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DNA BARCODING OF FISH SPECIES FROM THE MEDITERRANEAN COAST OF ISRAEL

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Supplementary Data

DNA barcoding of fish species from the Mediterranean coast of Israel

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Table S1. Fish samples by collection date.

Species No.	Taxonomic classification	Common name	Collection dates				
			Feb 2009	Sep 2009	Jan 2010	Jun 2014	Total
1	Pagrus caeruleostictus	Bluespotted seabream	6	0	0	0	6
2	Lithognathus mormyrus	Striped seabream	6	0	1	0	7
3	Atherina boyeri	Big-scale sand smelt	5	0	1	0	6
4	Decapterus russelli	Indian scad	5	3	6	0	14
5	Arnoglossus spp		2	3	3	0	8
6	Pagellus erythrinus	Common pandora	2	6	6	0	14
7	Pagellus acarne	Axillary seabream	1	4	5	6	16
8	Citharus linguatula	Atlantic spotted flounder	4	5	6	3	18
9	Spicara maena	Blotched picarel	6	0	1	5	12
10	Spicara smaris		2	0	2	0	4
11	Solea spp		1	0	0	0	1
12	Equulites klunzingeri		6	6	1	6	19
13	Diplodus annularis	Annular seabream	4	6	1	0	11
14	Upeneus pori	Por's goatfish	6	2	5	0	13
15	Ariosoma balearicum	Bandtooth conger	1	0	5	6	12
16	Nemipterus randalli	Randall's threadfin bream	5	3	6	6	20
17	Callionymus filamentosus	Blotchfin dragonet	6	0	6	6	18
18	Lagocephalus sceleratus	Silverstripe blaasop	2	0	0	0	2
19	Saurida undosquamis	Brushtooth lizardfish	2	0	6	6	14
20	Cynoglossus sinusarabici	Pelada Del Mar Rojo	5	4	4	6	19
21	Bothus podas	Wide-eyed flounder	6	0	6	6	18
22	Apogon smithi		3	6	6	6	21
23	Stephanolepis diaspros	Reticulated leatherjacket	6	6	4	5	21
24	Boops boops	Bogue	6	6	3	3	18
25	Lagocephalus guntheri	Half-smooth golden pufferfish	5	6	4	2	17
26	Lagocephalus suezensis		6	6	6	6	24
27	Plotosus lineatus	Striped eel catfish	5	6	6	6	23
28	Oxyurichthys petersii		0	1	0	0	1
29	Mullus barbatus	Red mullet	0	6	0	0	6
30	Sardinella aurita	Round sardinella	0	6	0	0	6
31	Serranus hepatus	Brown comber	0	5	5	6	16
32	Sphyraena chrysotaenia	Green-and-gold barracuda	0	1	0	0	1
33	Trachurus mediterraneus	Mediterranean scad	0	6	0	6	12
34	Herklotsichthys punctatus	Spotback herring	0	0	6	0	6
35	Trichiurus lepturus	Largehead hairtail	0	0	1	0	1
36	Serranus cabrilla	Comber	0	0	6	1	7
38	Uranoscopus scaber	Atlantic stargazer	0	0	4	0	4
39	Trigloporus lastoviza	Streaked gurnard	0	0	1	0	1
40	Upeneus moluccensis	Gold band goatfish	0	0	0	2	2
41	Gobius niger	Black goby	0	0	0	1	1
42	Siganus rivulatus	Rabbitfish	0	0	0	2	2
43	Torquigener flavimaculosus	Yellowspotted puffer	0	0	0	4	4
44	Apogonichthyoides pharaonis		0	0	0	1	1
46	Ostorhinchus fasciatus	Broadbanded cardinalfish	0	0	0	6	6
47	Raja miraletus	Twineye Skate	0	0	0	4	4
48	Torpedo torpedo	Eyed electric ray	0	0	0	2	2
49	Synodus saurus	Atlantic lizardfish	0	0	0	1	1
50	Scomber colias	Atlantic chub mackerel	0	0	0	6	6
51	Pomadasys stridens	Striped grunt	0	0	0	2	2

Table S2. Sample accession numbers in BOLD and GenBank.

