Avocetta 28: 86-95 (2004)

Brevi note – *Short communications*

Waterbird abundance in a residual wetland of Central Italy during two years of contrasting water level

CORRADO BATTISTI[1], ALBERTO SORACE[2], EGIDIO DE ANGELIS[1], CARLO GALIMBERTI[1], NARCISO TRUCCHIA[1]

[1]*Servizio Ambiente, Ufficio Conservazione Natura, Provincia di Roma, via Tiburtina 691, I–00159 Roma, Italy (cbattisti@inwind.it);*
[2]*Stazione Romana Osservazione e Protezione Uccelli, via Crippa 60, I–00125 Roma, Italy*

Riassunto – *Abbondanza degli uccelli acquatici in una zona umida del centro Italia in due anni con opposti livelli d'acqua.* In questo studio abbiamo confrontato le abbondanze di Anatidi e Ardeidi presenti in un'area umida della costa tirrenica interessata da deficit idrico dovuto a scarse precipitazioni nel 2002 e da immissione artificiale di acqua nel 2003. L'apporto idrico artificiale ha permesso il mantenimento di un livello delle acque relativamente costante nel 2003 rispetto all'anno precedente. Il livello di acqua più elevato nel 2003 ha consentito la presenza di un maggiore numero di uccelli acquatici, in particolare marzaiole *Anas querquedula*, nonché la nidificazione del germano reale *Anas platyrhynchos* e la sosta di individui di moretta tabaccata *Aythya nyroca*. Nel 2003, l'immissione artificiale di acqua ha anche permesso il ripristino dell'attività di piscicoltura nell'area umida e il rilascio di avannotti di cefalo *Mugil cephalus* ha verosimilmente causato la comparsa degli Ardeidi. L'apporto idrico artificiale e attività estensive di piscicoltura possono pertanto essere considerate utili interventi per ripristinare il ruolo funzionale di aree umide residuali sia come sito di sosta sia come habitat trofico e riproduttivo per alcune specie acquatiche di interesse conservazionistico.

In anthropized mosaic landscapes, wetlands can assume residual characteristics due to their limited size, reduced habitat diversity, high isolation and edge effect that may affect the presence of several waterbird species (Tscharntke 1992). Moreover, the anthropic matrix surrounding these fragments can markedly influence internal processes that can be under the complete control of external, stochastic, factors. One of the main disturbance is the decrease of water level caused by the reduced flow of superficial running water and the use of water for irrigation of surrounding areas leading to drawdown. In these conditions, rain may be the only water source for wetlands. Therefore, scarce precipitation is a stochastic factor that may cause catastrophic effects on bird populations and communities of these residual environments (Saunders *et al.* 1991).

Although in Italy some studies were undertaken on bird communities of wetlands placed in fragmented landscape (e.g., Celada and Bogliani 1993, Lebboroni *et al.* 2001), data on the effects of water deficit on such residual areas are still lacking.

The winter 2001–2002 was characterised by scarce rainfall (see results) in Tyrrhenian central Italy. This produced a strong water deficit in the Torre Flavia Reserve, a protected residual wetland of Latium coast (Rome Province), that led to complete drying up in summer. To mitigate the effects of reduced precipitation, in the October 2002 the managers of the protected area (Province of Rome, Environmental Service) undertook a plan of artificial flooding aimed at restoring the water levels of the wetland.

The aim of the present study was to compare the population abundance of Anatidae and Ardeidae between the periods of water deficit and artificial flooding of the wetland.

The study area is encompassed into the Natural Monument "Palude di Torre Flavia" (Ladispoli, Cerveteri; Rome; 41° 58' N; 12° 03' E; Special Conservation Area *sensu* 79/409/CE Directive; code IT6030020), a remnant wetland 40 ha–wide located on Tyrrhenian coastline.

In 2002, the Province of Rome stipulated an agreement with the "Consorzio di bonifica Tevere ed Agro

Received 4 March 2004, accepted 25 April 2004
Assistant editor: R. Sacchi

Romano" to provide an artificial flooding (100000 m³/year) to minimise the dramatic water level variation (first water immission: 9 October 2002). In the following period (autumn 2002 – spring 2003) a pisciculture activity (mullet *Mugil cephalus*) was set up in the study area by a private society according to the constitutive rule of the Natural Monument.

