

Short Communication

Alien fish species in reservoir systems in Turkey: a review

Deniz Innal

Mehmet Akif Ersoy University, Department of Biology, Hydrobiology, 15100, Burdur, Turkey

E-mail: innald@yahoo.com

**Corresponding author*

Received: 26 December 2011 / Accepted: 16 July 2012 / Published online: 24 December 2012

Handling editor: Elias Dana, University of Almeria, Spain

Abstract

Turkey's natural river systems have been anthropogenically altered in the past century. Native fish communities of river systems have come under increasing pressure from water engineering projects, pollution, overfishing and the movements of alien fish species. Introduction of alien fishes is one of the main threats to the survival and genetic integrity of native fishes around the world. In Turkey, alien freshwater fish are continuing to increase in number of species, abundance, and distribution. The present paper reviews fish stocking studies in Turkey's reservoirs.

Key words: alien fish; native translocated fish; distribution; Turkey

Introduction

The introduction of alien fishes is a major cause of biodiversity decline in freshwater ecosystems (Rowe et al. 2008). Certain freshwater fish species used for recreational angling have been transported around the globe to rivers, dams and lakes, frequently without environmental impact assessments or monitoring (Cambray 2003). The abundance of introduced fish has apparently increased in recent years and the diversity of freshwater species has changed in Turkey (Cetinkaya 2006; Innal and Erk'akan 2006; Unlü et al. 2011).

Aquatic species have been introduced for several reasons, namely to establish fisheries (commercial and sport) and for aquaculture, as forage for other important species, control of unwanted organisms (aquatic vegetation, mosquitos, snails, blooms of phytoplankton, other fish) and accidental (Welcomme 1988; Coad 1996; Cowx 1999).

The impacts associated with the introduction of alien fishes are many, including; competition, habitat alteration, parasitism, predation,

hybridisation, alteration of habitat quality and/or ecosystem function, host of pests or parasites (Westman and Tuunainen 1984; Copp et al. 2005; Roll et al. 2007; Britton et al. 2010; Pino Del Carpio et al. 2010).

The Turkish Rivers contain a distinctive fish fauna characterized by endemic species and species of biogeographic significance (Geldiay and Balik 1999). Turkey's natural river systems have been anthropogenically altered in the past century and some alien fish species are now considered a threat factor for endemic species. The purpose of the present study is to investigate the alien fish species of reservoir systems in Turkey.

Materials and methods

This report examines reviews of published literature, reports and working papers about distribution and biology of alien fish species in the natural and altered aquatic systems of Turkey. For each species, introduced systems (including reservoir, river, lake and closed systems) and reason for introduction

(aquaculture, research, improvement of wild stocks, recreational or commercial fishing, biocontrol, bioteraphy and accidental) are assessed.

Results and discussion

The number of reservoir systems in Turkey has apparently increased in recent years. Fish introduction is widely applied in these reservoirs. This practice is primarily financed by the State and other agencies, e.g., hydroelectric power companies, universities, fishermen or fisheries organizations. The main reason for the introduction of fish species is for the purpose of food production. Other reasons include fisheries improvement, aquaculture, ornamental fish production and plant and animal control. Some introductions have been recorded as accidental. Alien and native translocated fish species of Turkey are given in Appendix 1. Introduced fish species of some reservoir systems are given in Appendix 2.

Alien and native translocated fish species of Turkey are reported as 54 (listed in Appendix 1) in this paper. Fish species are distributed amongst 22 families, with Cyprinidae representing the greatest number of species, followed by Salmonidae and Cichlidae.

Translocations of native fish species have been one of the major reasons for the enhancement of inland water bodies in Turkey. Translocated native freshwater fish are reported as 24. Common carp (*Cyprinus carpio* Linnaeus, 1758) and European tench [*Tinca tinca* (Linnaeus, 1758)] are currently the most widely distributed translocated fish in Turkey's reservoirs.

