla			**30**			**30**

Table A29. Frequency distribution of the number of scales above the lateral line (ALL).

ALL	**11**	**12**	**12.5**	**13**	**13.5**	**14**	**14.5**	**15**	**15.5**	**16**	**17**	**18**	**19**	**20**	**21**	**24**	**n**
C. buhsei						**3**		**2**		**4**							**9**
C. damascina from Damascus basin		4		21		22		8		1							56
N. Quwayq		1	1			4		6		7	1						20
Orontes R. drainage	1	9		30		26		13		5							84
Litani R. drainage				1		4		8		7	1	1					22
Jordan R. drainage basin						2		16		26	17	13	3	1			78
Rivers in the Dead Sea Valley						3		7		16	27	10		2			65
Seyhan N. drainage		5	1	6		9											21
Ceyhan N. drainage				4		3		1		1							9
Arsuz N.		7		8		2											17
N. al-Kabir (N) drainage				13		12		13		3							41
N. Sanawbar				3		6		4									13
N. Marqiyah		3		8		4											15
N. Abu Ali		1		3		3		2									9
N. Ibrahim							2	4		2							8
N. al-Kalb		1				1		3									5
N. Antelias					1	1	4	7	1	10	1						25
N. Beirut						6		8									14
N. ad-Damur						4		5		2		1					12
Tigris-Euphrates river system								2		7	13	2					24
***C. damascina* (compiled)**	**1**	**31**	**2**	**97**	**1**	**112**	**6**	**107**	**1**	**87**	**60**	**27**	**3**	**3**			**538**
C. saadii from R. Helleh drainage	2	10		4				1									17
R. Mand drainage	2	5		6		1											14
R. Kol drainage		1		5		2		1		1							10
R. Kor basin		7	1	15		5											28
***C. saadii* (compiled)**	**4**	**23**	**1**	**30**		**8**		**2**		**1**							**69**
***Capoeta* sp.1**				**8**		**2**		**4**		**3**							**17**
C. umbla												**1**	**6**	**6**	**4**	**1**	**18**

Table A30. Frequency distribution of the number of scales below the lateral line (BLL).

BLL		**7**	**7.5**	**8**	**8.5**	**9**	**9.5**	**10**	**10.5**	**11**	**11.5**	**12**	**12.5**	**13**	**13.5**	**14**	**14.5**	**15**	**15.5**	**n**
C. buhsei								**2**	**2**		**3**									**7**
C. damascina from	Damascus basin				7	6	15	5	8	1	1	2								45
	N. Quwayq				1	1	7	5	1	3	1									19
	Orontes R. drainage		3	1	28	9	26	12	4	1		1								85
	Litani R. drainage					5	3	9	1	1										19
	Jordan R. drainage basin					4	11	11	22	6	19	3	4				1			81
	Rivers in the Dead Sea Valley				2		16	2	21	4	14	1	4							64
	Seyhan N. drainage		1	1	5	4	2	4	1											18
	Ceyhan N. drainage				2	4	1	2												9
	Arsuz N.			2	4	6	5													17
	N. al-Kabir (N) drainage				5	3	14	4	17				1							44
	N. Sanawbar					1	2	3	5		1									12
	N. Marqiyah		1		10		5	1												17
	N. Abu Ali			4		2	1	2												9
	N. Ibrahim				1	2	3	1	2											9
	N. al-Kalb					1		4		1										6
	N. Antelias				3		11		12		1									27
	N. Beirut					1	2	1	5											9
	N. ad-Damur					2	4	4		1		1								12
	Tigris-Euphrates river system				2		2	9	3	4	1	1								22
***C. damascina* (compiled)**			**5**	**8**	**70**	**51**	**130**	**79**	**102**	**22**	**38**	**9**	**9**				**1**			**524**
C. saadii from	R. Helleh drainage			3	1	10	1	1												16
	R. Mand drainage	1		5	1	7														14
	R. Kol drainage			2	1	2	2	2												9
	R. Kor basin			8	2	8	6	3												27
***C. saadii* (compiled)**		**1**		**18**	**5**	**27**	**9**	**6**												**66**
***Capoeta* sp.1**								**8**		**9**										**17**
C. umbla											**1**	**2**	**7**	**3**	**5**	**2**	**2**	**1**	**2**	**25**

Table A31. Frequency distribution of the circumpendicular scale counts (CCP).

CCP	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**n**
C. buhsei							**6**		**3**									**9**
C. damascina from Damascus basin	2	1	14	9	21	8	2	1										58
N. Quwayq			1	1	6	4	4	3	2									21
Orontes R. drainage	4	21	23	21	13	2		1	1									86
Litani R. drainage			1	7	12	5	1											26
Jordan R. drainage basin			2	1	11	19	20	15	9	3	2	1						83
Rivers in the Dead Sea Valley			1	3	8	18	17	10	5	2								64
Seyhan N. drainage		2	4	3	6	1	1											17
Ceyhan N. drainage			3	1	4		1											9
Arsuz N.		2	8	5	3													18
N. al-Kabir (N) drainage		5	12	13	10	4												44
N. Sanawbar			3		4	8	1											16
N. Marqiyah	2	8	7	2														19
N. Abu Ali		4	4	1														9
N. Ibrahim				7	3	1												11
N. al-Kalb				4	2		1											7
N. Antelias			1	3	17	7		1										29
N. Beirut			1	5	6	1	1											14
N. ad-Damur					4	5	1	1										11
Tigris-Euphrates river system					1	5	4	6	6	1	1							24
C. damascina **(compiled)**	**8**	**43**	**85**	**86**	**131**	**88**	**54**	**38**	**23**	**6**	**3**	**1**						**566**
C. saadii from R. Helleh drainage	1	1	5	3	3													13
R. Mand drainage		3	5	3	2													13
R. Kol drainage			2	2	1													5
R.Kor basin	1	8	7	8	2	1												27
C. saadii **(compiled)**	**2**	**12**	**19**	**16**	**8**	**1**												**58**
Capoeta **sp.1**					**6**	**1**	**7**	**1**	**3**									**18**
C. umbla										**1**	**2**	**2**	**9**	**4**	**1**	**1**	**1**	**21**

Table A32. Frequency distribution of the lateral-line scale counts (LL).

LL	61	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	104	n
C. buhsei																					**1**	**1**	**3**		**1**	**2**				**1**				**1**								**10**
C. damascina from Damascus			1	1	2	2	2	2	6	7	11	1	6	2	3	4	2	2			1																					55
Quwayq							1				1	3	1	2	1	2	1	2	1	2	1	1	2																			21
Orontes				5	1	5	10	8	9	6	7	14	8	7	6	2		1	1																							90
Litani						1		2	4	3	6	6	3	2	1	3	3	2	1	2		1		1																		41
Jordan River drainage basin							1	1	1	1	4	8	10	7	4	6	9	6	12	8	8	4	1	1	1			1	1													95
Rivers in the Dead Sea Valley										1		2	4	7	10	8	4	8	7	4	8	6	1	2	3	1	1		1	1												79
Seyhan		1	1	1	1		1	2		3	3		2	4		1																										20
Ceyhan				1					4		1	1		1		1																										9
Arsuz				1	2	3	3	3	1		2	1			1																											17
al-Kabir (N)		1	1	1	2	6	2	11	5	6	2	1	3	2	1	1																										45
Sanawbar						1		2	3	1		1		1		1	1																									11
Marqiyah						1	2		4	4	2	1		5																												19
Abu Ali	1	1			1	1		2	1	1				1																												9
Ibrahim												2	3		1	4																										10
al-Kalb												1		1	3	1		1																								7
Antelias						1	1	5	2	3	4	3	2	2	2	1		1																								27
Beirut							1	1	1	1	4			1			2	3																								14
ad-Damur						1						1		2	2	2	1		1		1		1																			12
Tigris-Euphrates														1	1		1	2	2	1	3	2	2	2	1	2	2		1													23
***C. damascina* (compiled)**	**1**	**3**	**3**	**10**	**9**	**22**	**24**	**39**	**41**	**37**	**47**	**46**	**42**	**48**	**36**	**37**	**24**	**28**	**25**	**17**	**22**	**14**	**7**	**6**	**5**	**3**	**3**	**1**	**3**	**1**												**604**
C. saadii from Helleh			1	1	4	3	1	1	2		2																															15
Mand		1		1	2	1	1		2	1	1	1			1		1	1																								14
Kol		1			1	1	2		3	1					1																											10
Kor			1	1			1	3	4	2	2	2	1	1	3	1																										22
***C. saadii* (compiled)**		**2**	**2**	**3**	**7**	**5**	**5**	**4**	**11**	**4**	**5**	**3**	**1**	**1**	**5**	**1**	**1**	**1**																								**61**
***Capoeta* sp.1**				**1**					**2**		**1**	**3**	**1**	**2**	**2**		**1**	**1**		**3**	**1**																					**18**
C. umbla																									**1**			**1**	**1**	**3**	**3**	**2**	**1**	**4**	**1**	**2**	**1**	**1**	**1**	**1**	**1**	**24**

Table A33. Frequency distribution of the number of gill rakers on the lower limb of the first gill arch ($GR_{\text{Lower limb count}}$).

$GR_{\text{Lower limb count}}$	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**n**
C. buhsei	**1**	**3**	**4**	**2**									**10**
C. damascina from Damascus basin						19	19	10	3			1	52
N. Quwayq								3	3	3	7		16
Orontes R. drainage							2	16	9	21	13	2	63
Litani R. drainage						1	2	17	4				24
Jordan R. drainage basin						1	3	21	24	21	10	7	87
Rivers in the Dead Sea Valley							2	24	18	15	10		69
Seyhan N. drainage							1	3	11	4			19
Ceyhan N. drainage								1	1	7			9
Arsuz N.							1		4	3	4		12
N. al-Kabir (N) drainage							8	31	8	2	1		50
N. Sanawbar							2	9	3	2	1		17
N. Marqiyah								9	5	3	2		19
N. Abu Ali								3	4	1	1		9
N. Ibrahim								5	2	2			9
N. al-Kalb							1	1	3	1			6
N. Antelias							3	16	8	1			28
N. Beirut								5	6	1			12
N. ad-Damur							2	7	1	1			11
Tigris-Euphrates river system								3	7	6	4	2	22
***C. damascina* (compiled)**						**21**	**46**	**184**	**124**	**94**	**53**	**12**	**534**
C. saadii from R. Helleh drainage					9	5	2						16
R. Mand drainage				5	10			1					16
R. Kol drainage			2	5	4								11
R. Kor basin			4	11	9	2	3		1				30
***C. saadii* (compiled)**			**6**	**21**	**32**	**7**	**5**	**1**	**1**				**73**
***Capoeta* sp.1**				**1**	**3**	**4**	**8**						**16**
C. umbla									**3**	**9**			**12**

Table A34. Frequency distribution of the total vertebral counts (VC).

VC	**42**	**43**	**44**	**45**	**46**	**47**	**48**	**49**	**50**	**n**
C. buhsei			**4**							**4**
C. damascina from Damascus basin			1	6	4	2				13
N. Quwayq					7	2				9
Orontes R. drainage			1	2	4	2				9
Litani R. drainage				2	1	2				5
Jordan R. drainage basin			5	13	3					21
Rivers in the Dead Sea Valley		1	9	10	6					26
Seyhan N. drainage				2	3					5
Ceyhan N. drainage				1	1	2				4
Arsuz N.			1	5	3	1	1			11
N. al-Kabir (N) drainage				1	3	1				5
N. Sanawbar				3		1				4
N. Marqiyah			1	1	1					3
N. Abu Ali				1	5	2				8
N. Ibrahim						3	6			9
N. al-Kalb			1		2	2				5
N. Antelias				1	3	2				6
N. Beirut			1	3	1					5
N. ad-Damur					4					4
Tigris-Euphrates river system				2	2	3				7
***C. damascina* (compiled)**		**1**	**20**	**53**	**53**	**25**	**7**			**159**
C. saadii from R. Helleh drainage	1	4	1							6
R. Mand drainage		2	2	1						5
R. Kol drainage	1	2	2							5
R. Kor basin		6	9	4	1					20
***C. saadii* (compiled)**	**2**	**14**	**14**	**5**	**1**					**36**
***Capoeta* sp.1**				**1**	**2**	**1**				**4**
C. umbla					**1**	**6**	**6**	**1**	**1**	**15**

Table A35. Frequency distribution of the total number of barbels.

Total number of barbels	**2 posterior**	**2 anterior and 2 posterior**	**2 posterior and 1 anterior**	**n**
C. buhsei	**10**			**10**
C. damascina from Damascus basin	63			63
N. Quwayq	20			20
Orontes R. drainage	94	1		95
Litani R. drainage	25			25
Jordan R. drainage basin	93	1	3	97
Rivers in the Dead Sea Valley	82	4		86
Seyhan N. drainage	20		1	21
Ceyhan N. drainage	9			9
Arsuz N.	18			18
N. al-Kabir (N) drainage	49		2	51
N. Sanawbar	18			18
N. Marqiyah	19			19
N. Abu Ali	9			9
N. Ibrahim	11			11
N. al-Kalb	7			7
N. Antelias	29			29
N. Beirut	12	2		14
N. ad-Damur	40	6	5	51
Tigris-Euphrates river system	27			27
***C. damascina* (compiled)**	**645**	**14**	**11**	**670**
C. saadii from R. Helleh drainage	15			15
R. Mand drainage	15			15
R. Kol drainage	11			11
R. Kor basin	30		1	31
***C. saadii* (compiled)**	**71**		**1**	**72**
***Capoeta* sp.1**	**17**	**1**		**18**
C. umbla	**30**			**30**

Table A36. P-values obtained from pairwise comparisons of regression line slopes (a) for the predorsal length between populations and species (significant differences highlighted in yellow, Bonferroni-corrected significance level: 0.000184).

	C. damascina from Damascus basin	N. Quwayq	Orontes R. drainage	Litani R. drainage	Jordan R. drainage basin	Rivers in the Dead Sea Valley	Seyhan N. drainage	Arsuz N.	N. al-Kabir (N) drainage	N. Sanawbar	N. Marqiyah	N. Antelias	Tigris-Euphrates	*C. saadii* from R. Mand drainage	R. Kor basin	*Capoeta* sp.1	*C. umbla*
n	61	19	82	25	98	87	24	17	51	18	21	27	23	15	28	19	21
C. damascina from Damascus basin	x	9.83E-01	1.63E-02	1.33E-01	2.46E-07	3.78E-05	1.61E-01	1.03E-01	1.03E-01	4.37E-01	1.84E-04	9.22E-01	2.32E-01	9.17E-01	1.20E-04	9.22E-01	6.84E-01
N. Quwayq		x	4.45E-01	2.29E-01	1.15E-01	1.61E-01	3.52E-01	1.90E-01	1.90E-01	6.73E-01	8.79E-02	9.31E-01	6.13E-01	9.46E-01	6.45E-02	9.31E-01	7.99E-01
Orontes R. drainage			x	3.89E-01	5.53E-03	1.38E-01	2.13E-02	5.85E-02	5.85E-02	5.22E-01	7.23E-02	2.11E-01	7.25E-01	5.79E-01	2.43E-02	2.11E-01	7.83E-01
Litani R. drainage				x	6.90E-01	4.81E-01	3.39E-02	4.24E-02	4.24E-02	2.07E-01	6.91E-01	8.94E-02	3.65E-01	2.39E-01	9.27E-01	8.94E-02	4.36E-01
Jordan R. drainage basin					x	1.72E-01	5.65E-04	1.69E-02	1.69E-02	4.45E-02	8.91E-01	1.42E-02	5.61E-02	2.24E-01	3.52E-01	1.42E-02	3.43E-01
Rivers in the Dead Sea Valley						x	6.26E-04	1.19E-02	1.19E-02	1.03E-01	2.95E-01	2.43E-02	1.82E-01	2.76E-01	8.17E-02	2.43E-02	4.68E-01
Seyhan N. drainage							x	2.65E-01	2.65E-01	2.96E-02	9.24E-05	1.51E-01	6.51E-02	2.95E-01	2.33E-04	1.51E-01	3.19E-01
Arsuz N.								x	1.03E-01	5.50E-02	1.10E-02	7.16E-02	1.09E-01	1.59E-01	1.30E-02	7.16E-02	2.22E-01
N. al-Kabir (N) drainage									x	8.75E-01	1.29E-02	5.13E-01	6.57E-01	8.24E-01	6.55E-03	5.13E-01	9.04E-01
N. Sanawbar										x	1.89E-02	3.49E-01	7.82E-01	7.38E-01	1.64E-02	3.49E-01	9.69E-01
N. Marqiyah											x	1.91E-03	1.02E-01	1.25E-01	4.69E-01	1.91E-03	3.66E-01
N. Antelias												x	3.61E-01	8.38E-01	2.90E-03	9.22E-01	6.78E-01
Tigris-Euphrates													x	7.09E-01	5.01E-02	9.31E-01	9.22E-01
C. saadii from R. Mand drainage														x	1.13E-01	2.11E-01	8.51E-01
R. Kor basin															x	8.94E-02	2.55E-01
Capoeta sp.1																x	6.67E-01
C. umbla																	x

Table A37. P-values obtained from pairwise comparisons of regression line intercepts (b) for the predorsal length between populations and species (significant differences highlighted in yellow, Bonferroni-corrected significance level: 0.000184).

	C. damascina from Damascus basin	N. Quwayq	Orontes R. drainage	Litani R. drainage	Jordan R. drainage basin	Rivers in the Dead Sea Valley	Seyhan N. drainage	Arsuz N.	N. al-Kabir (N) drainage	N. Sanawbar	N. Marqiyah	N. Antelias	Tigris-Euphrates	*C. saadii* from R. Mand drainage	R. Kor basin	*Capoeta* sp.1	*C. umbla*
n	61	19	82	25	98	87	24	17	51	18	21	27	23	15	28	19	21
C. damascina from Damascus basin	x	7.25E-03	1.20E-04	1.66E-03	2.56E-17	1.20E-12	7.97E-02	3.70E-02	5.54E-04	4.09E-03	3.44E-02	2.75E-02	3.97E-02	1.85E-01	1.07E-01	2.73E-02	7.65E-01
N. Quwayq		x	2.65E-01	2.46E-04	4.39E-01	8.11E-01	4.69E-02	2.61E-01	1.78E-05	1.08E-04	1.09E-01	5.96E-02	2.07E-01	4.45E-03	3.15E-03	9.44E-02	1.17E-01
Orontes R. drainage			x	8.54E-07	6.79E-08	2.60E-04	2.05E-01	8.18E-01	3.25E-11	1.59E-06	4.42E-01	4.31E-01	5.29E-01	1.20E-02	1.83E-04	1.71E-04	1.81E-01
Litani R. drainage				x	3.65E-14	2.47E-13	5.52E-05	3.97E-04	1.90E-01	5.50E-01	6.16E-05	6.85E-06	4.12E-04	5.05E-01	2.11E-01	7.85E-01	3.33E-01
Jordan R. drainage basin					x	1.22E-01	4.52E-07	1.18E-03	9.79E-26	1.90E-14	9.50E-06	7.23E-06	2.71E-05	1.03E-05	2.38E-11	5.81E-09	4.12E-03
Rivers in the Dead Sea Valley						x	1.33E-05	8.86E-03	9.77E-22	7.38E-14	2.12E-04	1.32E-04	7.84E-04	9.32E-06	4.18E-10	4.47E-07	7.37E-03
Seyhan N. drainage							x	4.35E-01	1.53E-06	8.03E-06	6.22E-01	5.61E-01	6.31E-01	1.08E-02	6.88E-03	5.69E-02	3.84E-01
Arsuz N.								x	1.56E-05	2.59E-04	7.09E-01	6.58E-01	8.16E-01	2.55E-02	9.76E-03	8.60E-02	3.18E-01
N. al-Kabir (N) drainage									x	4.92E-01	8.48E-07	1.17E-07	9.53E-06	9.99E-01	5.66E-01	2.91E-01	4.79E-01
N. Sanawbar										x	1.51E-05	1.96E-07	5.08E-04	7.01E-01	3.82E-01	6.37E-01	4.39E-01
N. Marqiyah											x	9.94E-01	9.27E-01	1.17E-02	4.77E-03	5.52E-02	3.30E-01
N. Antelias												x	9.14E-01	1.77E-03	1.72E-03	4.06E-02	2.73E-01
Tigris-Euphrates													x	4.90E-02	1.14E-02	4.89E-02	3.69E-01
C. saadii from R. Mand drainage														x	7.81E-01	6.98E-01	6.49E-01
R. Kor basin															x	3.97E-01	7.30E-01
Capoeta sp.1																x	5.58E-01
C. umbla																	x

Table A38. P-values obtained from pairwise comparisons of regression line slopes (a) for the prepelvic length between populations and species (significant differences highlighted in yellow, Bonferroni-corrected significance level: 0.000184).

	C. damascina from Damascus basin	N. Quwayq	Orontes R. drainage	Litani R. drainage	Jordan R. drainage basin	Rivers in the Dead Sea Valley	Seyhan N. drainage	Arsuz N.	N. al-Kabir (N) drainage	N. Sanawbar	N. Marqiyah	N. Antelias	Tigris-Euphrates	*C. saadii* from R. Mand drainage	R. Kor basin	*Capoeta* sp.1	*C. umbla*
n	58	19	80	25	94	87	24	16	51	18	21	27	23	15	26	19	18
C. damascina from Damascus basin	x	5.93E-01	9.43E-01	4.98E-02	3.88E-02	4.72E-01	4.56E-01	1.62E-01	6.76E-01	6.85E-01	5.96E-01	1.05E-01	9.12E-01	5.45E-01	4.32E-05	4.04E-01	2.85E-01
N. Quwayq		x	6.30E-01	6.17E-02	2.04E-01	3.80E-01	3.77E-01	1.59E-01	7.83E-01	7.89E-01	4.17E-01	5.87E-01	5.87E-01	9.05E-01	8.46E-03	9.90E-01	2.93E-01
Orontes R. drainage			x	6.67E-02	2.78E-02	4.23E-01	4.66E-01	1.96E-01	7.25E-01	7.39E-01	5.85E-01	1.47E-01	8.75E-01	5.98E-01	8.20E-05	4.50E-01	3.04E-01
Litani R. drainage				x	9.06E-02	3.82E-02	1.20E-01	7.59E-01	2.49E-02	2.22E-02	3.24E-02	3.42E-03	5.13E-02	2.37E-02	6.65E-01	3.57E-02	3.69E-01
Jordan R. drainage basin					x	1.12E-01	9.46E-01	2.59E-01	1.15E-01	1.15E-01	3.37E-01	6.90E-03	1.83E-01	2.30E-01	4.10E-04	3.92E-02	5.34E-01
Rivers in the Dead Sea Valley						x	6.00E-01	1.43E-01	3.73E-01	3.66E-01	9.67E-01	2.65E-02	6.82E-01	3.62E-01	1.28E-05	1.62E-01	3.05E-01
Seyhan N. drainage							x	2.75E-01	3.22E-01	3.13E-01	6.29E-01	4.45E-02	5.21E-01	2.86E-01	2.56E-02	2.46E-01	6.03E-01
Arsuz N.								x	9.14E-02	6.74E-02	9.56E-02	1.35E-02	1.53E-01	4.85E-02	9.94E-01	1.14E-01	5.91E-01
N. al-Kabir (N) drainage									x	9.94E-01	3.94E-01	2.37E-01	6.34E-01	6.73E-01	1.56E-04	7.16E-01	2.00E-01
N. Sanawbar										x	3.22E-01	1.75E-01	6.32E-01	6.10E-01	1.61E-04	7.16E-01	2.21E-01
N. Marqiyah											x	1.45E-02	7.04E-01	2.44E-01	1.23E-04	2.20E-01	3.43E-01
N. Antelias												x	8.53E-02	6.67E-01	4.00E-06	4.48E-01	5.04E-02
Tigris-Euphrates													x	4.86E-01	3.42E-04	4.22E-01	3.34E-01
C. saadii from R. Mand drainage														x	5.26E-03	8.76E-01	2.17E-01
R. Kor basin															x	2.72E-04	3.67E-01
Capoeta sp.1																x	2.13E-01
C. umbla																	x

Table A39. P-values obtained from pairwise comparisons of regression line intercepts (b) for the prepelvic length between populations and species (significant differences highlighted in yellow, Bonferroni-corrected significance level: 0.000184).