Breeding and migratory communities were investigated by mapping method and ringing techniques (Battisti *et al.* in press, Sorace *et al.* 2001, Sorace *et al.* 2003). In each visit, waterbirds were censused by transects. Overall, 285 visits were carried out from November 2001 to June 2003. Due to reduced size, good visibility and easy access, the whole study area was covered in each visit, and individuals of species belonging to the families Anatidae and Ardeidae were counted. Data were expressed as maximum number of observed individuals for each species per 10 days (total of 57 decades). We used the maximum value rather than the mean because the former give a better picture of waterbirds variation. Data were not collected in the second decade of January, in the second decade of July, and in the first decade of September 2002. We measured the water level in the wetland with metric pole (± 1 cm) once per decade.

The number of censused individuals per decade was correlated with the water level and the total rainfall (mm) per decade by Pearson correlation coefficient, after log–transforming of data. Precipitation data were obtained from weather bureau of UCEA Observatory (Rome, Collegio Romano).

The numbers of Anatidae and Ardeidae per decade were compared between the period of water deficit (3rd decade of November 2001 – 2nd decade of June 2002) and the period of artificial flooding (3rd decade of November 2002 – 2nd decade of June 2003) by means of the Wilcoxon matched pairs test. Statistical analysis was carried out using the Statistica software package (StatSoft, Inc. 1984–2000).

In winter, rainfall was lower during water deficit than during flooding period, while no difference was detected in other seasons. In all seasons, water level was higher in periods of artificial flooding (Tab. 1). Water level was not related to rainfall ($r_p = 0.25$, $N = 57$, $P = 0.081$).

Over the study period, the following waterbird species were observed: among Anatidae, teal *Anas crecca,* mallard *A. plathyrynchos*, garganey *A. querquedula* (from 25th February to 16th April 2003; maximum about 150 ind. on 3rd March), shoveler *A. clypeata,* ferruginous duck *Aythya nyroca* (from 28th January to 21st March 2003; maximum 7 ind.); among Ardeidae, little bittern *Ixobrychus minutus*, little egret *Egretta garzetta,* great egret *E. alba*, squacco heron *Ardeola ralloides,* cattle egret *Bubulcus ibis*, grey heron *Ardea cinerea,* purple heron *A. purpurea*.

Table 1. Mean water level per decade (cm) among seasons during the periods of water deficit and artificial flooding. – *Livello medio dell'acqua (cm) per decade durante i periodi di deficit idrico e di immissione artificiale d'acqua.*

	Water level (cm)	
	Water deficit Mean ± SD	Artificial flooding Mean ± SD
Winter	53.5 ± 7.5	122.8 ± 9.5
Early spring	63.2 ± 4.6	112.2 ± 8.6
Late spring	50.8 ± 10.5	72.4 ± 17.1

The values of abundance of individuals varied among years and groups. Anatidae showed two peaks of abundance (> 30 ind.; 2001–2002: 2nd – 3rd decade of December; 2002–2003: 1st decade of March – 2nd decade of April, Fig. 1). Ardeidae showed lower abundance values or irregular presence in 2001–2002 with a peak in the 3rd decade of March 2003.

Abundance of Anatidae increased significantly in migratory and prebreeding period of 2003 (i.e. with artificial flooding; Tab. 2). No difference was observed in other seasons. In all seasons abundance of Ardeidae was higher in periods of flooding (Tab. 2). Abundance of Anatidae and Ardeidae was positively related to water level in the study area (respectively, $r_p = 0.34$, $N = 57$, $P = 0.016$ and $r_p = 0.47$; $N = 57$; $P = 0.0006$).

