

SPECIFIC DIVERSITY OF PHYTOPLANKTON IN A NORTHERN ADRIATIC COASTAL LAGOON

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In the North Adriatic Sea the main brackish areas are located in its Eastern part: the lagoon of Venice and the lagoons of Grado and Marano. The first studies on phytoplankton of the Marano and Grado lagoons are dated 1976 (TOLOMIO, 1976); recently FONDA UMANI and SPECCHI (1983) and CABRINI *et al.* (1993) have integrated researches on these environments, in order to gain a better understanding of the biological community. The trophic availability of this ecosystem, due to the primary production, sustains an intensive aquaculture activity and therefore it is necessary to assess the specific phytoplankton composition and its abundance. The specific diversity and the biomass are influenced by the effects of tide hydrodynamism and the chemical-physical factors, particularly salinity.

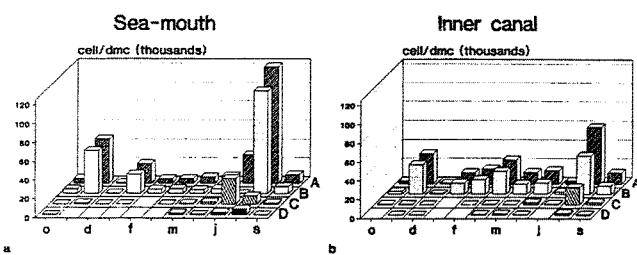
To continue the previous observations, a study on seasonal dynamics of phytoplankton was carried out from October 1990 to September 1991. In two stations in the Marano lagoon, environmental parameters were recorded and samples of surface water were collected to determine the microalgae according to the Utermöhl method. The first station was located near one of the mouths of the lagoon, the second one in its inner part. On phytoplankton matrices we applied three indexes of specific diversity to characterize the richness (Margalef), equitability (Pielou) and diversity (Shannon) of the two stations (GANIS, 1991).

Phytoplankton data do not allow us to pinpoint any typical lagoon community, but show that a few marine species can survive in such a variable environment. The diatoms are dominant in this ecosystem (Fig. 1 a and b); *Cerataulina pelagica* with 89200 cells/l and *Nitzschia gr. Pseudonitzschia* with 45200 cells/l, are the most abundant species. The dinoflagellates are usually scarce; the highest value is reached by *Prorocentrum minimum* with a maximum of only 19920 cells/l. *Cryptophyceae*, *Prymnesiophyceae* and *Euglenophyceae* are also found, but always in low concentrations.

Among the identified species, eleven are present in both stations, another thirteen are present at the sea mouth, while only three are typical of the inner canal. In this station the Pielou index presents elevated values that shows an equidistribution of the species during the year. The specific diversity is always rather low in both stations and the highest values of the Shannon index, with a maximum of 1.737, are reached in the inner part of the lagoon. In this site both the richness and the microalgal biomass are low. The station on the sea-mouth presents lower values of the Shannon index than in the inner canal, but the Margalef index and the cell density are generally higher.

The phytoplankton of the Marano lagoon is not a typical brackish microalgal community and the specific diversity increases from the sea mouth to the inner canal. In summer and autumn the highest biomass is found in the outer part of the lagoon, while in spring it is more abundant in the inner station. However the phytoplankton density is not very high if referred to the sea coastal community. In spite of this the mariculture activities are intensive in this lagoon, sustained probably by small species belonging to picoplankton fraction. The specific composition and the biomass of this component, till now not well known, should be considered in future researches.

Fig. 1 (a and b) : A = Total phytoplankton; B = Diatoms; C = Dinoflagellates; D = Others.



REFERENCES

TOLOMIO C. 1976.- Problemativa e dinamica del fitoplancton nelle acque salmastre. Arch. Oceanogr. Limnol., 18 suppl.: 343-356.
FONDA UMANI S. & SPECCHI M. 1983.- Two years research in the Lagoon of Marano (North Adriatic Sea). Rapp. Comm. Int. Mer. Médit., 28, (6): 247-249.
CABRINI M., COK S. & TULLI F. 1993.- Seasonal dynamics of phytoplankton in the lagoon of Marano (Northern Adriatic Sea). Gior. Bot. It., 127, (4): 847-849.
GANIS P. 1991.- La diversità specifica nelle comunità ecologiche: concetti, metodi e programmi di calcolo. GEAD-EQ n. 10: 100 pp.

LIFE CYCLE AND DIET OF TWO PIPEFISH (SYNGNATHIDAE) IN THE STAGNONE LAGOON (NW SICILY)

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Pipefish commonly inhabits shallow vegetated waters in coastal and estuarine areas, where they form a large component of fish assemblage associated with macroalgae and macrophytiae beds. We investigated population structure, life cycle and food niche segregation of *Syngnathus abaster* Risso, 1826 and *S. typhle* Linnaeus 1758, in a Mediterranean coastal lagoon. Pipefish were collected in the Stagnone di Marsala, this biotope, located in the western part of Sicily, is characterized by phanerogame and seaweed beds. Wide salinity and temperature fluctuations are recorded during the seasonal cycles. Monthly samplings were carried out from January to December 1993 by means of a beach seine 15 m long (4 mm mesh size in the bag), in six stations characterized by sandy and/or muddy bottom showing a patchy submersed vegetation (mainly *Cymodocea nodosa* beds but also *Caulerpa prolifera* and *Cystoseira spp.*). Samples were preserved in 10% neutralized formalin, species were sorted out in order to record standard length and weight. Syngnathids were sexed by presence or absence of a male brood pouch. Fecundity of ripe females and brooding males was estimated: the mean number and diameter of oocytes and eggs. Brood pouch length in males and standard length at birth were also measured. Gut contents