	C. damascina from Damascus basin	N. Quwayq	Orontes R. drainage	Litani R. drainage	Jordan R. drainage basin	Rivers in the Dead Sea Valley	Seyhan N. drainage	Arsuz N.	N. al-Kabir (N) drainage	N. Sanawbar	N. Marqiyah	N. Antelias	Tigris-Euphrates	*C. saadii* from R. Mand drainage	R. Kor basin	*Capoeta* sp.1	*C. umbla*
n	58	19	80	25	94	87	24	16	51	18	21	27	23	15	26	19	18
C. damascina from Damascus basin	x	1.99E-01	1.05E-10	8.48E-02	8.62E-17	3.25E-10	3.20E-02	1.21E-01	5.20E-02	3.68E-01	7.62E-06	6.48E-06	2.54E-06	3.73E-03	4.02E-03	4.98E-05	5.05E-01
N. Quwayq		x	2.18E-01	4.27E-02	3.85E-02	1.94E-01	8.38E-01	7.37E-01	5.25E-01	4.33E-01	3.13E-01	2.76E-01	2.74E-01	2.80E-01	6.92E-01	3.75E-01	8.01E-01
Orontes R. drainage			x	4.15E-08	6.84E-02	6.75E-01	3.77E-03	9.03E-03	1.06E-06	2.86E-04	5.19E-01	6.12E-01	8.32E-01	9.21E-01	1.64E-01	6.69E-01	1.93E-01
Litani R. drainage				x	1.53E-12	1.31E-09	1.76E-03	5.91E-03	1.53E-03	1.84E-02	3.75E-07	2.29E-07	1.42E-06	1.21E-04	2.06E-04	2.16E-05	1.71E-01
Jordan R. drainage basin					x	2.44E-02	6.29E-06	5.08E-05	6.96E-12	1.52E-07	3.42E-02	5.49E-02	1.09E-01	5.41E-01	7.24E-03	8.64E-02	4.36E-02
Rivers in the Dead Sea Valley						x	2.83E-03	4.47E-03	1.83E-06	6.72E-05	6.85E-01	8.02E-01	9.21E-01	7.51E-01	1.80E-01	8.55E-01	1.51E-01
Seyhan N. drainage							x	8.05E-01	4.21E-01	2.87E-01	2.04E-02	1.64E-02	1.63E-02	6.21E-02	3.03E-01	5.15E-02	8.62E-01
Arsuz N.								x	6.87E-01	4.30E-01	1.03E-02	8.99E-03	1.59E-02	2.69E-02	2.28E-01	4.97E-02	9.55E-01
N. al-Kabir (N) drainage									x	6.14E-01	3.72E-04	3.19E-04	1.69E-04	1.30E-02	5.78E-02	1.65E-03	9.07E-01
N. Sanawbar										x	2.76E-04	2.58E-04	8.84E-04	3.57E-03	4.45E-02	5.53E-03	7.69E-01
N. Marqiyah											x	8.79E-01	6.62E-01	5.05E-01	3.31E-01	8.82E-01	2.26E-01
N. Antelias												x	7.60E-01	5.89E-01	2.86E-01	9.70E-01	1.99E-01
Tigris-Euphrates													x	8.09E-01	2.36E-01	8.35E-01	2.22E-01
C. saadii from R. Mand drainage														x	2.66E-01	7.22E-01	2.06E-01
R. Kor basin															x	3.79E-01	5.05E-01
Capoeta sp.1																x	3.03E-01
C. umbla																	x

Table A40. P-values obtained from pairwise comparisons of regression line slopes (a) for the preanal length between populations and species (significant differences highlighted in yellow, Bonferroni-corrected significance level: 0.000184).

	C. damascina from Damascus basin	N. Quwayq	Orontes R. drainage	Litani R. drainage	Jordan R. drainage basin	Rivers in the Dead Sea Valley	Seyhan N. drainage	Arsuz N.	N. al-Kabir (N) drainage	N. Sanawbar	N. Marqiyah	N. Antelias	Tigris-Euphrates	*C. saadii* from R. Mand drainage	R. Kor basin	*Capoeta* sp.1	*C. umbla*
n	61	20	84	25	98	87	24	17	51	18	21	28	24	15	28	19	21
C. damascina from Damascus basin	x	2.13E-01	4.97E-01	2.44E-01	6.97E-06	4.17E-03	4.50E-01	8.86E-01	3.69E-01	5.25E-01	8.55E-01	1.61E-01	9.96E-01	4.36E-01	4.41E-02	8.12E-01	2.44E-02
N. Quwayq		x	3.48E-01	7.02E-01	7.73E-01	9.12E-01	5.92E-01	4.14E-01	5.76E-01	3.65E-01	2.04E-01	7.35E-01	3.18E-01	1.39E-01	9.73E-01	3.25E-01	3.46E-01
Orontes R. drainage			x	3.53E-01	5.22E-05	1.88E-02	6.73E-01	7.93E-01	6.09E-01	8.27E-01	7.48E-01	3.42E-01	6.59E-01	3.64E-01	1.20E-01	8.80E-01	5.07E-02
Litani R. drainage				x	8.58E-01	6.89E-01	4.23E-01	2.52E-01	4.51E-01	2.26E-01	1.62E-01	4.28E-01	3.11E-01	8.70E-02	6.82E-01	2.61E-01	6.50E-01
Jordan R. drainage basin					x	1.89E-01	2.64E-01	3.52E-01	1.68E-01	8.26E-02	3.10E-03	4.03E-01	4.39E-03	1.12E-01	5.49E-03	1.99E-01	3.53E-01
Rivers in the Dead Sea Valley						x	5.70E-01	5.03E-01	4.81E-01	3.14E-01	5.73E-02	8.19E-01	6.06E-02	5.94E-01	3.44E-01	6.11E-01	2.32E-01
Seyhan N. drainage							x	6.27E-01	9.98E-01	7.96E-01	4.96E-01	6.77E-01	5.52E-01	4.22E-01	2.22E-01	8.33E-01	1.40E-01
Arsuz N.								x	6.42E-01	6.32E-01	8.11E-01	3.51E-01	9.04E-01	8.20E-01	7.34E-01	2.93E-01	1.65E-01
N. al-Kabir (N) drainage									x	7.95E-01	4.65E-01	6.82E-01	4.72E-01	2.53E-01	4.66E-01	5.92E-01	1.17E-01
N. Sanawbar										x	5.50E-01	3.17E-01	6.27E-01	1.97E-01	2.68E-01	7.28E-01	5.39E-02
N. Marqiyah											x	1.11E-01	8.99E-01	3.20E-01	7.92E-02	9.21E-01	2.45E-02
N. Antelias												x	2.49E-01	5.90E-02	7.17E-01	2.60E-01	1.16E-01
Tigris-Euphrates													x	7.78E-01	6.23E-01	4.47E-01	7.09E-02
C. saadii from R. Mand drainage														x	1.14E-01	3.94E-01	3.99E-02
R. Kor basin															x	1.89E-01	2.62E-01
Capoeta sp.1																x	6.16E-02
C. umbla																	x

Table A41. P-values obtained from pairwise comparisons of regression line intercepts (b) for the preanal length between populations and species (significant differences highlighted in yellow, Bonferroni-corrected significance level: 0.000184).

	C. damascina from Damascus basin	N. Quwayq	Orontes R. drainage	Litani R. drainage	Jordan R. drainage basin	Rivers in the Dead Sea Valley	Seyhan N. drainage	Arsuz N.	N. al-Kabir (N) drainage	N. Sanawbar	N. Marqiyah	N. Antelias	Tigris-Euphrates	*C. saadii* from R. Mand drainage	R. Kor basin	*Capoeta* sp.1	*C. umbla*
n	61	20	84	25	98	87	24	17	51	18	21	28	24	15	28	19	21
C. damascina from Damascus basin	x	3.23E-02	1.32E-05	7.80E-01	2.11E-11	3.04E-04	5.23E-04	4.02E-02	1.36E-02	3.37E-02	9.79E-07	3.78E-09	1.31E-02	2.87E-01	8.71E-02	5.78E-04	6.94E-02
N. Quwayq		x	6.66E-01	1.40E-02	5.64E-01	6.74E-01	7.82E-01	3.78E-01	2.56E-01	2.73E-01	5.50E-01	1.74E-01	5.50E-01	3.93E-01	3.06E-01	8.91E-01	9.61E-01
Orontes R. drainage			x	2.80E-03	4.05E-03	9.56E-01	7.47E-01	5.17E-01	8.89E-02	3.65E-01	6.44E-02	4.07E-03	6.13E-01	5.48E-01	2.73E-01	5.94E-01	6.79E-01
Litani R. drainage				x	5.64E-06	8.28E-03	1.29E-03	1.80E-02	4.52E-02	1.09E-02	1.75E-06	1.40E-09	3.62E-02	1.63E-01	8.49E-02	1.14E-03	4.22E-02
Jordan R. drainage basin					x	1.47E-02	1.02E-01	2.50E-02	3.00E-05	7.63E-03	9.06E-01	3.61E-01	1.75E-02	1.12E-01	5.49E-03	1.99E-01	6.76E-01
Rivers in the Dead Sea Valley						x	7.47E-01	5.85E-01	1.67E-01	4.46E-01	9.67E-02	1.02E-02	6.84E-01	5.94E-01	3.44E-01	6.11E-01	6.86E-01
Seyhan N. drainage							x	3.65E-01	1.11E-01	2.24E-01	1.45E-01	8.73E-03	5.26E-01	4.22E-01	2.22E-01	8.33E-01	7.79E-01
Arsuz N.								x	6.72E-01	8.48E-01	1.59E-02	2.19E-04	8.65E-01	8.20E-01	7.34E-01	2.93E-01	4.49E-01
N. al-Kabir (N) drainage									x	7.72E-01	1.76E-03	2.53E-05	4.91E-01	9.61E-01	9.84E-01	8.76E-02	3.24E-01
N. Sanawbar										x	2.76E-03	7.99E-06	7.38E-01	8.93E-01	8.22E-01	1.69E-01	3.60E-01
N. Marqiyah											x	2.00E-01	6.89E-02	6.73E-02	1.22E-02	2.49E-01	6.87E-01
N. Antelias												x	5.64E-03	5.37E-03	4.04E-04	2.25E-02	3.24E-01
Tigris-Euphrates													x	7.78E-01	6.23E-01	4.47E-01	5.88E-01
C. saadii from R. Mand drainage														x	9.73E-01	3.69E-01	4.49E-01
R. Kor basin															x	1.84E-01	3.72E-01
Capoeta sp.1																x	8.68E-01
C. umbla																	x

Table A42. P-values obtained from pairwise comparisons of regression line slopes (a) for the head length between populations and species (significant differences highlighted in yellow, Bonferroni-corrected significance level: 0.000184).

	C. damascina from Damascus basin	N. Quwayq	Orontes R. drainage	Litani R. drainage	Jordan R. drainage basin	Rivers in the Dead Sea Valley	Seyhan N. drainage	Arsuz N.	N. al-Kabir (N) drainage	N. Sanawbar	N. Marqiyah	N. Antelias	Tigris-Euphrates	*C. saadii* from R. Mand drainage	R. Kor basin	*Capoeta* sp.1	*C. umbla*
n	63	20	82	25	98	87	24	17	51	18	21	27	24	15	28	19	22
C. damascina from Damascus basin	x	3.05E-01	1.23E-04	2.40E-01	2.50E-05	2.23E-02	1.84E-01	3.65E-01	5.34E-01	3.06E-01	1.27E-01	2.63E-01	1.69E-02	6.36E-01	4.95E-04	1.67E-01	6.13E-01
N. Quwayq		x	6.86E-01	5.54E-01	7.03E-01	8.28E-01	9.95E-01	1.25E-01	4.99E-01	6.57E-01	6.87E-01	6.55E-02	8.37E-01	2.08E-01	2.93E-01	8.86E-01	7.81E-01
Orontes R. drainage			x	7.63E-01	9.22E-01	6.62E-02	6.09E-01	9.43E-02	9.88E-02	2.24E-01	1.38E-01	3.11E-03	6.33E-01	1.19E-01	9.14E-02	3.86E-01	4.92E-01
Litani R. drainage				x	7.48E-01	4.89E-01	4.90E-01	6.07E-02	2.73E-01	2.82E-01	2.74E-01	5.12E-02	5.62E-01	9.90E-02	7.67E-01	4.65E-01	4.90E-01
Jordan R. drainage basin					x	4.59E-02	6.29E-01	9.45E-02	9.93E-02	2.28E-01	1.34E-01	2.78E-03	6.61E-01	1.20E-01	6.58E-02	3.94E-01	4.99E-01
Rivers in the Dead Sea Valley						x	7.75E-01	1.66E-01	4.86E-01	7.92E-01	8.48E-01	2.48E-02	4.17E-01	2.58E-01	8.61E-03	9.10E-01	8.58E-01
Seyhan N. drainage							x	6.94E-02	3.97E-01	5.42E-01	5.68E-01	2.09E-02	7.89E-01	1.18E-01	1.88E-01	8.45E-01	7.37E-01
Arsuz N.								x	1.88E-01	8.86E-02	5.72E-02	6.08E-01	5.08E-02	5.40E-01	1.05E-01	1.27E-01	2.98E-01
N. al-Kabir (N) drainage									x	6.87E-01	5.40E-01	1.09E-01	1.75E-01	3.72E-01	1.92E-02	4.80E-01	8.50E-01
N. Sanawbar										x	8.49E-01	3.27E-02	2.78E-01	1.65E-01	7.02E-02	7.15E-01	9.70E-01
N. Marqiyah											x	9.50E-03	2.31E-01	1.02E-01	3.31E-02	7.61E-01	9.11E-01
N. Antelias												x	2.93E-03	8.36E-01	3.87E-03	3.15E-02	2.59E-01
Tigris-Euphrates													x	7.11E-02	1.14E-01	5.93E-01	6.04E-01
C. saadii from R. Mand drainage														x	9.81E-02	2.03E-01	4.72E-01
R. Kor basin															x	1.13E-01	2.57E-01
Capoeta sp.1																x	8.32E-01
C. umbla																	x

Table A43. P-values obtained from pairwise comparisons of regression line intercepts (b) for the head length between populations and species (significant differences highlighted in yellow, Bonferroni-corrected significance level: 0.000184).

	C. damascina from Damascus basin	N. Quwayq	Orontes R. drainage	Litani R. drainage	Jordan R. drainage basin	Rivers in the Dead Sea Valley	Seyhan N. drainage	Arsuz N.	N. al-Kabir (N) drainage	N. Sanawbar	N. Marqiyah	N. Antelias	Tigris-Euphrates	*C. saadii* from R. Mand drainage	R. Kor basin	*Capoeta* sp.1	*C. umbla*
n	63	20	82	25	98	87	24	17	51	18	21	27	24	15	28	19	22
C. damascina from Damascus basin	x	4.70E-04	1.29E-04	1.01E-03	1.30E-01	9.48E-01	3.70E-02	1.65E-01	3.32E-06	1.23E-03	4.13E-02	1.62E-01	4.39E-01	5.85E-02	4.73E-02	1.65E-02	8.50E-01
N. Quwayq		x	2.99E-02	7.34E-08	2.35E-03	3.90E-04	8.58E-07	5.93E-03	6.42E-09	5.59E-08	1.19E-03	1.19E-05	3.21E-04	1.23E-01	1.13E-03	6.14E-06	3.16E-02
Orontes R. drainage			x	3.98E-08	1.12E-02	4.34E-04	1.38E-06	3.65E-01	1.44E-15	2.80E-08	4.05E-01	6.09E-05	2.75E-02	6.45E-01	4.47E-05	1.24E-06	3.25E-01
Litani R. drainage				x	2.43E-05	9.59E-04	5.99E-02	2.32E-05	7.40E-01	7.69E-01	3.07E-08	3.10E-02	2.17E-05	1.82E-05	5.54E-01	2.84E-01	6.66E-02
Jordan R. drainage basin					x	1.80E-01	1.31E-03	6.03E-01	8.04E-10	2.42E-05	3.41E-01	1.40E-02	7.06E-01	1.76E-01	3.22E-03	5.68E-04	7.90E-01
Rivers in the Dead Sea Valley						x	3.72E-02	1.79E-01	7.53E-06	1.18E-03	5.29E-02	1.55E-01	4.85E-01	5.82E-02	3.92E-02	1.53E-02	8.63E-01
Seyhan N. drainage							x	8.33E-04	5.93E-02	6.64E-02	2.72E-06	5.56E-01	1.92E-03	2.78E-04	6.54E-01	5.41E-01	2.64E-01
Arsuz N.								x	2.03E-06	1.33E-05	7.54E-01	9.62E-03	3.60E-01	2.44E-01	3.20E-02	1.39E-03	6.20E-01
N. al-Kabir (N) drainage									x	9.70E-01	7.63E-10	2.08E-02	7.53E-07	1.48E-05	5.55E-01	3.21E-01	5.86E-02
N. Sanawbar										x	1.92E-09	3.59E-02	1.03E-05	6.70E-06	6.58E-01	3.62E-01	8.04E-02
N. Marqiyah											x	3.18E-04	1.05E-01	1.78E-01	6.38E-03	1.34E-05	4.70E-01
N. Antelias												x	2.63E-02	2.83E-03	4.53E-01	2.98E-01	4.11E-01
Tigris-Euphrates													x	5.22E-02	3.80E-02	1.78E-03	9.02E-01
C. saadii from R. Mand drainage														x	3.05E-02	8.81E-04	2.71E-01
R. Kor basin															x	9.43E-01	3.47E-01
Capoeta sp.1																x	2.20E-01
C. umbla																	x

Table A44. P-values obtained from pairwise comparisons of regression line slopes (a) for the caudal peduncle length between populations and species (significant differences highlighted in yellow, Bonferroni-corrected significance level: 0.000184).

	C. damascina from Damascus basin	N. Quwayq	Orontes R. drainage	Litani R. drainage	Jordan R. drainage basin	Rivers in the Dead Sea Valley	Seyhan N. drainage	Arsuz N.	N. al-Kabir (N) drainage	N. Sanawbar	N. Marqiyah	N. Antelias	Tigris-Euphrates	*C. saadii* from R. Mand drainage	R. Kor basin	*Capoeta* sp.1	*C. umbla*
n	63	20	84	25	98	86	24	17	51	18	21	28	24	15	28	19	22
C. damascina from Damascus basin	x	8.62E-01	9.70E-04	3.68E-02	2.44E-03	6.37E-04	1.93E-01	1.45E-01	6.71E-01	2.33E-01	4.66E-06	6.48E-01	8.93E-03	3.38E-01	2.65E-01	1.62E-02	5.56E-02
N. Quwayq		x	3.24E-01	5.34E-02	4.31E-01	3.10E-01	4.66E-01	2.73E-01	9.25E-01	5.94E-01	3.69E-02	6.44E-01	3.02E-01	5.29E-01	4.73E-01	2.29E-01	1.46E-01
Orontes R. drainage			x	7.36E-03	6.93E-01	5.92E-01	7.73E-01	4.07E-01	1.81E-01	5.07E-01	1.81E-02	3.66E-02	6.77E-01	9.52E-01	2.10E-03	6.62E-01	4.58E-03
Litani R. drainage				x	1.95E-02	1.67E-02	2.61E-03	1.65E-02	3.55E-02	5.86E-03	2.07E-04	2.97E-02	7.70E-03	2.05E-02	9.85E-02	1.24E-03	5.90E-01
Jordan R. drainage basin					x	3.48E-01	9.10E-01	4.18E-01	2.77E-01	6.67E-01	1.42E-02	8.18E-02	5.31E-01	8.91E-01	6.86E-03	5.57E-01	1.19E-02
Rivers in the Dead Sea Valley						x	6.44E-01	5.29E-01	1.48E-01	4.12E-01	9.27E-02	4.38E-02	9.75E-01	9.41E-01	3.12E-03	9.24E-01	9.06E-03
Seyhan N. drainage							x	3.32E-01	4.56E-01	7.72E-01	4.39E-02	8.55E-02	6.01E-01	8.13E-01	5.32E-02	4.84E-01	1.51E-02
Arsuz N.								x	2.25E-01	3.11E-01	8.16E-01	9.79E-02	5.32E-01	5.59E-01	1.06E-01	4.92E-01	5.63E-02
N. al-Kabir (N) drainage									x	5.76E-01	5.87E-03	4.92E-01	1.65E-01	5.06E-01	2.59E-01	1.51E-01	6.20E-02
N. Sanawbar										x	1.38E-02	1.33E-01	4.02E-01	7.03E-01	7.00E-02	2.98E-01	2.52E-02
N. Marqiyah											x	1.25E-04	1.38E-01	4.05E-01	2.52E-05	1.32E-01	5.00E-04
N. Antelias												x	3.22E-02	2.16E-01	6.62E-01	1.17E-02	1.19E-01
Tigris-Euphrates													x	9.30E-01	7.47E-03	9.46E-01	1.11E-02
C. saadii from R. Mand drainage														x	1.93E-01	8.87E-01	7.69E-02
R. Kor basin															x	5.49E-03	2.27E-01
Capoeta sp.1																x	5.41E-03
C. umbla																	x

Table A45. P-values obtained from pairwise comparisons of regression line intercepts (b) for the caudal peduncle length between populations and species (significant differences highlighted in yellow, Bonferroni-corrected significance level: 0.000184).

	C. damascina from Damascus basin	N. Quwayq	Orontes R. drainage	Litani R. drainage	Jordan R. drainage basin	Rivers in the Dead Sea Valley	Seyhan N. drainage	Arsuz N.	N. al-Kabir (N) drainage	N. Sanawbar	N. Marqiyah	N. Antelias	Tigris-Euphrates	*C. saadii* from R. Mand drainage	R. Kor basin	*Capoeta* sp.1	*C. umbla*
n	63	20	84	25	98	86	24	17	51	18	21	28	24	15	28	19	22
C. damascina from Damascus basin	x	5.68E-02	1.68E-11	4.98E-01	1.63E-06	3.10E-02	2.10E-06	2.91E-02	3.88E-08	1.10E-03	3.26E-04	9.35E-09	4.92E-05	3.42E-03	1.68E-01	1.68E-07	2.84E-02
N. Quwayq		x	4.99E-01	1.37E-01	9.67E-01	4.55E-01	5.97E-01	7.24E-01	6.78E-01	9.49E-01	9.87E-01	1.84E-01	7.90E-01	4.52E-01	3.27E-01	2.95E-01	6.48E-01
Orontes R. drainage			x	2.54E-04	8.47E-02	3.85E-04	6.83E-01	8.48E-02	5.01E-01	1.80E-01	1.73E-01	2.68E-01	4.69E-01	6.86E-01	2.45E-03	4.80E-01	9.49E-01
Litani R. drainage				x	1.91E-02	3.95E-01	3.28E-04	1.82E-01	1.49E-03	1.80E-02	1.30E-02	5.16E-06	1.02E-02	1.22E-02	5.51E-01	5.02E-05	7.12E-02
Jordan R. drainage basin					x	4.38E-02	4.24E-01	4.92E-01	3.74E-01	8.58E-01	9.12E-01	4.03E-02	6.44E-01	3.60E-01	7.58E-02	9.46E-02	5.96E-01
Rivers in the Dead Sea Valley						x	2.57E-02	5.77E-01	8.03E-03	2.34E-01	1.74E-01	1.13E-03	6.11E-02	1.05E-01	7.73E-01	4.08E-03	2.46E-01
Seyhan N. drainage							x	1.79E-01	9.01E-01	2.71E-01	3.06E-01	9.97E-02	7.64E-01	5.01E-01	1.01E-02	2.36E-01	8.12E-01
Arsuz N.								x	2.06E-01	6.29E-01	5.70E-01	1.96E-02	3.74E-01	2.45E-01	4.46E-01	5.64E-02	4.30E-01
N. al-Kabir (N) drainage									x	3.90E-01	4.06E-01	1.15E-01	8.36E-01	5.17E-01	1.29E-02	2.47E-01	7.87E-01
N. Sanawbar										x	9.32E-01	1.55E-02	5.82E-01	2.61E-01	1.33E-01	5.01E-02	5.18E-01
N. Marqiyah											x	1.71E-02	6.12E-01	2.77E-01	1.02E-01	5.50E-02	5.37E-01
N. Antelias												x	1.26E-01	8.66E-01	3.49E-04	7.01E-01	6.73E-01
Tigris-Euphrates													x	5.11E-01	5.58E-02	2.57E-01	7.50E-01
C. saadii from R. Mand drainage														x	5.77E-02	9.68E-01	8.43E-01
R. Kor basin															x	1.89E-03	1.72E-01
Capoeta sp.1																x	8.13E-01
C. umbla																	x

Table A46. P-values obtained from pairwise comparisons of regression line slopes (a) for the body depth between populations and species (significant differences highlighted in yellow, Bonferroni-corrected significance level: 0.000275).