Overall alien fish species in Turkey are reported as 30. with 15 species specifically introduced into reservoirs namely, *Lepomis gibbosus* (Linnaeus, 1758), *Oncorhynchus mykiss* (Walbaum, 1792), *Oreochromis aureus* (Steindachner, 1864), *Oreochromis mossambicus* (Peters, 1852), *Oreochromis niloticus niloticus* (Linnaeus, 1758), *Sarotherodon galilaeus galilaeus* (Linnaeus, 1758), *Tilapia rendalli* (Boulenger, 1897), *Tilapia zillii* (Gervais, 1848), *Carassius auratus* (Linnaeus, 1758), *Carassius gibelio* (Bloch, 1782), *Ctenopharyngodon idella* (Valenciennes, 1844), *Pseudorasbora parva* (Temminck and Schlegel, 1846), Hybrid of *Morone chrysops* x *Morone saxatilis*, *Gambusia affinis* (Baird and Girard, 1853) and *Gambusia holbrooki* Girard, 1859.

12 species have established self reproducing populations. Five species, gibel carp (*C. gibelio*), topmouth gudgeon (*P. parva*), rainbow trout (*O. mykiss*) and mosquito fishes (*G. affinis* and *G. hoolbrooki*), are currently the most widely distributed alien fishes in Turkey's reservoirs.

The introduction of alien fishes into inland waters of Turkey has a long history beginning with the stocking of exotic Poeciliidae (*G. affinis*, *G. holbrooki*) to control mosquito larvae (Innal & Erk'akan 2006). Introduction and translocations of exotic and indigenous species have been carried out mostly in the last 60 years in Turkey. At the end of 1960s DSI (State Water Works) began to stock common carp, *C. carpio*, zander *Sander lucioperca* (Linnaeus, 1758), wels catfish *Silurus glanis* Linnaeus, 1758 and bleak, *Alburnus* spp. in reservoirs (Anonymous 1988; Geldiay and Balik 1999). Currently, rainbow trout *O. mykiss*, wels catfish *S. glanis*, zander *S. lucioperca*, common carp *C. carpio*, grass carp *C. idella*, silver carp *Hypophthalmichthys molitrix* (Valenciennes, 1844), European perch *Perca fluviatilis* Linnaeus, 1758 and barb *Barbus grypus* Heckel, 1843 are the species produced in hatcheries for stocking inland waters. Common carp, mirror carp (*C. carpio* Linnaeus, 1758) and rainbow trout are the most common species used for stocking reservoirs. Common carp and mirror carp account for the major production in reservoir freshwater fisheries.

Many introductions into reservoirs are associated with aquaculture. Some species have successfully maintains populations from escapes and releases. Cichlids *Oreochromis* spp. and *Tilapia* spp., and hybrid striped-bass *Morone chrysops* x *Morone saxatilis* were introduced to open waters as aquaculture experiments (Dikel and Celik 1998; Gökce et al. 2003; Celik and Gökce 2003; Güner et al. 2007).

The ornamental fish trade is also a source of accidental introductions of non-native fish species into open water systems. A few introductions of exotic fish into open freshwater systems of Turkey have involved the accidental or deliberate release of aquarium species, mainly piranha Characidae [*Pygocentrus nattereri* Kner, 1858] and catfish Loricariidae [*Pterygoplichthys disjunctivus* (Weber 1991)]. These species were reported from natural lakes and streams of Turkey (Yalçın Ozdilek 2007; Innal 2008).

Three species of Carassius carp were introduced to numerous inland waters throughout Turkey. These species were physically similar to the native carp and through early mis-

identification their expansion was originally unnoticed. Currently they compete with native carp for food and space in several systems (Mumcular Dam Lake, Nazik Lake) (Yılmaz 2004; Cetinkaya et al. 1999). Economic losses of *C. carpio* stocking practices have been continuing for many years. There are no monitoring or evaluation programs in place regarding fish stock assessments.

Fish species have been introduced into aquatic systems to control unwanted organisms e.g. aquatic vegetation, phytoplankton blooms and mosquitos. *Gambusia* spp. used in the biological control of mosquito species, has been introduced into Turkey's reservoirs; stocking research was carried out by local fisherman, pest control corporations and the Ministry of Health and Malaria Control Department. Grass carp, *C. idella*, has been introduced into reservoirs to control aquatic vegetation.

In many systems, natural river fauna is unable to adapt to new reservoir habitat and fail to colonize the new waterbody. Many native river fish species of Turkey have been seriously damaged by the river damming and construction operations (Sarı and Bilecenoğlu 2002; Smith and Darwall 2006; Ozcan 2008a; Turan and Ozcan 2009; Kara et al. 2010). Habitat modification combined with stocking practices, cause displacement of unique local assemblages, with widespread species that are better able to tolerate human activities, leading to homogenization (Havel et al. 2005).