Species	Sample ID	BOLD	GenBank
Apogon smithi	ApSm22A-C	JFS084-09…JFS086-09	KM538174, 76, 77
	ApSm22G-L	JFS157-14…JFS162-14	KM538181-82, 87-89, 92
	ApSm22M-R	JFS289-14…JFS294-14	KM538175, 78-80, 83-84
	ApSm22S-X	JFS397-14...JFS402-14	KM538185-86, 90-91, 93-94
Apogonichthyoides pharaonis	ApPh44S	JFS447-14	KM538173
Ariosoma balearicum	ArBa15A	JFS057-09	KM538206
	ArBa15M-Q	JFS256-14...JFS260-14	KM538196-99
	ArBa15S-W	JFS361-14...JFS365-14	KM538200-204
	ArBa15X	JFS366-14	KM538205
Arnoglossus spp.	ArSp5A-B	JFS023-09...JFS024-09	KM538207, 214
	ArSp5G-I	JFS118-14...JFS120-14	KM538208, 212-213
	ArSp5M-O	JFS226-14...JFS228-14	KM538209-211
Atherina boyeri	AtBo3A-E	JFS013-09...JFS017-09	KM538215-17, 19, 20
	AtBo3M	JFS219-14	KM538218
Boops boops	BoBo24A-F	JFS093-09...JFS098-09	KM538222-24,30,31,35
	BoBo24G-L	JFS169-14...JFS174-14	KM538221, 25-29
	BoBo24M-O	JFS299-14...JFS301-14	KM538236-38
	BoBo24S-U	JFS408-14...JFS410-14	KM538232-34
Bothus podas	BoPo21A-F	JFS078-09...JFS083-09	KM538240-42, 44-45, 56
	BoPo21M-R	JFS283-14...JFS288-14	KM538239, 50-52, 54-55
	BoPo21S-X	JFS391-14...JFS396-14	KM538243, 46-49, 53
Callionymus filamentosus	CaFi17A-F	JFS063-09…JFS068-09	KM538258-63
	CaFi17M-R	JFS267-14...JFS272-14	KM538257, 70-74
	CaFi17S-X	JFS373-14...JFS378-14	KM538264-69
Citharus linguatula	CiLi8A-D	JFS028-09...JFS031-09	KM538275-78
	CiLi8G-K	JFS131-14...JFS135-14	KM538288-92
	CiLi8M-R	JFS240-14...JFS245-14	KM538279-80, 82-85
	CiLi8S-U	JFS347-14...JFS349-14	KM538281, 86-87
Cynoglossus sinusarabici	CySi20A-E	JFS073-09...JFS077-09	KM538299-303
	CySi20G-J	JFS153-14...JFS156-14	KM538304-07
	CySi20M-P	JFS279-14...JFS282-14	KM538308-11
	CySi20S-X	JFS385-14...JFS390-14	KM538293..98
Decapterus russelli	DeRu4A-E	JFS018-09…JFS022-09	KM538312-13, 19, 22-23
	DeRu4G-I	JFS115-14...JFS117-14	KM538316, 24-25
	DeRu4M-R	JFS220-14...JFS225-14	KM538314-15, 17-18, 20-21
Diplodus annularis	DiAn13A-D	JFS047-09...JFS050-09	KM538327-29, 35
	DiAn13G-L	JFS142-14...JFS147-14	KM538326, 31-34, 36
	DiAn13M	JFS250-14	KM538330
Equulites klunzingeri	EqKl12A-F	JFS041-09...JFS046-09	KM538337, 41, 45-46, 49-50
	EqKl12G-L	JFS136-14…JFS141-14	KM538340, 42-43, 47-48, 51
	EqKl12M	JFS249-14	KM538344
	EqKl12S-X	JFS355-14...JFS360-14	KM538338-39, 52-55
Gobius niger	GoNi41S	JFS440-14	KM538356
Herklotsichthys punctatus	HePu34M-R	JFS323-14...JFS328-14	KM538357-62
Lagocephalus sceleratus	LaSc18A-B	JFS069-09...JFS070-09	KM538363-64
Lagocephalus spadiceus	LaSp25A-E	JFS099-09...JFS103-09	KM538365,68-71
	LaSp25G-L	JFS175-14...JFS180-14	KM538376-81
	LaSp25M-P	JFS302-14...JFS305-14	KM538372-75
	LaSp25S-T	JFS411-14...JFS412-14	KM538366-67
Lagocephalus suezensis	LaSu26A-F	JFS104-09...JFS109-09	KM538389-90, 95, 98, 400, 403
	LaSu26G-L	JFS181-14...JFS186-14	KM538382-85, 404-405
	LaSu26M-R	JFS306-14...JFS311-14	KM538388, 91-94, 96
	LaSu26S-X	JFS413-14...JFS418-14	KM538386-87, 97, 99, 401-402
Lithognathus mormyrus	LiMo2A-F	JFS007-09...JFS012-09	KM538406-11
	LiMo2M	JFS218-14	KM538412
Mullus barbatus	MuBa29G-L	JFS194-14...JFS199-14	KM538413-18