In Latium, the aquatic species we observed in the present study prefer coastal fresh and salt water wetlands (Biondi *et al.* 1999). A higher water level might have promoted the migratory stop–over of a higher number of individuals of Anatidae, even if this increase in 2003 (3rd decade of February – 2nd decade of April) was probably due to the high number of garganey, which were absent in 2002 (Fig. 1). The alternative hypothesis that such absence in the study area was related to a scarce passage of the species throughout the Latium region rather than to the low water level in the study area was not supported by observations in other areas. During the 20 years preceding 2002 garganey was always observed in spring in the study area, and was one of the com-

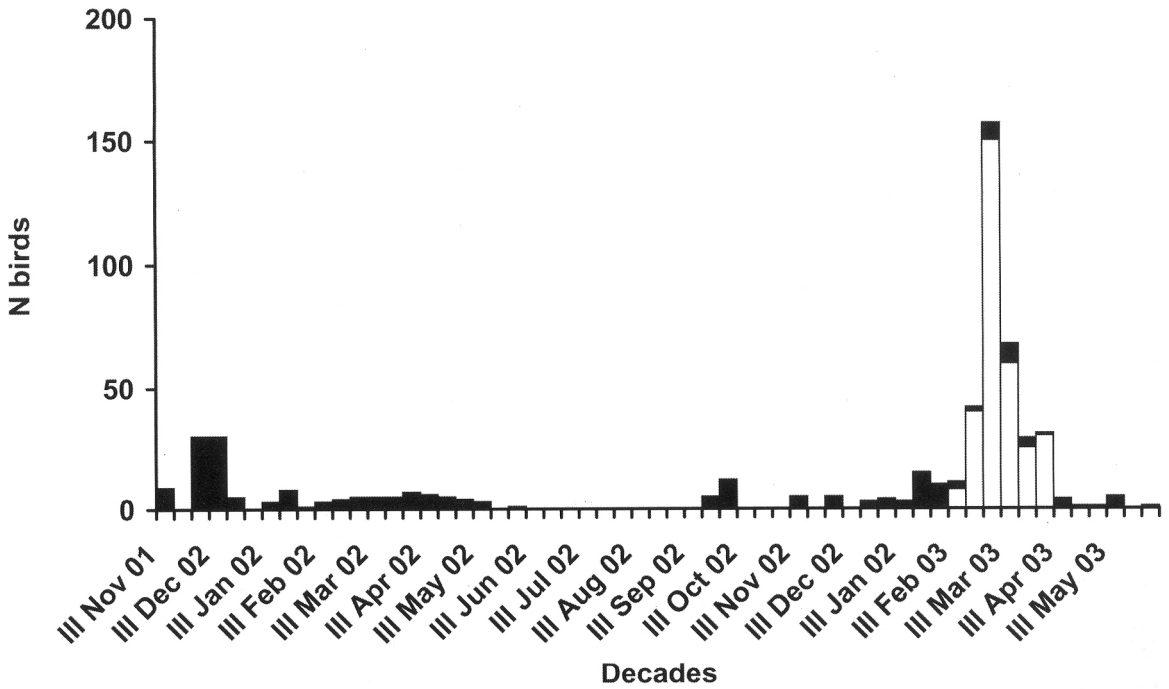

Fig. 1. Maximum number of Anatidae observed per decade during the period November 2001 – June 2003. In white: garganey *Anas querquedula*; in black: other species. – *Massimo numero di Anatidae osservati per decade durante il periodo novembre 2001 – giugno 2003. In bianco: marzaiola* Anas querquedula*; in nero le altre specie.*

monest species among Anatidae (e.g. up to 1000 individuals on 16th March 2001, C. Battisti and A. Sorace, unpublished data).

The presence of an adequate water level in the wetland allowed mallards to breed in 2003 and ferruginous ducks, the only recorded species that feeds mainly by diving, to stop–over. Data on this species are scarce in Latium (Brunelli *et al.* 1998), and Costa and Bondi (2001) reported the sensitivity of ferruginous duck to water deficit.

The increase of Ardeidae in 2003 is clearly due to restoration of pisciculture activity and the related introduction of mullet fries (a trophic resource for Ardeidae). Artificial flooding of small wetlands (and the consequent increase in the wet area: about 20%) can be considered a management technique, allowing

Table 2. Mean number of waterbirds (Anatidae and Ardeidae) observed per decade during the periods of water deficit and artificial flooding (Wilcoxon matched pairs test). – *Numero medio di uccelli acquatici (Anatidae and Ardeidae) osservati per decade durante i periodi di deficit idrico e di immissione artificiale d'acqua (Test di Wilcoxon).*