Introduced and transplanted species contribute significantly to the overall fish production of reservoirs in Turkey. Distribution, abundance and reproduction of many native river species have been affected by invasive species. Water released from the reservoirs can facilitate the spread of alien species to downstream reaches. Escapees of some fish species have resulted in the establishment of self-maintaining populations in river systems. Gibel carp (*C. gibelio*) and top-mouth gudgeon (*P. parva*) are now considered a threat for endemic species in river systems. These exotic species can significantly affect the community structure of aquatic systems.

Alien freshwater fish and translocated native freshwater fish continue to increase steadily in number. 21 out of 32 reservoirs studied have been invaded by at least one alien fish species. The impact of most introductions of fishes is still unknown. Recent interest in exotic fish species for aquaculture, biological control and fish stocking programmes raise the possibility of

future introductions. An increasing number of alien fish introductions in the river basin of Turkey will inevitably alter natural fish species diversity.

Acknowledgements

Many thanks are due to Prof. Fusun Erk'akan (Hacettepe University-Turkey) who encouraged me to study alien species.

References

- Alaş A, Yılmaz F, Solak K (1998) Adaptation and competition of tench (*Tinca tinca* L., 1758) implanted to the Kayaboğazi Dam Lake (Tavşanlı- Kütahya. In: Celikkale MS, Duzgunes E, Okumus I, Mutlu C (eds), Proceedings of First International Symposium on Fisheries and Ecology, 2–4 September, 1998, Trabzon, Turkey, pp 466–468
- Alp A, Büyükçapar HM, Eren A (2003) Commercially fish species and their fisheries in Menzelet Dam Lake (Kahramanmaraş) (In Turkish with English summary). *Kahramanmaraş Sutcu Imam University Journal of Science and Engineering* 6(2): 142–153
- Anonymous (1988) Bulletin of water products DSI (State Water Works). Republic of Turkey, Ankara, 73 pp
- Anonymous (2001) Bulletin of statistics DSI (State Water Works). Republic of Turkey, Ankara, 571 pp
- Anonymous (2005) Hidroelektrik santrallerde sorun yaratan zebra midye araştırmaları. İşletme ve Bakım Daire Başkanlığı Yayınları, 170 pp
- Balık S, Ustaoglu MR (2006) Türkiye'nin göl, gölet ve baraj göllerinde gerçekleştirilen balıklandırma çalışmaları ve sonuçları. In: Emre Y, Diler I (ed), Balıklandırma ve Rezervuar Yönetimi Sempozyumu Bildiriler Kitabı, T.K.B Akdeniz Su Ürünleri Araştırma, Üretim ve Eğitim Enstitüsü Yayınları, pp 1–10
- Balık S, Ustaoglu MR, Sari HM, Ilhan A, Topkara ET (2005) The fish fauna of Yuvarlakçay (Köyceğiz, Muğla) Ege University *Journal of Fisheries and Aquatic Sciences* 22(1–2): 221–223
- Barlas M, Dirican S (2004) The Fish fauna of the Dipsiz-Çine (Muğla-Aydın) Stream (In Turkish with English summary). *Gazi University Journal of Science* 17(3): 35–48
- Britton JR, Gozlan RE, Copp Gordon H (2010) Managing non-native fish in the environment. *Fish and Fisheries* 12(3): 256–274, <http://dx.doi.org/10.1111/j.1467-2979.2010.00390.x>
- Cambray JA (2003) Impact on indigenous species biodiversity caused by the globalisation of alien recreational freshwater fisheries. *Hydrobiologia* 500: 217–230, <http://dx.doi.org/10.1023/A:1024648719995>
- Celik M, Gökce MA (2003) Determination of fatty acid compositions of five different Tilapia species from the Çukurova (Adana/Turkey) Region (In Turkish with English summary). *Turkish Journal of Veterinary and Animal Sciences* 27: 75–79
- Cetinkaya O (2006) Türkiye sularına aşılana veya stoklanan egzotik ve yerli balık türleri, bunların yetiştiricilik, balıkçılık, doğal populasyonlar ve sucul ekosistemler üzerindeki etkileri veri tabanı için bir ön çalışma. In: Emre Y, Diler I (eds), Balıklandırma ve Rezervuar Yönetimi Sempozyumu Bildiriler Kitabı, T.K.B Akdeniz Su Ürünleri Araştırma, Üretim ve Eğitim Enstitüsü Yayınları, pp 205–235
- Cetinkaya O, Elp M, Sen F (1999) Studies on Crucian Carp (*Carassius carassius*, L., 1758) introduced into lake Nazik (In Turkish with English summary). X. Ulusal Su Ürünleri Sempozyumu Adana, pp 814–825