	C. damascina from Damascus basin	Orontes R. drainage	Litani R. drainage	Jordan R. drainage basin	Rivers in the Dead Sea Valley	Seyhan N. drainage	N. al-Kabir (N) drainage	N. Sanawbar	N. Marqiyah	N. Antelias	Tigris-Euphrates	*C. saadii* from R. Mand drainage	R. Kor basin	*Capoeta* sp.1
n	33	57	25	83	80	20	51	18	21	28	19	15	16	18
C. damascina from Damascus basin	x	3.05E-01	3.45E-01	9.17E-02	7.87E-01	2.44E-01	9.65E-01	8.42E-01	3.69E-01	5.39E-01	2.15E-01	4.94E-01	5.75E-01	2.25E-01
Orontes R. drainage		x	1.72E-01	2.18E-04	2.11E-01	5.74E-01	3.76E-01	4.96E-01	9.55E-01	1.36E-01	4.99E-01	7.45E-01	9.69E-01	5.37E-01
Litani R. drainage			x	6.57E-01	2.27E-01	3.74E-02	2.33E-01	1.62E-01	9.84E-02	4.36E-01	1.76E-01	1.50E-01	2.35E-01	6.69E-02
Jordan R. drainage basin				x	1.14E-03	1.89E-02	1.37E-01	1.04E-01	2.96E-03	5.96E-01	1.64E-03	1.57E-01	1.02E-01	9.26E-03
Rivers in the Dead Sea Valley					x	1.97E-01	8.59E-01	9.73E-01	3.09E-01	3.18E-01	9.96E-02	4.49E-01	5.47E-01	1.54E-01
Seyhan N. drainage						x	1.76E-01	1.37E-01	4.29E-01	4.83E-02	9.93E-01	9.92E-01	7.11E-01	9.90E-01
N. al- Kabir (N) drainage							x	8.56E-01	3.64E-01	4.66E-01	2.04E-01	4.07E-01	5.34E-01	1.71E-01
N. Sanawbar								x	4.30E-01	3.45E-01	3.22E-01	4.57E-01	6.45E-01	1.91E-01
N. Marqiyah									x	1.03E-01	5.26E-01	6.92E-01	9.45E-01	4.50E-01
N. Antelias										x	1.10E-01	2.42E-01	3.06E-01	5.97E-02
Tigris-Euphrates											x	9.98E-01	7.62E-01	9.86E-01
C. saadii from R. Mand drainage												x	8.25E-01	9.87E-01
R. Kor basin													x	7.19E-01
Capoeta sp.1														x

Table A47. P-values obtained from pairwise comparisons of regression line intercepts (b) for the body depth between populations and species (significant differences highlighted in yellow, Bonferroni-corrected significance level: 0.000275).

	C. damascina from Damascus basin	Orontes R. drainage	Litani R. drainage	Jordan R. drainage basin	Rivers in the Dead Sea Valley	Seyhan N. drainage	N. al-Kabir (N) drainage	N. Sanawbar	N. Marqiyah	N. Antelias	Tigris-Euphrates	*C. saadii* from R. Mand drainage	R. Kor basin	*Capoeta* sp.1
n	33	57	25	83	80	20	51	18	21	28	19	15	16	18
C. damascina from Damascus basin	x	3.29E-02	5.50E-02	9.62E-01	3.14E-02	1.28E-01	1.12E-01	3.38E-01	7.38E-04	6.43E-01	2.07E-02	1.12E-01	1.17E-02	1.25E-02
Orontes R. drainage		x	8.13E-01	6.41E-03	8.74E-01	6.53E-01	3.72E-07	1.02E-03	3.89E-02	8.59E-02	2.43E-01	5.25E-01	8.89E-02	3.10E-01
Litani R. drainage			x	3.08E-02	7.08E-01	4.47E-01	2.12E-05	3.96E-04	8.37E-02	6.69E-02	4.54E-01	5.92E-01	1.52E-01	4.59E-01
Jordan R. drainage basin				x	9.37E-03	8.97E-02	4.06E-02	2.47E-01	5.65E-05	6.22E-01	2.86E-03	7.70E-02	2.56E-03	3.04E-03
Rivers in the Dead Sea Valley					x	7.25E-01	4.37E-07	5.60E-04	1.90E-02	8.81E-02	1.68E-01	4.37E-01	4.92E-02	2.22E-01
Seyhan N. drainage						x	5.63E-05	3.19E-04	4.86E-03	1.69E-01	1.97E-01	2.97E-01	5.22E-02	1.04E-01
N. al- Kabir (N) drainage							x	7.14E-01	2.24E-10	1.45E-02	5.25E-06	2.10E-03	1.19E-05	2.85E-07
N. Sanawbar								x	3.16E-07	7.28E-02	2.13E-03	7.91E-03	8.04E-04	4.19E-05
N. Marqiyah									x	3.44E-04	6.59E-01	6.38E-01	6.50E-01	3.38E-01
N. Antelias										x	3.15E-02	1.04E-01	1.04E-02	1.09E-02
Tigris-Euphrates											x	9.43E-01	5.50E-01	8.30E-01
C. saadii from R. Mand drainage												x	5.59E-01	9.38E-01
R. Kor basin													x	3.48E-01
Capoeta sp.1														x

Table A48. P-values obtained from pairwise comparisons of regression line slopes (a) for the caudal peduncle depth between populations and species (significant differences highlighted in yellow, Bonferroni-corrected significance level: 0.000184).

	C. damascina from Damascus basin	N. Quwayq	Orontes R. drainage	Litani R. drainage	Jordan R. drainage basin	Rivers in the Dead Sea Valley	Seyhan N. drainage	Arsuz N.	N. al-Kabir (N) drainage	N. Sanawbar	N. Marqiyah	N. Antelias	Tigris-Euphrates	*C. saadii* from R. Mand drainage	R. Kor basin	*Capoeta* sp.1	*C. umbla*
n	63	20	79	25	98	87	24	17	51	18	21	28	23	15	28	19	22
C. damascina from Damascus basin	x	3.70E-01	7.03E-04	1.15E-02	5.72E-05	1.25E-01	9.94E-01	5.48E-01	4.17E-02	5.81E-01	5.45E-04	1.29E-02	3.07E-01	8.98E-01	4.33E-01	1.12E-02	7.11E-01
N. Quwayq		x	6.63E-01	3.30E-03	6.48E-01	8.56E-01	5.06E-01	2.67E-01	6.54E-01	5.29E-01	2.83E-01	3.19E-01	9.22E-01	4.31E-01	8.00E-01	4.49E-01	9.05E-01
Orontes R. drainage			x	3.48E-03	8.81E-01	8.84E-02	1.59E-01	2.44E-01	9.45E-01	1.67E-01	4.89E-01	6.01E-01	3.78E-01	3.10E-01	2.50E-01	6.35E-01	6.32E-01
Litani R. drainage				x	9.22E-04	1.99E-02	3.33E-02	1.60E-01	5.69E-04	2.23E-03	1.05E-04	1.34E-04	4.93E-02	3.12E-02	2.80E-02	1.49E-03	1.34E-01
Jordan R. drainage basin					x	4.95E-02	1.15E-01	1.86E-01	9.98E-01	1.17E-01	3.44E-01	4.96E-01	3.35E-01	2.52E-01	2.03E-01	5.23E-01	6.09E-01
Rivers in the Dead Sea Valley						x	5.38E-01	4.54E-01	3.94E-01	7.12E-01	7.56E-02	2.08E-01	9.27E-01	6.25E-01	8.79E-01	1.90E-01	9.69E-01
Seyhan N. drainage							x	6.13E-01	1.83E-01	7.30E-01	5.88E-02	8.76E-02	6.14E-01	9.16E-01	6.75E-01	1.39E-01	8.04E-01
Arsuz N.								x	1.55E-01	3.33E-01	6.51E-02	6.91E-02	5.30E-01	6.31E-01	5.03E-01	1.60E-01	6.49E-01
N. al-Kabir (N) drainage									x	1.76E-01	4.91E-01	5.39E-01	5.44E-01	2.31E-01	3.83E-01	6.18E-01	6.74E-01
N. Sanawbar										x	8.36E-03	2.92E-02	7.44E-01	6.17E-01	8.51E-01	8.43E-02	9.11E-01
N. Marqiyah											x	9.43E-01	2.75E-01	7.16E-02	1.42E-01	9.61E-01	5.49E-01
N. Antelias												x	3.58E-01	8.66E-02	2.16E-01	9.27E-01	5.48E-01
Tigris-Euphrates													x	6.78E-01	8.72E-01	4.05E-01	9.55E-01
C. saadii from R. Mand drainage														x	6.96E-01	1.94E-01	8.02E-01
R. Kor basin															x	2.60E-01	9.82E-01
Capoeta sp.1																x	6.09E-01
C. umbla																	x

Table A49. P-values obtained from pairwise comparisons of regression line intercepts (b) for the caudal peduncle depth between populations and species (significant differences highlighted in yellow, Bonferroni-corrected significance level: 0.000184).

	C. damascina from Damascus basin	N. Quwayq	Orontes R. drainage	Litani R. drainage	Jordan R. drainage basin	Rivers in the Dead Sea Valley	Seyhan N. drainage	Arsuz N.	N. al-Kabir (N) drainage	N. Sanawbar	N. Marqiyah	N. Antelias	Tigris-Euphrates	*C. saadii* from R. Mand drainage	R. Kor basin	*Capoeta* sp.1	*C. umbla*
n	63	20	79	25	98	87	24	17	51	18	21	28	23	15	28	19	22
C. damascina from Damascus basin	x	6.08E-01	4.53E-03	2.51E-04	6.64E-01	4.12E-05	5.88E-01	1.41E-01	3.39E-02	7.97E-04	9.03E-03	1.66E-05	2.16E-02	8.48E-02	2.18E-08	2.50E-01	5.89E-06
N. Quwayq		x	1.39E-01	5.29E-03	7.25E-01	4.25E-02	4.76E-01	1.40E-01	1.27E-01	8.00E-02	2.89E-01	2.58E-02	1.92E-01	5.25E-02	1.09E-03	8.72E-01	1.62E-03
Orontes R. drainage			x	8.95E-02	5.29E-04	6.22E-02	1.62E-01	7.61E-01	4.10E-01	4.16E-06	3.19E-05	3.00E-08	5.63E-01	6.14E-01	5.47E-05	5.09E-03	1.20E-04
Litani R. drainage				x	5.97E-05	7.70E-01	1.12E-02	6.38E-02	7.96E-03	2.19E-08	1.86E-07	3.31E-10	4.55E-01	5.52E-01	5.07E-02	2.24E-04	9.41E-03
Jordan R. drainage basin					x	2.20E-06	3.88E-01	7.88E-02	8.93E-03	1.62E-03	1.82E-02	3.62E-05	5.59E-03	5.74E-02	4.06E-10	3.61E-01	3.74E-07
Rivers in the Dead Sea Valley						x	1.34E-02	1.69E-01	1.33E-02	4.87E-07	2.22E-06	3.98E-09	4.95E-01	7.83E-01	1.20E-02	3.55E-04	1.70E-03
Seyhan N. drainage							x	4.34E-01	3.37E-01	2.62E-03	1.45E-02	1.45E-04	2.10E-01	2.28E-01	1.17E-04	2.18E-01	8.90E-04
Arsuz N.								x	8.29E-01	3.71E-05	4.07E-04	1.82E-06	5.83E-01	4.24E-01	2.14E-03	4.45E-02	3.44E-03
N. al-Kabir (N) drainage									x	3.30E-07	8.19E-06	1.65E-09	2.71E-01	2.95E-01	2.43E-06	6.91E-03	4.14E-05
N. Sanawbar										x	2.30E-01	3.57E-01	1.14E-03	6.89E-05	1.77E-08	5.99E-02	3.39E-05
N. Marqiyah											x	3.91E-02	2.72E-03	5.48E-04	2.94E-08	2.68E-01	3.77E-05
N. Antelias												x	5.50E-05	1.18E-05	1.02E-10	8.30E-03	1.90E-06
Tigris-Euphrates													x	9.14E-01	2.30E-02	3.71E-02	1.36E-02
C. saadii from R. Mand drainage														x	8.85E-02	3.42E-02	2.54E-02
R. Kor basin															x	6.41E-06	1.07E-01
Capoeta sp.1																x	3.54E-04
C. umbla																	x

Table A50. P-values obtained from pairwise comparisons of regression line slopes (a) for the dorsal-fin base length between populations and species (significant differences highlighted in yellow, Bonferroni-corrected significance level: 0.000184).

	C. damascina from Damascus basin	N. Quwayq	Orontes R. drainage	Litani R. drainage	Jordan R. drainage basin	Rivers in the Dead Sea Valley	Seyhan N. drainage	Arsuz N.	N. al-Kabir (N) drainage	N. Sanawbar	N. Marqiyah	N. Antelias	Tigris-Euphrates	*C. saadii* from R. Mand drainage	R. Kor basin	*Capoeta* sp.1	*C. umbla*
n	62	20	83	25	98	87	24	17	51	17	20	28	24	15	28	19	22
C. damascina from Damascus basin	x	4.61E-01	7.51E-01	1.79E-01	3.21E-02	7.83E-01	6.27E-03	5.86E-01	9.21E-02	3.58E-01	6.31E-01	1.66E-01	1.74E-02	6.56E-01	9.83E-02	7.85E-01	7.98E-01
N. Quwayq		x	4.41E-01	8.17E-02	1.21E-01	3.35E-01	8.61E-02	8.69E-01	7.20E-01	8.83E-01	4.81E-01	7.72E-01	5.54E-01	9.01E-01	7.82E-01	5.95E-01	3.98E-01
Orontes R. drainage			x	9.48E-02	2.59E-03	4.78E-01	1.49E-03	5.53E-01	7.35E-02	3.42E-01	7.37E-01	1.32E-01	6.80E-03	6.54E-01	7.18E-02	8.88E-01	6.74E-01
Litani R. drainage				x	3.02E-01	1.40E-01	2.64E-03	1.35E-01	2.04E-02	5.27E-02	6.72E-02	1.59E-02	1.86E-02	1.21E-01	6.66E-02	1.59E-01	2.64E-01
Jordan R. drainage basin					x	2.61E-02	9.95E-05	3.25E-01	2.54E-03	3.17E-02	3.16E-02	1.02E-02	2.28E-05	2.96E-01	1.75E-03	1.38E-01	7.05E-01
Rivers in the Dead Sea Valley						x	9.75E-04	4.92E-01	3.78E-02	2.13E-01	4.24E-01	7.89E-02	2.44E-03	5.48E-01	3.53E-02	6.26E-01	8.41E-01
Seyhan N. drainage							x	3.53E-01	9.56E-02	4.79E-03	6.44E-05	1.28E-02	8.50E-02	7.45E-02	1.81E-01	1.24E-02	1.05E-02
Arsuz N.								x	9.79E-01	7.64E-01	5.18E-01	9.58E-01	8.83E-01	7.97E-01	9.87E-01	6.43E-01	4.55E-01
N. al-Kabir (N) drainage									x	4.84E-01	1.13E-01	8.72E-01	7.60E-01	6.55E-01	9.93E-01	2.12E-01	1.65E-01
N. Sanawbar										x	3.54E-01	4.64E-01	2.41E-01	9.72E-01	5.86E-01	5.53E-01	3.37E-01
N. Marqiyah											x	6.25E-02	1.43E-02	6.63E-01	1.95E-01	9.26E-01	5.30E-01
N. Antelias												x	5.77E-01	6.39E-01	9.02E-01	2.53E-01	1.43E-01
Tigris-Euphrates													x	5.14E-01	7.89E-01	1.07E-01	1.07E-01
C. saadii from R. Mand drainage														x	7.42E-01	7.54E-01	5.15E-01
R. Kor basin															x	3.07E-01	2.75E-01
Capoeta sp.1																x	6.88E-01
C. umbla																	x

Table A51. P-values obtained from pairwise comparisons of regression line intercepts (b) for the dorsal-fin base length between populations and species (significant differences highlighted in yellow, Bonferroni-corrected significance level: 0.000184).

	C. damascina from Damascus basin	N. Quwayq	Orontes R. drainage	Litani R. drainage	Jordan R. drainage basin	Rivers in the Dead Sea Valley	Seyhan N. drainage	Arsuz N.	N. al-Kabir (N) drainage	N. Sanawbar	N. Marqiyah	N. Antelias	Tigris-Euphrates	*C. saadii* from R. Mand drainage	R. Kor basin	*Capoeta* sp.1	*C. umbla*
n	62	20	83	25	98	87	24	17	51	17	20	28	24	15	28	19	22
C. damascina from Damascus basin	x	7.78E-01	2.20E-04	9.85E-01	3.92E-16	1.17E-12	2.13E-01	3.71E-02	1.42E-11	1.11E-03	7.12E-07	3.36E-01	1.01E-01	3.56E-01	3.96E-01	9.33E-03	4.45E-01
N. Quwayq		x	2.33E-01	7.71E-01	1.61E-03	2.01E-03	6.30E-01	2.31E-01	1.33E-03	3.46E-02	1.16E-03	7.53E-01	4.97E-01	5.32E-01	4.53E-01	2.10E-01	6.16E-01
Orontes R. drainage			x	1.60E-02	5.02E-10	2.78E-07	9.44E-02	8.77E-01	1.75E-06	1.28E-01	3.56E-04	5.85E-02	2.61E-01	6.83E-01	7.16E-04	5.40E-01	7.11E-01
Litani R. drainage				x	1.05E-07	4.64E-07	2.61E-01	6.41E-02	5.57E-07	3.61E-03	1.93E-05	3.59E-01	1.70E-01	3.43E-01	5.13E-01	4.03E-02	4.35E-01
Jordan R. drainage basin					x	5.66E-01	3.34E-08	1.24E-03	1.40E-01	1.86E-02	3.32E-01	3.35E-08	3.06E-07	1.33E-02	6.08E-10	1.50E-03	3.24E-02
Rivers in the Dead Sea Valley						x	2.24E-07	3.02E-03	4.11E-01	4.20E-02	5.83E-01	1.60E-07	2.42E-06	1.68E-02	5.01E-09	5.11E-03	3.93E-02
Seyhan N. drainage							x	9.75E-02	2.95E-08	3.66E-04	1.57E-08	6.74E-01	5.69E-01	5.87E-01	5.91E-02	7.04E-02	7.22E-01
Arsuz N.								x	3.39E-03	2.30E-01	3.71E-03	4.91E-02	3.11E-01	6.16E-01	1.77E-02	7.62E-01	6.70E-01
N. al-Kabir (N) drainage									x	6.53E-02	9.27E-01	1.24E-08	1.41E-06	1.31E-02	1.26E-08	1.09E-02	3.93E-02
N. Sanawbar										x	3.77E-02	8.33E-05	1.19E-02	1.38E-01	8.17E-04	4.93E-01	2.52E-01
N. Marqiyah											x	1.78E-09	9.58E-06	5.76E-03	3.67E-06	3.00E-02	3.46E-02
N. Antelias												x	3.67E-01	4.36E-01	8.84E-02	3.94E-02	6.02E-01
Tigris-Euphrates													x	8.75E-01	3.66E-02	1.95E-01	9.27E-01
C. saadii from R. Mand drainage														x	1.80E-01	5.31E-01	9.80E-01
R. Kor basin															x	9.03E-03	2.54E-01
Capoeta sp.1																x	5.79E-01
C. umbla																	x

Table A52. P-values obtained from pairwise comparisons of regression line slopes (a) for the anal-fin base length between populations and species (significant differences highlighted in yellow, Bonferroni-corrected significance level: 0.000184).

	C. damascina from Damascus basin	N. Quwayq	Orontes R. drainage	Litani R. drainage	Jordan R. drainage basin	Rivers in the Dead Sea Valley	Seyhan N. drainage	Arsuz N.	N. al-Kabir (N) drainage	N. Sanawbar	N. Marqiyah	N. Antelias	Tigris-Euphrates	*C. saadii* from R. Mand drainage	R. Kor basin	*Capoeta* sp.1	*C. umbla*
n	63	20	82	25	97	87	24	17	51	18	20	28	23	15	28	19	22
C. damascina from Damascus basin	x	7.41E-01	7.60E-06	2.69E-01	6.33E-10	8.82E-06	4.00E-01	9.69E-02	9.83E-01	1.47E-02	8.23E-03	7.87E-01	4.66E-01	9.43E-01	2.55E-01	9.86E-01	1.52E-01
N. Quwayq		x	1.74E-01	3.86E-01	6.49E-02	1.85E-01	2.69E-01	6.09E-02	6.80E-01	1.74E-01	2.26E-01	5.75E-01	9.68E-01	8.96E-01	7.41E-01	7.05E-01	3.28E-01
Orontes R. drainage			x	8.49E-01	1.29E-01	9.24E-01	1.52E-03	6.54E-03	4.11E-03	9.83E-01	5.12E-01	6.68E-03	8.11E-03	2.55E-01	7.78E-02	4.54E-03	9.72E-01
Litani R. drainage				x	9.45E-01	8.70E-01	6.78E-02	2.61E-02	1.59E-01	8.46E-01	6.66E-01	1.57E-01	3.07E-01	4.35E-01	4.41E-01	2.01E-01	8.84E-01
Jordan R. drainage basin					x	1.70E-01	1.32E-04	2.64E-03	2.30E-04	4.83E-01	9.27E-02	6.38E-04	2.12E-04	1.36E-01	8.03E-03	2.31E-04	7.14E-01
Rivers in the Dead Sea Valley						x	2.37E-03	9.31E-03	5.34E-03	9.78E-01	4.93E-01	8.77E-03	9.82E-03	2.66E-01	8.18E-02	6.05E-03	9.96E-01
Seyhan N. drainage							x	4.41E-02	2.96E-01	1.54E-04	5.24E-05	4.67E-01	7.67E-02	5.76E-01	5.88E-02	2.52E-01	1.82E-02
Arsuz N.								x	2.28E-02	1.71E-03	9.76E-04	4.26E-02	2.16E-02	1.84E-01	2.51E-02	3.22E-02	1.18E-02
N. al-Kabir (N) drainage									x	5.63E-03	6.37E-03	7.73E-01	4.67E-01	9.23E-01	2.63E-01	9.98E-01	7.62E-02
N. Sanawbar										x	5.08E-01	5.64E-03	2.88E-02	2.97E-01	1.52E-01	6.40E-03	9.81E-01
N. Marqiyah											x	5.07E-03	3.00E-02	3.49E-01	2.18E-01	4.53E-03	7.14E-01
N. Antelias												x	3.48E-01	8.30E-01	2.19E-01	7.69E-01	7.49E-02
Tigris-Euphrates													x	8.46E-01	6.12E-01	4.73E-01	2.03E-01
C. saadii from R. Mand drainage														x	7.02E-01	9.36E-01	4.02E-01
R. Kor basin															x	2.89E-01	3.72E-01
Capoeta sp.1																x	1.02E-01
C. umbla																	x

Table A53. P-values obtained from pairwise comparisons of regression line intercepts (b) for the anal-fin base length between populations and species (significant differences highlighted in yellow, Bonferroni-corrected significance level: 0.000184).

	C. damascina from Damascus basin	N. Quwayq	Orontes R. drainage	Litani R. drainage	Jordan R. drainage basin	Rivers in the Dead Sea Valley	Seyhan N. drainage	Arsuz N.	N. al-Kabir (N) drainage	N. Sanawbar	N. Marqiyah	N. Antelias	Tigris-Euphrates	*C. saadii* from R. Mand drainage	R. Kor basin	*Capoeta* sp.1	*C. umbla*
n	63	20	82	25	97	87	24	17	51	18	20	28	23	15	28	19	22
C. damascina from Damascus basin	x	7.19E-01	8.56E-01	5.37E-01	3.73E-08	1.78E-08	1.79E-02	7.34E-03	4.90E-01	4.39E-01	3.47E-05	1.93E-02	6.31E-01	5.76E-01	1.82E-01	3.54E-02	5.25E-01
N. Quwayq		x	6.44E-01	9.84E-01	7.22E-02	3.54E-02	2.92E-01	1.61E-01	8.73E-01	3.68E-01	2.36E-02	3.01E-01	4.98E-01	8.68E-01	6.73E-01	3.72E-01	7.76E-01
Orontes R. drainage			x	4.28E-01	4.14E-10	2.97E-10	5.86E-03	2.13E-03	3.35E-01	4.63E-01	2.54E-06	6.91E-03	6.94E-01	4.96E-01	1.13E-01	1.39E-02	4.53E-01
Litani R. drainage				x	4.05E-03	1.09E-03	1.48E-01	5.98E-02	7.70E-01	1.97E-01	2.01E-03	1.52E-01	3.06E-01	8.49E-01	5.67E-01	2.17E-01	7.53E-01
Jordan R. drainage basin					x	2.25E-01	4.87E-02	6.06E-01	1.67E-07	3.72E-06	5.90E-01	1.05E-01	1.85E-06	1.53E-01	2.01E-02	7.56E-02	2.36E-01
Rivers in the Dead Sea Valley						x	8.85E-03	2.37E-01	3.65E-08	1.55E-06	6.95E-01	2.34E-02	6.90E-07	8.21E-02	4.81E-03	1.75E-02	1.37E-01
Seyhan N. drainage							x	1.92E-01	5.97E-03	1.18E-04	1.15E-03	8.15E-01	8.75E-04	5.62E-01	4.56E-01	9.94E-01	6.33E-01
Arsuz N.								x	1.30E-03	4.01E-04	2.69E-01	3.68E-01	1.04E-03	3.52E-01	1.57E-01	2.93E-01	3.63E-01
N. al-Kabir (N) drainage									x	8.37E-02	2.20E-07	9.57E-03	1.87E-01	6.63E-01	2.33E-01	1.87E-02	5.59E-01
N. Sanawbar										x	2.04E-07	9.01E-04	6.92E-01	3.43E-01	4.57E-02	1.91E-03	2.37E-01
N. Marqiyah											x	1.91E-02	1.02E-06	1.11E-01	8.61E-03	1.04E-02	1.04E-01
N. Antelias												x	2.65E-03	5.35E-01	4.14E-01	8.42E-01	6.06E-01
Tigris-Euphrates													x	4.27E-01	7.89E-02	5.73E-03	3.30E-01
C. saadii from R. Mand drainage														x	8.85E-01	6.21E-01	9.33E-01
R. Kor basin															x	5.26E-01	9.76E-01
Capoeta sp.1																x	6.84E-01
C. umbla																	x

Table A54. P-values obtained from pairwise comparisons of regression line slopes (a) for the longest dorsal-fin ray length between populations and species (significant differences highlighted in yellow, Bonferroni-corrected significance level: 0.000184).