(continued)

Supp. Table 2 *(continued)*

Species	Sample ID	BOLD	GenBank
	NeRa16A-E	JFS058-09...JFS062-09	KM538420-21, 27-29
Nemipterus randalli	NeRa16G-I	JFS150-14...JFS152-14	KM538422-23, 35
	NeRa16M-X	JFS261-14...JFS372-14	KM538419, 24-26, 30-34, 36-38
Ostorhinchus fasciatus	ApFa46S-X	JFS448-14...JFS453-14	KM538439-44
Oxyurichthys petersii	OxPe28G	JFS193-14	KM538445
	PaAc7A	JFS027-09	KM538456
Pagellus acarne	PaAc7G-J	JFS127-14...JFS130-14	KM538446, 53-55
	PaAc7M-Q	JFS235-14...JFS239-14	KM538457-61
	PaAc7S-X	JFS341-14...JFS346-14	KM538447-52
	PaEr6A-B	JFS025-09...JFS026-09	KM538474-75
Pagellus erythrinus	PaEr6G-L	JFS121-14...JFS126-14	KM538466, 68, 70-73
	PaEr6M-R	JFS229-14...JFS234-14	KM538462-65, 67, 69
Pagrus caeruleostictus	PaCo1A-F	JFS001-09...JFS006-09	KM538476-81
	PlLi27A-E	JFS110-09...JFS114-09	KM538482, 01-504
Plotosus lineatus	PlLi27G-L	JFS187-14...JFS192-14	KM538495-500
	PlLi27M-R	JFS312-14...JFS317-14	KM538489-94
	PlLi27S-X	JFS419-14...JFS424-14	KM538483-88
Pomadasys stridens	PoSt51S-T	JFS467-14...JFS468-14	KM538505-06
Raja miraletus	RaMi47S-V	JFS454-14...JFS457-14	KM538507-10
Sardinella aurita	SaAu30G-L	JFS200-14...JFS205-14	KM538511-16
	SaUn19A-B	JFS071-09...JFS072-09	KM538526-27
Saurida undosquamis	SaUn19M-R	JFS273-14...JFS278-14	KM538517, 20-21, 25, 29-30
	SaUn19S-X	JFS379-14...JFS384-14	KM538518-19, 22-24, 28
Scomber colias	ScCo50S-X	JFS461-14...JFS466-14	KM538531-36
Serranus cabrilla	SeCa36M-R	JFS330-14...JFS335-14	KM538537-39, 41-43
	SeCa36S	JFS437-14	KM538540
	SeHe31G-K	JFS206-14-FS210-14	KM538546, 49-51, 56
Serranus hepatus	SeHe31M-Q	JFS318-14...JFS322-14	KM538544-45, 47, 52-53
	SeHe31S-X	JFS425-14...JFS430-14	KM538548, 54-55, 57-59
Siganus rivulatus	SiRi42S-T	JFS441-14..JFS442-14	KM538560-61
Solea spp.	SoSp11A	JFS040-09	KM538562
Sphyraena chrysotaenia	SpCh32G	JFS211-14	KM538563
	SpMa9A-F	JFS032-09...JFS037-09	KM538564-67, 70-71
Spicara maena	SpMa9M	JFS246-14	KM538569
	SpMa9S-W	JFS350-14...JFS354-14	KM538568, 72-75
Spicara smaris	SpSm10A-B	JFS038-09...JFS039-09	KM538577-78
	SpSm10M-N	JFS247-14...JFS248-14	KM538576, 79
	StDi23A-F	JFS087-09...JFS092-09	KM538593-98
Stephanolepis diaspros	StDi23G-L	JFS163-14...JFS168-14	KM538580-83, 99, 600
	StDi23M-P	JFS295-14...JFS298-14	KM538584-87
	StDi23S-W	JFS403-14...JFS407-14	KM538588-92
Synodus saurus	SySa49S	JFS460-14	KM538601
Torpedo torpedo	ToTo48S-T	JFS458-14...JFS459-14	KM538602-03
Torquigener flavimaculosus	ToFl43S-V	JFS443-14...JFS446-14	KM538604-07
Trachurus mediterraneus	TrMe33G-L	JFS212-14...JFS217-14	KM538608-10, 17-19
	TrMe33S-X	JFS431-14...JFS436-14	KM538611-16
Trichiurus lepturus	TrLe35M	JFS329-14	KM538620
Trigloporus lastoviza	TrLa39M	JFS340-14	KM538621
Upeneus moluccensis	UpMo40S-T	JFS438-14...JFS439-14	KM538622-23
	UpPo14A-F	JFS051-09...JFS056-09	KM538628-30, 34-36
Upeneus pori	UpPo14G-H	JFS148-14...JFS149-14	KM538624, 31
	UpPo14M-Q	JFS251-14...JFS255-14	KM538625-27, 32-33
Uranoscopus scaber	UrSc38M-P	JFS336-14...JFS339-14	KM538637-40

