6. Gelatinous Zooplankton

John R. Green (node #6)

Background

Gelatinous zooplankton are common constituents of plankton samples. They can be locally very abundant and have significant predatory impact on the composition of the plankton community (Reeve and Walter, 1978). As considered here, gelatinous zooplankton are a taxonomically diverse group that includes the Cnidaria (both the medusae and hydrozoans); the Ctenophores (comb jellies); the colonial Siphonophores; and the colonial Salpidae. All are characterized by a high water content in body tissues that causes significant distortion and shrinkage upon preservation, and by delicate structures that can be fragmented or extruded during capture, making identification and enumeration for abundance estimates extremely difficult and uncertain.

Biomass Estimates

Gelatinous zooplankton biomass was estimated from 60 cm bongo tows with 333 mm mesh nets taken on NEFSC monitoring cruises from 1996-2000. Mean abundances per m^3 for each station are the calculated mean of the abundance for each stratum sampled. These were done for six 2-month periods for all the main gelatinous zooplankton groups (Table 6.1). Mean station abundance was multiplied by the sampling depth to calculated no./m^2.

Individual group biomasses were calculated using the following relationship (Reeve and Walter 1976):

(EQ. 6.1) $$\text{Log DW} = 2.65 * \text{Log L}$$

Where DW is dry weight (g) and L is length (mm). This relationship was established for ctenophores and is assumed to be similar enough for all other gelatinous zooplankton groups such that we used it for all these zooplankton taxa. A mean length of 1.3 mm was assumed for this calculation. Total biomass for all groups was then integrated into an annual average, summed across all gelatinous zooplankton taxa, and then converted to g wet weight per m^{-2}. Conversion to wet weight from dry weight was approximated from Pages (1997), with DW = 4.48% of WW. Estimates for all four regions are given in Table 6.2.

Production Estimates

Gelatinous zooplankton production was scaled from estimates derived from a study of Ctenophore trophodynamics from the Caribbean (Persad *et al.* 2003). Rates from that study were adjusted for EMAX purposes using a Q10 rule of 2 (i.e., temperature correction of rate processes, with a halving or doubling for each change in temperature of 10^{o}C) to approximate the difference in temperature conditions and the seasonal cycle of prey abundance found in the coastal Northeast Atlantic Ocean.

Upon further reflection, these production estimates were slightly modified to account for depth patchiness, vertical stratification of distribution, seasonality, and the bloom nature of these

organisms. To do so, we adjusted the production value to fall within the range of previously reported (literature) gelatinous zooplankton P:B ratios, resulting in a P:B ratio of ~ 40.

Consumption Estimates

Gelatinous zooplankton consumption rates were scaled to the results of Reeve and Walter (1976). As with production, these estimates were modified to account for depth patchiness, vertical stratification of distribution, seasonality, and the bloom nature of these organisms. Reeve and Walter (1976) estimate a clearance rate of approximately 17% body weight per day. Scaling to other nodes and the Reeve and Walter estimate, our calculations assumed an adjusted clearance rate of approximately 40% body weight per day, which was then annualized. This gives a C:B ratio value of ~146, well within the range of other reported values for similar organisms. This also gives a C:P of 3.5-3.7, a reasonable value and consistent with similar nodes at this trophic level.

References

Persad, G; Hopcroft, R.; Webber, M.; Roff, J. 2003. Abundance biomass and production of ctenophores and medusae off Kingston, Jamaica. *Bull. Mar. Sci*. 73(2):379-396.

Reeve. M; Walter, M. 1976. A large scale experiment on the growth and predation potential of ctenophore populations. *In*: Mackie, G, ed. *Coelenterate ecology and behavior*. New York, NY: Plenum Pubcorp.; p. 187-199.

Reeve.M; Walter, M. 1978. Nutritional ecology of ctenophores-a review of recent research. *In* Russel, FS; Yonge, M, eds. *Advances in Marine Biology* New York, NY; Academic Press; Vol. 15 p. 249-287.

Table 6.1. Estimates of gelantious zooplankton group abundances (no. 10 m^{-2}). The averages are presented for each of six 2-month seasons and as an integrated annual estimate. These estimates are for each region and were used to calculate biomass estimates.

Siphonophores	EMAX Regions			
	MAB	SNE	GB	GOM
Jan - Feb	304	529	5608	32832
Mar - Apr	3840	5827	1172	13239
May - Jun	22671	17529	5967	10855
Jul - Aug	-	15264	67811	92589
Sep - Oct	5462	23359	10608	72970
Nov - Dec	20260	10683	10918	84336
Total	8756	12199	17014	51137
Ctenophores				
Jan - Feb	0	0	0	10
Mar - Apr	0	5	0	0
May - Jun	106	435	0	0
Jul - Aug	-	0	2	18
Sep - Oct	18	85	3	9
Nov - Dec	9	0	118	0
Total	22	88	20	6
Salps				
Jan - Feb	669	0	0	75
Mar - Apr	498	1430	19	36
May - Jun	105	186	443	178
Jul - Aug	-	14128	38321	77151
Sep - Oct	79430	42869	29728	25987
Nov - Dec	19062	4866	615	322
Total	16627	10580	11521	17292
Coelenterata				
Jan - Feb	83	216	234	1468
Mar - Apr	86	2584	12372	462
May - Jun	8984	29559	43376	10606
Jul - Aug	-	4364	14805	73400
Sep - Oct	5137	5449	1720	14266
Nov - Dec	2342	1459	316	2137
Total	2772	7272	12137	17057

Table 6.2. Total estimate of gelatinous zooplankton biomass for the different EMAX regions. Values are in g m^{-2}.

EMAX Region	Biomass (g m^{-2})
MAB	3.6
SNE	3.9
GB	5.2
GOM	11.0