

M. ZAMMIT-MANGION, A. DEIDUN*

Department of Biochemistry and Physiology, University of Malta.

*Physical Oceanography Unit, University of Malta.

alan.deidun@um.edu.mt

MANAGEMENT RECOMMENDATIONS FOR THE CONSERVATION OF THREATENED *APHANIUS FASCIATUS* NARDO POPULATIONS FROM TWO WETLANDS IN THE MALTESE ISLANDS

RACCOMANDAZIONI PER LA GESTIONE E LA CONSERVAZIONE DI DUE POPOLAZIONI DI APHANIUS FASCIATUS NARDO DALLE ISOLE MALTESI

Abstract - The *Aphanius fasciatus* populations at the two Maltese wetlands of Simar and Ghadira were monitored during the May-October 2008 period for signs of pathogenesis and in terms of sex ratio and individual morphology. The putative impact of a number of abiotic factors on population structure was also assessed. The study concludes that the percentage of juveniles within the two killifish populations is highest during the July-August period, and that reproductive activity resumes in October at the end of the dry season which coincides with a stalling of reproductive activity and with a high juvenile mortality. Recommendations for the amplification of killifish-specific monitoring protocols are also made.

Key-words: wetlands, *Aphanius fasciatus*, Maltese Islands, pathogenesis, monitoring.

Introduction - The euryhaline cyprinodontid *Aphanius fasciatus* Nardo is currently distributed in the saline coastal waters of the central and eastern Mediterranean, in salt flats and also occasionally in inland fresh water (Wildekamp, 1993). The species' distribution on the Maltese Islands has regressed in recent times, with the species' having been extirpated from a number of locations due to a variety of anthropogenic pressures. Ghadira and Simar are the only two RAMSAR wetland sites from the Maltese Islands, being also designated as Special Areas of Conservation (SAC's, under the Habitats Directive) and as Special Protection Areas (SPA's, under the Birds Directive). The current study aimed to collect morphological, sex ratio and phenological data for the *A. fasciatus* populations from these two sites, pursuant to investigating the influence of the abiotic environment on the population structure and on the occurrence of pathogenesis in the species, with the ultimate aim of improving conservation and management strategies for the species.

Materials and methods - Sampling was carried out between May-October 2008 at two wetlands in the Maltese Islands. At the Simar wetland, quadrangular handheld sweep nets (40×40 cm, mesh size 8 mm) were used to sieve the water. Traps (40 cm in diameter, 8 mm mesh size) were used in the deeper areas of Simar and at the Ghadira site. The traps were baited and positioned two metres from the shoreline. After 15 minutes, the traps were opened and the fish were checked for any signs of pathogenesis. For each individual, the total length and sex were recorded *in situ*. All fish were then released back into the water body. Juveniles were defined as all killifish individuals up to a maximum size of 2.8 cm, below which the typical colouration of the adult fish was absent. A total of 1079 fish were monitored in this way.

Results - This study illustrates that, as the summer progressed, the two wetlands were exposed to extreme abiotic conditions, including a rapid increase in the salinity of the habitat, a decrease in oxygen concentration (down to 2.19 mg/l), a sharp increase in aquatic temperature (from 23.0 °C at the end of May to over 33.0 °C by

the end of August) and a decrease in the depth of the water (50% decrease in water depth at the Ghadira wetland and a 25% decrease at Simar). Females were more abundant than males at both sites (3:1 at Ghadira and 2:1 at Salina, Zammit-Mangion *et al.*, in press), with the overall number of males at the Ghadira site decreasing by 8.8% as the summer progressed. The results also showed that a significant number of the population were juveniles (75% and 46.3% of the populations at Ghadira and Simar respectively) (Zammit-Mangion *et al.*, in press). At the Ghadira site, juvenile abundances peaked in August, with juveniles exhibiting a fairly uniform mean size (mean length=26.3 mm, +/-1.8 mm). At Simar, the juvenile abundances peaked in June, exhibiting a mean length of 21.5 mm (+/-2.6 mm). Juvenile mortality was high, with juveniles showing sharp declines in abundance by the end of summer, with over 80% and 60% decline in juveniles at Ghadira and Simar, respectively. Abiotic stress during late July and early August had a negative effect on reproductive success, on the number of males recorded at Ghadira and on reproductive activity. However, once the water temperature decreased, and dissolved oxygen increased, the female killifish individuals resumed reproductive effort, with 33% of females studied in October at the Ghadira site exhibiting the swollen bellies characteristic of pregnant fish. No signs of pathogenesis were found on the particular sampling days.

Conclusions - This study indicated that the two *A. fasciatus* populations at the two wetlands, especially at the Ghadira site, were exposed to extreme abiotic conditions during the peak summer months. These factors, coupled with the physical and genetic isolation of the two populations, constitute perennial constraints to the long-term viability of the species and justify the need for a constantly high conservation priority being assigned to the species. The authors propose that targeted management measures should be adopted immediately if the populations at the two wetlands are to be effectively conserved. These include i) increasing protective measures during the reproductive and recruitment periods through late March to May ii) starting a re-introduction programme at sites previously known to support *Aphanius* species (strictly monitoring the haplotypes of introduced individuals) and iii) introducing a water monitoring programme.

References

- WILDEKAMP R.H. (1993) - The genus *Aphanius* Nardo. In: Watters B.R. (ed), *A World of killies, atlas of the oviparous cyprinodontiform Fishes of the world, Vol I*. American Killifish Association, Hishawaka Indiana: 19–67.
- ZAMMIT-MANGION M., GAUCI M., GAUCI C. (in press) - Studies on the Biology of *Aphanius fasciatus* at the Ghadira wetland in the Maltese Islands. *Proceedings of the 39th CIESM Congress, Venice, Italy, 10-14th May 2010*.