	C. damascina from Damascus basin	N. Quwayq	Orontes R. drainage	Litani R. drainage	Jordan R. drainage basin	Rivers in the Dead Sea Valley	Seyhan N. drainage	Arsuz N.	N. al-Kabir (N) drainage	N. Sanawbar	N. Marqiyah	N. Antelias	Tigris-Euphrates	*C. saadii* from R. Mand drainage	R. Kor basin	*Capoeta* sp.1	*C. umbla*
n	56	18	73	25	81	78	24	15	49	18	18	28	23	15	24	19	20
C. damascina from Damascus basin	x	9.96E-01	8.67E-05	7.05E-01	1.25E-04	5.66E-02	9.52E-03	8.31E-01	6.84E-01	1.58E-01	3.66E-01	6.03E-01	4.66E-03	9.36E-01	6.24E-02	1.30E-01	5.08E-01
N. Quwayq		x	1.98E-01	7.58E-01	2.52E-01	5.41E-01	1.64E-01	8.43E-01	8.18E-01	4.26E-01	5.95E-01	7.50E-01	1.83E-01	9.47E-01	3.46E-01	4.71E-01	6.63E-01
Orontes R. drainage			x	2.25E-01	5.39E-01	2.01E-02	4.38E-01	6.94E-01	4.91E-02	5.98E-04	4.30E-03	1.04E-02	5.63E-01	2.79E-01	3.25E-01	3.53E-01	5.65E-01
Litani R. drainage				x	2.67E-01	4.47E-01	1.63E-01	6.45E-01	5.62E-01	8.55E-01	9.84E-01	8.29E-01	1.34E-01	6.63E-01	2.44E-01	3.59E-01	5.12E-01
Jordan R. drainage basin					x	4.16E-02	3.01E-01	7.49E-01	8.52E-02	1.05E-03	7.39E-03	1.84E-02	8.58E-01	3.44E-01	5.03E-01	5.12E-01	6.68E-01
Rivers in the Dead Sea Valley						x	7.67E-02	9.35E-01	4.71E-01	1.87E-02	6.93E-02	1.39E-01	2.34E-01	6.35E-01	6.27E-01	7.22E-01	9.40E-01
Seyhan N. drainage							x	5.56E-01	3.90E-02	4.26E-03	1.10E-02	1.21E-02	2.65E-01	1.90E-01	1.86E-01	2.47E-01	4.07E-01
Arsuz N.								x	9.00E-01	3.08E-01	4.32E-01	5.63E-01	5.94E-01	7.99E-01	7.75E-01	8.51E-01	9.16E-01
N. al-Kabir (N) drainage									x	9.08E-02	2.20E-01	3.86E-01	6.18E-02	8.85E-01	2.31E-01	3.43E-01	6.47E-01
N. Sanawbar										x	4.88E-01	2.43E-01	9.21E-07	1.54E-01	3.49E-04	1.31E-02	1.98E-01
N. Marqiyah											x	5.94E-01	3.69E-05	3.32E-01	3.41E-03	4.28E-02	2.89E-01
N. Antelias												x	4.06E-04	5.70E-01	1.32E-02	7.29E-02	3.47E-01
Tigris-Euphrates													x	1.06E-01	4.84E-01	5.60E-01	6.81E-01
C. saadii from R. Mand drainage														x	3.05E-01	4.88E-01	6.84E-01
R. Kor basin															x	9.47E-01	8.85E-01
Capoeta sp.1																x	9.28E-01
C. umbla																	x

Table A55. P-values obtained from pairwise comparisons of regression line intercepts (b) for the longest dorsal-fin ray length between populations and species (significant differences highlighted in yellow, Bonferroni-corrected significance level: 0.000184).

	C. damascina from Damascus basin	N. Quwayq	Orontes R. drainage	Litani R. drainage	Jordan R. drainage basin	Rivers in the Dead Sea Valley	Seyhan N. drainage	Arsuz N.	N. al-Kabir (N) drainage	N. Sanawbar	N. Marqiyah	N. Antelias	Tigris-Euphrates	*C. saadii* from R. Mand drainage	R. Kor basin	*Capoeta* sp.1	*C. umbla*
n	56	18	73	25	81	78	24	15	49	18	18	28	23	15	24	19	20
C. damascina from Damascus basin	x	7.34E-01	1.35E-09	3.74E-07	2.07E-16	1.28E-01	2.26E-03	4.08E-08	3.06E-12	5.21E-01	1.75E-03	5.16E-14	1.36E-04	3.46E-01	6.91E-01	1.01E-05	6.26E-01
N. Quwayq		x	5.75E-02	1.43E-02	4.04E-03	7.84E-01	3.00E-01	1.39E-03	8.10E-03	9.73E-01	1.72E-01	6.04E-05	1.21E-01	6.93E-01	8.98E-01	7.05E-02	8.80E-01
Orontes R. drainage			x	3.86E-01	4.42E-03	2.50E-05	1.96E-01	4.07E-02	4.86E-01	2.06E-04	1.24E-01	3.47E-03	1.26E-01	9.95E-02	3.44E-04	9.85E-01	1.79E-01
Litani R. drainage				x	3.56E-01	2.11E-04	9.81E-02	1.08E-01	5.75E-01	2.68E-06	7.70E-03	3.72E-02	1.00E-02	7.80E-03	1.48E-05	4.33E-01	8.14E-02
Jordan R. drainage basin					x	1.08E-10	1.65E-03	5.06E-01	2.83E-02	6.95E-08	7.53E-04	3.90E-01	2.73E-04	6.58E-03	2.45E-07	6.15E-02	3.17E-02
Rivers in the Dead Sea Valley						x	6.99E-02	1.83E-05	8.51E-07	5.64E-01	1.02E-01	3.74E-09	3.53E-02	8.63E-01	4.91E-01	2.24E-03	9.85E-01
Seyhan N. drainage							x	1.48E-02	5.37E-02	4.65E-02	8.44E-01	5.46E-04	9.86E-01	4.25E-01	4.61E-02	3.34E-01	5.01E-01
Arsuz N.								x	1.87E-02	2.23E-10	1.91E-06	8.75E-01	8.35E-06	1.72E-05	5.75E-08	3.80E-02	1.88E-02
N. al-Kabir (N) drainage									x	7.53E-08	6.67E-03	1.09E-03	6.81E-03	8.44E-03	6.05E-07	5.98E-01	6.55E-02
N. Sanawbar										x	5.17E-05	1.34E-15	5.41E-05	2.83E-01	8.19E-01	3.19E-04	8.04E-01
N. Marqiyah											x	1.36E-09	6.94E-01	1.15E-01	2.79E-03	1.15E-01	4.32E-01
N. Antelias												x	4.72E-09	2.04E-07	3.69E-12	3.87E-03	3.93E-03
Tigris-Euphrates													x	1.02E-01	9.45E-04	1.40E-01	3.55E-01
C. saadii from R. Mand drainage														x	3.80E-01	7.01E-02	8.99E-01
R. Kor basin															x	6.81E-04	7.56E-01
Capoeta sp.1																x	2.11E-01
C. umbla																	x

Table A56. P-values obtained from pairwise comparisons of regression line slopes (a) for the pectoral-fin length between populations and species (significant differences highlighted in yellow, Bonferroni-corrected significance level: 0.000184).

	C. damascina from Damascus basin	N. Quwayq	Orontes R. drainage	Litani R. drainage	Jordan R. drainage basin	Rivers in the Dead Sea Valley	Seyhan N. drainage	Arsuz N.	N. al-Kabir (N) drainage	N. Sanawbar	N. Marqiyah	N. Antelias	Tigris-Euphrates	*C. saadii* from R. Mand drainage	R. Kor basin	*Capoeta* sp.1	*C. umbla*
n	60	20	84	25	97	87	24	17	51	18	21	28	24	15	27	19	21
C. damascina from Damascus basin	x	5.07E-01	3.90E-06	2.98E-01	1.76E-06	3.98E-02	3.97E-01	9.86E-01	5.39E-01	6.23E-01	4.94E-01	5.32E-01	2.12E-02	4.58E-01	3.79E-01	3.26E-01	2.92E-01
N. Quwayq		x	2.88E-01	5.88E-01	3.37E-01	8.66E-01	9.74E-01	7.27E-01	8.13E-01	3.63E-01	7.00E-01	2.99E-01	6.41E-01	8.65E-01	3.19E-01	9.92E-01	1.85E-01
Orontes R. drainage			x	9.19E-01	5.55E-01	1.20E-02	1.55E-01	3.71E-01	4.09E-02	3.99E-03	4.54E-03	5.24E-03	1.52E-01	5.13E-01	4.71E-04	9.46E-02	2.21E-02
Litani R. drainage				x	1.00E+00	6.88E-01	4.86E-01	4.17E-01	4.38E-01	2.04E-01	3.25E-01	1.65E-01	6.86E-01	6.69E-01	2.20E-01	5.78E-01	1.07E-01
Jordan R. drainage basin					x	1.70E-02	1.94E-01	3.95E-01	5.59E-02	4.16E-03	5.49E-03	5.78E-03	2.30E-01	5.75E-01	4.18E-04	1.23E-01	2.22E-02
Rivers in the Dead Sea Valley						x	7.99E-01	7.10E-01	5.43E-01	1.48E-01	3.48E-01	1.44E-01	6.95E-01	9.79E-01	5.47E-02	7.79E-01	1.58E-01
Seyhan N. drainage							x	6.47E-01	7.91E-01	1.94E-01	5.90E-01	1.58E-01	4.57E-01	7.86E-01	1.87E-01	9.81E-01	7.49E-02
Arsuz N.								x	8.28E-01	7.96E-01	7.97E-01	7.29E-01	4.09E-01	5.42E-01	7.56E-01	7.42E-01	4.15E-01
N. al-Kabir (N) drainage									x	3.71E-01	8.98E-01	3.15E-01	2.93E-01	6.89E-01	2.55E-01	7.71E-01	1.86E-01
N. Sanawbar										x	2.23E-01	8.62E-01	1.67E-02	2.51E-01	7.82E-01	2.72E-01	3.84E-01
N. Marqiyah											x	1.83E-01	6.68E-02	4.98E-01	1.81E-01	6.25E-01	7.50E-02
N. Antelias												x	1.44E-02	2.08E-01	9.01E-01	2.17E-01	4.61E-01
Tigris-Euphrates													x	8.51E-01	1.47E-02	5.21E-01	1.56E-02
C. saadii from R. Mand drainage														x	2.97E-01	8.55E-01	1.03E-01
R. Kor basin															x	1.94E-01	6.12E-01
Capoeta sp.1																x	1.63E-01
C. umbla																	x

Table A57. P-values obtained from pairwise comparisons of regression line intercepts (b) for the pectoral-fin length between populations and species (significant differences highlighted in yellow, Bonferroni-corrected significance level: 0.000184).

	C. damascina from Damascus basin	N. Quwayq	Orontes R. drainage	Litani R. drainage	Jordan R. drainage basin	Rivers in the Dead Sea Valley	Seyhan N. drainage	Arsuz N.	N. al-Kabir (N) drainage	N. Sanawbar	N. Marqiyah	N. Antelias	Tigris-Euphrates	*C. saadii* from R. Mand drainage	R. Kor basin	*Capoeta* sp.1	*C. umbla*
n	60	20	84	25	97	87	24	17	51	18	21	28	24	15	27	19	21
C. damascina from Damascus basin	x	2.33E-01	2.16E-02	3.68E-13	3.67E-14	2.69E-06	8.56E-08	1.90E-11	8.34E-12	2.41E-02	3.26E-02	2.19E-17	2.05E-02	1.44E-02	5.29E-01	4.84E-06	1.24E-02
N. Quwayq		x	7.35E-02	1.06E-06	1.01E-04	6.06E-03	1.11E-04	1.21E-06	6.85E-05	2.06E-02	1.82E-02	1.04E-08	2.02E-02	8.73E-03	1.89E-01	2.29E-03	5.29E-03
Orontes R. drainage			x	2.37E-08	1.55E-08	3.55E-03	1.54E-03	1.67E-06	4.68E-06	6.43E-01	8.58E-01	4.32E-11	7.63E-01	2.28E-01	4.09E-01	4.77E-03	1.78E-01
Litani R. drainage				x	5.87E-03	6.39E-04	2.65E-04	3.60E-01	4.48E-04	6.57E-07	1.38E-08	7.71E-01	3.11E-08	6.82E-03	1.55E-07	5.56E-03	3.08E-02
Jordan R. drainage basin					x	6.39E-02	3.55E-01	6.38E-02	4.36E-01	1.23E-03	9.62E-05	5.12E-04	7.52E-05	3.88E-01	1.54E-05	4.66E-01	6.62E-01
Rivers in the Dead Sea Valley						x	5.49E-01	8.28E-03	2.62E-01	1.23E-01	4.76E-02	3.85E-05	4.90E-02	9.70E-01	9.55E-03	5.55E-01	8.10E-01
Seyhan N. drainage							x	6.68E-04	7.02E-01	3.04E-03	1.60E-04	1.45E-06	5.73E-04	5.60E-01	4.15E-04	9.42E-01	9.57E-01
Arsuz N.								x	6.68E-03	3.28E-07	1.63E-09	1.18E-01	3.07E-08	4.94E-03	8.68E-07	2.54E-02	3.56E-02
N. al-Kabir (N) drainage									x	1.89E-03	1.25E-04	7.97E-06	1.59E-04	4.97E-01	4.33E-05	8.19E-01	8.28E-01
N. Sanawbar										x	6.69E-01	4.58E-10	7.91E-01	1.78E-01	2.28E-01	3.35E-02	1.04E-01
N. Marqiyah											x	1.31E-12	8.84E-01	6.92E-02	2.96E-01	7.48E-03	4.00E-02
N. Antelias												x	8.73E-12	3.72E-04	5.09E-10	3.66E-04	4.72E-03
Tigris-Euphrates													x	1.24E-01	2.59E-01	1.03E-02	7.42E-02
C. saadii from R. Mand drainage														x	7.40E-02	6.64E-01	7.09E-01
R. Kor basin															x	4.25E-03	5.09E-02
Capoeta sp.1																x	9.39E-01
C. umbla																	x

Table A58. P-values obtained from pairwise comparisons of regression line slopes (a) for the pelvic-fin length between populations and species (significant differences highlighted in yellow, Bonferroni-corrected significance level: 0.000184).

	C. damascina from Damascus basin	N. Quwayq	Orontes R. drainage	Litani R. drainage	Jordan R. drainage basin	Rivers in the Dead Sea Valley	Seyhan N. drainage	Arsuz N.	N. al-Kabir (N) drainage	N. Sanawbar	N. Marqiyah	N. Antelias	Tigris-Euphrates	*C. saadii* from R. Mand drainage	R. Kor basin	*Capoeta* sp.1	*C. umbla*
n	62	20	83	25	97	87	24	17	51	18	21	28	24	15	27	19	20
C. damascina from Damascus basin	x	7.24E-01	2.95E-05	9.07E-01	1.99E-08	6.92E-03	1.34E-02	8.41E-01	9.96E-01	2.74E-01	3.17E-01	9.63E-02	5.35E-02	7.57E-01	5.33E-01	1.04E-01	6.11E-02
N. Quwayq		x	9.16E-02	7.55E-01	3.12E-02	2.25E-01	4.94E-02	7.05E-01	7.70E-01	7.38E-01	3.80E-01	1.48E-01	1.72E-01	6.17E-01	9.95E-01	2.77E-01	2.53E-01
Orontes R. drainage			x	4.24E-01	8.74E-01	4.93E-02	9.36E-01	5.13E-01	2.27E-02	3.59E-03	2.50E-02	3.79E-01	1.09E-01	3.77E-01	3.13E-03	3.23E-01	1.20E-02
Litani R. drainage				x	3.07E-01	6.37E-01	2.42E-01	9.30E-01	9.13E-01	5.00E-01	8.24E-01	4.82E-01	5.71E-01	9.00E-01	7.24E-01	6.20E-01	2.39E-01
Jordan R. drainage basin					x	5.93E-03	8.63E-01	3.97E-01	4.21E-03	1.46E-04	2.32E-03	2.34E-01	2.69E-02	2.49E-01	1.25E-04	1.81E-01	1.96E-03
Rivers in the Dead Sea Valley						x	3.88E-01	7.25E-01	1.50E-01	2.18E-02	2.70E-01	9.70E-01	7.43E-01	6.44E-01	3.17E-02	9.96E-01	2.07E-02
Seyhan N. drainage							x	3.15E-01	4.85E-02	1.05E-03	4.36E-02	3.39E-01	1.55E-01	2.09E-01	8.37E-03	4.42E-01	9.13E-03
Arsuz N.								x	8.53E-01	4.27E-01	9.25E-01	5.75E-01	6.72E-01	9.80E-01	6.72E-01	7.15E-01	2.63E-01
N. al-Kabir (N) drainage									x	4.21E-01	5.12E-01	1.95E-01	2.02E-01	7.83E-01	6.66E-01	2.41E-01	1.06E-01
N. Sanawbar										x	3.19E-02	6.95E-03	3.64E-03	2.80E-01	6.39E-01	5.20E-02	2.21E-01
N. Marqiyah											x	2.75E-01	3.30E-01	9.30E-01	1.63E-01	4.11E-01	4.36E-02
N. Antelias												x	7.16E-01	4.87E-01	4.68E-02	9.76E-01	1.77E-02
Tigris-Euphrates													x	5.96E-01	3.25E-02	8.00E-01	1.86E-02
C. saadii from R. Mand drainage														x	5.51E-01	6.50E-01	1.74E-01
R. Kor basin															x	9.92E-02	1.59E-01
Capoeta sp.1																x	5.58E-02
C. umbla																	x

Table A59. P-values obtained from pairwise comparisons of regression line intercepts (b) for the pelvic-fin length between populations and species (significant differences highlighted in yellow, Bonferroni-corrected significance level: 0.000184).

	C. damascina from Damascus basin	N. Quwayq	Orontes R. drainage	Litani R. drainage	Jordan R. drainage basin	Rivers in the Dead Sea Valley	Seyhan N. drainage	Arsuz N.	N. al-Kabir (N) drainage	N. Sanawbar	N. Marqiyah	N. Antelias	Tigris-Euphrates	*C. saadii* from R. Mand drainage	R. Kor basin	*Capoeta* sp.1	*C. umbla*
n	62	20	83	25	97	87	24	17	51	18	21	28	24	15	27	19	20
C. damascina from Damascus basin	x	3.18E-01	1.09E-04	9.67E-09	7.12E-12	1.76E-04	2.40E-05	1.03E-10	1.36E-10	2.94E-01	2.10E-05	3.97E-13	1.30E-01	9.06E-01	6.46E-01	4.16E-05	8.79E-02
N. Quwayq		x	5.40E-01	9.74E-03	8.37E-02	4.98E-01	2.17E-01	1.37E-03	7.40E-02	6.45E-01	1.87E-01	7.40E-04	7.69E-01	4.84E-01	2.47E-01	2.17E-01	4.69E-01
Orontes R. drainage			x	3.04E-02	1.37E-02	9.68E-01	6.01E-01	3.34E-03	4.42E-02	1.03E-01	5.69E-01	8.02E-04	9.51E-02	2.19E-01	9.31E-03	3.41E-01	7.54E-01
Litani R. drainage				x	3.17E-01	1.63E-02	1.63E-02	1.82E-01	2.15E-01	1.16E-06	1.54E-02	2.10E-01	1.66E-06	1.95E-04	4.05E-07	1.93E-01	4.35E-01
Jordan R. drainage basin					x	1.81E-02	1.84E-01	3.65E-02	8.37E-01	2.21E-04	2.22E-01	2.22E-02	7.22E-05	1.28E-02	2.75E-06	5.77E-01	7.28E-01
Rivers in the Dead Sea Valley						x	5.51E-01	1.08E-03	4.07E-02	7.80E-02	5.15E-01	2.58E-04	7.88E-02	1.66E-01	5.22E-03	2.93E-01	7.14E-01
Seyhan N. drainage							x	3.96E-04	2.11E-01	2.66E-03	9.31E-01	1.55E-04	4.08E-03	2.01E-02	2.50E-04	5.91E-01	8.85E-01
Arsuz N.								x	1.58E-02	1.29E-08	2.66E-04	8.49E-01	1.89E-08	1.23E-05	2.28E-08	3.37E-02	2.20E-01
N. al-Kabir (N) drainage									x	1.29E-04	2.47E-01	8.48E-03	5.70E-05	7.77E-03	2.51E-06	6.72E-01	7.65E-01
N. Sanawbar										x	1.12E-03	1.43E-09	7.37E-01	5.49E-01	1.87E-01	1.07E-02	2.32E-01
N. Marqiyah											x	1.28E-04	2.23E-03	1.19E-02	1.65E-04	6.34E-01	9.08E-01
N. Antelias												x	1.10E-09	5.58E-06	7.56E-10	1.81E-02	1.96E-01
Tigris-Euphrates													x	4.47E-01	1.00E-01	9.16E-03	2.52E-01
C. saadii from R. Mand drainage														x	7.02E-01	5.23E-02	2.35E-01
R. Kor basin															x	1.07E-03	1.00E-01
Capoeta sp.1																x	9.28E-01
C. umbla																	x

Table A60. P-values obtained from pairwise comparisons of regression line slopes (a) for the longest anal-fin ray length between populations and species (Bonferroni-corrected significance level: 0.000184).

	C. damascina from Damascus basin	N. Quwayq	Orontes R. drainage	Litani R. drainage	Jordan R. drainage basin	Rivers in the Dead Sea Valley	Seyhan N. drainage	Arsuz N.	N. al-Kabir (N) drainage	N. Sanawbar	N. Marqiyah	N. Antelias	Tigris-Euphrates	*C. saadii* from R. Mand drainage	R. Kor basin	*Capoeta* sp.1	*C. umbla*
n	60	20	82	25	94	87	24	16	49	18	21	28	24	15	27	19	21
C. damascina from Damascus basin	x	2.80E-02	6.32E-01	7.22E-01	3.05E-03	8.25E-01	7.26E-01	5.20E-01	6.29E-01	1.50E-01	3.26E-01	1.27E-01	4.14E-01	6.21E-01	2.71E-01	1.42E-02	9.88E-03
N. Quwayq		x	1.35E-01	5.80E-01	1.01E-02	1.34E-01	5.15E-02	9.35E-01	4.79E-02	1.98E-01	1.39E-01	2.64E-01	2.08E-02	4.00E-01	2.37E-01	5.30E-01	4.05E-03
Orontes R. drainage			x	8.35E-01	6.03E-04	5.20E-01	6.41E-01	6.51E-01	5.24E-01	4.24E-01	6.52E-01	3.70E-01	3.38E-01	7.98E-01	5.37E-01	1.11E-01	2.82E-02
Litani R. drainage				x	4.24E-01	7.64E-01	6.88E-01	8.13E-01	6.48E-01	9.40E-01	9.32E-01	8.82E-01	6.31E-01	9.89E-01	9.91E-01	7.37E-01	1.86E-01
Jordan R. drainage basin					x	1.28E-02	3.69E-01	4.02E-01	3.16E-01	1.27E-02	7.06E-03	1.50E-02	2.07E-01	2.92E-01	1.18E-02	8.04E-04	1.77E-01
Rivers in the Dead Sea Valley						x	8.89E-01	6.39E-01	8.10E-01	3.16E-01	4.17E-01	2.88E-01	6.83E-01	7.08E-01	3.67E-01	8.86E-02	7.94E-02
Seyhan N. drainage							x	5.31E-01	9.49E-01	1.85E-01	3.99E-01	1.47E-01	8.78E-01	5.67E-01	3.61E-01	5.62E-02	6.70E-02
Arsuz N.								x	5.05E-01	7.57E-01	6.97E-01	7.79E-01	5.01E-01	7.72E-01	7.43E-01	9.12E-01	2.19E-01
N. al-Kabir (N) drainage									x	1.78E-01	3.23E-01	1.46E-01	9.34E-01	5.40E-01	2.82E-01	4.52E-02	5.86E-02
N. Sanawbar										x	5.89E-01	8.21E-01	6.46E-02	8.75E-01	8.11E-01	3.57E-01	6.08E-03
N. Marqiyah											x	4.77E-01	1.69E-01	9.18E-01	8.24E-01	1.72E-01	1.56E-02
N. Antelias												x	5.23E-02	7.87E-01	6.88E-01	5.15E-01	3.26E-03
Tigris-Euphrates													x	4.81E-01	1.64E-01	9.35E-03	5.38E-02
C. saadii from R. Mand drainage														x	9.93E-01	5.74E-01	8.68E-02
R. Kor basin															x	3.39E-01	1.70E-02
Capoeta sp.1																x	2.57E-03
C. umbla																	x

Table A61. P-values obtained from pairwise comparisons of regression line intercepts (b) for the longest anal-fin ray length between populations and species (significant differences highlighted in yellow, Bonferroni-corrected significance level: 0.000184).