Table S3. Morphology- and sequence-based classifications of fish samples and their geographic origin.

Morphology-based identification	Similarity score of 1st and 2nd thresholds, %* (# of sequences**)		Closely related species	Cluster ***	Geographic origin of samples****	
					Israeli cluster	Other clusters
T. torpedo	99-100(8[a])	94-96(1[a],7[b])	T. fuscomaculata	1	North Africa, PT, IT	-
R. miraletus	97-100(67[a])	93-94(24[a])		2	North Africa, PT, IT	South Africa
S. aurita	96-100(29[a],43[c])	86(3[b],3[c])	S. maderensis	2	IT	US, Argentina. Mexico
H. punctatus	99-100(7[a])	85(1[b])	Pseudocorynopoma doriae	1	-	-
A. balearicum	98-100(23[a])	97(4[a])		3	IT, Africa	USA, Mexico
S. undosquamis	99-100(14[a],5[c])	93-95(28[a],6[b])	S. grandisquamis	1	-	-
S. saurus	99-100(5[a])	95(1[a])	-	1	PT, IT	Bahamas
P. lineatus	99-100(28[a])	95-97(10[a])		1	-	-
A. boyeri	99-100(8[a])	88-89(12[a],25[b],9[c])	A. hepsetus	5	-	TR, Africa, PT
T. lastoviza	97-100(23[a])	93-94(45[b],31[c])	Chelidonichthys cuculus	2	PT, UK, IT	Africa
S. hepatus	99-100(34[a])	88-89(23[b],9[c])	S. scriba	1	PT, MT, IT	-
S. cabrilla	97-100(59[a],12[c])	94(4[b])	S. atricauda	2	-	IL, PT, IT, ES
A. smithi	98-100(23[a])	95-96(11[a],5[b])	A. ellioti	2	-	Australia
A. pharaonis	99-100(5[a])	90(9[b])	A. nigripinnis	1	-	-
O. fasciatus	99-100(23[a])	96-97(6[a],4[b])	O. novemfasciatus	1	North Africa, India	-
D. russelli	98-100(38[a],30[b],7[c])	93(2[a],5[b])	D. maruadsi	3	Africa	Malaysia, IR, India
T. mediterraneus	99-100(21[a])	98(1[a],7[b],3[c])	T. japonicus	2	TR, IT, ES	IL
E. klunzingeri	98-100(24[a],11[b],2[c])	94(3[b],1[c])	E. leuciscus	2	-	ID, China
N. randalli	100(24[a])	99(6[b])	N. mesoprion	1	-	-
P. stridens	99-100(12[a])	87-88(7[b])	Isacia conceptionis	1	IR	-
P. caeruleostictus	99-100(16[a])	91-92(26[b],1[c])	P. auriga	1	Atlantic Ocean	-
L. mormyrus	95-100(50[a])	88-89(37[b],1[c])	Sparus aurata	4	IT	Africa, TR
P. erythrinus	99-100(54[a],2[c])	94(3[b],5[c])	P. natalensis	1	TR, ES, PT, IT	-
P. acarne	99-100(49[a],2[b])	92-93(21[b],1[c])	Oblada melanura	1	Africa, ES, PT, IT	-
D. annularis	99-100(18[a])	98(11[a])		2	TR, IT	TR, PT
B. boops	97-100(76[a],2[c])	90(21[b])	Sarpa salpa	1	PT, IT,TR, Africa	-
S. maena	99-100(22[a],1[c])	92-93(33[b],4[a])	S. smaris	2	PT, IT	MT, FR
S. smaris	99-100(34[a])	92-93(26[b],1[c])	S. maena	2	MT, IT	TR
U. pori	99-100(20[a],8[c])	92-94(4[b],6[c])	U. asymmetricus	2	North Africa	ID, India
M. barbatus	99-100(46[a])	89-91(2[a],41[b])	M. surmuletus	1	PT, MT, TR, IT	-
U. moluccensis	98-100(48[a],1[c])	93(3[b])	U. subvittatus	2	Africa, Far East	TR
U. scaber	99-100(10[a])	92(2[b])	U. polli	1	MT, IT, Africa	-
C. filamentosus	98-100(99[a])	nd	nd	nd	-	-
O. petersii	99-100(2[a],1[b],2[c])	96(4[b])	O. auchenolepis	1	-	-