- Cıldır H (2001) Introduction of exotic vertebrates in Turkey: A review and an assessment of their impact. MSc Thesis, Middle East Technical University, 101 pp
- Coad BW (1996) Exotic and transplanted fishes in southwest Asia. *Publicaciones Especiales Instituto Espanol de Oceanografia* 21: 81–106
- Copp GH, Garthwaite R, Gozlan RE (2005) Risk identification and assessment of non-native freshwater Fishes: Concepts and Perspectives on Protocols for the UK, Cefas Science Series Technical Report No.129, 36 pp
- Cowx IG (1999) An appraisal of stocking strategies in the light of developing country constraints. *Fisheries Management and Ecology* 6: 21–34, <http://dx.doi.org/10.1046/j.1365-2400.1999.00139.x>
- Dikel S, Celik M (1998) Body and nutritional composition of *Tilapia* (*Tilapia* sp.) from the Southern Seyhan River (In Turkish with English summary). *Turkish Journal of Veterinary and Animal Sciences* 22: 517–520
- Ekmekçi FG, Kirankaya SG (2004) Determination of variations in fish growth during reservoir ontogeny: a case study of the Mirror Carp population in Gelingüllü Dam Lake (Yozgat, Turkey) (In Turkish with English summary). *Turkish Journal of Veterinary and Animal Sciences* 28: 1129–1135
- Gaygusuz O, Tarkan AS, Gürsoy Gaygusuz C (2007) Changes in the fish community of the Ömerli Reservoir (Turkey) following the introduction of non-native gibel carp *Carassius gibelio* (Bloch, 1782) and other human impacts. *Aquatic Invasions* 2: 117–120, <http://dx.doi.org/10.3391/ai.2007.2.2.6>
- Geldiay R, Balik S (1999) Türkiye Tatlısu Balıkları. *Ege Üniversitesi Su Ürünleri Fakültesi Yayınları* 46: 254–262
- Gökçe MA, Dikel S, Celik M, Taşbozan O (2003) Investigation of body compositions of three *Tilapia* species (*Tilapia rendalli* (Boulenger, 1896), *Tilapia zilli* (Gervais, 1848), *Oreochromis aureus* (Steindachner, 1864)) reared in cage condition in the Seyhan Dam Lake (Adana) (In Turkish with English summary). *Ege University Journal of Fisheries and Aquatic Sciences*. 20 (1-2): 9–14
- Güner Y, Altunok M, Kızak V, Tokşen E (2007) A New Morone Species “Hybrid Striped Bass (*Morone chrysops* x *Morone saxatilis*)” from Aydın Bozdoğan Dam Lake in Turkey. *Ekoloji* 16 (64): 49–52
- Havel JE, Carol EL, Zanden, MJV (2005) Do reservoirs facilitate invasions into landscapes? *BioScience* 55(6): 518–525, [http://dx.doi.org/10.1641/0006-3568\(2005\)055\[0518:DRFIII\]2.0.CO;2](http://dx.doi.org/10.1641/0006-3568(2005)055[0518:DRFIII]2.0.CO;2)
- Ilhan A, Balik S, Sari HM, Ustaoglu MR (2005) Bati ve Orta Anadolu, Güney Marmara, Trakya ve Bati Karadeniz Bölgeleri içsularındaki *Carassius* (Cyprinidae, Pisces) türleri ve Dağılımları. *Ege University Journal of Fisheries and Aquatic Sciences* 22 (3–4): 343–346
- Innal D (2008) Comparison of fish species diversity living in estuary zone of Aksu and Köprüçay Rivers. Phd Thesis, Hacettepe University, 191 pp
- Innal D (2011) Distribution and impacts of *Carassius* species (Cyprinidae) in Turkey: a review. *Management of Biological Invasions* 2: 57–68
- Innal D, Erk'akan F (2006) Effects of exotic and translocated fish species in inland waters of Turkey. *Reviews in Fish Biology and Fisheries* 16: 39–50, <http://dx.doi.org/10.1007/s11160-006-9005-y>
- Kara C, Alp A, Simşekli M (2010) Distribution of fish fauna on the Upper and Middle Basin of Ceyhan River, Turkey. *Turkish Journal of Fisheries and Aquatic Sciences* 10: 111–122, <http://dx.doi.org/10.4194/trjfas.2010.0116>
- Kirankaya GS, Ekmekçi GF, Yalçın Ozdilek S, Yoğurtcuoğlu B, Gencoğlu L (2009) Preliminary data on an invasive fish, *Pseudorasbora parva*, from Hirfanlı Dam Lake in Turkey. 13th European Congress of Ichthyology, University of Klaipeda. 6–12 September 2009, Klaipeda, Lithuania