	C. damascina from Damascus basin	N. Quwayq	Orontes R. drainage	Litani R. drainage	Jordan R. drainage basin	Rivers in the Dead Sea Valley	Seyhan N. drainage	Arsuz N.	N. al-Kabir (N) drainage	N. Sanawbar	N. Marqiyah	N. Antelias	Tigris-Euphrates	*C. saadii* from R. Mand drainage	R. Kor basin	*Capoeta* sp.1	*C. umbla*
n	60	20	82	25	94	87	24	16	49	18	21	28	24	15	27	19	21
C. damascina from Damascus basin	x	4.64E-02	3.49E-01	1.19E-02	1.16E-07	3.69E-02	2.17E-02	1.40E-02	9.43E-06	3.61E-01	5.58E-01	3.27E-07	3.77E-02	9.78E-03	6.99E-01	2.42E-02	1.30E-02
N. Quwayq		x	7.06E-02	1.47E-02	8.16E-04	4.21E-02	4.62E-03	1.15E-02	6.08E-04	1.25E-01	4.82E-02	4.62E-06	7.38E-03	3.69E-03	1.75E-01	3.32E-03	4.72E-01
Orontes R. drainage			x	9.37E-02	1.25E-05	1.76E-01	2.39E-01	1.05E-01	2.07E-03	2.18E-01	8.87E-01	6.75E-04	3.15E-01	9.16E-02	4.00E-01	2.59E-01	2.54E-02
Litani R. drainage				x	4.28E-01	5.27E-01	4.83E-01	8.30E-01	8.97E-01	2.09E-02	1.29E-01	3.11E-01	4.03E-01	6.03E-01	5.68E-02	5.12E-01	1.06E-02
Jordan R. drainage basin					x	2.72E-02	4.65E-02	7.31E-01	2.57E-01	8.29E-05	1.89E-03	7.46E-01	2.62E-02	8.99E-01	5.69E-04	6.58E-02	5.25E-04
Rivers in the Dead Sea Valley						x	9.81E-01	4.53E-01	2.37E-01	6.37E-02	2.97E-01	6.67E-02	8.55E-01	3.49E-01	1.26E-01	1.00E+00	1.94E-02
Seyhan N. drainage							x	3.67E-01	1.90E-01	7.89E-03	1.99E-01	7.85E-03	8.39E-01	1.97E-01	7.17E-02	9.75E-01	4.39E-03
Arsuz N.								x	8.32E-01	1.77E-02	1.13E-01	5.40E-01	3.12E-01	7.54E-01	5.62E-02	3.85E-01	1.07E-02
N. al-Kabir (N) drainage									x	1.62E-04	9.13E-03	1.62E-01	1.23E-01	5.19E-01	2.49E-03	2.19E-01	5.22E-04
N. Sanawbar										x	2.21E-01	8.17E-08	1.53E-02	5.13E-03	7.54E-01	4.65E-03	5.80E-02
N. Marqiyah											x	1.92E-04	2.74E-01	6.06E-02	5.02E-01	1.89E-01	2.68E-02
N. Antelias												x	4.69E-03	9.60E-01	1.14E-04	6.39E-03	3.99E-05
Tigris-Euphrates													x	1.70E-01	1.01E-01	8.16E-01	6.11E-03
C. saadii from R. Mand drainage														x	3.51E-02	1.93E-01	5.22E-03
R. Kor basin															x	7.26E-02	7.34E-02
Capoeta sp.1																x	4.37E-03
C. umbla																	x

Table A62. P-values obtained from pairwise comparisons of regression line slopes (a) for the posterior barbel length between populations and species (Bonferroni-corrected significance level: 0.000208).

	C. damascina from Damascus basin	Orontes R. drainage	Litani R. drainage	Jordan R. drainage basin	Rivers in the Dead Sea Valley	Seyhan N. drainage	Arsuz N.	N. al - Kabir (N) drainage	N. Sanawbar	N. Marqiyah	N. Antelias	Tigris-Euphrates	*C. saadii* from R. Mand drainage	R. Kor basin	*Capoeta* sp.1	*C. umbla*
n	56	74	25	93	86	23	15	50	18	21	25	23	15	26	18	20
C. damascina from Damascus basin	x	7.70E-01	2.16E-01	5.94E-01	7.90E-01	3.93E-01	3.57E-01	3.79E-01	1.64E-02	9.48E-01	9.87E-01	4.86E-01	1.41E-01	6.01E-01	5.24E-01	5.59E-01
Orontes R. drainage		x	1.15E-01	7.45E-01	5.06E-01	3.69E-01	2.83E-01	3.91E-01	4.01E-03	8.51E-01	8.30E-01	5.15E-01	5.45E-02	6.38E-01	5.45E-01	5.28E-01
Litani R. drainage			x	2.00E-01	2.20E-01	4.91E-02	5.46E-02	5.78E-02	4.29E-03	1.14E-01	8.77E-02	1.50E-01	9.68E-01	1.37E-01	1.20E-01	1.79E-01
Jordan R. drainage basin				x	3.33E-01	5.75E-01	4.52E-01	5.87E-01	4.25E-02	7.23E-01	7.66E-01	7.10E-01	1.17E-01	8.11E-01	7.37E-01	6.55E-01
Rivers in the Dead Sea Valley					x	2.99E-01	3.08E-01	2.76E-01	6.44E-03	7.66E-01	8.89E-01	3.26E-01	1.37E-01	4.66E-01	3.85E-01	4.82E-01
Seyhan N. drainage						x	4.44E-01	8.95E-01	1.03E-01	2.82E-01	2.46E-01	7.56E-01	2.48E-02	7.26E-01	7.60E-01	8.71E-01
Arsuz N.							x	4.36E-01	9.15E-01	2.05E-01	1.25E-01	4.91E-01	4.95E-02	4.46E-01	4.50E-01	7.37E-01
N. al-Kabir (N) drainage								x	1.01E-01	3.41E-01	3.59E-01	8.19E-01	2.53E-02	7.94E-01	8.39E-01	8.04E-01
N. Sanawbar									x	8.75E-04	2.93E-04	9.60E-02	1.00E-03	8.91E-02	8.03E-02	6.27E-01
N. Marqiyah										x	9.24E-01	5.24E-01	6.50E-02	5.96E-01	5.12E-01	5.32E-01
N. Antelias											x	5.50E-01	4.59E-02	5.80E-01	5.04E-01	4.83E-01
Tigris-Euphrates												x	1.00E-01	9.67E-01	9.83E-01	7.73E-01
C. saadii from R. Mand drainage													x	9.49E-02	7.95E-02	1.71E-01
R. Kor basin														x	9.52E-01	7.56E-01
Capoeta sp.1															x	7.75E-01
C. umbla																x

Table A63. P-values obtained from pairwise comparisons of regression line intercepts (b) for the posterior barbel length between populations and species (significant differences highlighted in yellow, Bonferroni-corrected significance level: 0.000208).

	C. damascina from Damascus basin	Orontes R. drainage	Litani R. drainage	Jordan R. drainage basin	Rivers in the Dead Sea Valley	Seyhan N. drainage	Arsuz N.	N. al - Kabir (N) drainage	N. Sanawbar	N. Marqiyah	N. Antelias	Tigris-Euphrates	*C. saadii* from R. Mand drainage	R. Kor basin	*Capoeta* sp.1	*C. umbla*
n	56	74	25	93	86	23	15	50	18	21	25	23	15	26	18	20
C. damascina from Damascus basin	x	6.95E-01	3.65E-08	3.46E-04	1.83E-01	9.36E-08	4.78E-05	7.57E-06	1.59E-05	1.18E-01	2.14E-01	3.84E-02	9.60E-03	8.20E-04	3.92E-04	2.25E-01
Orontes R. drainage		x	6.06E-12	6.50E-06	5.40E-02	8.68E-12	1.13E-07	6.45E-09	1.27E-08	1.02E-01	5.62E-02	4.33E-03	7.62E-04	1.29E-05	3.21E-06	1.11E-01
Litani R. drainage			x	7.78E-04	7.42E-07	1.27E-01	8.34E-02	9.55E-05	1.72E-02	1.06E-10	5.46E-08	4.49E-04	2.80E-01	3.14E-02	1.72E-02	2.04E-01
Jordan R. drainage basin				x	2.54E-02	9.08E-03	8.70E-02	5.57E-01	1.03E-01	2.39E-05	1.01E-01	4.87E-01	2.83E-01	3.17E-01	3.19E-01	8.54E-01
Rivers in the Dead Sea Valley					x	7.02E-06	8.24E-04	2.56E-03	5.73E-04	7.40E-03	9.19E-01	2.81E-01	3.20E-02	9.56E-03	6.58E-03	3.78E-01
Seyhan N. drainage						x	5.77E-01	2.88E-03	2.40E-01	1.92E-11	8.47E-08	2.68E-03	7.67E-01	2.01E-01	1.32E-01	4.08E-01
Arsuz N.							x	5.59E-02	6.75E-01	2.22E-08	1.21E-05	3.22E-02	9.79E-01	4.83E-01	3.95E-01	5.68E-01
N. al-Kabir (N) drainage								x	6.75E-02	4.62E-09	3.24E-03	1.80E-01	2.43E-01	4.05E-01	4.31E-01	9.63E-01
N. Sanawbar									x	1.81E-10	1.74E-07	2.69E-02	7.92E-01	5.94E-01	4.84E-01	6.10E-01
N. Marqiyah										x	3.40E-04	1.41E-03	1.67E-04	9.78E-06	3.48E-06	5.90E-02
N. Antelias											x	3.30E-01	5.80E-03	5.51E-03	3.68E-03	3.21E-01
Tigris-Euphrates												x	1.70E-01	1.65E-01	1.58E-01	6.88E-01
C. saadii from R. Mand drainage													x	6.40E-01	5.85E-01	6.41E-01
R. Kor basin														x	9.32E-01	8.25E-01
Capoeta sp.1															x	8.50E-01
C. umbla																x

Table A64. P-values obtained from pairwise comparisons of regression line slopes (a) for the horizontal eye diameter between populations and species (significant differences highlighted in yellow, Bonferroni-corrected significance level: 0.000208).

	C. damascina from Damascus basin	N. Quwayq	Orontes R. drainage	Litani R. drainage	Jordan R. drainage basin	Rivers in the Dead Sea Valley	Seyhan N. drainage	N. al-Kabir (N) drainage	N. Sanawbar	N. Marqiyah	N. Antelias	Tigris-Euphrates	*C. saadii* from R. Mand drainage	R. Kor basin	*Capoeta* sp.1	*C. umbla*
n	62	19	83	25	96	86	20	51	18	21	28	24	15	23	19	21
C. damascina from Damascus basin	x	5.68E-01	7.92E-01	1.78E-01	3.48E-01	1.05E-01	1.22E-01	1.98E-01	8.29E-01	8.00E-02	7.74E-01	9.28E-01	9.15E-01	1.87E-01	2.66E-01	6.55E-01
N. Quwayq		x	3.36E-01	2.40E-01	2.83E-01	9.65E-01	3.29E-02	8.26E-01	3.13E-01	7.13E-01	2.80E-01	5.59E-01	5.14E-01	1.08E-01	9.14E-01	9.20E-01
Orontes R. drainage			x	3.85E-02	3.74E-01	1.59E-02	2.59E-02	4.60E-02	8.85E-01	2.92E-03	7.93E-01	7.23E-01	9.43E-01	7.43E-02	5.22E-02	4.25E-01
Litani R. drainage				x	5.55E-02	2.53E-01	1.54E-03	1.93E-01	1.24E-02	1.53E-01	1.23E-02	1.09E-01	5.71E-02	1.28E-02	1.12E-01	1.20E-01
Jordan R. drainage basin					x	9.60E-04	1.09E-01	2.88E-02	7.81E-01	1.63E-03	8.90E-01	4.11E-01	8.97E-01	2.31E-01	3.69E-02	3.74E-01
Rivers in the Dead Sea Valley						x	1.11E-02	6.90E-01	2.07E-01	4.72E-01	2.11E-01	2.56E-01	5.38E-01	1.26E-02	8.18E-01	9.54E-01
Seyhan N. drainage							x	9.79E-04	1.06E-02	1.52E-05	2.87E-02	6.04E-02	1.41E-01	5.08E-01	1.20E-04	9.01E-03
N. al- Kabir (N) drainage								x	6.51E-02	8.45E-01	6.52E-02	1.86E-01	2.89E-01	4.81E-03	8.48E-01	7.18E-01
N. Sanawbar									x	1.89E-03	8.68E-01	7.34E-01	9.97E-01	1.61E-01	1.38E-02	2.08E-01
N. Marqiyah										x	4.69E-03	7.89E-02	1.31E-01	4.81E-04	5.75E-01	5.16E-01
N. Antelias											x	6.67E-01	9.31E-01	2.21E-01	2.54E-02	2.25E-01
Tigris-Euphrates												x	8.62E-01	1.45E-01	2.40E-01	6.12E-01
C. saadii from R. Mand drainage													x	4.46E-01	2.15E-01	4.26E-01
R. Kor basin														x	4.26E-03	9.07E-02
Capoeta sp.1															x	7.48E-01
C. umbla																x

Table A65. P-values obtained from pairwise comparisons of regression line intercepts (b) for the horizontal eye diameter between populations and species (significant differences highlighted in yellow, Bonferroni-corrected significance level: 0.000208).

	C. damascina from Damascus basin	N. Quwayq	Orontes R. drainage	Litani R. drainage	Jordan R. drainage basin	Rivers in the Dead Sea Valley	Seyhan N. drainage	N. al-Kabir (N) drainage	N. Sanawbar	N. Marqiyah	N. Antelias	Tigris-Euphrates	*C. saadii* from R. Mand drainage	R. Kor basin	*Capoeta* sp.1	*C. umbla*
n	62	19	83	25	96	86	20	51	18	21	28	24	15	23	19	21
C. damascina from Damascus basin	x	7.42E-02	1.66E-02	4.53E-03	1.67E-01	1.60E-01	5.81E-01	4.15E-01	5.81E-01	4.17E-01	4.91E-01	1.08E-01	6.65E-01	1.14E-01	9.31E-02	1.68E-01
N. Quwayq		x	9.99E-02	7.93E-01	8.08E-02	9.55E-03	3.59E-02	2.63E-03	2.71E-02	2.32E-03	2.40E-02	2.62E-01	1.31E-01	3.30E-01	1.66E-01	7.17E-01
Orontes R. drainage			x	1.32E-02	2.64E-01	4.60E-05	2.10E-01	4.39E-05	2.16E-01	5.45E-04	2.38E-01	7.65E-01	6.29E-01	4.92E-01	6.23E-01	2.59E-01
Litani R. drainage				x	7.21E-03	4.78E-05	1.31E-03	1.56E-06	6.13E-04	1.90E-06	6.37E-04	1.10E-01	4.83E-02	2.18E-01	4.41E-02	8.32E-01
Jordan R. drainage basin					x	2.81E-03	7.07E-01	9.31E-03	7.20E-01	2.74E-02	7.86E-01	3.43E-01	9.71E-01	2.57E-01	2.77E-01	2.10E-01
Rivers in the Dead Sea Valley						x	8.32E-02	4.29E-01	8.52E-02	7.40E-01	5.30E-02	4.17E-03	2.56E-01	7.74E-03	3.17E-03	3.50E-02
Seyhan N. drainage							x	8.50E-02	9.85E-01	3.03E-02	8.73E-01	2.75E-01	8.10E-01	1.41E-01	6.54E-02	3.46E-02
N. al- Kabir (N) drainage								x	7.53E-02	6.99E-01	4.52E-02	3.50E-03	2.35E-01	3.37E-03	4.98E-04	8.09E-03
N. Sanawbar									x	1.20E-02	8.70E-01	2.71E-01	7.84E-01	1.23E-01	3.05E-02	1.35E-02
N. Marqiyah										x	1.08E-02	9.21E-03	1.03E-01	3.25E-03	6.73E-05	8.71E-04
N. Antelias											x	2.71E-01	8.70E-01	1.29E-01	6.01E-02	2.61E-02
Tigris-Euphrates												x	6.19E-01	7.52E-01	9.00E-01	4.22E-01
C. saadii from R. Mand drainage													x	4.18E-01	3.46E-01	1.11E-01
R. Kor basin														x	7.79E-01	5.05E-01
Capoeta sp.1															x	2.23E-01
C. umbla																x

Table A66. P-values obtained from pairwise comparisons of regression line slopes (a) for the interorbital width between populations and species (Bonferroni-corrected significance level: 0.000184).

	C. damascina from Damascus basin	N. Quwayq	Orontes R. drainage	Litani R. drainage	Jordan R. drainage basin	Rivers in the Dead Sea Valley	Seyhan N. drainage	Arsuz N.	N. al-Kabir (N) drainage	N. Sanawbar	N. Marqiyah	N. Antelias	Tigris-Euphrates	*C. saadii* from R. Mand drainage	R. Kor basin	*Capoeta* sp.1	*C. umbla*
n	63	20	84	25	98	87	24	17	51	18	21	28	24	15	28	19	22
C. damascina from Damascus basin	x	4.45E-01	4.90E-02	1.37E-01	4.22E-02	9.93E-02	3.12E-01	2.88E-01	3.28E-01	7.76E-01	5.58E-01	9.60E-02	3.81E-04	8.19E-01	8.38E-02	1.17E-01	2.16E-01
N. Quwayq		x	9.25E-01	2.29E-01	9.48E-01	9.49E-01	1.84E-01	8.92E-02	1.09E-01	4.79E-01	5.58E-01	5.56E-01	2.14E-01	7.74E-01	7.18E-01	7.42E-01	5.62E-01
Orontes R. drainage			x	4.25E-01	9.34E-01	6.52E-01	9.92E-02	2.29E-01	5.72E-02	4.25E-01	3.70E-01	7.00E-01	6.13E-02	7.62E-01	6.48E-01	8.49E-01	6.66E-01
Litani R. drainage				x	4.34E-01	3.32E-01	8.30E-02	4.77E-02	3.16E-02	1.19E-01	1.31E-01	3.50E-01	8.07E-01	2.97E-01	5.36E-01	3.15E-01	5.84E-01
Jordan R. drainage basin					x	6.81E-01	1.11E-01	2.52E-01	6.84E-02	4.55E-01	3.96E-01	6.81E-01	5.07E-02	7.83E-01	6.14E-01	8.19E-01	6.60E-01
Rivers in the Dead Sea Valley						x	1.09E-01	2.17E-01	7.15E-02	5.28E-01	5.14E-01	5.14E-01	1.97E-02	8.31E-01	4.53E-01	6.37E-01	5.40E-01
Seyhan N. drainage							x	6.11E-01	7.54E-01	2.94E-01	1.99E-01	4.17E-02	8.76E-03	5.00E-01	9.98E-02	6.86E-02	1.28E-01
Arsuz N.								x	3.70E-01	1.82E-01	1.58E-01	4.32E-02	6.21E-02	3.24E-01	1.98E-01	8.06E-02	1.12E-01
N. al-Kabir (N) drainage									x	2.32E-01	1.25E-01	1.10E-02	3.31E-04	4.54E-01	3.71E-02	1.72E-02	5.91E-02
N. Sanawbar										x	8.54E-01	1.37E-01	2.39E-02	9.22E-01	3.13E-01	2.28E-01	2.80E-01
N. Marqiyah											x	1.45E-01	9.44E-03	9.83E-01	2.79E-01	2.34E-01	2.94E-01
N. Antelias												x	2.82E-01	5.04E-01	9.92E-01	7.73E-01	8.06E-01
Tigris-Euphrates													x	2.98E-01	3.50E-01	1.75E-01	6.61E-01
C. saadii from R. Mand drainage														x	6.47E-01	6.32E-01	5.41E-01
R. Kor basin															x	8.32E-01	8.65E-01
Capoeta sp.1																x	6.90E-01
C. umbla																	x

Table A67. P-values obtained from pairwise comparisons of regression line intercepts (b) for the interorbital width between populations and species (significant differences highlighted in yellow, Bonferroni-corrected significance level: 0.000184).

	C. damascina from Damascus basin	N. Quwayq	Orontes R. drainage	Litani R. drainage	Jordan R. drainage basin	Rivers in the Dead Sea Valley	Seyhan N. drainage	Arsuz N.	N. al-Kabir (N) drainage	N. Sanawbar	N. Marqiyah	N. Antelias	Tigris-Euphrates	*C. saadii* from R. Mand drainage	R. Kor basin	*Capoeta* sp.1	*C. umbla*
n	63	20	84	25	98	87	24	17	51	18	21	28	24	15	28	19	22
C. damascina from Damascus basin	x	9.93E-01	1.78E-03	1.17E-02	4.36E-10	1.82E-05	8.04E-01	5.88E-02	7.27E-13	1.09E-08	1.47E-01	2.47E-04	4.64E-01	1.43E-03	6.05E-03	3.62E-01	2.03E-02
N. Quwayq		x	2.59E-01	6.89E-02	1.95E-02	6.93E-02	8.86E-01	1.57E-01	9.41E-05	1.51E-05	3.03E-01	6.26E-03	6.95E-01	5.89E-03	1.43E-01	5.06E-01	3.17E-02
Orontes R. drainage			x	7.87E-01	4.07E-04	1.64E-01	6.44E-02	1.42E-03	2.80E-04	1.83E-03	3.54E-01	3.35E-01	1.40E-01	3.06E-04	4.43E-05	2.05E-01	5.28E-03
Litani R. drainage				x	6.82E-02	5.03E-01	6.09E-02	3.44E-04	6.01E-03	1.98E-03	1.90E-01	4.63E-01	1.30E-01	4.71E-05	4.18E-04	9.70E-02	7.08E-04
Jordan R. drainage basin					x	6.24E-02	5.40E-05	1.30E-06	9.66E-01	4.08E-01	1.27E-03	1.41E-01	1.75E-04	4.80E-06	9.01E-09	6.24E-04	2.35E-04
Rivers in the Dead Sea Valley						x	4.06E-03	3.49E-05	4.13E-02	2.30E-02	4.40E-02	9.27E-01	1.18E-02	1.30E-05	8.58E-07	2.06E-02	5.50E-04
Seyhan N. drainage							x	9.37E-02	1.85E-07	1.43E-05	3.49E-01	5.01E-03	7.25E-01	6.44E-03	2.92E-02	6.03E-01	3.51E-02
Arsuz N.								x	1.78E-11	1.43E-08	3.00E-03	2.22E-06	5.02E-02	5.91E-02	4.85E-01	1.21E-02	2.04E-01
N. al-Kabir (N) drainage									x	1.61E-01	1.57E-06	2.01E-02	1.56E-06	3.28E-10	2.94E-11	4.17E-07	1.68E-07
N. Sanawbar										x	4.65E-06	2.20E-03	6.03E-05	1.49E-07	2.23E-07	2.64E-06	2.20E-06
N. Marqiyah											x	1.59E-02	5.97E-01	2.08E-04	2.66E-03	6.28E-01	2.90E-03
N. Antelias												x	1.67E-02	8.82E-07	1.15E-05	5.48E-03	3.96E-05
Tigris-Euphrates													x	4.38E-03	1.44E-02	8.94E-01	2.50E-02
C. saadii from R. Mand drainage														x	2.96E-01	6.73E-04	6.96E-01
R. Kor basin															x	8.67E-03	5.64E-01
Capoeta sp.1																x	6.80E-03
C. umbla																	x

Table A68. P-values obtained from pairwise comparisons of regression line slopes (a) for the preorbital length between populations and species (significant differences highlighted in yellow, Bonferroni-corrected significance level: 0.000184).