(continued)

Supp. Table 3 *(continued)*

Morphology-based identification	Similarity score of 1st and 2nd thresholds, %* (# of sequences**)		Closely related species	Cluster ***	Geographic origin of samples****	
					Israeli cluster	Other clusters
S. rivulatus	98-100(7[a])	96-97(2[a],26[b],1[c])	S. sutor	1	Saudi Arabia	-
S. chrysotaenia	99-100(15[a])	94(3[b],2[c])	S. pinguis var Indo	1	Africa	-
T. lepturus	100(1[a])	96(10[a])		1	-	-
S. colias	100(2[a])	99(26[a])		1	-	-
C. linguatula	97-100(60[a])	83(5[b],3[c])	Atherinomorus vaigiensis	2	MT, PT, IT	TR
Arnoglossus sp. (A. laterna)	99-100(37[a])	85-86(10[b],6[c])	A. rueppelii	1	PT, UK, Norway, FR	-
Arnoglossus sp. (A.thori)	98-100(8[a])	90-92(12[b],6[c])	A. capensis	1	MT	-
B. podas	99-100(34[a])	90-91(5[b])	B. mellissi	2	IT, PT, Africa	UK
Solea spp (B. luteum)	98-100(23[a])	83-84(6[b],9[c])	Bathysolea profundicola	1	North Sea, PT, UK	-
C. sinusarabici	99-100(23[a])	83-85(14[b],13[c])	C. kopsii	1	-	-
S. diaspros	99-100(23[a],2[c])	96-98(1[a],21[b],18[c])	S. hispidus	1	North Africa	-
L. sceleratus	99-100(11[a],4[c])	89-91(9[a],32[b])	L. suezensis	2	North Africa	Australia
L. guntheri	96-100(18[a],22[c])	93-94(15[a],5[b],4[c])	L. wheeleri	3	-	India, IR, Taiwan, China
L. suezensis	98-100(28[a])	94-95(3[a],9[b])	L. sceleratus	1	-	-
T. flavimaculosus	98-100(8[a],8[c])	93(4[b],1[c])	T. brevipinnis	2	Africa	IL, Africa, Australia

* Significant similarity score between thresholds by t-test ($p < 0.001$).
** [a]Morphology-based classification, [b]closely related species, and [c]other related species or not determined (nd).
*** No. of clusters based on phylogenetic cluster analysis.
**** Country codes: Israel IL, Turkey TR, Portugal PT, Italy IT, Iran IR, France FR, Spain ES, Malta MT, Indonesia ID.