- Kişisel HD (2006) Yavru Balık üretimi ve balıklandırma çalışmaları. In: Emre Y, Diler I (eds), Balıklandırma ve Rezervuar Yönetimi Sempozyumu Bildiriler Kitabı, T.K.B Akdeniz Su Ürünleri Araştırma, Üretim ve Eğitim Enstitüsü Yayınları, pp 61–68
- Küçük F (1997) Fish fauna of streams discharging to Antalya Bay (In Turkish with English summary). *Ege University Journal of Fisheries and Aquatic Sciences* 21 (3–4): 287–294
- Ozcan G (2008a) Threatened fishes of the world: *Chondrostoma meandrense* Elvira, 1987 (Cyprinidae). *Environmental Biology of Fishes* 83(3): 297–298, <http://dx.doi.org/10.1007/s10641-008-9335-9>
- Ozcan G (2008b) Büyük Menderes Nehir Havzası'ndaki egzotik balık türleri ve etkileri. *Türk Bilimsel Derlemeler Dergisi* 1 (2): 23–25
- Ozcan G (2009) The status of the freshwater Gobiid, *Knipowitschia mermere* Ahnelt, 1995: distribution ecology and threats. *Biharean Biologist* 3 (2): 139–141
- Ozcan G, Balik S (2008) Species composition of the fish species in Kemer Reservoir and Akcay Stream, Aydın, Turkey. *Journal of Central European of Agriculture* 9 (4): 683–688
- Ozuluğ M (1999) Taxonomic Study on the fish in the Basin of Büyükçekmece Dam Lake. *Turkish Journal of Zoology* 23: 439–451
- Ozuluğ M, Acıpınar H, Gaygusuz O, Gürsoy C, Tarkan AS (2005) Effects of human factor on the fish fauna in a drinking-water Resource (Ömerli Dam Lake-Istanbul, Turkey). *Research Journal of Agriculture and Biological Sciences* 1(1): 50–55
- Pino Del Carpio A, Miranda R, Puig J (2010) Non-native freshwater fish management in Biosphere Reserves. *Management of Biological Invasions* 1: 13–33
- Roll U, Dayan T, Simberloff D, Goren M (2007) Characteristics of the introduced fish fauna of Israel. *Biological Invasions* 9: 813–824, <http://dx.doi.org/10.1007/s10530-006-9083-8>
- Rowe DK, Moore, A, Giorgetti A, Maclean C, Grace P, Wadhwa S, Cooke J (2008) Review of the impacts of gambusia, redbfin perch, tench, roach, yellowfin goby and streaked goby in Australia. Prepared for the Australian Government Department of the Environment, Water, Heritage and the Arts., 245 pp
- Sarı HM, Bilecenoğlu M (2002) Threatened fishes of the world: *Acanthobrama mirabilis* Ladiges, 1960 (Cyprinidae). *Environmental Biology of Fishes* 65(3): 318, <http://dx.doi.org/10.1023/A:1020570900120>
- Smith KG, Darwall WRT (2006) The status and distribution of freshwater fish endemic to the mediterranean basin IUCN, Gland, Switzerland and Cambridge UK, 34 pp
- TorcuKoç H, Türker Cakır D, Ulunehir G (2008) An Investigation in fish fauna İkizcetepeler Dam Lake (Balıkesir), Turkey. *Journal of Applied Biological Sciences* 2 (2): 63–67
- Turan C, Ozcan G (2009) Threatened fishes of the world: *Capoeta antalyensis* (Battalgiil, 1943) (Cyprinidae). *Environmental Biology of Fishes* 84 (3): 243–244, <http://dx.doi.org/10.1007/s10641-008-9415-x>
- Unlü E, Çiçek T, Değer D, Coad BW (2011) Range extension of the exotic Indian stinging catfish, *Heteropneustes fossilis* (Bloch, 1794) (Heteropneustidae) into the Turkish part of the Tigris River watershed. *Journal of Applied Ichthyology* 27: 141–143, <http://dx.doi.org/10.1111/j.1439-0426.2010.01580.x>
- Van Neer W, Wildekamp RH, Küçük F, Unlusayın M (19 99) First inland records of the euryhaline goby *Knipowitschia caucasica* from lakes in Anatolia, Turkey. *Journal of Fish Biology* 54(6): 1334–1337, <http://dx.doi.org/10.1111/j.1095-8649.1999.tb02060.x>
- Welcomme RL (1988) International Introductions of Inland Aquatic Species, FAO Fisheries Technical paper 294, 318 pp
- Westman K, Tuunainen P (1984) A review of fish and crayfish introductions made in Finland, stock enhancement in the