	C. damascina from Damascus basin	N. Quwayq	Orontes R. drainage	Litani R. drainage	Jordan R. drainage basin	Rivers in the Dead Sea Valley	Seyhan N. drainage	Arsuz N.	N. al-Kabir (N) drainage	N. Sanawbar	N. Marqiyah	N. Antelias	Tigris-Euphrates	*C. saadii* from R. Mand drainage	R. Kor basin	*Capoeta* sp.1	*C. umbla*
n	62	20	84	25	98	87	24	17	51	18	21	27	24	15	26	19	22
C. damascina from Damascus basin	x	4.27E-01	3.85E-04	9.73E-01	1.11E-06	3.02E-03	9.18E-01	4.85E-01	6.22E-02	3.27E-01	3.65E-04	3.87E-01	3.08E-02	6.19E-01	4.57E-02	1.01E-01	4.97E-01
N. Quwayq		x	5.86E-01	6.66E-01	3.77E-01	7.59E-01	4.15E-01	1.57E-01	6.72E-01	8.40E-01	1.98E-01	1.65E-01	7.05E-01	2.82E-01	6.10E-01	7.91E-01	9.68E-01
Orontes R. drainage			x	4.65E-01	2.56E-01	4.61E-01	8.86E-02	1.72E-01	8.18E-01	2.74E-01	4.07E-01	1.31E-02	8.17E-01	1.50E-01	7.89E-01	6.34E-01	6.96E-01
Litani R. drainage				x	3.58E-01	5.46E-01	9.31E-01	4.84E-01	4.61E-01	6.79E-01	1.96E-01	6.51E-01	5.35E-01	6.94E-01	5.21E-01	5.29E-01	7.21E-01
Jordan R. drainage basin					x	4.77E-02	3.35E-02	1.27E-01	4.36E-01	1.02E-01	9.12E-01	3.51E-03	3.61E-01	9.33E-02	8.29E-01	2.99E-01	5.01E-01
Rivers in the Dead Sea Valley						x	1.48E-01	2.02E-01	8.71E-01	4.61E-01	1.64E-01	2.50E-02	8.12E-01	1.93E-01	5.32E-01	9.32E-01	8.45E-01
Seyhan N. drainage							x	4.26E-01	1.32E-01	3.40E-01	6.81E-03	5.26E-01	1.75E-01	6.53E-01	1.97E-01	1.83E-01	5.29E-01
Arsuz N.								x	1.08E-01	4.27E-02	1.90E-03	6.99E-01	1.98E-01	6.73E-01	2.68E-01	9.09E-02	3.48E-01
N. al-Kabir (N) drainage									x	3.98E-01	3.39E-01	2.54E-02	9.75E-01	1.28E-01	7.16E-01	8.27E-01	7.85E-01
N. Sanawbar										x	7.54E-03	7.74E-02	4.31E-01	1.80E-01	3.92E-01	4.91E-01	8.60E-01
N. Marqiyah											x	3.61E-04	3.78E-01	1.01E-02	8.16E-01	1.68E-01	4.51E-01
N. Antelias												x	4.19E-02	9.90E-01	6.86E-02	3.86E-02	2.94E-01
Tigris-Euphrates													x	2.18E-01	7.52E-01	8.19E-01	8.07E-01
C. saadii from R. Mand drainage														x	2.64E-01	1.57E-01	4.38E-01
R. Kor basin															x	6.42E-01	7.04E-01
Capoeta sp.1																x	8.93E-01
C. umbla																	x

Table A69. P-values obtained from pairwise comparisons of regression line intercepts (b) for the preorbital length between populations and species (significant differences highlighted in yellow, Bonferroni-corrected significance level: 0.000184).

	C. damascina from Damascus basin	N. Quwayq	Orontes R. drainage	Litani R. drainage	Jordan R. drainage basin	Rivers in the Dead Sea Valley	Seyhan N. drainage	Arsuz N.	N. al-Kabir (N) drainage	N. Sanawbar	N. Marqiyah	N. Antelias	Tigris-Euphrates	*C. saadii* from R. Mand drainage	R. Kor basin	*Capoeta* sp.1	*C. umbla*
n	62	20	84	25	98	87	24	17	51	18	21	27	24	15	26	19	22
C. damascina from Damascus basin	x	1.72E-02	1.37E-01	1.14E-04	2.14E-02	1.76E-02	1.09E-04	5.16E-01	6.42E-04	8.73E-08	1.70E-04	3.28E-10	9.73E-02	3.44E-01	6.86E-01	1.45E-05	1.32E-01
N. Quwayq		x	5.11E-03	9.19E-06	2.25E-03	1.15E-03	1.41E-05	1.09E-02	4.40E-05	2.07E-08	1.19E-06	2.08E-08	5.80E-03	5.19E-03	7.77E-02	4.95E-06	1.23E-02
Orontes R. drainage			x	3.15E-03	3.62E-01	2.71E-01	4.57E-03	1.32E-01	4.33E-02	1.00E-05	8.26E-03	4.26E-08	5.11E-01	7.18E-01	7.46E-01	6.88E-04	2.90E-01
Litani R. drainage				x	1.65E-02	2.73E-02	5.55E-01	1.54E-05	4.24E-02	1.82E-01	3.70E-01	3.34E-02	4.81E-02	1.16E-01	4.60E-02	8.86E-01	7.24E-01
Jordan R. drainage basin					x	7.74E-01	2.94E-02	4.81E-02	2.64E-01	1.33E-04	4.91E-02	9.35E-07	9.61E-01	9.68E-01	4.47E-01	5.29E-03	4.24E-01
Rivers in the Dead Sea Valley						x	5.52E-02	2.90E-02	4.52E-01	2.90E-04	8.36E-02	3.37E-06	8.70E-01	9.39E-01	3.70E-01	1.06E-02	4.70E-01
Seyhan N. drainage							x	2.38E-05	1.08E-01	2.92E-02	8.02E-01	3.10E-03	8.82E-02	2.06E-01	7.03E-02	4.23E-01	9.26E-01
Arsuz N.								x	8.86E-04	1.02E-11	7.83E-08	7.96E-10	7.15E-02	5.23E-02	5.06E-01	1.92E-06	7.79E-02
N. al-Kabir (N) drainage									x	1.32E-04	1.47E-01	1.81E-06	4.29E-01	6.41E-01	1.78E-01	1.56E-02	6.00E-01
N. Sanawbar										x	1.67E-03	2.44E-01	1.53E-03	3.06E-03	5.71E-03	1.89E-01	3.33E-01
N. Marqiyah											x	4.07E-04	1.02E-01	1.49E-01	8.29E-02	2.33E-01	9.96E-01
N. Antelias												x	9.14E-05	2.36E-03	6.18E-04	3.21E-02	1.64E-01
Tigris-Euphrates													x	9.89E-01	5.61E-01	2.81E-02	5.08E-01
C. saadii from R. Mand drainage														x	6.88E-01	8.20E-02	5.49E-01
R. Kor basin															x	3.45E-02	3.88E-01
Capoeta sp.1																x	6.76E-01
C. umbla																	x

Table A70. P-values obtained from pairwise comparisons of regression line slopes (a) for the postorbital length between different populations and species (Bonferroni-corrected significance level: 0.000208).

	C. damascina from Damascus basin	N. Quwayq	Orontes R. drainage	Litani R. drainage	Jordan R. drainage basin	Rivers in the Dead Sea Valley	Seyhan N. drainage	N. al-Kabir (N) drainage	N. Sanawbar	N. Marqiyah	N. Antelias	Tigris-Euphrates	*C. saadii* from R. Mand drainage	R. Kor basin	*Capoeta* sp.1	*C. umbla*
n	62	19	81	25	96	86	20	51	18	21	27	24	15	23	19	22
C. damascina from Damascus basin	x	7.42E-02	3.64E-03	5.09E-03	6.82E-02	3.77E-02	4.02E-01	8.42E-01	6.27E-01	2.88E-01	3.07E-01	3.96E-02	8.35E-01	7.58E-03	3.93E-02	6.67E-01
N. Quwayq		x	5.25E-01	1.17E-01	3.01E-01	3.44E-01	3.06E-01	1.83E-01	1.44E-01	1.01E-01	4.40E-02	3.97E-01	1.36E-01	9.77E-01	5.27E-01	3.03E-01
Orontes R. drainage			x	4.62E-02	1.55E-01	3.67E-01	6.28E-01	1.88E-01	2.56E-01	2.20E-01	2.68E-02	8.52E-01	3.32E-01	3.04E-01	8.56E-01	5.93E-01
Litani R. drainage				x	2.92E-02	2.79E-02	1.89E-02	1.69E-02	8.74E-03	3.45E-03	4.85E-03	2.01E-02	1.12E-02	1.32E-01	2.48E-02	2.29E-02
Jordan R. drainage basin					x	6.64E-01	9.65E-01	4.99E-01	6.46E-01	7.67E-01	9.59E-02	4.70E-01	5.39E-01	9.28E-02	3.70E-01	8.91E-01
Rivers in the Dead Sea Valley						x	9.07E-01	3.80E-01	4.98E-01	5.59E-01	6.17E-02	6.54E-01	4.55E-01	1.33E-01	4.86E-01	7.92E-01
Seyhan N. drainage							x	6.11E-01	6.51E-01	7.55E-01	1.68E-01	6.54E-01	4.24E-01	2.57E-01	4.54E-01	8.51E-01
N. al- Kabir (N) drainage								x	8.52E-01	6.40E-01	3.68E-01	2.66E-01	7.89E-01	8.09E-02	2.07E-01	8.04E-01
N. Sanawbar									x	7.19E-01	2.38E-01	2.56E-01	6.00E-01	8.78E-02	1.44E-01	8.79E-01
N. Marqiyah										x	9.09E-02	2.24E-01	3.58E-01	5.08E-02	8.62E-02	9.80E-01
N. Antelias											x	3.31E-02	7.02E-01	1.63E-02	2.48E-02	3.29E-01
Tigris-Euphrates												x	2.40E-01	2.66E-01	6.95E-01	5.80E-01
C. saadii from R. Mand drainage													x	1.57E-01	1.33E-01	5.88E-01
R. Kor basin														x	4.46E-01	2.86E-01
Capoeta sp.1															x	4.25E-01
C. umbla																x

Table A71. P-values obtained from pairwise comparisons of regression line intercepts (b) for the postorbital length between different populations and species (significant differences highlighted in yellow, Bonferroni-corrected significance level: 0.000208).

	C. damascina from Damascus basin	N. Quwayq	Orontes R. drainage	Litani R. drainage	Jordan R. drainage basin	Rivers in the Dead Sea Valley	Seyhan N. drainage	N. al-Kabir (N) drainage	N. Sanawbar	N. Marqiyah	N. Antelias	Tigris-Euphrates	*C. saadii* from R. Mand drainage	R. Kor basin	*Capoeta* sp.1	*C. umbla*
n	62	19	81	25	96	86	20	51	18	21	27	24	15	23	19	22
C. damascina from Damascus basin	x	5.44E-06	2.13E-13	8.55E-01	1.82E-06	1.74E-01	4.55E-01	4.80E-05	8.83E-01	3.74E-08	9.55E-05	1.38E-04	2.23E-04	9.19E-02	2.12E-01	1.31E-02
N. Quwayq		x	9.70E-02	8.39E-05	1.16E-02	1.93E-04	3.66E-05	9.08E-08	1.74E-05	1.45E-02	2.42E-02	2.58E-03	2.65E-01	2.07E-05	3.08E-05	1.10E-01
Orontes R. drainage			x	1.43E-05	4.47E-03	5.31E-08	1.30E-05	2.23E-21	2.67E-06	7.21E-01	1.87E-01	2.56E-02	5.91E-01	6.75E-08	3.87E-05	8.19E-01
Litani R. drainage				x	7.20E-03	4.80E-01	6.72E-01	6.72E-03	9.65E-01	2.03E-05	6.24E-03	7.11E-03	1.08E-03	1.57E-01	4.09E-01	2.52E-02
Jordan R. drainage basin					x	2.67E-03	1.18E-02	2.23E-14	3.40E-03	9.98E-02	5.96E-01	9.17E-01	1.29E-01	6.15E-05	2.81E-02	5.15E-01
Rivers in the Dead Sea Valley						x	7.54E-01	2.25E-06	4.19E-01	8.86E-05	8.01E-03	1.98E-02	4.96E-03	2.16E-02	9.33E-01	7.59E-02
Seyhan N. drainage							x	5.70E-04	5.76E-01	2.24E-06	7.45E-03	7.00E-03	3.91E-04	5.65E-02	6.35E-01	2.19E-02
N. al- Kabir (N) drainage								x	3.84E-03	1.10E-12	7.94E-09	2.22E-09	2.49E-06	4.35E-01	8.64E-05	3.45E-04
N. Sanawbar									x	2.95E-07	2.58E-03	1.64E-03	1.44E-04	1.34E-01	2.81E-01	1.05E-02
N. Marqiyah										x	3.12E-01	2.83E-02	2.33E-01	8.54E-07	1.37E-06	9.14E-01
N. Antelias											x	5.42E-01	2.01E-01	2.48E-04	1.37E-02	6.75E-01
Tigris-Euphrates												x	4.00E-02	1.74E-04	1.36E-02	3.76E-01
C. saadii from R. Mand drainage													x	2.14E-04	2.81E-04	4.67E-01
R. Kor basin														x	2.25E-02	4.36E-03
Capoeta sp.1															x	2.65E-02
C. umbla																x

Table A72. P-values obtained from pairwise comparisons of regression line slopes (a) for the width of the mouth between different populations and species (significant differences highlighted in yellow, Bonferroni-corrected significance level: 0.000208).

	C. damascina from Damascus basin	Orontes R. drainage	Litani R. drainage	Jordan R. drainage basin	Rivers in the Dead Sea Valley	Seyhan N. drainage	Arsuz N.	N. al - Kabir (N) drainage	N. Sanawbar	N. Marqiyah	N. Antelias	Tigris-Euphrates	*C. saadii* from R. Mand drainage	R. Kor basin	*Capoeta* sp.1	*C. umbla*
n	56	74	25	93	86	23	15	50	18	21	25	23	15	26	18	20
C. damascina from Damascus basin	x	1.84E-06	4.00E-01	6.28E-08	4.14E-03	9.90E-02	3.67E-01	5.33E-01	2.33E-01	9.73E-02	6.10E-04	1.69E-04	6.07E-01	6.94E-01	2.00E-02	9.64E-01
Orontes R. drainage		x	3.56E-02	8.42E-01	1.81E-02	6.14E-01	3.67E-02	4.97E-02	7.09E-02	2.13E-02	1.65E-01	4.32E-01	3.55E-01	1.08E-02	7.42E-01	1.27E-01
Litani R. drainage			x	3.58E-02	1.16E-01	6.32E-02	8.76E-01	3.10E-01	4.92E-02	4.08E-02	7.46E-04	1.76E-02	1.81E-01	3.61E-01	5.63E-02	5.25E-01
Jordan R. drainage basin				x	4.40E-03	5.63E-01	3.85E-02	3.51E-02	5.79E-02	1.32E-02	1.97E-01	4.88E-01	3.39E-01	5.98E-03	6.65E-01	1.12E-01
Rivers in the Dead Sea Valley					x	6.35E-01	1.12E-01	3.90E-01	6.34E-01	5.89E-01	1.81E-02	2.27E-02	7.72E-01	1.90E-01	3.57E-01	3.65E-01
Seyhan N. drainage						x	4.17E-02	3.74E-01	3.57E-01	3.38E-01	8.92E-02	3.60E-01	5.63E-01	2.71E-01	8.39E-01	3.44E-01
Arsuz N.							x	2.94E-01	1.39E-03	2.50E-03	2.53E-05	1.37E-02	8.13E-02	3.41E-01	4.49E-02	4.86E-01
N. al-Kabir (N) drainage								x	7.27E-01	6.42E-01	2.06E-02	4.25E-02	8.82E-01	8.34E-01	2.28E-01	7.38E-01
N. Sanawbar									x	8.84E-01	5.20E-05	1.78E-02	9.22E-01	5.33E-01	2.04E-01	5.26E-01
N. Marqiyah										x	2.69E-05	5.50E-03	8.76E-01	4.15E-01	1.57E-01	4.70E-01
N. Antelias											x	3.85E-01	2.59E-02	8.11E-03	1.23E-01	3.92E-02
Tigris-Euphrates												x	2.19E-01	1.79E-02	4.28E-01	1.20E-01
C. saadii from R. Mand drainage													x	7.82E-01	4.82E-01	6.99E-01
R. Kor basin														x	1.49E-01	8.43E-01
Capoeta sp.1															x	2.87E-01
C. umbla																x

Table A73. P-values obtained from pairwise comparisons of regression line intercepts (b) for the width of the mouth between different populations and species (significant differences highlighted in yellow, Bonferroni-corrected significance level: 0.000208).

	C. damascina from Damascus basin	Orontes R. drainage	Litani R. drainage	Jordan R. drainage basin	Rivers in the Dead Sea Valley	Seyhan N. drainage	Arsuz N.	N. al - Kabir (N) drainage	N. Sanawbar	N. Marqiyah	N. Antelias	Tigris-Euphrates	*C. saadii* from R. Mand drainage	R. Kor basin	*Capoeta* sp.1	*C. umbla*
n	56	74	25	93	86	23	15	50	18	21	25	23	15	26	18	20
C. damascina from Damascus basin	x	1.18E-01	6.53E-03	4.28E-18	4.76E-08	6.34E-06	9.11E-02	5.66E-04	1.03E-04	4.05E-03	1.97E-05	7.95E-04	1.11E-01	4.54E-01	1.06E-07	4.79E-01
Orontes R. drainage		x	4.20E-02	3.24E-17	2.45E-06	3.86E-05	3.67E-01	1.10E-02	7.42E-04	4.09E-02	1.23E-04	7.06E-03	2.46E-01	7.28E-02	1.74E-07	7.59E-01
Litani R. drainage			x	2.74E-04	2.05E-01	9.63E-02	2.42E-01	9.02E-01	1.92E-01	6.80E-01	5.08E-02	7.42E-01	9.50E-01	7.81E-03	5.19E-03	5.80E-01
Jordan R. drainage basin				x	6.01E-04	2.78E-02	1.18E-05	3.23E-07	4.41E-03	3.99E-06	4.76E-02	1.65E-04	2.35E-02	1.81E-10	7.43E-01	2.16E-02
Rivers in the Dead Sea Valley					x	6.47E-01	2.96E-02	6.80E-02	7.98E-01	6.46E-02	6.58E-01	2.95E-01	4.07E-01	1.27E-05	4.36E-02	2.35E-01
Seyhan N. drainage						x	6.37E-03	7.58E-02	4.36E-01	1.43E-02	9.82E-01	1.83E-01	2.49E-01	1.69E-04	1.57E-01	2.18E-01
Arsuz N.							x	4.49E-01	1.54E-04	1.70E-01	1.43E-04	1.73E-01	4.06E-01	5.92E-02	3.75E-04	9.19E-01
N. al-Kabir (N) drainage								x	2.58E-01	8.52E-01	9.19E-02	6.35E-01	9.79E-01	4.65E-03	3.23E-03	6.46E-01
N. Sanawbar									x	5.71E-03	2.57E-01	4.26E-01	2.86E-01	4.98E-04	2.37E-02	2.92E-01
N. Marqiyah										x	1.27E-03	4.29E-01	8.30E-01	5.50E-03	2.81E-04	6.48E-01
N. Antelias											x	1.43E-01	1.25E-01	9.86E-05	1.20E-01	1.66E-01
Tigris-Euphrates												x	7.90E-01	3.48E-03	1.27E-02	5.09E-01
C. saadii from R. Mand drainage													x	8.34E-02	5.68E-02	6.85E-01
R. Kor basin														x	2.38E-05	3.70E-01
Capoeta sp.1															x	8.72E-02
C. umbla																x

Table A74. P-values obtained from Mann-Whitney tests (significant differences highlighted in yellow).

Character	**P-value**	**n**
Unbranched D	0.798	96
Branched D	0.061	96
Unbranched A	1.000	96
Branched A	0.306	96
Pc	0.311	86
P	0.088	91
Branched C	0.570	95
ALL	0.137	77
BLL	0.167	80
CCP	0.589	82
LL	0.070	93
$GR_{\text{Lower limb count}}$	0.003	88
VC	0.088	21
Total number of barbels	0.582	96

Table A75. P-values obtained from Mann-Whitney tests for the number of unbranched dorsal-fin rays (significant differences highlighted in yellow, Bonferroni-corrected significance level: 0.000368).

	C. damascina from Damascus basin	N. Quwayq	Orontes R. drainage	Litani R. drainage	Jordan R. drainage basin	Rivers in the Dead Sea Valley	Seyhan N. drainage	Arsuz N.	N. al-Kabir (N) drainage	N. Sanawbar	N. Marqiyah	N. Antelias	Tigris-Euphrates	*C. saadii* from R. Mand drainage	R. Kor basin	*Capoeta* sp.1	*C. umbla*
n	61	21	92	26	97	82	21	18	51	18	19	29	28	15	32	17	27
C. damascina from Damascus basin	x	8.70E-07	4.03E-03	8.96E-01	2.06E-01	8.52E-04	9.29E-02	4.89E-01	1.48E-03	6.81E-03	1.76E-01	1.52E-02	1.35E-02	4.55E-01	3.01E-07	6.13E-01	3.77E-10
N. Quwayq		x	2.43E-03	9.88E-05	1.26E-05	1.46E-02	1.15E-04	6.25E-05	2.45E-12	2.24E-06	8.52E-06	1.93E-08	1.56E-02	3.35E-03	6.83E-01	1.31E-03	3.47E-01
Orontes R. drainage			x	5.00E-02	4.83E-02	4.93E-01	3.79E-03	1.99E-02	2.63E-07	2.11E-04	4.06E-03	5.91E-05	8.40E-01	3.14E-01	5.00E-04	1.92E-01	8.70E-06
Litani R. drainage				x	4.32E-01	2.09E-02	1.58E-01	4.74E-01	1.29E-03	1.32E-02	1.78E-01	1.41E-02	6.42E-02	5.84E-01	9.81E-05	7.38E-01	4.63E-07
Jordan R. drainage basin					x	1.05E-02	2.36E-02	1.56E-01	4.94E-05	1.63E-03	4.31E-02	1.83E-03	1.05E-01	9.91E-01	1.86E-06	7.78E-01	4.36E-09
Rivers in the Dead Sea Valley						x	1.77E-03	9.41E-03	3.96E-08	1.01E-04	1.79E-03	1.80E-05	7.76E-01	1.88E-01	4.27E-03	1.06E-01	2.01E-04
Seyhan N. drainage							x	3.73E-01	5.82E-01	7.75E-01	5.32E-01	6.70E-01	1.17E-02	1.37E-01	6.49E-05	1.56E-01	1.24E-06
Arsuz N.								x	1.65E-02	4.86E-02	5.21E-01	6.95E-02	2.39E-02	2.56E-01	1.10E-04	3.37E-01	3.96E-07
N. al-Kabir (N) drainage									x	1.65E-02	1.01E-01	1.00E+00	4.55E-07	1.59E-04	1.08E-11	3.94E-04	1.07E-15
N. Sanawbar										x	8.30E-02	6.95E-02	5.15E-04	1.14E-02	3.94E-06	1.36E-02	1.18E-08
N. Marqiyah											x	2.17E-01	5.15E-03	8.48E-02	1.90E-05	1.19E-01	4.01E-08
N. Antelias												x	8.40E-05	3.93E-03	5.96E-08	6.85E-03	3.74E-11
Tigris-Euphrates													x	3.01E-01	1.00E-02	1.94E-01	2.96E-04
C. saadii from R. Mand drainage														x	4.23E-03	8.40E-01	5.75E-05
R. Kor basin															x	1.64E-03	8.02E-01
Capoeta sp.1																x	1.60E-05
C. umbla																	x

Table A76. P-values obtained from Mann-Whitney tests for the number of branched dorsal-fin rays (significant differences highlighted in yellow, Bonferroni-corrected significance level: 0.000327).