TAB.1- Life cycle traits

Species	<i>S. abaster</i>	<i>S. typhle</i>
No. tot ind.	277	321
Occurrence of juveniles	end MAY- OCT	begin MAY- OCT
Breeding season	MAR-OCT	APR- OCT
S.L. max (mm)	106	229
Sex-ratio (Males/Females)	0.46	0.198
No. of eggs/ Male (S.L. range mm.)	(74-96)	(130-150)
(mean ± SD, n=5)	27 ± 4.08	51 ± 11.8
No. of oocytes/ Female (S.L. range mm.)	(74-96)	(130-150)
(mean ± SD, n=5)	29.5 ± 6.45	73.6 ± 38.4
Eggs diameter (mm)		
range (mode)	1-2 (1.3-1.5)	0.8-2.5 (2-2.5)
Oocytes diameter (mm.)		
range (mode)	0.3-1.3 (1-1.3)	0.8-2 (1.7-2)
Average length of brood pouches (mm)(S.L. range mm.)	(74-96)	(130-150)
(mean ± SD, n=5)	24.5 ± 2.38	44 ± 4
Average S.L. at birth (mm)	(N=10)	(N=10)
(mean ± SD; n=5)	18.2 ± 0.5	19.5 ± 0.4

Analysing the population structure of these pipefish for both species the occurrence of two cohorts per year was evident: the parent cohort (age 1+), and the recruit cohort (age 0+). The newly-born fish of both species appeared in May and were present until the end of October. The occurrence of more subcohorts of age 0+, suggests that females are batch spawners and males can incubate several broods during the breeding season. Tab.1 shows a comparison between some life-history traits of these pipefish. In females several batches of oocytes in different maturity stages were observed. The number of oocytes increased with female body size, also the number of eggs incubated by males increased with brood pouch size. Diet compositions of both pipefish species are reported in Tab.2. Feeding habits of *S. abaster* and *S. typhle* are seemingly different: *S. abaster* preyed mainly on zoobenthos, especially harpacticoids of genus *Tisbe* and to a lesser extent on Amphipods (Gammaridea, Caprellidea), Isopods (*Idotea sp.*, *Sphaeroma sp.*, Arcturidae), Tanaidacea and Ostracods. *S. typhle* fed especially on Mysis, a macroplanktonic prey that in shallow waters occupies the entire water column, from surface to bottom. *S. abaster* and *S. typhle* are among the most typical representatives of Stagnone fish community. The continued capture throughout all the year, the presence of juveniles and the occurrence of males brooding embryos all suggest the existence of established, breeding populations of both species. These resident species group and show abbreviate iteroparity ("sensu" Miller, 1984), namely: short life span with only one or few reproductive seasons; increased parental care; in addition females spawn several times and males are able to hatch subsequent batches of eggs during the same breeding season. *S. abaster* and *S. typhle* seem to avoid competition for food, showing different foraging microhabitats. Food niche differences pointed out between these pipefish species may be related to snout morphology. *S. typhle* snout is longer, *S. abaster*'s is shorter and conical; this enables the former species to catch relatively fast pelagic preys, the later to prey small organisms hiding themselves in the submersed vegetation (FRANZOI *et al.*, 1993).

TAB.2- Gut content analysis

Sample month	July		October	
	<i>S. typhle</i>	<i>S. abaster</i>	<i>S. typhle</i>	<i>S. abaster</i>
Species	10	10	10	10
No. of fishes	85-157	60-76	67-140	63-86
SL range (mm)	11.0(2.0)	8.8(2.0)	1.8(0.9)	19.1(14.9)
Average no. of prey per gut (SD)	1.2(0.4)	3.3(1.4)	1.0(0.0)	3.4(1.9)
Average no. of food items per gut (SD)				
DIET COMPOSITION(%Number of prey)	N%	N%	N%	N%
GASTEROPODA	4.5	0.6		
ACARINA				0.65
OSTRACODA		6		1.3
COPEPODA HARPACTICOLIDA		71.3		66
MYSIDACEA	87.9	1.3	84.6	1.3
TANAIDACEA		3.3		5.9
ISOPODA:				
Idoteidae		7.3		1.3
Sphaerominae		1.3		6.5
Arcturidae				0.7
AMPHIPODA:				
Gammaridea		8.7	15.4	15.7
Caprellidea				0.7
OSTRICHTHYES (post-larvae)	7.6			
RENKONEN INDEX	July: 2.0		October: 16.7	

REFERENCES

FRANZOI P., R. MACCAGNANI, R. ROSSI, V. U. CECCHERELLI, 1993. Life cycles and feeding habits of *Syngnathus taenionotus* and *S. abaster* (Pisces, Syngnathidae) in a brackish bay of the Po River Delta (Adriatic Sea). Mar. Ecol. Prog. Ser., Vol. 97: 71-81.
MILLER P.J., 1984. The tokology of Gobioid Fishes. In: Fishes reproduction: strategies and tactics, (eds. Potts G. W., Wootton R.J.). Academic Press, Harcourt Brace Jovanovich Publishers, London, 119-153.
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