- management of freshwater fish. EIFAC, Technical Paper, 42 (suppl.2), pp 436–447
- Yağcı Apaydın M, Ozkök R, Erol KG, Cubuk H (2006) Beyşehir Gölü'ndeki sudak populasyonu (*Sander lucioperca* (Linnaeus, 1758))'nun beslenme özellikleri. I.Uluslararası Beyşehir ve Yöresi Sempozyumu, Beyşehir/Konya, 11–13 May 2006
- Yalçın Ozdilek S (2007) Possible threat for middle east inland water: an exotic and invasive species, *Pterygoplichthys disjunctivus* (Weber, 1991) in Asi River, Turkey (Pisces: Loricariidae). *Ege University Journal of Fisheries and Aquatic Sciences* 2 (3–4): 303–306
- Yegen V, Balık S, Bostan H, Uysal R, Bilcen E (2006) Göller bölgesindeki bazı göl ve baraj göllerinin balık faunalarının son durumu. In: Emre Y, Diler I (eds), Balıklandırma ve Rezervuar Yönetimi Sempozyumu Bildiriler Kitabı, T.K.B Akdeniz Su Ürünleri Araştırma, Üretim ve Eğitim Enstitüsü Yayınları, pp 129–141
- Yılmaz F (2002) Reproductive biology of the tench *Tinca tinca* (L., 1758) inhabiting Porsuk Dam Lake (Kutahya, Turkey). *Fisheries Research* 55: 313–317, [http://dx.doi.org/10.1016/S0165-7836\(01\)00294-6](http://dx.doi.org/10.1016/S0165-7836(01)00294-6)
- Yılmaz F (2004) Physico-chemical features of Mumcular Dam Lake (Muğla-Bodrum) (In Turkish with English summary). *Ekoloji* 50:10–17
- Yılmaz F, Barlas M, Yorulmaz B, Ozdemir N (2006) A Taxonomical study on the inland water fishes of Muğla. *Ege University Journal of Fisheries and Aquatic Sciences* 23 (1–2): 27–30
- Yılmaz M, Gül A (2001) Hirfanlı Baraj Gölü (Kırşehir)'nde Yaşayan *Sander lucioperca* (L., 1758) nin üreme özellikleri. *Gazi Üniversitesi Gazi Eğitim Fakültesi Dergisi* 21(3): 19–32
- Yılmaz M, Gül A, Solak, K (1995) Kapulukaya Baraj Gölü (Kırkkale) balık faunası. *Gazi University Journal of Science* 8 (2): 33–42
- Zengin M (2006) Balıklandırmanın genel kriterleri, Dünyada ve Ülkemizde stoklama deneyimleri. In: Emre Y, Diler I (eds), Balıklandırma ve Rezervuar Yönetimi Sempozyumu Bildiriler Kitabı, T.K.B Akdeniz Su Ürünleri Araştırma, Üretim ve Eğitim Enstitüsü Yayınları, pp 69–82
- Zengin M, Buhan E (2007) Almus-Ataköy Baraj Gölleri'nde (Yeşilirmak Havzası, Tokat) balıklandırma sonrası balık faunasında görülen değişimin değerlendirilmesi. Ulusal Su Günleri 2007, 16–18 May 2007, Antalya

Supplementary material

The following supplementary material is available for this article.

Appendix 1. List of alien and native translocated fish species of Turkey.

Appendix 2. Introduced fish species of some reservoir systems.

This material is available as part of online article from:

http://www.reabic.net/journals/mbi/2012/2/MBI_2012_2_Innal_Supplement.pdf