	C. damascina from Damascus basin	N. Quwayq	Orontes R. drainage	Litani R. drainage	Jordan R. drainage basin	Rivers in the Dead Sea Valley	Seyhan N. drainage	Arsuz N.	N. al-Kabir (N) drainage	N. Sanawbar	N. Marqiyah	N. Antelias	Tigris-Euphrates	*C. saadii* from R. Helleh drainage	R. Mand drainage	R. Kor basin	*Capoeta* sp.1	*C. umbla*
n	61	20	95	26	97	82	21	18	51	18	19	29	27	16	16	33	18	30
C. damascina from Damascus basin	x	5.19E-02	7.52E-01	3.46E-02	8.24E-01	6.97E-02	2.35E-01	7.65E-01	7.11E-01	4.18E-03	5.42E-01	3.99E-04	1.43E-01	3.27E-01	1.44E-03	1.08E-02	4.53E-01	9.19E-01
N. Quwayq		x	4.96E-02	2.01E-03	3.96E-02	2.51E-03	4.20E-01	5.11E-02	4.72E-02	2.45E-01	2.56E-01	7.75E-05	4.14E-01	1.99E-02	2.16E-04	7.80E-04	2.62E-02	1.81E-01
Orontes R. drainage			x	8.94E-03	5.44E-01	1.42E-02	2.71E-01	5.83E-01	9.30E-01	2.08E-03	6.35E-01	2.45E-05	1.67E-01	1.97E-01	1.88E-04	1.70E-03	2.94E-01	7.66E-01
Litani R. drainage				x	4.19E-02	4.13E-01	9.08E-03	1.72E-01	1.09E-02	6.50E-04	4.10E-02	2.31E-01	2.54E-03	4.79E-01	2.09E-01	8.11E-01	3.30E-01	1.81E-01
Jordan R. drainage basin					x	7.71E-02	1.85E-01	8.81E-01	5.39E-01	2.87E-03	4.54E-01	3.35E-04	1.04E-01	3.98E-01	1.65E-03	1.17E-02	5.44E-01	9.86E-01
Rivers in the Dead Sea Valley						x	1.71E-02	3.65E-01	2.72E-02	2.15E-04	7.83E-02	1.90E-02	4.91E-03	8.73E-01	3.10E-02	2.31E-01	6.54E-01	2.88E-01
Seyhan N. drainage							x	1.90E-01	2.79E-01	7.49E-02	6.52E-01	3.45E-04	9.14E-01	7.20E-02	7.07E-04	3.88E-03	9.97E-02	3.96E-01
Arsuz N.								x	5.32E-01	1.26E-02	4.45E-01	1.58E-02	1.13E-01	5.57E-01	1.89E-02	1.04E-01	7.04E-01	9.02E-01
N. al-Kabir (N) drainage									x	2.67E-03	6.71E-01	7.56E-05	1.72E-01	1.73E-01	2.54E-04	2.97E-03	2.63E-01	7.33E-01
N. Sanawbar										x	5.58E-02	4.17E-05	5.18E-02	7.06E-03	2.10E-04	2.29E-04	7.56E-03	4.97E-02
N. Marqiyah											x	2.54E-03	5.43E-01	2.07E-01	4.22E-03	2.08E-02	2.72E-01	6.36E-01
N. Antelias												x	4.90E-05	8.21E-02	8.01E-01	3.05E-01	4.16E-02	1.82E-02
Tigris-Euphrates													x	3.41E-02	1.26E-04	8.69E-04	5.06E-02	3.05E-01
C. saadii from R. Helleh drainage														x	8.13E-02	3.48E-01	8.27E-01	5.58E-01
R. Mand drainage															x	2.68E-01	4.49E-02	3.06E-02
R. Kor basin																x	2.21E-01	1.05E-01
Capoeta sp.1																	x	6.71E-01
C. umbla																		x

Table A77. P-values obtained from Mann-Whitney tests for the total number of pectoral-fin rays (significant differences highlighted in yellow, Bonferroni-corrected significance level: 0.000327).

	C. damascina from Damascus basin	N. Quwayq	Orontes R. drainage	Litani R. drainage	Jordan R. drainage basin	Rivers in the Dead Sea Valley	Seyhan N. drainage	Arsuz N.	N. al-Kabir (N) drainage	N. Sanawbar	N. Marqiyah	N. Antelias	Tigris-Euphrates	*C. saadii* from R. Helleh drainage	R. Mand drainage	R. Kor basin	*Capoeta* sp.1	*C. umbla*
n	58	19	88	26	87	74	20	18	46	17	18	29	23	16	15	30	16	16
C. damascina from Damascus basin	x	1.29E-01	4.49E-05	1.17E-01	7.62E-02	1.95E-03	1.70E-03	3.63E-03	7.75E-02	1.00E-02	3.48E-01	8.20E-01	1.32E-03	3.68E-01	1.30E-02	6.62E-01	2.66E-03	5.49E-05
N. Quwayq		x	2.16E-01	9.80E-01	7.29E-01	5.74E-01	1.18E-01	2.39E-01	1.30E-02	3.23E-01	7.58E-01	1.30E-01	1.64E-01	8.71E-02	3.12E-03	1.08E-01	1.15E-01	2.03E-02
Orontes R. drainage			x	1.76E-01	8.92E-03	2.17E-01	2.61E-01	8.49E-01	6.28E-07	9.22E-01	1.46E-01	7.60E-04	5.25E-01	2.87E-03	2.43E-05	5.07E-04	2.67E-01	5.43E-02
Litani R. drainage				x	6.92E-01	6.20E-01	7.50E-02	2.43E-01	1.23E-02	2.90E-01	7.59E-01	1.34E-01	1.30E-01	1.00E-01	6.18E-03	1.16E-01	8.90E-02	1.14E-02
Jordan R. drainage basin					x	1.59E-01	1.56E-02	6.92E-02	1.32E-03	1.17E-01	9.74E-01	1.09E-01	2.62E-02	7.57E-02	1.29E-03	8.15E-02	2.23E-02	1.14E-03
Rivers in the Dead Sea Valley						x	6.54E-02	3.06E-01	2.50E-05	4.21E-01	4.53E-01	7.54E-03	1.51E-01	1.35E-02	1.16E-04	6.03E-03	8.94E-02	7.57E-03
Seyhan N. drainage							x	4.01E-01	4.27E-04	4.84E-01	7.26E-02	4.84E-03	6.74E-01	1.00E-02	1.30E-03	4.38E-03	8.56E-01	5.93E-01
Arsuz N.								x	5.02E-04	9.57E-01	2.00E-01	6.57E-03	7.14E-01	1.23E-02	4.84E-04	6.87E-03	4.29E-01	1.28E-01
N. al-Kabir (N) drainage									x	1.32E-03	7.51E-02	2.08E-01	1.58E-04	7.99E-01	2.79E-01	3.00E-01	5.78E-04	2.02E-05
N. Sanawbar										x	2.35E-01	1.53E-02	7.17E-01	1.92E-02	8.14E-04	1.37E-02	4.39E-01	1.75E-01
N. Marqiyah											x	3.36E-01	1.13E-01	2.46E-01	3.59E-02	3.16E-01	8.19E-02	1.41E-02
N. Antelias												x	3.68E-03	5.06E-01	3.45E-02	8.49E-01	5.69E-03	2.47E-04
Tigris-Euphrates													x	7.30E-03	3.23E-04	3.24E-03	6.11E-01	2.85E-01
C. saadii from R. Helleh drainage														x	3.10E-01	5.98E-01	1.00E-02	1.10E-03
R. Mand drainage															x	5.97E-02	9.36E-04	7.56E-05
R. Kor basin																x	5.41E-03	2.42E-04
Capoeta sp.1																	x	7.38E-01
C. umbla																		x

Table A78. P-values obtained from Mann-Whitney tests for the total number of pelvic-fin rays (significant differences highlighted in yellow, Bonferroni-corrected significance level: 0.000327).

	C. damascina from Damascus basin	N. Quwayq	Orontes R. drainage	Litani R. drainage	Jordan R. drainage basin	Rivers in the Dead Sea Valley	Seyhan N. drainage	Arsuz N.	N. al-Kabir (N) drainage	N. Sanawbar	N. Marqiyah	N. Antelias	Tigris-Euphrates	*C. saadii* from R. Helleh drainage	R. Mand drainage	R. Kor basin	*Capoeta* sp.1	*C. umbla*
n	62	20	95	26	92	81	21	18	51	18	19	29	27	16	16	32	18	29
C. damascina from Damascus basin	x	9.44E-04	1.33E-04	2.71E-01	5.62E-04	7.76E-06	1.05E-02	2.34E-02	6.11E-01	6.85E-01	3.57E-01	8.16E-01	8.29E-03	1.81E-10	1.24E-11	5.29E-07	7.92E-03	3.01E-03
N. Quwayq		x	4.89E-01	3.94E-02	1.12E-01	6.74E-01	3.49E-01	5.63E-01	1.84E-02	9.37E-03	2.59E-02	4.42E-03	2.06E-01	1.45E-07	3.45E-08	2.55E-06	7.31E-01	3.47E-01
Orontes R. drainage			x	7.00E-02	2.51E-01	6.15E-01	7.10E-01	9.14E-01	7.00E-03	8.64E-03	7.14E-02	2.92E-03	5.02E-01	5.53E-13	4.35E-14	1.18E-11	3.20E-01	7.44E-01
Litani R. drainage				x	1.62E-01	2.10E-02	1.68E-01	2.23E-01	6.32E-01	2.53E-01	8.89E-01	2.75E-01	1.88E-01	8.16E-08	1.30E-08	1.78E-05	9.85E-02	1.15E-01
Jordan R. drainage basin					x	7.71E-02	7.09E-01	5.86E-01	2.76E-02	9.43E-03	1.35E-01	4.94E-03	9.13E-01	1.46E-15	6.62E-17	8.18E-13	1.04E-01	5.87E-01
Rivers in the Dead Sea Valley						x	4.54E-01	6.82E-01	1.50E-03	1.88E-03	2.14E-02	4.53E-04	2.63E-01	7.00E-14	5.64E-15	1.49E-12	4.26E-01	4.57E-01
Seyhan N. drainage							x	8.57E-01	1.01E-01	2.40E-02	9.10E-02	1.96E-02	7.95E-01	5.44E-08	1.06E-08	3.69E-06	3.48E-01	9.25E-01
Arsuz N.								x	1.22E-01	6.32E-02	1.75E-01	4.48E-02	6.94E-01	1.16E-06	2.68E-07	3.73E-05	4.87E-01	9.01E-01
N. al-Kabir (N) drainage									x	5.28E-01	7.46E-01	5.86E-01	1.01E-01	1.15E-07	1.78E-08	1.73E-05	3.61E-02	5.32E-02
N. Sanawbar										x	2.71E-01	8.73E-01	1.84E-02	9.89E-06	1.79E-06	1.86E-03	5.15E-02	1.27E-02
N. Marqiyah											x	3.30E-01	1.01E-01	3.55E-07	6.07E-08	7.81E-05	1.00E-01	6.78E-02
N. Antelias												x	1.58E-02	2.41E-06	4.73E-07	4.28E-04	2.42E-02	8.65E-03
Tigris-Euphrates													x	3.67E-09	6.09E-10	4.69E-07	2.42E-01	7.03E-01
C. saadii from R. Helleh drainage														x	6.76E-01	2.74E-02	1.37E-05	2.57E-09
R. Mand drainage															x	8.36E-03	4.37E-06	4.36E-10
R. Kor basin																x	1.14E-04	2.03E-07
Capoeta sp.1																	x	3.21E-01
C. umbla																		x

Table A79. P-values obtained from Mann-Whitney tests for the number of branched anal-fin rays (significant differences highlighted in yellow, Bonferroni-corrected significance level: 0.000327).

	C. damascina from Damascus basin	N. Quwayq	Orontes R. drainage	Litani R. drainage	Jordan R. drainage basin	Rivers in the Dead Sea Valley	Seyhan N. drainage	Arsuz N.	N. al-Kabir (N) drainage	N. Sanawbar	N. Marqiyah	N. Antelias	Tigris-Euphrates	*C. saadii* from R. Helleh drainage	R. Mand drainage	R. Kor basin	*Capoeta* sp.1	*C. umbla*
n	61	20	96	26	97	82	21	18	49	18	19	29	27	16	16	33	18	30
C. damascina from Damascus basin	x	8.99E-02	2.83E-04	5.40E-02	3.84E-02	7.96E-01	8.25E-02	1.07E-01	8.78E-03	1.07E-01	9.82E-02	4.22E-02	1.82E-01	1.28E-01	1.28E-01	3.05E-02	1.07E-01	3.89E-02
N. Quwayq		x	1.00E+00	1.00E+00	3.58E-01	6.99E-02	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	3.89E-01	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
Orontes R. drainage			x	1.00E+00	4.49E-02	1.09E-04	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	5.93E-02	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
Litani R. drainage				x	2.94E-01	3.95E-02	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	3.26E-01	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
Jordan R. drainage basin					x	1.43E-02	3.46E-01	3.83E-01	1.51E-01	3.83E-01	3.70E-01	2.68E-01	9.22E-01	4.10E-01	4.10E-01	2.38E-01	3.83E-01	2.60E-01
Rivers in the Dead Sea Valley						x	6.34E-02	8.51E-02	5.13E-03	8.52E-02	7.71E-02	2.99E-02	1.30E-01	1.04E-01	1.04E-01	2.08E-02	8.51E-02	2.73E-02
Seyhan N. drainage							x	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	3.78E-01	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
Arsuz N.								x	1.00E+00	1.00E+00	1.00E+00	1.00E+00	4.14E-01	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
N. al-Kabir (N) drainage									x	1.00E+00	1.00E+00	1.00E+00	1.78E-01	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
N. Sanawbar										x	1.00E+00	1.00E+00	4.14E-01	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
N. Marqiyah											x	1.00E+00	4.02E-01	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
N. Antelias												x	3.00E-01	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
Tigris-Euphrates													x	4.41E-01	4.41E-01	2.69E-01	4.14E-01	2.92E-01
C. saadii from R. Helleh drainage														x	1.00E+00	1.00E+00	1.00E+00	1.00E+00
R. Mand drainage															x	1.00E+00	1.00E+00	1.00E+00
R. Kor basin																x	1.00E+00	1.00E+00
Capoeta sp.1																	x	1.00E+00
C. umbla																		x

Table A80. P-values obtained from Mann-Whitney tests for the number of scales above the lateral line (significant differences highlighted in yellow, Bonferroni-corrected significance level: 0.000417).

	C. damascina from Damascus basin	N. Quwayq	Orontes R. drainage	Litani R. drainage	Jordan R. drainage basin	Rivers in the Dead Sea Valley	Seyhan N. drainage	Arsuz N.	N. al-Kabir (N) drainage	N. Marqiyah	N. Antelias	Tigris-Euphrates	*C. saadii* from R. Helleh drainage	R. Kor basin	*Capoeta* sp.1	*C. umbla*
n	56	20	84	22	78	65	21	17	41	15	25	25	17	28	17	18
C. damascina from Damascus basin	x	3.20E-05	9.20E-01	2.10E-07	6.78E-21	1.26E-19	4.80E-02	1.60E-04	2.03E-02	2.10E-02	2.00E-09	6.97E-13	2.45E-06	2.02E-04	2.56E-01	7.02E-11
N. Quwayq		x	5.12E-05	6.36E-01	5.00E-05	2.61E-06	2.46E-05	9.84E-06	6.21E-03	7.54E-05	4.82E-01	7.08E-06	4.07E-06	1.45E-06	4.67E-02	1.07E-07
Orontes R. drainage			x	4.04E-07	7.42E-24	1.57E-22	6.90E-02	4.69E-04	1.96E-02	3.94E-02	5.03E-09	1.10E-13	5.21E-06	5.93E-04	2.31E-01	1.11E-11
Litani R. drainage				x	1.79E-04	1.27E-05	5.91E-07	3.32E-07	3.01E-04	2.51E-06	8.15E-01	2.86E-05	3.75E-07	1.08E-08	7.48E-03	5.68E-08
Jordan R. drainage basin					x	2.38E-01	1.87E-12	6.50E-11	7.93E-15	6.28E-10	4.27E-05	2.11E-01	1.07E-10	2.82E-15	1.52E-07	1.25E-10
Rivers in the Dead Sea Valley						x	6.28E-12	1.20E-10	8.25E-15	1.12E-09	1.13E-06	8.49E-01	1.55E-10	1.36E-14	3.39E-08	2.38E-10
Seyhan N. drainage							x	8.22E-02	6.40E-04	6.82E-01	2.56E-08	3.67E-09	2.94E-03	2.50E-01	2.47E-02	6.87E-08
Arsuz N.								x	4.44E-06	1.49E-01	4.98E-08	2.49E-08	6.69E-02	3.23E-01	5.36E-03	2.90E-07
N. al-Kabir (N) drainage									x	5.04E-04	2.04E-05	7.83E-11	3.25E-07	1.03E-06	8.02E-01	6.64E-10
N. Marqiyah										x	2.56E-07	7.84E-08	5.12E-03	4.57E-01	1.57E-02	7.23E-07
N. Antelias											x	2.85E-06	1.18E-07	5.17E-10	2.54E-03	2.08E-08
Tigris-Euphrates												x	2.75E-08	1.85E-10	4.31E-07	7.61E-08
C. saadii from R. Helleh drainage													x	4.56E-03	3.08E-05	2.71E-07
R. Kor basin														x	7.78E-04	6.58E-09
Capoeta sp.1															x	3.15E-07
C. umbla																x

Table A81. P-values obtained from Mann-Whitney tests for the number of scales below the lateral line (significant differences highlighted in yellow, Bonferroni-corrected significance level: 0.000417).

	C. damascina from Damascus basin	N. Quwayq	Orontes R. drainage	Litani R. drainage	Jordan R. drainage basin	Rivers in the Dead Sea Valley	Seyhan N. drainage	Arsuz N.	N. al-Kabir (N) drainage	N. Marqiyah	N. Antelias	Tigris-Euphrates	*C. saadii* from R. Helleh drainage	R. Kor basin	*Capoeta* sp.1	*C. umbla*
n	45	19	85	19	81	64	18	17	44	17	27	23	16	27	17	25
C. damascina from Damascus basin	x	1.95E-01	2.87E-03	5.79E-01	2.01E-07	6.09E-06	2.23E-02	8.60E-04	2.34E-01	4.88E-04	1.65E-01	5.44E-03	5.79E-04	2.84E-04	1.91E-03	5.55E-12
N. Quwayq		x	4.37E-04	5.05E-01	2.07E-03	1.11E-02	4.87E-03	6.38E-05	7.28E-01	1.13E-04	9.63E-01	1.05E-01	4.97E-05	6.10E-05	5.59E-02	1.62E-08
Orontes R. drainage			x	1.95E-03	3.51E-18	1.78E-14	7.00E-01	1.52E-01	1.81E-05	6.34E-02	9.29E-05	5.17E-07	1.28E-01	8.30E-02	4.85E-07	1.50E-14
Litani R. drainage				x	4.27E-05	3.50E-04	1.15E-02	2.01E-04	4.69E-01	1.45E-04	3.11E-01	1.68E-02	1.59E-04	2.45E-04	5.34E-03	1.40E-08
Jordan R. drainage basin					x	5.61E-01	8.33E-08	2.25E-09	6.33E-06	3.65E-09	4.65E-04	9.22E-02	3.85E-09	5.99E-12	2.32E-01	9.36E-13
Rivers in the Dead Sea Valley						x	6.34E-07	1.51E-08	1.01E-04	3.51E-08	2.58E-03	2.55E-01	1.53E-08	1.22E-10	5.16E-01	1.49E-12
Seyhan N. drainage							x	5.42E-01	1.73E-03	2.61E-01	1.87E-03	1.84E-04	5.17E-01	4.35E-01	7.52E-05	2.61E-08
Arsuz N.								x	3.41E-05	5.86E-01	4.43E-05	5.19E-06	7.73E-01	9.31E-01	2.56E-06	4.28E-08
N. al-Kabir (N) drainage									x	3.13E-05	6.55E-01	4.29E-02	2.55E-05	5.62E-06	8.65E-03	6.22E-12
N. Marqiyah										x	6.32E-05	5.50E-06	6.27E-01	8.24E-01	3.13E-06	3.68E-08
N. Antelias											x	1.12E-01	2.78E-05	1.44E-05	2.95E-02	4.05E-10
Tigris-Euphrates												x	1.05E-05	8.94E-07	7.09E-01	3.47E-09
C. saadii from R. Helleh drainage													x	8.22E-01	3.82E-06	6.48E-08
R. Kor basin														x	9.12E-07	4.97E-10
Capoeta sp.1															x	3.90E-08
C. umbla																x

Table A82. P-values obtained from Mann-Whitney tests for the number of circumpendicular scales (significant differences highlighted in yellow, Bonferroni-corrected significance level: 0.000417).

	C. damascina from Damascus basin	N. Quwayq	Orontes R. drainage	Litani R. drainage	Jordan R. drainage basin	Rivers in the Dead Sea Valley	Seyhan N. drainage	Arsuz N.	N. al-Kabir (N) drainage	N. Sanawbar	N. Marqiyah	N. Antelias	Tigris-Euphrates	*C. saadii* from R. Kor basin	*Capoeta* sp.1	*C. umbla*
n	58	21	86	26	83	64	17	18	44	16	19	29	24	27	18	21
C. damascina from Damascus basin	x	4.47E-05	9.40E-06	1.17E-01	3.13E-15	1.35E-12	4.51E-01	5.49E-03	4.02E-02	1.70E-02	4.83E-07	1.10E-02	7.69E-11	1.31E-04	2.99E-06	7.06E-12
N. Quwayq		x	4.01E-09	2.21E-03	6.44E-02	2.61E-01	4.08E-04	3.33E-06	7.47E-07	9.73E-02	1.26E-07	8.17E-03	3.60E-03	1.87E-07	4.42E-01	2.26E-08
Orontes R. drainage			x	2.41E-07	3.38E-24	1.17E-20	2.92E-02	5.59E-01	1.86E-02	9.56E-06	5.41E-03	1.79E-09	4.69E-13	5.54E-01	2.41E-07	6.86E-13
Litani R. drainage				x	8.26E-09	1.83E-07	5.56E-02	4.21E-05	4.93E-04	1.35E-01	3.85E-08	2.81E-01	3.07E-08	1.92E-06	1.14E-04	3.09E-09
Jordan R. drainage basin					x	2.30E-01	8.25E-08	3.16E-10	2.45E-16	1.24E-04	1.55E-11	2.29E-08	4.86E-02	1.57E-13	3.98E-01	1.83E-12
Rivers in the Dead Sea Valley						x	4.84E-07	1.21E-09	2.43E-14	7.82E-04	4.84E-11	6.70E-07	4.78E-03	1.70E-12	9.36E-01	4.80E-12
Seyhan N. drainage							x	1.19E-01	4.92E-01	1.67E-02	3.12E-04	7.43E-03	4.24E-07	2.02E-02	6.19E-05	1.20E-07
Arsuz N.								x	1.96E-01	2.87E-04	2.19E-03	1.99E-06	3.80E-08	3.12E-01	8.14E-07	7.02E-08
N. al-Kabir (N) drainage									x	5.78E-04	2.46E-05	1.07E-05	4.08E-11	1.63E-02	7.86E-08	5.71E-11
N Sanawbar										x	4.24E-06	2.66E-01	1.36E-05	3.97E-05	1.35E-02	1.77E-07
N. Marqiyah											x	6.70E-09	1.83E-08	4.06E-02	1.36E-07	4.40E-08
N. Antelias												x	2.85E-08	7.76E-08	4.47E-04	8.48E-10
Tigris-Euphrates													x	1.23E-09	3.03E-02	1.06E-08
C. saadii from R. Kor basin														x	6.43E-08	2.68E-09
Capoeta sp.1															x	7.18E-08
C. umbla																x

Table A83. P-values obtained from Mann-Whitney tests for the number of lateral-line scales (significant differences highlighted in yellow, Bonferroni-corrected significance level: 0.000417).