	Number of waterbirds per decade				
	Water deficit Mean ± SD	Artificial flooding Mean ± SD	*N*	*Z*	*P*
Anatidae					
Winter	12.8 ± 13.6	2.7 ± 2.2	6	1.826	ns
Early spring	4.9 ± 2.1	39.8 ± 45.7	9	2.547	0.011
Late spring	2.6 ± 2.1	1.6 ± 1.9	5	1.069	ns
Ardeidae					
Winter	0.0	3.0 ± 1.7	6	2.201	0.028
Early spring	0.6 ± 1.0	5.2 ± 3.5	9	2.521	0.012
Late spring	0.0	3.4 ± 5.1	5	1.604	ns

species migrating in large flocks (e.g., garganey) to rest in such areas. The garganey could show a significantly increased abundance when quality of residual wetlands is improved (Tomialojc *et al.* 1994, Farago and Zomerdijk 1997). In particular, a significant increase of water level restores the functional role of these areas as stopover sites for migrant bird species. This technique might be useful also for threatened species (e.g., ferruginous duck). Moreover, the economic activities linked to the increase of water level, such as pisciculture, can directly increase trophic resources available for Ardeidae.

Further studies on wider spatial and temporal scales and on different species are required to evaluate more exhaustively the effects of these environmental management actions in residual wetlands.

Acknowledgements – This work was carried out for the conservation and management activities of the Environmental Service – Province of Rome, that manages the protected area. We are grateful to Alessandro Zocchi for the English revision and to the weather bureau of UCEA Observatory (Rome, Collegio Romano) for the rainfall data. We wish to thank two anonymous referees for useful comments.

REFERENCES

Battisti C, Aglitti C, Sorace A, Trotta M in press. Water level decrease and its effects on the breeding bird community in a remnant wetland in Central Italy. Ekologìa (Bratislava).

Biondi M, Guerrieri G, Pietrelli L 1999. Atlante degli uccelli presenti in inverno lungo la fascia costiera del Lazio (1992–95). Alula 6: 3–124.

Brunelli M, Calvario E, Cascianelli D, Corbi F, Sarrocco S 1998. Lo svernamento degli uccelli acquatici nel Lazio, 1993–1998. Alula 5: 3–124.

Celada C, Bogliani G 1993. Breeding bird communities in fragmented wetlands. Bollettino di Zoologia 60: 73–80.

Costa M, Bondi S 2001. Status e biologia della Moretta tabaccata, *Aythya nyroca,* nel complesso palustre di Punte Alberete e Valle Mandriole (Ravenna). Rivista italiana di Ornitologia 71: 125–131.

Farago S, Zomerdijk P 1997. Garganey *Anas querquedula.* In: Hagemeijer EJM, Blair MJ (eds). The EBCC Atlas of European Breeding Birds: their distribution and abundance. T & AD Poyser, London, pp. 96–97.

Lebboroni M, Santini G, Scoccianti C 2001. Le comunità ornitiche dei laghi della Piana Fiorentina: applicazione di modelli di distribuzione spaziale in habitat frammentati. Avocetta 25: 98.

Saunders DA, Hobbs RJ, Margules CR 1991. Biological consequences of ecosystem fragmentation: a review. Conservation Biology 5: 18–32.

Sorace A, Battisti C, Gustin M, Savo E, Biscontini D, Cecere J, Duiz A, Trotta M, Laurenti S, Monti P, Fanfani A 2001. Primo anno di attività della stazione di inanellamento di Torre Flavia (Ladispoli). Alula 8: 34–40.

Sorace A, Battisti C, Cecere J, Savo E, Gustin M, Laurenti S, Duiz A, Fanfani A 2003. Variazioni annuali del passaggio di migratori nel Monumento naturale "Palude di Torre Flavia" (Ladispoli, Roma). Avocetta 27: 50.

Tomialojc L, Perennou C, Rose P 1994. Garganey *Anas querquedula.* In: Tucker GM, Heath MF (eds). Birds in Europe: their conservation status. BirdLife International, Cambridge, pp. 124–125.

Tscharntke T 1992. Fragmentation of *Phragmites* habitats, minimum viable populations size, habitat suitability, and local extinction of moths, midges, flies, aphids, and birds. Conservation Biology 6: 530–536.