	C. damascina from Damascus basin	N. Quwayq	Orontes R. drainage	Litani R. drainage	Jordan R. drainage basin	Rivers in the Dead Sea Valley	Seyhan N. drainage	Arsuz N.	N. al-Kabir (N) drainage	N. Marqiyah	N. Antelias	Tigris-Euphrates	*C. saadii* from R. Helleh drainage	R. Kor basin	*Capoeta* sp.1	*C. umbla*
n	55	21	90	41	95	79	20	17	45	19	27	24	15	22	18	24
C. damascina from Damascus basin	x	2.38E-05	2.00E-01	2.48E-02	7.05E-12	4.61E-15	3.11E-01	9.51E-04	2.75E-04	3.70E-01	7.40E-01	2.59E-11	4.23E-05	3.05E-01	1.18E-02	1.76E-12
N. Quwayq		x	4.82E-07	8.62E-03	7.76E-01	1.07E-01	7.82E-05	3.34E-06	5.20E-08	5.03E-05	6.56E-05	1.77E-04	1.21E-06	6.84E-05	1.70E-01	9.54E-09
Orontes R. drainage			x	5.04E-04	7.39E-19	3.02E-23	8.18E-01	4.31E-03	9.03E-03	8.79E-01	4.32E-01	2.13E-13	1.05E-04	9.30E-01	7.87E-04	5.31E-14
Litani R. drainage				x	2.08E-05	4.21E-08	1.36E-02	8.02E-06	2.40E-07	1.16E-02	2.42E-02	1.17E-08	7.17E-07	8.61E-03	3.05E-01	2.13E-11
Jordan R. drainage basin					x	2.91E-02	1.08E-07	1.80E-09	7.46E-17	7.35E-08	8.01E-09	1.53E-06	1.41E-09	3.12E-08	4.78E-02	4.94E-14
Rivers in the Dead Sea Valley						x	7.08E-10	4.42E-10	1.56E-18	4.50E-10	2.52E-11	2.55E-04	9.95E-10	3.35E-10	1.20E-03	2.37E-13
Seyhan N. drainage							x	9.23E-02	1.40E-01	8.65E-01	4.82E-01	2.54E-08	1.52E-02	8.40E-01	6.36E-03	1.47E-08
Arsuz N.								x	2.20E-01	7.76E-03	1.32E-03	8.10E-08	1.88E-01	1.44E-02	1.23E-04	6.43E-08
N. al-Kabir (N) drainage									x	1.93E-02	3.37E-03	1.31E-11	1.76E-02	4.36E-02	1.93E-05	8.83E-12
N. Marqiyah										x	5.98E-01	3.22E-08	3.64E-04	9.47E-01	5.61E-03	2.28E-08
N. Antelias											x	2.96E-09	6.84E-05	5.92E-01	9.19E-03	9.19E-10
Tigris-Euphrates												x	1.96E-07	1.53E-08	9.98E-06	1.65E-08
C. saadii from R. Helleh drainage													x	1.88E-03	3.28E-05	1.93E-07
R. Kor basin														x	6.32E-03	6.15E-09
Capoeta sp.1															x	3.87E-08
C. umbla																x

Table A84. P-values obtained from pairwise comparisons of regression line slopes (a) for the number of gill rakers on the lower limb of the first gill arch between different populations and species (Bonferroni-corrected significance level: 0.000208).

	C. damascina from Damascus basin	N. Quwayq	Orontes R. drainage	Litani R. drainage	Jordan R. drainage basin	Rivers in the Dead Sea Valley	Seyhan N. drainage	N. al-Kabir (N) drainage	N. Sanawbar	N. Marqiyah	N. Antelias	Tigris-Euphrates	*C. saadii* from R. Helleh drainage	R. Mand drainage	R. Kor basin	*Capoeta* sp.1
n	52	16	63	24	87	69	19	50	17	19	28	22	16	16	30	16
C. damascina from Damascus basin	x	5.47E-01	2.30E-04	1.36E-01	1.60E-02	8.84E-02	5.30E-01	6.31E-01	3.89E-01	3.69E-01	1.24E-01	5.18E-01	7.76E-01	5.75E-01	2.45E-01	1.14E-01
N. Quwayq		x	2.92E-02	4.88E-02	1.75E-01	2.06E-01	2.90E-01	6.49E-01	2.92E-01	8.90E-01	8.15E-02	7.60E-01	4.48E-01	9.73E-01	3.75E-01	9.82E-02
Orontes R. drainage			x	4.14E-01	5.80E-02	1.07E-02	4.27E-01	5.22E-04	9.96E-02	2.47E-04	3.96E-01	2.50E-04	1.09E-01	3.26E-02	2.31E-01	5.09E-01
Litani R. drainage				x	3.27E-01	2.11E-01	1.62E-01	2.72E-02	1.54E-01	2.30E-02	1.54E-01	4.83E-02	9.10E-02	6.03E-02	4.29E-01	8.12E-01
Jordan R. drainage basin					x	4.63E-01	8.95E-01	4.35E-02	6.30E-01	1.73E-02	8.31E-01	1.91E-02	4.97E-01	1.85E-01	8.68E-01	3.24E-01
Rivers in the Dead Sea Valley						x	9.37E-01	8.35E-02	9.07E-01	3.23E-02	5.27E-01	4.58E-02	6.43E-01	2.21E-01	8.17E-01	2.06E-01
Seyhan N. drainage							x	2.69E-01	8.86E-01	1.96E-01	7.25E-01	3.01E-01	6.69E-01	3.21E-01	9.72E-01	3.14E-01
N. al-Kabir (N) drainage								x	1.78E-01	6.28E-01	2.83E-02	8.82E-01	4.81E-01	6.92E-01	1.90E-01	2.90E-02
N. Sanawbar									x	1.18E-01	4.90E-01	1.90E-01	7.35E-01	3.20E-01	8.38E-01	2.41E-01
N. Marqiyah										x	1.12E-02	7.60E-01	3.39E-01	9.29E-01	1.64E-01	4.09E-02
N. Antelias											x	2.92E-02	3.06E-01	9.79E-02	8.03E-01	2.79E-01
Tigris-Euphrates												x	4.82E-01	7.97E-01	1.94E-01	6.37E-02
C. saadii from R. Helleh drainage													x	4.84E-01	6.98E-01	1.82E-01
R. Mand drainage														x	3.89E-01	1.11E-01
R. Kor basin															x	4.56E-01
Capoeta sp.1																x

Table A85. P-values obtained from pairwise comparisons of regression line intercepts (b) for the number of gill rakers on the lower limb of the first gill arch between different populations and species (significant differences highlighted in yellow, Bonferroni-corrected significance level: 0.000208).

	C. damascina from Damascus basin	N. Quwayq	Orontes R. drainage	Litani R. drainage	Jordan R. drainage basin	Rivers in the Dead Sea Valley	Seyhan N. drainage	N. al-Kabir (N) drainage	N. Sanawbar	N. Marqiyah	N. Antelias	Tigris-Euphrates	*C. saadii* from R. Helleh drainage	R. Mand drainage	R. Kor basin	*Capoeta* sp.1
n	52	16	63	24	87	69	19	50	17	19	28	22	16	16	30	16
C. damascina from Damascus basin	x	2.22E-05	1.30E-24	8.90E-05	9.23E-23	1.08E-17	7.46E-09	6.61E-08	1.28E-05	1.27E-08	1.36E-04	8.33E-14	1.61E-05	1.85E-06	7.62E-12	2.01E-03
N. Quwayq		x	2.56E-01	1.12E-03	3.36E-01	1.31E-01	3.44E-02	2.18E-04	1.78E-02	5.49E-02	2.43E-04	3.97E-01	5.70E-08	8.26E-08	1.74E-07	2.00E-06
Orontes R. drainage			x	1.77E-06	9.61E-01	1.13E-01	6.36E-03	3.53E-14	1.07E-04	1.15E-02	1.57E-09	7.22E-01	5.47E-24	2.48E-19	1.64E-30	9.68E-21
Litani R. drainage				x	8.84E-05	1.02E-03	1.25E-02	5.44E-01	4.46E-01	2.06E-02	3.81E-01	2.57E-05	4.42E-12	7.33E-11	5.70E-12	8.61E-09
Jordan R. drainage basin					x	1.70E-01	2.75E-02	3.15E-11	1.09E-03	3.80E-02	4.18E-07	7.39E-01	3.54E-21	5.15E-17	1.66E-31	2.29E-18
Rivers in the Dead Sea Valley						x	2.04E-01	7.01E-08	1.27E-02	2.53E-01	1.30E-05	1.48E-01	8.26E-20	1.52E-16	4.45E-27	9.24E-17
Seyhan N. drainage							x	5.21E-04	1.87E-01	9.28E-01	6.14E-04	1.55E-02	5.71E-13	4.74E-11	1.10E-13	3.07E-10
N. al-Kabir (N) drainage								x	1.37E-01	7.30E-04	7.59E-01	3.13E-09	5.93E-16	5.08E-14	1.67E-20	4.27E-12
N. Sanawbar									x	2.00E-01	1.25E-01	1.71E-03	1.49E-09	1.28E-08	3.34E-11	2.28E-07
N. Marqiyah										x	1.40E-03	2.87E-02	6.93E-12	2.66E-10	2.24E-13	1.66E-09
N. Antelias											x	3.14E-07	1.45E-12	2.60E-11	3.18E-13	4.69E-09
Tigris-Euphrates												x	5.14E-14	7.76E-12	2.03E-16	7.31E-12
C. saadii from R. Helleh drainage													x	3.66E-02	2.17E-02	2.15E-01
R. Mand drainage														x	9.13E-01	7.73E-03
R. Kor basin															x	1.94E-03
Capoeta sp.1																x

Table A86. P-values obtained from Mann-Whitney tests for the vertebral counts (significant differences highlighted in yellow, Bonferroni-corrected significance level: 0.0167).

	C. damascina	***C. saadii***	***C. umbla***
n	159	36	15
C. damascina	x	1.84E-15	3.29E-08
C. saadii		x	1.18E-08
C. umbla			x

Table A87. P-values obtained from Mann-Whitney tests for the total number of barbels (significant differences highlighted in yellow, Bonferroni-corrected significance level: 0.000292).

	C. damascina from Damascus basin	N. Quwayq	Orontes R. drainage	Litani R. drainage	Jordan R. drainage basin	Rivers in the Dead Sea Valley	Seyhan N. drainage	Arsuz N.	N. al-Kabir (N) drainage	N. Sanawbar	N. Marqiyah	N. Antelias	N. ad-Damur	Tigris-Euphrates	*C. saadii* from R. Helleh drainage	R. Mand drainage	R. Kor basin	*Capoeta* sp.1	*C. umbla*
n	63	51	18	20	19	95	29	55	25	18	31	15	15	18	21	97	83	27	30
C. damascina from Damascus basin	x	1.00E+00	4.15E-01	1.00E+00	1.04E-01	2.16E-01	8.33E-02	1.00E+00	1.14E-01	1.00E+00	1.00E+00	1.00E+00	2.09E-04	1.00E+00	1.00E+00	1.00E+00	1.54E-01	6.10E-02	1.00E+00
N. Quwayq		x	6.46E-01	1.00E+00	3.58E-01	4.85E-01	3.29E-01	1.00E+00	3.72E-01	1.00E+00	1.00E+00	1.00E+00	3.20E-02	1.00E+00	1.00E+00	1.00E+00	4.22E-01	2.92E-01	1.00E+00
Orontes R. drainage			x	6.08E-01	1.87E-01	4.88E-01	2.46E-01	6.63E-01	2.53E-01	6.63E-01	6.55E-01	5.81E-01	4.43E-05	5.94E-01	6.91E-01	6.91E-01	4.10E-01	1.86E-01	5.74E-01
Litani R. drainage				x	3.04E-01	4.36E-01	2.75E-01	1.00E+00	3.19E-01	1.00E+00	1.00E+00	1.00E+00	1.70E-02	1.00E+00	1.00E+00	1.00E+00	3.69E-01	2.39E-01	1.00E+00
Jordan R. drainage basin					x	5.30E-01	9.04E-01	3.83E-01	9.44E-01	3.83E-01	3.70E-01	2.68E-01	1.44E-03	2.85E-01	4.25E-01	4.25E-01	8.17E-01	7.60E-01	2.60E-01
Rivers in the Dead Sea Valley						x	5.76E-01	5.08E-01	6.30E-01	5.08E-01	4.97E-01	4.01E-01	5.60E-04	4.18E-01	5.46E-01	5.46E-01	8.18E-01	4.69E-01	3.93E-01
Seyhan N. drainage							x	3.55E-01	8.72E-01	3.55E-01	3.42E-01	2.40E-01	9.54E-02	2.57E-01	3.98E-01	3.98E-01	7.80E-01	8.83E-01	2.32E-01
Arsuz N. drainage								x	3.97E-01	1.00E+00	1.00E+00	1.00E+00	4.16E-02	1.00E+00	1.00E+00	1.00E+00	4.46E-01	3.17E-01	1.00E+00
N. al-Kabir (N) drainage									x	3.97E-01	3.85E-01	2.83E-01	1.01E-02	3.00E-01	4.40E-01	4.40E-01	8.72E-01	7.42E-01	2.75E-01
N. Sanawbar										x	1.00E+00	1.00E+00	4.20E-02	1.00E+00	1.00E+00	1.00E+00	4.46E-01	3.17E-01	1.00E+00
N. Marqiyah											x	1.00E+00	3.65E-02	1.00E+00	1.00E+00	1.00E+00	4.34E-01	3.04E-01	1.00E+00
N. Antelias												x	1.04E-02	1.00E+00	1.00E+00	1.00E+00	3.33E-01	2.04E-01	1.00E+00
N. ad-Damur													x	1.33E-02	6.20E-02	6.20E-02	2.91E-02	1.71E-01	9.23E-03
Tigris-Euphrates														x	1.00E+00	1.00E+00	3.51E-01	2.21E-01	1.00E+00
C. saadii from R. Helleh drainage															x	1.00E+00	4.87E-01	3.61E-01	1.00E+00
R. Mand drainage																x	4.87E-01	3.61E-01	1.00E+00
R. Kor basin																	x	6.72E-01	3.25E-01
Capoeta sp.1																		x	1.97E-01
C. umbla																			x

Table A88. Factor loadings for the first three PC axes resulting from a PCA carried out on 17 log-transformed measurements of 614 specimens fully examined. PCI is regarded as a size factor, PCII and PCIII as shape factors (the most important loadings on PCII and PCIII are in bold).

Morphometric characters	**PCI**	**PCII**	**PCIII**
Log SL	0.9969	-0.0231	0.0437
Log SD	0.9937	-0.0203	0.0663
Log SP	0.9949	-0.0171	0.0703
Log SA	0.9960	-0.0192	0.0554
Log HL	0.9946	-0.0119	0.0429
Log CL	0.9854	-0.0141	0.0042
Log CD	0.9859	-0.0537	-0.0119
Log LDB	0.9791	-0.0436	-0.0366
Log LAB	0.9749	**-0.0825**	0.0154
Log LD	0.9827	0.0687	**-0.1352**
Log LPC	0.9913	0.0408	-0.0815
Log LP	0.9923	0.0400	-0.0826
Log LA	0.9834	0.0078	**-0.1031**
Log ED	0.9536	**0.2806**	0.0932
Log IOW	0.9911	-0.0362	0.0059
Log PrOL	0.9810	-0.0214	-0.0041
Log POL	0.9812	**-0.0866**	0.0588
Percent variance explained	97.185	0.644	0.426

Table A89. Factor loadings for the first two PC axes resulting from a PCA carried out on 12 meristic characters of 446 specimens fully examined (the most important loadings on PCI and PCII are in bold).

Meristic characters	**PCI**	**PCII**
Unbranched D	0.2911	0.0689
Branched D	0.0949	0.3703
Pc	0.2664	**0.6532**
P	0.4575	**0.6332**
Branched A	0.0329	0.1337
Branched C	0.0381	0.0486
ALL	**0.8563**	-0.1900
BLL	0.7921	-0.3242
CCP	**0.8708**	-0.2501
LL	**0.8218**	-0.1642
$GR_{\text{Lower limb count}}$	0.4461	**0.5547**
Total number of barbels	0.0022	-0.1546
Percent variance explained	28.081	12.933

Table A90. Factor loadings for the PC axes resulting from a PCA carried out on 12 meristic characters of 439 specimens fully examined (the most important loadings on PCI and PCIV are in bold).

Meristic characters	**PCI**	**PCIV**
Unbranched D	0.2045	**-0.6775**
Branched D	0.0859	-0.1216
Pc	0.2371	-0.1347
P	0.4637	0.2097
Branched A	0.0532	**0.2941**
Branched C	0.0462	0.1330
ALL	**0.8408**	0.0489
BLL	0.7547	-0.0944
CCP	**0.8487**	0.0160
LL	**0.7872**	-0.0631
$GR_{\text{Lower limb count}}$	0.4621	0.2446
Total number of barbels	0.0242	**0.6219**
Percent variance explained	26.300	9.185

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Masters student (Masters of Science in Biology)

(Mark: Excellent, Average Final Grade: 92.36/100)

Masters Thesis Project entitled "Isolation, molecular characterization and antimicrobial resistance of Brucella and Listeria species in representative Lebanese foods"

Supervisor: Dr. Steve Harakeh

Committee members: Dr. Elias Baydoun, Dr. Elie Barbour

October 2000-June2003 **American University of Beirut, Beirut, Lebanon**

Bachelor of Science in Biology (Mark: Very Good, Average Final Grade: 80.62/100)

June 2000 **Makassed High School, Beirut, Lebanon**

Lebanese Baccalaureate II in Experimental Sciences

ACADEMIC AWARDS AND HONORS

1. SYNTHESYS grant for a research stay at the Natural History Museum, London (April 2009)
2. Peer reviewer-Journal of Ichthyological Exploration of Freshwaters (April 2009)
3. SYNTHESYS grant for a research stay at the Natural History Museum, Vienna (March 2009)
4. GRADE-Goethe Graduate Academy grant for a research stay at the Natural History Museum, London (April 2009)
5. GRADE-Goethe Graduate Academy grant for a research stay at the Natural History Museum, Vienna (March 2009)
6. SYNTHESYS grant for a research stay at the Natural History Museum, Paris (November 2008 – December 2008)
7. German Academic Exchange Service (Deutscher Akademischer Austauschdienst, DAAD) scholarship for attending the International Congress: Documenting, Analyzing and Managing Biodiversity in the Middle East, Jordan (October 2008)
8. PhD scholarship granted by the DAAD (June 2007 – December 2010)
9. Honors: Deans Honor List, American University of Beirut (Spring 2002)

PROFESSIONAL EXPERIENCE

American University of Beirut, Beirut, Lebanon

Part-time Instructor *Fall 2005 – Spring 2007*

- Teaching ecology laboratories for junior and senior students
- Teaching genetics laboratories for junior students
- Teaching general biology laboratories for sophomore students

American University of Beirut, Beirut, Lebanon
Part-time Research Assistant *Fall 2005 – 2007*

Involved in the curation of marine as well as freshwater organisms at the American University of Beirut Museum

American University of Beirut, Beirut, Lebanon
Graduate Teaching Assistant *Fall 2003 – Spring 2005*

- Teaching ecology laboratories for junior and senior students
- Working in the microbiology laboratory (familiar with the techniques concerned with isolation, molecular characterization and antimicrobial resistance of certain bacterial species)

American University of Beirut, Beirut, Lebanon
Research Assistant *Summer 2003*

- Working in the field of food and environmental microbiology

PROJECTS

Below are some of the projects I have participated in:

Senckenberg Research Institute and Natural History Museum, Frankfurt, Germany

(*August 2006 – October 2006)*

- Biological research on fishes in preparation of my planned PhD dissertation
- Attending a training workshop on collection management and natural history museum curatorship

These activities were carried out in the framework of the project “Establishment of a Middle Eastern Biodiversity Research, Training and Conservation Network”. This project is funded by the DAAD.

University of Balamand, El-Koura, Lebanon

- Attended an inception workshop implementing a project entitled "Integrated Management of East Mediterranean Coastlines (IMAC) in the Northern District of Lebanon"

American University of Beirut, Beirut, Lebanon

- Worked on Lebanese pelagic water fisheries
- Worked on the microbiological quality of Lebanese fresh water
- Worked on the microbiological quality of Lebanese ready-to-eat meat products

CONFERENCES, SYMPOSIA & COURSES ATTENDED

- Evolutionary Ecology of Fishes – Diversification, Adaptation and Speciation (23.-25.11.2009), Berlin
  (Berlin, Germany; November 23–25, 2009)

- **ALWAN, N.** (2009). Living abroad-Sharing the experience. A talk addressed to the new DAAD scholarship holders from the Middle East organized by the DAAD.
  (Bonn, Germany; October 26, 2009)

- HARAKEH, S., SALEH, I., BARBOUR, E., GHOSN, N. & **ALWAN, N.** (2009). Antimicrobial resistance patterns of *Brucella abortus* isolated from dairy-based food products (**Oral Presentation**). The 7th Arab Conference for Antimicrobial Agents
  (Beirut, Lebanon; November 6–8, 2009)

- **ALWAN, N.** (2009). SYNTHESYS Invitation for a user/stakeholder feedback meeting at the Natural History Museum, London
  (London, UK; July 24, 2009)

- Short course on scientific writing and presentation: preparing a conference poster offered by GRADE-Goethe Graduate Academy
  (Frankfurt, Germany; May 21– 22, 2009)

- **ALWAN, N.** (2008). The cyprinid fish *Capoeta damascina*: a single species or a group of closely related species? (**Poster Presentation**). International

Congress: Documenting, Analyzing and Managing Biodiversity in the Middle East

(Amman, Jordan; October 20 – 23, 2008)

- BORKENHAGEN, K., WICKER, F., **ALWAN, N.** & FREYHOF, J. (2008). Translating biodiversity research into conservation action: The case of the River Barada fish fauna in Syria (**Oral Presentation**). International Congress: Documenting, Analyzing and Managing Biodiversity in the Middle East

  (Amman, Jordan; October 20 – 23, 2008)

- Summer short course in statistics (R program) offered by the GRADE-Goethe Graduate Academy

  (Frankfurt, Germany; July7– 8, 2008)

- 6th Conference of the German Society of Ichthyology/ 6. Tagung der Gesellschaft für Ichthyologie (GFI)

  (Munich, Germany; March 13–15, 2008)

- HARAKEH, S. & **ALWAN, N.** (2005). Isolation, molecular characterization and antibiotic resistance of *Listeria* species in representative Lebanese foods (**Poster Presentation**). The XI International Congress of Bacteriology and Applied Microbiology

  (San Francisco, USA; July 23–28, 2005)

PUBLICATIONS

Bariche, M., **Alwan, N.**, & El-Fadel, M. (2006). Structure and biological characteristics of purse seine landings off the Lebanese coast (eastern Mediterranean). *Fisheries Research*, *82*, 246-252.

Saleh, I., Zouhairi, O., **Alwan, N.**, Hawi, A., Barbour, E., & Harakeh, S. (2009). Antimicrobial resistance and pathogenicity of *Escherichia coli* isolated from common dairy products in the Lebanon. *Annals of Tropical Medicine and Parasitology*, *103*, 39-52.

Bariche, M., **Alwan, N.**, El-Assi, H., & Zurayk, R. (2009). Diet composition of the Lessepsian bluespotted cornetfish *Fistularia commersonii* in the eastern Mediterranean. *Journal of Applied Ichthyology*, *25*, 460-465.

Harakeh, S., Saleh, I., Zouhairi, O., Baydoun, E., Barbour, E., & **Alwan, N.** (2009). Antimicrobial resistance of *Listeria monocytogenes* isolated from dairy-based food products. *The Science of the Total Environment*, *407*, 4022-4027.

Alwan, N., Saleh, I., Beydoun, E., Barbour, E., Ghosn, N., & Harakeh, S. (2010). Resistance of *Brucella abortus* isolated from Lebanese dairy-based food products against commonly used antimicrobials. *Dairy Science & Technology*, *90*, 579-588.

Harakeh, S., Zouhairi, O., Saleh, I., **Alwan, N.**, Toufeili, I., & Barbour, E. Antimicrobial resistance of *Staphylococcus* species isolated from Lebanese dairy-based products. *Eastern Mediterranean Health Journal* (in press).

Alwan, N., Bariche, M., Freyhof, J., Esmaeili, H. R. & Krupp, F. Systematics, taxonomy, phylogeny and zoogeography of the *Capoeta damascina* species complex (Pisces: Teleostei: Cyprinidae) inferred from comparative morphology and molecular markers (in preparation).

BIOLOGICAL FIELD WORK, EXCURSIONS AND EXPEDITIONS

- Collection of freshwater fishes funded by the DAAD

(Syria; October – November 2008)

- Collection of freshwater fishes funded by the DAAD

(Jordan; October – November 2008)

- Collection of freshwater fishes funded by the DAAD

(Lebanon; August 2008)

- Collection of freshwater fishes funded by the DAAD

(Iran; February – March 2008)

- Field excursion funded by the DAAD

(Wilhemshaven, Germany; August – September 2006)

SKILLS

Software: Microsoft Office applications (Word, PowerPoint, Excel), SPSS, Adobe Photoshop, Sigma Plot

Languages: Arabic (mother tongue), English (fluent), German (very good), French (fair)

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I would like also to thank the German Academic Exchange Service (DAAD) for kindly supporting my stay in Germany and for funding all the field expeditions carried out for this study. My thanks are also attributed to the SYNTHESYS Project, which is financed by European Community Research Infrastructure Action under the FP6 "Structuring the European Research Area" Programme, for supporting all the visits to the Natural History Museums in London, Paris and Vienna. Many thanks are also expressed to the authorities at the Grunelius-Möllgaard Laboratory for Molecular Evolution Research and the LOEWE Biodiversity and Climate Research Centre (BiK-F) (Germany) for all the facilities offered during this work.

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